00:00:00.000 --> 00:00:14.920
Flowe, Tammy (FAA)
Deepika Doctor Beeper Darling is going to be our moderator this evening. So I'm gonna turn it over to her. At this point and deep goes so please. You know it. The the show is yours. Thank you.

00:00:16.070 --> 00:00:45.860
Wiebke Deierling (Guest)
Thank you Tammy flow, yeah, well welcome everybody to our second day of the turbulence workshop. We're excited that you can join us as Tammy said in these difficult times. The second day topic is still is focus is like yesterday on emerging science of aviation turbulence as well as future challenges for aviation turbulence.

00:00:45.910 --> 00:01:15.530
Wiebke Deierling (Guest)
On topics in in this area and so we have several speakers. Today, that will talk about science new emerging science on various topics as well as talk about challenges that we are seeing in the years to come and our first speaker that will focus on challenges.

00:01:16.580 --> 00:01:32.790
Wiebke Deierling (Guest)
Actually is Matthias Steiner Doctor Matthias Steiner, who is the senior scientist at end car and also the director of the aviation applications program at end car and has done.

00:01:33.010 --> 00:01:39.590
Wiebke Deierling (Guest)
A significant amount of work and the last years in this area, so materials without further ado.

00:01:39.640 --> 00:01:41.070
Wiebke Deierling (Guest)
Here come the?

00:01:41.670 --> 00:01:42.710
Wiebke Deierling (Guest)
Yeah, it's all yours.

00:01:44.570 --> 00:01:56.280
Matthias Steiner (Guest)
Thank you Rebecca and thank you for the invitation to share some thoughts about emerging needs of aerial transportation and so let me hopefully.

00:01:57.440 --> 00:02:05.330
Matthias Steiner (Guest)
Being able to share that and go in presentation mode mode. Let's not look good for you.

00:02:05.990 --> 00:02:09.140
Wiebke Deierling (Guest)
Yes, you're yeah, you're really you're full screen.

00:02:08.350 --> 00:02:08.800
Matthias Steiner (Guest)
OK.

00:02:10.390 --> 00:02:11.110
Matthias Steiner (Guest)
Did it?

00:02:11.860 --> 00:02:45.200
Matthias Steiner (Guest)
So I I'm really focusing here on non traditional flight operations and particularly low and high altitude for for this presentation here, So what I want to do as I go through the slides here is really think in terms of what's happening on the aviation aerospace side and then? What are the aspect on the weather end and climate side and you see there in the overlapping area that's really where the weather and climate sensitivities.

00:02:45.250 --> 00:03:15.360
Matthias Steiner (Guest)
Come in and that ultimately drive the requirements and needs that we want to carve out here, but we want to look at it from a particular focus here on wind and turbulence because it's the turbulence workshop here and as I mentioned before I want to focus on what's happening at low altitude and at high altitude. And when I mean, low altitude. It's really in the lowest kilometre or 2 in.

00:03:15.420 --> 00:03:29.750
Matthias Steiner (Guest)
Off airports and maybe urban environments and when I talk about high altitudes. I am thinking of the upper troposphere and then particularly into the stratosphere, essentially the Upper Class E airspace.

00:03:30.720 --> 00:04:00.440
Matthias Steiner (Guest)
Yeah, we'll see more about that, so let's start first about the looking at the evolving obviation industry and what's happening there and this part. I really put pictures down because pictures are telling you so much more of his story than I can share in words and when I say low altitude here. It's really what NASA and everybody starts using advanced air mobility, but it's.

00:04:00.750 --> 00:04:30.880
Matthias Steiner (Guest)
Unmanned aerial systems Urban Air mobility, these kinds of modes that you see depicted here for example, here. This is a concept from Airbus which is actually a modular thing where you see this cap in here can be either attached to an aerial component with a propulsion that gets you off the ground or on on a physical or basis. That would be able to allow you to to drive on the ground so that's actually an interesting concept.

00:04:31.150 --> 00:04:51.000
Matthias Steiner (Guest)
Or Chobe evaluation that they are already operating flight demonstrations with Tiltrotors Lilium. the

German company is also doing demonstrations. There's this sort of more on a personal transport as side and then you have a lot of unmanned aerial systems.

00:04:51.890 --> 00:05:21.580
Matthias Steiner (Guest)
You ask this like sip line has been very active, particularly in on the African continent for medical supplies so they are having full operations there. This is a fixed wing drone that they catapult off and that flies and when you look closely. You may actually see that the belly has an opening so they do low altitude. Parachute drops of whatever they're delivering medical supplies for hospital remote hospitals.

00:05:22.050 --> 00:05:52.280
Matthias Steiner (Guest)
There's lots of Thrones out there. Uas is used for inspection of all sorts of things or other you know package delivery. Walmart is starting to do that. In in as as examples in the US so there is a wide variety of aerial vehicle out there and mission profiles that makes it pretty challenging to understand what the weather sensitivities are and what they need in terms of whether guidance.

00:05:52.720 --> 00:06:03.720
Matthias Steiner (Guest)
Uh for supporting the operations and these vehicles change at this designs change at a much faster rate than what you are.

00:06:03.770 --> 00:06:26.590
Matthias Steiner (Guest)
Or known for doing with with Chandra Levy Nation aircraft or large transport. Aggregation aircraft that have timescales of decades in their development and getting it through certification while here we're talking like in 6 months. You have yet another vehicle that is being designed and operated so a lot of things happening there.

00:06:27.660 --> 00:06:56.650
Matthias Steiner (Guest)
Same thing in the high altitude in the stratospheric operations. You see in the news. A lot of things happening. There people tourists going out into outer space coming back down, essentially space launch and reentry. There is in a resurgence of supersonic and hypersonic travel for example, here this is a.

00:06:56.930 --> 00:07:27.940
Matthias Steiner (Guest)
Uh and aircraft being designed by boom and United has already signed up for several aircraft of this type and booms. It's just down the street from us here in Colorado, then **** has been operating in the stratosphere, based on balloons. High altitude balloons that are stationary up there for possibly a month or 2 or more, particularly for communication purposes based on the payload here.

00:07:28.170 --> 00:07:57.910
Matthias Steiner (Guest)
And similarly you see other ones airports or air environment solar powered high altitude. You as that would also be stationary. There sort of like pseudo satellites with a payload that particularly may help

communication standards to to enable communication over some areas or some other purposes. Maybe more from a defense perspective or high altitude package delivery.

00:07:58.010 --> 00:07:59.720
Matthias Steiner (Guest)
Unmanned uh.

00:08:00.460 --> 00:08:14.670
Matthias Steiner (Guest)
Aircraft that fly at high altitudes, there, so you see quite a variety. There, too, and they have also different requirements from a weather perspective as to what they need.

00:08:16.010 --> 00:08:46.460
Matthias Steiner (Guest)
Now looking at the weather in starting again in the boundary layer at low altitudes. Here, there's a very dynamic environment as many of you know with a wide range of processes and scales that yield variable wind and turbulence in these processes may be driven through you know, thermal gradients or frontal systems or through thunderstorm dynamics, etc and because they are.

00:08:46.540 --> 00:09:15.690
Matthias Steiner (Guest)
Very localized and smaller in scale 's they may be less predictable and so you need higher resolution and understand what's happening at specific locations, especially in complex environments like urban landscapes to understand how the wind goes through these urban canyons and have Ward? Is is shedding off buildings and just to give you a flavor here and there's a setting up a Domingos talk later.

00:09:17.590 --> 00:09:35.410
Matthias Steiner (Guest)
About the urban environment here what you're looking at is and I'll let this simulation goal here is a very fine. Scale 5 meters simulation of a cold front passing through the downtown area in Dallas Fort Worth.

00:09:36.110 --> 00:10:06.690
Matthias Steiner (Guest)
Uh and this is about a 3 hour simulation here where you see how it a cold front goes through it gets colder. The wind direction changes and the turbulence increases significantly so initially you see the the flow coming from the South West here and then turning all away around 2. North and So what as you look at this on the left side here is essentially vertical motions going from minus.

00:10:06.730 --> 00:10:36.820
Matthias Steiner (Guest)
52 + 5 meters per second from blue to red and on the right side is the horizontal wind speed and just to give you a scale here. This Red Box is the great resolution of the high resolution. Rapid refresh which is the highest resolve operational weather model that at the National Weather Service is operating so all these things what's happening in here is totally subgrid scale and not resolved.

00:10:37.170 --> 00:10:45.880
Matthias Steiner (Guest)

Today's operational weather prediction models and Domingo will go much more in details on those things. This is just a teaser to set him up.

00:10:47.150 --> 00:11:00.460
Matthias Steiner (Guest)
Now going from the boundary layer higher up into the stratosphere. There's obviously different things going on the troposphere tropopause varies you see, those here.

00:11:00.520 --> 00:11:32.250
Matthias Steiner (Guest)
Error from you know southern to northern from the summer, hemisphere to the winter. Hemisphere you see how that that tropis pauses varying its height from 9 kilometres at the pole to going maybe 16 or 17 cloud. There's more in in the tropics and the wind regimes above changing seasonally as well. But that is kind of known from a more climatological perspective, but

00:11:32.300 --> 00:12:02.070
Matthias Steiner (Guest)
what makes it more dynamic and hazardous for operating up there is really. When you have rapidly changing wind conditions or vertical propagating gravity waves that mountains can generate or thunderstorms can generate and when these waves are breaking particularly if you have dynamic shear instabilities associated with it, it becomes potentially hazardous up there.

00:11:47.980 --> 00:11:48.390
+14*******45
Probably.

00:11:52.230 --> 00:11:53.630
+14*******45
Pretty straightforward.

00:12:02.520 --> 00:12:15.950
Matthias Steiner (Guest)
And just to show you one example here from an ER 2 flight. That was operating East of the Rocky Mountains here in in New Mexico, you see the flight path here.

00:12:16.540 --> 00:12:42.970
Matthias Steiner (Guest)
Uh it's probably too small for you to read exactly what's in the plot. But just to convey what you're looking at these are altitude. You know fluctuations that the aircraft experience that were significant and clearly indicative of Lee waves of the Rocky Mountains that the aircraft was experiencing here and there was a significant encounter there.

00:12:45.750 --> 00:13:14.500
Matthias Steiner (Guest)
Going one step further here looking at how our climate system is evolving and Paul Williams touched on many of these aspects already so I don't want to talk hear much about the the clear air aspects of intensifying check stream and how that yields stronger winds and turbulence. But more focusing on intensifying thunderstorm and more frequent Thunder storms that may also have.

00:13:14.550 --> 00:13:35.040
Matthias Steiner (Guest)
Changed patterns in their storm tracks. They may become deeper. It may have more lightning hail and so on, and therefore wind and turbulence associated with it and that is clearly a significant source of of wind and turbulence that we need to understand and how these things change.

00:13:35.440 --> 00:14:05.220
Matthias Steiner (Guest)
Uh with in the future without changing climate system and there is some analysis that for example, Andreas prying here at anchor has been doing where some colleagues also in the research applications lab where they did climate scale simulation running like 40 years of past climate and 40 years of future climate at convection resolving like 54 kilometer.

00:14:05.280 --> 00:14:25.750
Matthias Steiner (Guest)
Resolution where you really start resolving or or at least permitting convection to evolve in a realistic fashion. And so you can start looking at those patterns how they may be changing in a future climate and therefore look at what the implications, maybe for evaluation.

00:14:26.660 --> 00:14:56.720
Matthias Steiner (Guest)
And then there is obviously other things, if it gets you know warmer. It may also become dryer, which you may have impacts on how much lift you have for takeoff. You may get increased low level turbulence or you may get more wildfires and that create their own you know pyrocumulonimbus is that also our act like thunderstorms, but they're really driven by the wildfires and associated hazards, etc, so there is some aspects of.

00:14:56.770 --> 00:15:01.380
Matthias Steiner (Guest)
Changing climates that matters to which we may have to think about.

00:15:02.550 --> 00:15:32.900
Matthias Steiner (Guest)
So really all this is just to set the background as to what is happening out there in the aviation industry in the aerospace industry and from a weather perspective. But what the real work needs to happen. Here is understanding. The weather sensitivities and they have really depending on the particular type of vehicle and the particular mission that you're envisioning to to conduct so it's You cannot look at this.

00:15:33.210 --> 00:16:03.820
Matthias Steiner (Guest)
Action Eric Lee when you have seen some of these vehicles they they are not looking like a fixed wing per say where we have a long history of developing large aircraft and understand how these work, they may be tilt. Rotors they may be multi rotors and it's not straightforward forward to understand the performance limitations and that is really where we need to learn more engaging the the de manufacturer also for them.

00:16:04.110 --> 00:16:25.660
Matthias Steiner (Guest)
You to share that information such that from the weather community. We understand what what we need to provide so it's really about the control ability of the aircrafts on the windy and turbulence conditions which ultimately drives. The safety of flight or the platform stability, which matters 2, depending on what your mission is.

00:16:26.290 --> 00:16:28.360
Flowe, Tammy (FAA)
Alright Plan B Cup Holder.

00:16:30.040 --> 00:16:33.880
Matthias Steiner (Guest)
Sorry. Do I miss something am I going way overboard here.

00:16:34.440 --> 00:16:34.890
Flowe, Tammy (FAA)
Yeah.

00:16:35.500 --> 00:16:45.630
Matthias Steiner (Guest)
OK. Let me wrap up there is a a lot of things that you need to understand here and then also from an infrastructure perspective, the weather guidance.

00:16:46.710 --> 00:17:17.700
Matthias Steiner (Guest)
Is is very limited in terms of? What we currently have for low altitude and for high altitude operations? We need to understand? What are the needs? What are the requirements for spacetime resolution look ahead times ET cetera ET cetera and let's see there's obviously regulatory aspects to it as well. And this is just the summary slide. I mean, I touched base on all these things it really requires.

00:17:18.310 --> 00:17:20.880
Matthias Steiner (Guest)
Their collaboration across.

00:17:21.700 --> 00:17:43.720
Matthias Steiner (Guest)
Different stakeholders from the weather community from the manufacturer from your operators to come together to truly open up. The Hood and talk freely about what the criteria are that they need what their sensitivities are? What weather guidance. They they need etc. So I'll leave it at that thank you.

00:17:47.080 --> 00:17:54.700
Wiebke Deierling (Guest)
Thank you very much my tears and I think we had a I think there was some interference actually so you're doing fine on time.

00:17:48.170 --> 00:17:49.000
Matthias Steiner (Guest)
Back to you.

00:17:55.090 --> 00:17:55.910
Wiebke Deierling (Guest)
Uhm.

00:17:55.940 --> 00:17:59.830
Matthias Steiner (Guest)
OK, so I misunderstood so I can go back and talk, for 20 more minutes.

00:17:59.370 --> 00:18:00.010
Wiebke Deierling (Guest)
No.

00:18:06.500 --> 00:18:07.300
Wiebke Deierling (Guest)
Not that long.

00:18:08.570 --> 00:18:08.880
Matthias Steiner (Guest)
Right.

00:18:08.750 --> 00:18:14.430
Wiebke Deierling (Guest)
But anyway, thanks so much for a very interesting talk, UM Steve UM.

00:18:15.120 --> 00:18:30.470
Wiebke Deierling (Guest)
Uh monitoring the chat so come to the audience please. If you had to have any questions always pose them in the chat and Steve Ellman will pick up the questions Steve are there any questions?

00:18:30.090 --> 00:18:39.260
Steve Abelman
Uh and there was a couple of comments about the altitudes of the ER 2, which I think we're altitude were answered within the chat talking about PR out the R 2.

00:18:40.030 --> 00:18:46.390
Steve Abelman
Altitudes operates from 20 to 70,000 feeders or around 6, 22,000 meters or so.

00:18:46.940 --> 00:18:47.590
Steve Abelman
Uhm.

00:18:48.240 --> 00:18:52.210
Steve Abelman
It gets 50 millibars that's the typical operating altitudes so.

00:18:52.760 --> 00:18:53.430
Steve Abelman
Uhm.

00:18:54.440 --> 00:18:57.810
Steve Abelman
I I think that may have answered the questions regarding the E 2.

00:18:58.030 --> 00:19:08.380
Bob Sharman (Guest)
Well, I think sorry Steve this Bob I think the question was what was the altitude for the case material showed.

00:19:01.010 --> 00:19:01.490
Steve Abelman
Go ahead.

00:19:09.270 --> 00:19:11.690
Bob Sharman (Guest)
And the answer is 60,000 feet.

00:19:14.300 --> 00:19:14.710
Steve Abelman
Got it.

00:19:16.320 --> 00:19:18.160
Steve Abelman
Got it OK thank you.

00:19:19.330 --> 00:19:38.740
Steve Abelman
Uh Jeong Hoon from from soul good to see you, John Cooney has a question even though we emphasize weather for UAV developers and operators seems not to consider we seem not to consider whether in the development stage how about the atmosphere in the US side and I'm reading that verbatim so.

00:19:41.970 --> 00:19:49.840
Matthias Steiner (Guest)
I'm trying to understand what you're off to younghoon could you possibly chime in and elaborate a little more on this?

00:19:52.930 --> 00:20:09.060
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Well, thank you very much for your wonderful talk uh and hi. Welcome to see my my question is about the consideration of the weather in operators for UAB at the at the current time because.

00:20:09.490 --> 00:20:18.990
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh uh we keep emphasizing whether it's important, it's really important for for all of the users to to operating.

00:20:19.640 --> 00:20:38.820
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Their system, however, at the moment they are developing at ATM systems feature kind of new so they don't really care about the weather at the moment, so I just wonder in those kind of atmospheric I mean, those are pretty much the same atmosphere in US?

00:20:40.840 --> 00:21:11.880
Matthias Steiner (Guest)
Yeah, I think I I talked maybe from a UX perspective here, but it's it's really a global problem. That's the same problems. Wherever you are, and you're right that there is ways that people are thinking of managing the traffic and traffic management systems that are being developed. But you have to truly integrate weather. In all of that because it is a a key factor that influences your operations. You need to understand the operational.

00:21:12.020 --> 00:21:42.750
Matthias Steiner (Guest)
Environments and and the boundary layer is certainly studied heavily but not to the point as to how it affects these aircraft operations because we also don't necessarily understand what the weather sensitivities are and the same is true up in the stratosphere. So it all has to go hand in hand and that's why I'm saying we need to come together and work together. You can't do a traffic management system in isolation and the weather.

00:21:42.810 --> 00:22:01.200
Matthias Steiner (Guest)
In isolation and design and and operations of aircraft in R as in isolation. It really has to come together. We need to enter a dialogue and and have test beds where you can sort exercising these things to make real progress in a safe environment.

00:22:04.100 --> 00:22:06.010
Steve Abelman
We do have a couple more questions that popped up.

00:22:06.060 --> 00:22:20.830
Steve Abelman
But what do you think I'm from Todd Lane? What do you think the biggest immediate challenge for forecasting for UAB our ability to simulate the appropriate scales for UAV 's realistically or ability to initialize models at the appropriate scale.

00:22:22.350 --> 00:22:52.320
Matthias Steiner (Guest)
You know the answer to that 2 top yes, it's it's all of that. Uh I think part of the challenge is that some of these small scales atmospheric processes that matter for these smaller aerial vehicle 's or become or less predictable and so you also have to think in terms of maybe probabilistic prediction in terms of you know prediction along a flight path or for a particular mission.

00:22:52.380 --> 00:23:22.620
Matthias Steiner (Guest)

Not exactly what is happening where because you can't really do that. But what is the likelihood of exceeding mission critical you know thresholds of wind speed or terrible ONS or Windshear? Whatever it may be so as you go to these smaller and smaller scales clearly initializing the models. Having models that are able to predict weather fast enough in a timely fashion to provide guidance.

00:23:22.850 --> 00:23:29.920
Matthias Steiner (Guest)
And then how to interpret that information from a impact perspective, I think will be keen.

00:23:31.560 --> 00:23:45.760
Steve Abelman
If that question wasn't challenging enough. Pierce has one. Pierce Buchanan has one that says any suggestion as to how to get UAV operators to share weather data and a common format and ideally free to access seems to be a very emerging area at the moment.

00:23:47.420 --> 00:23:55.630
Matthias Steiner (Guest)
Uh I would even step back and say, I don't care what format as long as I understand the format, but shared the data please.

00:24:00.120 --> 00:24:03.530
Steve Abelman
That looks to be all I see because right now.

00:24:02.760 --> 00:24:05.450
Flowe, Tammy (FAA)
Yeah, I think we probably ought to move on.

00:24:05.060 --> 00:24:10.780
Wiebke Deierling (Guest)
Yes, and we do so I think that was just on time so thank you very much my tears.

00:24:09.460 --> 00:24:09.760
Matthias Steiner (Guest)
Right.

00:24:10.900 --> 00:24:11.300
Matthias Steiner (Guest)
Your.

00:24:11.630 --> 00:24:13.780
Wiebke Deierling (Guest)
Uh it was very informative.

00:24:14.350 --> 00:24:23.780
Wiebke Deierling (Guest)
Uh so our next speaker is Tim Doyle, uhm from NRL the US Naval Research Laboratory and he's a senior scientist there.

00:24:24.510 --> 00:24:26.820
Wiebke Deierling (Guest)
Uhm and dumb.

00:24:27.500 --> 00:24:28.990
Wiebke Deierling (Guest)
Uh has come.

00:24:29.710 --> 00:24:41.080
Wiebke Deierling (Guest)
Has done a lot of research in various areas, but one of them has been for a long time on top of traffic flows as well so Jim without further ado.

00:24:41.130 --> 00:24:47.740
Wiebke Deierling (Guest)
You UM, you'll be talking about mountain wave turbulence and predictability the floor is yours.

00:24:52.490 --> 00:24:57.630
Wiebke Deierling (Guest)
And Jim I can't hear you but we can see your slide.

00:24:59.630 --> 00:25:10.930
Jim Doyle (Guest)
Sorry about that I had to navigate to the mute button and it took me longer longer than expected. You'd think after all. This time you'd think I'd be able to do this faster or better, but no.

00:25:05.330 --> 00:25:07.220
Wiebke Deierling (Guest)
Now we can hear you well OK.

00:25:11.450 --> 00:25:31.910
Jim Doyle (Guest)
And so thanks very much for the introduction and Jim Doyle from the Naval Research Lab in Monterrey and I really appreciate the invitation to present and always enjoy this workshop very much so with great pleasure to participate and I think I'll turn off my camera to make sure.

00:25:32.550 --> 00:25:35.330
Jim Doyle (Guest)
Uh bandwidth is not an issue.

00:25:36.140 --> 00:25:36.830
Jim Doyle (Guest)
So.

00:25:37.700 --> 00:25:39.910
Jim Doyle (Guest)
Maybe my camera is off already.

00:25:41.280 --> 00:25:43.090
Wiebke Deierling (Guest)
I think it's off and and that's fine.

00:25:42.300 --> 00:25:44.610
Jim Doyle (Guest)
Yeah, sorry about that OK.

00:25:45.870 --> 00:26:15.940
Jim Doyle (Guest)
And so this is this will be more or less if quick survey of some of the modeling and observation. Ull examples of mountain wave induced turbulence that our group has been been involved with and will look a little bit at sources about wave turbulence. That includes Lee waves and Rotors wave breaking and Wall so touch on some modeling and predictability issues. I also want to acknowledge some of my colleagues listed below that we've worked with through the years on, some of these problems so the.

00:26:16.250 --> 00:26:20.440
Jim Doyle (Guest)
Collaborations have been really important for carrying out these studies.

00:26:23.330 --> 00:26:53.660
Jim Doyle (Guest)
I'd like to provide a little background based on climatology of mountain wave turbulence from Jamie Wolfson, Bob Sharmans really important contribution back in 2008. So mountain waves or sometimes referred to as internal gravity. Waves are generated when stabili stratified error is forced over a mountain or a barrier and these disturbances created and energy is carried a wave from the mountain based basically in terms of.

00:26:53.720 --> 00:26:57.850
Jim Doyle (Guest)
Through these waves so it can propagate to great distances horizontally and vertically.

00:26:59.270 --> 00:27:11.020
Jim Doyle (Guest)
So we all know major sorts of turbulence over the US had particularly the western US is due to mountain wave turbulence. You can see on the left the normalized Pireps Mountain or moderate or greater.

00:27:11.700 --> 00:27:33.390
Jim Doyle (Guest)
I'm from Jamies in bobs study really highlights some of the most mountainous regions. Colorado in the Intermountain West and the Pacific Northwest and you can actually look on the right there's an obvious correlation of the normal normalized moderate or greater turbulence pattern with the topography.

00:27:33.820 --> 00:27:41.370
Jim Doyle (Guest)
Uhm below so it's very clear that mountain wave induced turbulence is a.

00:27:42.060 --> 00:27:49.370
Jim Doyle (Guest)
A very large contributor to the overall turbulence problem in the over the continental US and other places around the world as well.

00:27:50.920 --> 00:28:02.000
Jim Doyle (Guest)
So first I want to start in the lower part of the atmosphere. This is an example from airflow over the central Alps mountain range called the Hoenn Tower HOA Tower and.

00:28:03.500 --> 00:28:06.620
Jim Doyle (Guest)
On the left here is based on some flights that.

00:28:07.550 --> 00:28:33.910
Jim Doyle (Guest)
Uh we participated in and it was quite awhile ago and this instrument on board. The research aircraft was as a louder and it was measuring uh backscatter. So you could see in these bright colors or actually clouds and the flow here is from left to right and these black lines are displacement Heights that were diagnosed from the aircraft data so you can think of them as air parcel streamlines.

00:28:34.900 --> 00:28:35.830
Jim Doyle (Guest)
And dumb.

00:28:37.000 --> 00:29:01.410
Jim Doyle (Guest)
So what we could see here is a series of waves that are excited by the flow over terrain and immediately. In the Lee of the Crest of the HOA tower and as a plunging flow. So you could see the cloud layer plunging rapidly downward and then bounces back upward in a series of these Lee waves downstream and Easley waves are not always.

00:29:02.440 --> 00:29:29.040
Jim Doyle (Guest)
Uniform but oftentimes we think of them as rather laminator and not so turbulent that you could see some of these have crests that are a bit bumpy and you could actually see in this in set as their zoom of the of the black box. You could see the Secondly. Wavecrest has a number of little signatures of turbulence on top of it, which may be occurring as of due to some shear along it.

00:29:30.320 --> 00:29:41.910
Jim Doyle (Guest)
And on the right is a high resolution simulation potential temperature in the black and wins in color and basically captured the salient characteristics of these trapped waves in the Lee of the mountains and.

00:29:43.790 --> 00:30:13.830
Jim Doyle (Guest)
What is obvious from this is a wave docked that forms that traps the energy and propagates it to the horrors in the horizontal as well, which results in these trapped. Lee waves, but this wave duct is

imperfect and oftentimes energy is able to leak through the wave dot and you can see in the upper levels. Now the isotopes are starting to steep in and we have winds that are in the color here in the blue shading that are getting to the point where they're very weak.

00:30:13.870 --> 00:30:26.740
Jim Doyle (Guest)
And a signature that wave overturning is occurring so some of the waves energy leaking and propagating vertically and then breaking in the lower stratosphere is not all that uncommon.

00:30:30.190 --> 00:30:59.720
Jim Doyle (Guest)
So let me switch gears a little bit to a subject that we worked quite a bit on and part collaboration with Dale Durran on Rotors and this like to show an example from some of this work and we managed to simulate rotors at very high resolution. This is at turbulence resolving scales of around 60 meters and what you're looking at is a vertical cross section. The mountain is actually to the left the flow is coming from.

00:31:00.010 --> 00:31:30.210
Jim Doyle (Guest)
To write and this color shading is the vorticity or spin in the horizontal so it's about a horizontal axis, so this pin is created by sheer and you could see these wind vectors. You have a very strong winds along the mountain surface and it's being lifted up as part of that. Lee wave that I just talked about you can see, there's a big gradient in speed across this and this creates this shear zone or this vorticity zone and so this sheet of vorticity.

00:31:30.270 --> 00:32:01.010
Jim Doyle (Guest)
Is lifted up by the Lee wave and as a result of this 4 tech sheet? You start to undergo some instabilities at these instabilities are these little bundles of vorticity or spin and the horizontal and so these are snapshots from the simulation every 40 seconds and as things go along. You could get intensification of these little regions of vorticity, reaching scales of something like 0.4 per second.

00:32:01.310 --> 00:32:12.970
Jim Doyle (Guest)
Is not that far from from for nettik scales or torn attic vorticity strength so quite impressive? How strong these can get in.

00:32:13.040 --> 00:32:32.910
Jim Doyle (Guest)
Uh I wanna note that this instability that it undergoes is a type of Shear. Instability is not all that different than the development of the Kelvin Helmholtz pillows that were mentioned yesterday and we refer to these little circulations that are really intense. As Sub Rotors as part of a larger scale. Rotor circulation that we tend to think of.

00:32:33.740 --> 00:32:35.220
Jim Doyle (Guest)
And we were able to come.

00:32:36.080 --> 00:32:49.090
Jim Doyle (Guest)
Animate this in 3 D this might give you a little better idea of this, you could see the vortex. She'd in these pieces of vorticity breaking off and shearing downstream and moving into the more or less this turbulent mess.

00:32:50.050 --> 00:33:20.060
Jim Doyle (Guest)
And if we, we actually during the T Rex Experiment went out and were able to observe these using a Doppler Lidar and this these are light are snapshots showing every 30 seconds blue and green towards the light or yellow away and you'll see a small scale circulation here in the lower diagram with really bright yellows and Blues next to each other indication of a really strong circulation. That's occurring and so that's

00:33:20.120 --> 00:33:22.470
Jim Doyle (Guest)
kind of a confirmation of these.

00:33:23.670 --> 00:33:44.820
Jim Doyle (Guest)
Of these sub rotor circulations and there's been a number of studies that have been following on related to this, some led by Strauss. This example from Strauss said. All I'm showing some of the wave breaking structure in the low levels, with the Lee wave so you have downward motion here coloring as in vertical motion in the upper left.

00:33:49.220 --> 00:33:50.650
Jim Doyle (Guest)
Like the edr here.

00:33:56.580 --> 00:33:58.870
Wiebke Deierling (Guest)
Jim you're breaking up a little bit.

00:33:59.680 --> 00:34:00.330
Wiebke Deierling (Guest)
Uh.

00:34:01.140 --> 00:34:02.050
Wiebke Deierling (Guest)
Can you hear us?

00:34:01.420 --> 00:34:02.720
Jim Doyle (Guest)
Theory army engaged.

00:34:05.360 --> 00:34:06.070
Jim Doyle (Guest)
What they?

00:34:06.920 --> 00:34:32.500
Jim Doyle (Guest)
Of attributed to a hydraulic like jump, so the flow comes plunging down the descending flow and jumps back up as part of the the mountain, forcing and this leads to very turbulent conditions as part of that jump and you could see this is colored by the turbulence or edr dissipation rate here and you can see these red colors, popping up in the hydraulic jump, but also extending pretty far downstream as well.

00:34:34.410 --> 00:34:38.510
Jim Doyle (Guest)
Just highlights the importance of this of vortex breakdown.

00:34:41.060 --> 00:34:50.530
Jim Doyle (Guest)
The steps example is a case of low level turbulence flying with a King air out of the Juneau Airport as part of a research program down the Gastineau Channel.

00:34:51.430 --> 00:35:13.860
Jim Doyle (Guest)
And A and then the flight went off to do its mission, and they experienced severe turbulence as it went down the the channel flying and low levels reached the turbulent kinetic energy values of 50 or greater as part of the one of the segments of the turbulence leg and you can see the vertical velocities here or something like plus or -15 meters per second very sharp.

00:35:14.950 --> 00:35:18.700
Jim Doyle (Guest)
Flying at a rather low altitude here, we did a simulation.

00:35:19.370 --> 00:35:50.730
Jim Doyle (Guest)
I'm at 150 meter resolution bit coarser than what we think of as classic turbulence resolving simulations, but nevertheless. I like it a lot because it really illustrates the multiple scales that are operating you sort of have this blue descending motion as the air flow comes down. The terrain and then before it hits Douglas Island. It rises again. So you see these warm colors of vertical motion that which really striking is all these little bright blue and red areas that are eddies being shed by the terrain.

00:35:51.080 --> 00:35:59.940
Jim Doyle (Guest)
And so these are embedded plus or -15 meter per second, a little eddies associated with the waves and wave breaking and the low levels so.

00:36:00.680 --> 00:36:08.520
Jim Doyle (Guest)
Very turbulent very hard to predict but nevertheless very important for low level aircraft.

00:36:10.620 --> 00:36:19.870
Jim Doyle (Guest)
Order to shift a little bit more tour. The upper levels now, so we have an example from a field program participated in called deep wave and dumb.

00:36:21.140 --> 00:36:36.880
Jim Doyle (Guest)
This is an example of some wave broke breaking and how sensitive it is in terms of the vertical levels. So it can you can have kind of smooth flow and right above that really turbulent breaking conditions so we are flying back and forth over the South Island.

00:36:37.690 --> 00:36:39.830
Jim Doyle (Guest)
I'm using the end card G 5.

00:36:40.660 --> 00:37:08.060
Jim Doyle (Guest)
And the terrain is shown here in the lower panel and the upper panel is the vertical velocity for 2 different levels. One around 12 kilometres one around 14 kilometres in the red first of all 12 kilometres. You could see just beyond the Crest nice kind of Lee waves, although they're not as regular as we saw over the Alps, but they're nevertheless were transient. Lee waves that weren't particularly turbulent.

00:37:08.830 --> 00:37:14.470
Jim Doyle (Guest)
Just uh about a kilometre at half about that the aircraft experienced some pretty.

00:37:15.520 --> 00:37:16.540
Jim Doyle (Guest)
Strong turbulence.

00:37:17.620 --> 00:37:18.390
Jim Doyle (Guest)
Associated with

00:37:24.410 --> 00:37:25.230
Jim Doyle (Guest)
it propagated.

00:37:27.980 --> 00:37:31.120
Jim Doyle (Guest)
Centered over the mountain range in dumb as part.

00:37:33.780 --> 00:37:35.170
Jim Doyle (Guest)
Please see the crowd.

00:37:35.760 --> 00:37:38.440
Jim Doyle (Guest)
Component at the 12 kilometre level 20 meters.

00:37:39.660 --> 00:37:41.470
Jim Doyle (Guest)
Oscillating and some of these Lee waves.

00:37:46.800 --> 00:37:57.870
Jim Doyle (Guest)
Meters per second and drop down to zero as part of that wave breaking process so that those sort of like a shoaling wave and you get turbulent dissipation and the airflow rapidly decreases.

00:37:58.660 --> 00:38:14.630
Jim Doyle (Guest)
And a little bit of another example of some similarities as a probably a much larger scale wave breaking of bent over Greenland. Of course, Greenland is very bit smoother, and very high terrain and this was done in collaboration with Mel Shapiro.

00:38:15.810 --> 00:38:16.620
Jim Doyle (Guest)
And dumb.

00:38:18.430 --> 00:38:48.740
Jim Doyle (Guest)
This shows the ice and tropes in this case, where were analyzed from a series of drop one songs that were deployed by the Noogie 4. You could see the analysis that Meldrew was a rather large region of which the atmosphere was over, turning into turbulence and the aircraft was flying at something like 35,000 feet measured. The upper part of this explicitly and so the wind speed and the cross Mount in component are shown in the red and blue.

00:38:48.790 --> 00:39:19.230
Jim Doyle (Guest)
Respectively, so this cross Mount in component. You could see the drop from about 30 meters per second down to -1. So it's reversed or -2 or so and then lots of turbulence in the sort of troth of that breaking region where things are really well mixed and you can see a very large potential temperature perturbation that is something like 30 degrees. Kelvin as it crossed through that breaking region at around 12.

00:39:19.290 --> 00:39:20.630
Jim Doyle (Guest)
Kilometer altitude.

00:39:24.650 --> 00:39:37.370
Jim Doyle (Guest)
Let's say I want to do a stick with Greenland and talk about a study that Todd Lane lead that I worked with Todd on I think believe Todds on the call so this is I thought it was super fascinating study and.

00:39:37.960 --> 00:40:07.970
Jim Doyle (Guest)
I'm in the upper left are some pilot reports of turbulence and these are colored by altitude and these are moderate or greater turbulence and they appear mostly in the 28,000 foot to 36,000 foot range. This is an interesting case where you had a cyclone kind of near the tip of Greenland and in the low levels. You have basically easterly flow and then the higher level, southerly flow and this is what we think of in terms of uh.

00:40:08.030 --> 00:40:14.920
Jim Doyle (Guest)
Critical level, it's actually a directional clip critical level, so at some level. The winds are opposing.

00:40:15.560 --> 00:40:42.060
Jim Doyle (Guest)
The low level flow, so the upper level winds are opposing the low level flow and what we like to refer to as filtering some of the gravity. Waves spectrum as it propagates vertically what that means for the aircraft aircraft. Passengers is usually turbulence in these critical levels right at the critical level itself, so the waves. We'd like to think of them as getting absorbed into the flow. But in actuality would happens is there.

00:40:42.130 --> 00:41:13.190
Jim Doyle (Guest)
I'm breaking down into turbulence and so on the right is a simulation of that event and the flow as I mentioned here. This is a West East Cross section and the flow is from the right to the left so you have the easterly flows in the low level and the upper levels basically westerly at this altitude. And this is the you wind component in color. So you could see a changes sign around between 10 and 15 kilometers.

00:41:13.960 --> 00:41:44.420
Jim Doyle (Guest)
And so we have highlighted here in red where the turbulent kinetic energy is large and you could see this really large breaking region that occurs just in the Lee of Greenland, but you could see lots of other regions of turbulence. Some of them along these arcs that are associated with this, you know vertically propagating waves and this critical level, so there being broken down as part of this critical critical level process you also see some low level turbulence as well and we had some.

00:41:44.580 --> 00:41:58.230
Jim Doyle (Guest)
A couple of low level turbulence reports, too, so it's a complicated case. But it really highlights the promise of these high resolution models and also some of the challenges with the very complicated flows.

00:41:59.160 --> 00:42:29.420
Jim Doyle (Guest)
Want to go further up into the atmosphere now for a illustration of a case that we flew there. Zealand I was on the aircraft for this flight and we took off from Christchurch in the South Island and flew over a 2 small islands. One of them was Auckland Island in New Zealand, Auckland Island, which is a territory of New Zealand and it's pretty far South of New Zealand over the open ocean has about Heights of about 700 meters. It's relatively small.

00:42:29.480 --> 00:42:39.200
Jim Doyle (Guest)
Island about 20 or 10 kilometres across kind of complex terrain. It's archipelago, uninhabited except by lots of.

00:42:40.420 --> 00:42:43.220
Jim Doyle (Guest)
Animals and birds and Penguins and so on.

00:42:44.360 --> 00:43:13.730
Jim Doyle (Guest)
So we had a nice flight and on board. This aircraft was a special instrument. A number of them that were looking up out of the top of the aircraft. The measuring various quantities at high altitudes. So we are very interested in gravity waves? What happens to the waves as they propagate from not only near the surface through the aircraft level, but to high levels in the atmosphere in this case. We're looking at an instrument that measures the airglow so this is up at 85 kilometre levels so.

00:43:13.780 --> 00:43:44.030
Jim Doyle (Guest)
Really high altitudes, but the remarkable thing I should point out about this instrument. It has some and up looking instrument. It has cameras on the wings, so it's looking up, and side and you'll see Gray shading of black and lighter Gray that indicate the wave structures at this altitude and this is Auckland Island, there in the middle that it flew over and you could see the aircraft flying. It churns in now. You could see all these wave crests that are generated by this tiny.

00:43:44.090 --> 00:43:49.300
Jim Doyle (Guest)
Little island so these very large amplitude waves can be generated.

00:43:50.360 --> 00:43:52.570
Jim Doyle (Guest)
And the the waves grow at the amplitude.

00:43:53.980 --> 00:44:23.700
Jim Doyle (Guest)
With the altitude, they grow in amplitude and they eventually breakdown in this case, it was breaking about at this level, so it was rather remarkable set of observations in underscoring as we push our limits and upward and operate at higher altitudes. We have to be mindful of the forcing from mountains and small mountains, especially that could be generating. These relatively small gravity waves at in the troposphere that grow to be rather large amplitude of the.

00:44:24.420 --> 00:44:25.780
Jim Doyle (Guest)
Stratosphere or above.

00:44:28.600 --> 00:44:51.720
Jim Doyle (Guest)
Uh lasted like to transition to a topic that looks at our ability to predict mountain waves in mountain wave turbulence and this is a simplified numerical simulation of 2 dimensions. It's along the flow X axis at the vertical and we have a a series of mountain waves that are generated by flow over this is the Sierra so we're simulating a Sierra.

00:44:52.360 --> 00:45:03.150
Jim Doyle (Guest)
A case and I wanna mention that there was an inversion near the mountain top in this excited sub strong way, so we're using an adulating modeling system and.

00:45:04.420 --> 00:45:11.230
Jim Doyle (Guest)
The edges of mathematically rigorous way of computing sensitivity of a quantity or response function to the model initial state.

00:45:11.920 --> 00:45:22.710
Jim Doyle (Guest)
I'm at an earlier time than the forecast or during the forecast so we're using a response function in this taste case or metric as the winds in the Lee of the train so we're asking what?

00:45:23.930 --> 00:45:45.550
Jim Doyle (Guest)
What are the impacts? What impacts the winds in the Lee of the terrain and these winds in the Lee of the trainer certainly linked with the mountain waves and the wave breaking a loft that occurs in this case. This is the wind speed shaded in color and there's a lot of overturning waves in this case above the mountains. This is a rather simple idealized case it's in 2 dimensions.

00:45:46.280 --> 00:45:48.790
Jim Doyle (Guest)
So now for the adjoint results so these colors.

00:45:49.720 --> 00:45:56.390
Jim Doyle (Guest)
So I will I think I'm running short on time. So I'll start to wrap up after this slide so thank you.

00:45:57.260 --> 00:46:25.830
Jim Doyle (Guest)
Uh so these colors show the sensitivity in the flow. So we have sensitivity to wave breaking aloft and these colors. We have sensitivity of the potential temperature so these are temperature sensitivities, so sensitivities of these strong winds in the mountain waves to the stability upstream so this suggests warming in this layer where you have the warm colors and cooling in the blue area where you have the cool colors and that would increase the stability.

00:46:26.510 --> 00:46:27.670
Jim Doyle (Guest)
Increases the

00:46:28.520 --> 00:46:39.420
Jim Doyle (Guest)
downslope winds and mountain waves. Likewise, the winds show sensitivity upstream of the breaking and we see things like stronger winds lead to stronger downslope flows which are Intuitive.

00:46:40.450 --> 00:46:49.370
Jim Doyle (Guest)
Now, if we look take those sensitive regions and propagate those forward in the model. We see perturbation growth that occurs and the perturbation growth.

00:46:49.980 --> 00:47:10.140
Jim Doyle (Guest)
And can be large it's increases the winds in the Lee of the train, which is what we asked the model to do. But we see lots of increases and decreases so perturbations in the lower stratosphere that indicate lots of potential uncertainties and difficult to forecast the position of these ways in the stratosphere, and let me just.

00:47:11.090 --> 00:47:42.390
Jim Doyle (Guest)
Uh end by saying This is the turbulent kinetic energy perturbation, so we see enhance regions of where the turbulent kinetic energy is growing in the lower stratosphere right along the upper troposphere lower stratosphere in the tropopause in further at higher altitudes around 20 kilometres. And So what this all means is that small errors in our initial state or observations could lead to rapid air growth in these upstream regions that will corrupt the forecasts of mountain waves.

00:47:42.810 --> 00:47:54.700
Jim Doyle (Guest)
So overall the message is that not just high resolutions or needed. But we need, and Sambals to capture the probabilistic nature of the turbulence so let me summarize.

00:47:55.720 --> 00:48:25.640
Jim Doyle (Guest)
Measurements and numerical simulations really show a rich spectrum of responses, including mountain wave turbulence that result from flow over large scale and complex terrain. We saw some examples of rotors that are really complicated, but nevertheless really intense. On the uh joint model results really show the high sensitivity to the stability and winds up stream of the mountains and also in the upper stratosphere, which is sometimes not all that, well observed.

00:48:25.730 --> 00:48:28.450
Jim Doyle (Guest)
In terms of the upstream of these breaking layers.

00:48:29.850 --> 00:48:40.350
Jim Doyle (Guest)
Predictive skill of numerical forecast is really encouraging of mountain wave turbulence and has really improved with the increased Fidelity of the models, but ultimately.

00:48:41.050 --> 00:48:52.070
Jim Doyle (Guest)
High resolution in sambol methods that are capable of explicitly resolving Mount ways should be used to provide probabilistic forecasts. I'll stop there and thank you very much.

00:48:52.790 --> 00:49:05.340
Wiebke Deierling (Guest)
Thank you very much Jim that was a very interesting talk, UM and an excellent overview of UM of various mechanisms. So I think we are out of time, unfortunately.

00:49:05.410 --> 00:49:19.550
Wiebke Deierling (Guest)
Uh to the audience if you do have questions for Jim dial. Please put them in the chat and we can maybe address them at a later time it then the discussion.

00:49:19.980 --> 00:49:26.770
Wiebke Deierling (Guest)
Uhm or otherwise through the chat, but I think we will need to move on.

00:49:28.400 --> 00:49:32.180
Wiebke Deierling (Guest)
Uh yeah in the interest of time to the our next speaker.

00:49:32.930 --> 00:49:42.490
Wiebke Deierling (Guest)
Uh, which is Doctor Paolo Paola. Rodriguez imagio and I'm sorry if uh. I hope I'm pronouncing your last name correctly.

00:49:40.940 --> 00:49:42.130
paola imazio (Invitado)
Right yes.

00:49:43.830 --> 00:49:44.680
paola imazio (Invitado)
Yes, Yeah.

00:49:45.310 --> 00:50:12.920
Wiebke Deierling (Guest)
Uh welcome power, Lisa research or off the National Science Council of Argentina. For the National Weather Service Argentinian Weather Service and she's the head of the Antarctic Atmospheric Research Group, there and and has been involved in a recent experiment with very interesting findings about clear trigger turbulence across the tropopause fold over the Drake passage and.

00:50:13.480 --> 00:50:18.860
Wiebke Deierling (Guest)
Without further ado Paula Please, please go ahead and start.

00:50:21.360 --> 00:50:25.490
paola imazio (Invitado)
OK, I will share my screen in a moment.

00:50:28.430 --> 00:50:30.810
paola imazio (Invitado)
Can everybody see me and hear me?

00:50:31.640 --> 00:50:34.720
Wiebke Deierling (Guest)
Yeah, and we see the slides fine.

00:50:32.830 --> 00:50:33.320
paola imazio (Invitado)
OK.

00:50:35.280 --> 00:51:06.510
paola imazio (Invitado)
OK, thank you so thank you for having me and thank you for the introduction. So I will try to summarize the results of the analysis of a clearer tournament event encountered by this research aircraft called Halo during itself track campaign already introduced by Andreas Dornbracht and Alex Sherman yesterday. So the aim of my talk is to show you evidence concerning more or less the fundamental nature of clearer journals that needs to be taken into account when characterizing and specially when forecasting clearer.

00:51:06.720 --> 00:51:07.280
paola imazio (Invitado)
One so.

00:51:08.190 --> 00:51:33.320
paola imazio (Invitado)
This took cover mostly basics in terms of science. The description of a turbulent atmospheric flow affect in aircraft. But maybe it will help, too. In between lies cheats. Some immagine lines feed. Some light into question regarding forecast in general and in particular for the calculation of Eddy. Dissipation rates and the role of Pireps and how aircraft campaign play a very important role in this context.

00:51:34.760 --> 00:52:04.760
paola imazio (Invitado)
Uh so as I was saying the aim of this study, hopefully published them is to characterize in detail, at Durban Active, ending counter by Halo during one of its flight, which comprehends North of the Antarctic Peninsula, where measurements are very scarce. Or as you know, and the study is performing this red leg of the flight when it was going back to Rio Grande so for this we have divided the this study, the idea to combine the approach from the classical study after balance where I come from with.

00:52:04.810 --> 00:52:34.590
paola imazio (Invitado)
Tools and analysis commonly used for operational forecasts of Gatt and for this we have divided the work into 3 main points. The first 2 where I go, which I will go very briefly are mainly to identify the large and the small scale patterns accounting for the turbulence in the surrounding atmosphere of the flag track and for this we use reanalysis data and operational radio sound that we launched once or 2 times a week from Adam, which is a tiny island here North of Albany.

00:52:34.830 --> 00:52:53.330
paola imazio (Invitado)
Yeah, and finally with will stab Lish atmospheric scenario. I will show you the analysis of time series

energy. Spectra and structure. Functions and also the calculation of turbulent kinetic energy and Eddy. Dissipation rates using the basic kalo measurement system, which has a sampling frequency of 10 Hertz.

00:52:54.420 --> 00:53:25.630
paola imazio (Invitado)
So just for you to have a very visual idea of the theological situation. I am showing you this. The animation of satellite images from tenant line of growth 16, which signified the low water vapor concentration associated with in a stratospheric air intrusion over the Drakes passage. So you can see the presence of a dryer mass identified by this very dark filament here, which moved very quickly between 12 and 18 UTC of that very same day, which is 12 November 2019.

00:53:25.880 --> 00:53:32.690
paola imazio (Invitado)
In around those times Halo was flying East Marambio on this location here approximately.

00:53:33.860 --> 00:53:43.370
paola imazio (Invitado)
So to be brief. I am showing you a different Maps to sketch this situation so they think ingredients. Here are a baller, although form South.

00:53:43.430 --> 00:54:13.330
paola imazio (Invitado)
A wet and South West of the building housing see which moved quickly between 12 and 18 UTC towards North of the Antarctic Peninsula. We can see here as in the black dot is our reference point, which is Mambu Island and we can see that the movement of this deformation between 12 and 18 UTC in this lower levels thickness and streamlines and at the same time as small and deprotonation was 4 was give gave place to the intrusion of Stratospheric.

00:54:13.440 --> 00:54:43.810
paola imazio (Invitado)
Air between 304 150 active pascals, so we see here. This air Mass with this very high content of potential vorticity and the same pool shift structured observe at lower levels moving towards the burning Salah Mario and very close to flight track and if we look for instance, to the horizontal temperature gradients. We see the presence of an upper level front more pronounced at 2:00, 158 to pascals here than 300 but we can see here on Apple level front.

00:54:44.070 --> 00:55:02.280
paola imazio (Invitado)
And if we draw a vertical line in 60 degrees very close to flight track. We can see it troubles fall identify by this well in potential vorticity between 64 and 60 degrees. South with the formation of very strong wind here on one of the edges of the falling.

00:55:03.370 --> 00:55:24.860
paola imazio (Invitado)
Uh so this pronounced values of potential vorticity horizontal temperature gradient and strong wind. Plus, the Dropper Post Falls are very good candidate for the development of clear air turbulence, so the

following step was using still reanalysis data to verify forecast forecasted cat indices. So I'm showing you here only the most significant level.

00:55:25.210 --> 00:55:58.820
paola imazio (Invitado)
Uh I I 200 and found that 258 to Pascal 's fall for Elder 12, Brown and Richardson number, according to previous thresholds using different models and in different places of the Globe, which may not apply here, but following this threshold. We can see that they all overcome threshold for moderate to severe turbulence at these levels and in particular. The Richland number indicates chair generated turbulence so moving to in situ data. I am showing you the vertical profile of the temperature from the radio song.

00:55:59.910 --> 00:56:02.250
paola imazio (Invitado)
From my Lambeau at 17:47.

00:56:03.310 --> 00:56:31.670
paola imazio (Invitado)
So what we can see here is this very sharp temperature inversion consistent what was shown in the synoptic analysis with a dropper post hide around 9.8 kilometers of 4 kilometers at 4:00. Kelvin strengthened with length of around one kilometer here, something to highlight here and is that Halo at this time was flying at around here at 13:00, 0.7 kilometers at the supplier level of 450 around these times.

00:56:32.810 --> 00:56:45.440
paola imazio (Invitado)
Uh so here I will go very briefly. This is the Model Intermodal Corporation that I will not go through, but the important thing. I want to see from this slide is that from the smoothed particle profiles of the radio sound we can calculate.

00:56:46.500 --> 00:57:17.180
paola imazio (Invitado)
Uh these 3 parameters, which are the vertical share of horizontal wind. The broom by SLF frequency and the rich person number So what we can see here is a very good description of the of the situation in terms of in theology. We see the tropopause. He hide here marked unread. We see the speak in the share that indicates a very strong dynamical instability. We see big this big here, indicating right above static stability and as a result, we see very small numbers for the Richardson number.

00:57:17.240 --> 00:57:21.360
paola imazio (Invitado)
Again, indicating sheer generated turbulence right about the troubles height.

00:57:22.780 --> 00:57:53.060
paola imazio (Invitado)
So now moving to a Hamas data, which is the the basic Halo measurement system. We can see that even though Halo was flying nearly 3 kilometers above. This folding and slightly East here on the red mark off the flag track all my theological parameters are show fluctuations usually associated with

aircraft turbulence. If we look at very closely at this time series around this latitudes. We see a temperature front within very large fluctuations in this fraction.

00:57:53.110 --> 00:58:07.540
paola imazio (Invitado)
In this latitudes for the 3 wind components and it will look more carefully. We see 2 regions very well. The limited in space. We see the Germans occurrence. The temperature front we can spot some gravity waves on North colder air.

00:58:08.080 --> 00:58:38.420
paola imazio (Invitado)
Uh right followed by constant values and a change in the wind. This is consistent with the more anisotropic flow in the direction of the Ming wind and South what we can see is a more isotropic flow and we can also deduce that the the turbulence may account for this change in the horizontal wind. So now the question is, are these fluctuations something close to fully developed airlines in the surrounding atmosphere and as you can see how it's see this which is also one of the.

00:58:38.490 --> 00:59:09.720
paola imazio (Invitado)
Actual methods to calculate edit dissipation rates using on board measurements is to still look at energy. Spectra from the velocity wing components. It's also for from for temperature, but I I will also show only. Show you the the velocity in Spectra. So I'm showing you here. The vertical left and the Sonos Energy Energy density in segments of a kilometer overlapping sub legs around. This large fluctuations observed in the time series, so we can see that both horizontal and vertical Spectra.

00:59:09.890 --> 00:59:40.740
paola imazio (Invitado)
Undergo an energy Cascade with Kolmogorov Spectrum, meaning with isotropic enormity instruments. But, however, there is a fundamental difference between vertical and horizontal Spectra and there is given by the fact that vertical Spectra seem to undergo a cascade, which stops here at around 1.3 kilometers. It becomes flat here, indicating some stability. So so the presence of stratification and if in fact, we calculate calculate the buoyancy link scale? Which.

00:59:40.880 --> 01:00:07.430
paola imazio (Invitado)
Accounts for the size of the stratification layer using our measurements. The measurements from Halo and from the radio song. We obtain a length of 1.5 kilometers and very good agreement so this will imply explain the fact that this. This signature of anisotropy prevents vertical eddies to take larger sizes where you ask for example, Eddie skin extends to further distances, generating a larger inertial range gas Cal gas gate.

01:00:08.760 --> 01:00:39.040
paola imazio (Invitado)
So now from the use of time Series A measure by the aircraft and the calculation of energy. Spectra we can calculate the departures of Wimby. Vlocity components from its main meaning the turbulent kinetic energy, which it's a good measure of large scale turbulence and the Eddy dissipation rate here at and on

the right which gives us a hint of small scale turbulence and its intensity, so for both indices. We have a big around location where the terminal spectral develops indicating moderate to severe.

01:00:39.240 --> 01:00:52.870
paola imazio (Invitado)
Rules here on Idiarte Edr on 20% of the leg, according to previous reference of on board measurements of fairly the same sampling frequencies, and light to moderate turbulence around 40% of the leg.

01:00:54.860 --> 01:01:02.950
paola imazio (Invitado)
And something that is also agreement in agreement with previous references is a slight dependence on the value of Eddy Dissipation grants with the mean wind.

01:01:03.610 --> 01:01:07.640
paola imazio (Invitado)
Which in this case is found mostly come across track?

01:01:08.280 --> 01:01:38.920
paola imazio (Invitado)
Uh in something not trivial. I would like to show here is the appearance of this second peak in the turbulent kinetic energy? Which made which is outside the the location where the spectral develops, which may indicate the presence of another turian Patch in that location. And this is quite important. We said before that, as we can see this big develops North of the event, where we said that the flow is more anisotropic and stratified with the mean wind and dispatching nature of stable is stratified.

01:01:39.310 --> 01:02:06.980
paola imazio (Invitado)
Has been recently reported in your direct numerical simulation and observational studies and it has been indicated in this reference as that I will go through later that turbulence flow with our stainless stratify are keen to develop these batches dispatches of turbulence for fruit numbers in the vicinity of 0.1 and this is a very close value to what we get here, so this is the evidence of Apache turbulent event.

01:02:08.030 --> 01:02:25.060
paola imazio (Invitado)
And finally for this case study. I would like to show you this complementary approach to characterize the flow properties and hopefully to calculate edit dissipation rate, which is the use of structure functions. This method is widely used in the classical study of turbulence and as you may know I put some.

01:02:25.700 --> 01:02:55.690
paola imazio (Invitado)
Some definitions here, but you may all know that the structure functions represent the real differences of the velocity in this case between 2 points and this approach has several advantages over spectral methods. One of them is the ability to characterize the flow independently from the aircraft. There also simpler and it's deputation. It's more straightforward in terms of real scales and that develop in the flow. So I'm showing you here. The second order structure function, which is merely the energy.

01:02:55.740 --> 01:03:25.470
paola imazio (Invitado)

In real space, we have second order structure functions for the vertical Winfield and for the so no for the horizontal win velocity along track, which is very similar to a cross track in this case. I'm not showing it so we can see as scaling consistent with the Kolmogorov prediction for inertial range that again is wider in the horizontal direction. This is another signature of anisotropy probably giving by stratification, but something more important here that the the.

01:03:26.130 --> 01:03:32.250
paola imazio (Invitado)
It's possible to be done is to go to a higher order into calculates 3rd order structure functions.

01:03:32.860 --> 01:04:02.870
paola imazio (Invitado)
Uhm so this is very good because we can if this is possible we can. Calculate edit dissipation rate from the 3rd order structure function. We can actually observe the only exact result. We have for the for the for us, dropping in homogeneous turbulence, but more importantly from here, we can actually conclude that there is a forward energy. Cascade and this is important. Because this information cannot be retrieved from Spectra or second order structure function since they are positive definite so.

01:04:03.330 --> 01:04:11.760
paola imazio (Invitado)
Here we can see again for also flex consider that they collapse to a single curve with Kolmogorov Spectra in this sub range.

01:04:12.530 --> 01:04:38.970
paola imazio (Invitado)
But this is a very nice form to calculate 3rd order structure and function who doesn't take into account fluctuations. So if we take into account for the fluctuations, meaning if we don't use the absolute value here. We get a much more fluctuating curve, which conserves the Kolmogorov scaling, but the more important here is that we can actually see that there has negative values, So what you're seeing here is a 3rd order structure function.

01:04:40.070 --> 01:04:55.930
paola imazio (Invitado)
Taking into account the fluctuations and the absolute value. Denden negative values, so the red line, which disappears here indicates negative values of the 3rd order structure function and this is what actually this is the only evidence of a forward Energy Cascade.

01:04:56.490 --> 01:05:05.130
paola imazio (Invitado)
Since uh scaling laws can appear and second order structure function and energy without an energy Spectra without flux of energy at all.

01:05:06.560 --> 01:05:35.690
paola imazio (Invitado)
And so finish in this with this case study what we can do here is to calculate with this sub inertial range. The mean any dissipation rate on each leg from the 3rd order structure function from the nice form of the structure function and we can see that the values obtained for each sub leg are in very good

agreement with those obtained with spectral methods. Show again here on the right for the 3 wind components in aircraft correlated system so this is an indication that this simple method.

01:05:35.740 --> 01:06:03.810
paola imazio (Invitado)
Method even at this low frequencies can be used to obtain Eddy. Dissipation rates and the last thing we can do here for the flow is to try to calculate the optimal of scales, which represents a smaller scales. This the the scales of the smaller eddies involved in that are real and using these mean and the broom by seller frequency obtained from the radio sound profile and what we get here is an ask me of scale of around 111 meters.

01:06:04.880 --> 01:06:34.720
paola imazio (Invitado)
So to conclude and I'm not finished yet. Uh we can simply go back to the 3 main points and read the bull case letters. But the most important thing is that based on radio sound of fairly low resolutions and aircraft measurements. We could make a very detailed description of the flow. The scales involved and we calculate edit dissipation rate using 2 different methods, which seemed to agree very well and something very important is that one of them does not depend on the type of aircraft and of course.

01:06:34.810 --> 01:07:00.660
paola imazio (Invitado)
Uh this much more comprehensive analysis can be found on the paper. Hopefully soon but being always said I would like to take one minute to draw your attention into the level of detail that needs to be considered when extrapolating. This results and methods into forecasts in general and in particular into category related products so for this. I will show you very briefly the same kind of analysis for different flight of Halo during the campaign.

01:07:01.250 --> 01:07:28.460
paola imazio (Invitado)
Related to a cat event, presumably generated by gravity wave breaking so in this case, we observed a large scale of large fluctuations in all my theological parameters, a consistent. Kolmogorov terms Spectra on a lag of around 130 kilometer, which is fairly the same as the case study. I just showed you but when calculating during chaotic energy and Eddy Dissipation rates. We don't longer see one peak associated with the event, but several.

01:07:29.220 --> 01:07:30.920
paola imazio (Invitado)
So we wonder why is this?

01:07:31.570 --> 01:08:01.290
paola imazio (Invitado)
And if we do, if we perform a closer inspection of this leg. We see that even when the whole leg, meaning this segment. I I put here. The vertical wind field velocity component and even if we can see Kolmogorov Cascade in the whole segment between the the blue lines. We can see patches like I marked hearing yellow green and red where different spectral develops no longer no longer with the Kolmogorov.

01:08:01.990 --> 01:08:18.030
paola imazio (Invitado)
A spectral in this index, so if we plot energy Spectra for these 3 patches from left to right. It's the 3 velocity components in an aircraft correlated system and from top to bottom. The different patches. We see that whereas.

01:08:18.640 --> 01:08:48.790
paola imazio (Invitado)
The yellow Patch seems to undergo a kolmogorov caps. Cascade the green and the red patches seem to have a slightly weaker turbulence in the sense of Spectral Index and this is very important because this modifies transport and dissipation properties in this patches, which we which are not which are different from Kolmogorov turbulence or from the expected from home or afternoon, so the line of thinking and I will finish here that I want you to bear in mind.

01:08:48.840 --> 01:09:20.080
paola imazio (Invitado)
Is that cat is recognized as the bursty event so the fundamental concepts related to these are still under study but the presence of dispatches can be attributed to the anisotropy imposed by stratification. We just you know, maybe important at flight level. So I put here. Some of the evidence that information and appearance of dispersed in the atmosphere and oceans and observational and direct numerical studies and I want to say that the appearance of dispatches model, which modifies transfer, and diffusions needs to be taking into account.

01:09:20.130 --> 01:09:45.380
paola imazio (Invitado)
Otherwise, we might lead we may end up with wrong. Edr calculations and wrong global statistic with at the same time, we'll give we'll have a negative impact on numerical prediction models. So this basic results related to fundamental physics of stratified terminals in the atmosphere. I think need to be taken into account seriously in the context of cap forecasts. Thank you.

01:09:47.450 --> 01:09:51.730
Wiebke Deierling (Guest)
Thank you very much. Paola UM and it was a very a great talk.

01:09:52.290 --> 01:09:56.670
Wiebke Deierling (Guest)
Uh we might have time for a very quick question.

01:09:53.160 --> 01:09:53.700
paola imazio (Invitado)
Just.

01:09:57.410 --> 01:09:59.730
Wiebke Deierling (Guest)
Uhm Steve if there are any.

01:10:00.100 --> 01:10:22.800
Steve Abelman

I don't see any specific quest oh wait. I do just just one from Jeong Hoon came across I'm wondering what is the horizontal and vertical resolution till calculate elrod one and 2 indices for capturing mountain wave turbulence. Kate, the Mount wave turbines case in your slide. Ellrod index is not inferring mountain wave turbulence, but seems to have any ability to capture them we use high resolution data.

01:10:23.920 --> 01:10:26.180
paola imazio (Invitado)
Yeah, I'm reading the question because I think.

01:10:28.450 --> 01:10:36.600
paola imazio (Invitado)
Ah, This Is This is the the resolution of Area 5 reanalysis data for the one I show it's around 25 kilometer.

01:10:37.730 --> 01:10:39.770
paola imazio (Invitado)
If this is your if that is your question.

01:10:43.790 --> 01:10:49.840
Wiebke Deierling (Guest)
OK, thank you. Paola maybe come and yeah, thank you.

01:10:46.230 --> 01:10:46.700
paola imazio (Invitado)
Thank you.

01:10:50.520 --> 01:11:05.150
Wiebke Deierling (Guest)
Uh if there's any further questions come then. Please post them in the chat and then I will have time at the end of today and the discussion session.

01:11:05.840 --> 01:11:12.940
Wiebke Deierling (Guest)
Uhm to pick them back up or alternative power light if you would wouldn't mind looking and addressing them in the in the chat.

01:11:13.510 --> 01:11:14.040
Wiebke Deierling (Guest)
Uhm.

01:11:14.430 --> 01:11:18.500
Wiebke Deierling (Guest)
Uh otherwise so thanks again.

01:11:19.120 --> 01:11:26.540
Wiebke Deierling (Guest)
Uh so then let's move on to our next speaker with a which is Walt Rogers.

01:11:27.330 --> 01:11:33.840
Wiebke Deierling (Guest)
Uhm fault, Rogers is a retired forecaster for the National Weather Service.

01:11:35.170 --> 01:11:45.740
Wiebke Deierling (Guest)
And he was managing the center Weather Service unit at the LA artsy and as I've learned I think author debit glider pilot.

01:11:46.330 --> 01:11:58.860
Wiebke Deierling (Guest)
Uhm so well, UM will provide a talk on the need for mountain wave forecasts. And so, yeah, it's it's all yours and we can see your slide 12.

01:12:00.450 --> 01:12:07.170
Walter Rogers (Guest)
Hello everyone now I don't get to practice setting this up in teams, so, give me a moment to gather here.

01:12:08.560 --> 01:12:09.470
Walter Rogers (Guest)
Ah.

01:12:11.270 --> 01:12:12.350
Walter Rogers (Guest)
There we go.

01:12:19.810 --> 01:12:21.270
Walter Rogers (Guest)
Let's see.

01:12:23.300 --> 01:12:24.930
Walter Rogers (Guest)
Let's see I need to share.

01:12:26.860 --> 01:12:34.300
Wiebke Deierling (Guest)
We can, we can see your slides, they're not in presentation mode, but the.

01:12:36.790 --> 01:12:39.110
Wiebke Deierling (Guest)
But there are pretty big.

01:12:41.980 --> 01:12:43.910
Walter Rogers (Guest)
Let me bring something over here.

01:12:46.670 --> 01:12:47.990
Walter Rogers (Guest)
Do you see anything now?

01:12:48.680 --> 01:12:50.260
Wiebke Deierling (Guest)
Yes, we can see your slides.

01:12:50.620 --> 01:12:51.210
Walter Rogers (Guest)
OK.

01:12:52.080 --> 01:12:56.100
Walter Rogers (Guest)
We're gonna go to the old favorite PDF file simple.

01:12:53.920 --> 01:12:54.460
Wiebke Deierling (Guest)
Perfect.

01:12:57.060 --> 01:13:01.100
Walter Rogers (Guest)
Well, thank you everyone for inviting me for this presentation.

01:13:01.150 --> 01:13:01.510
Walter Rogers (Guest)
No.

01:13:03.300 --> 01:13:26.170
Walter Rogers (Guest)
A little more about myself, I I'm going to be coming at this question of on the need for mountain wave forecasts from a point of view of the United States. Western United States in particular, and from the point of view of a practicality of being an operational forecaster for the many years in aviation and a glider pilot so let's get on with this.

01:13:28.170 --> 01:13:39.580
Walter Rogers (Guest)
We all know what mountain waves are it's a phenomena or environment and uh the identification of it from pilots point of view may be difficult or easy depending on their training.

01:13:40.390 --> 01:13:41.090
Walter Rogers (Guest)
Uhm.

01:13:43.230 --> 01:13:52.100
Walter Rogers (Guest)
Those of us that are meteorologist to researchers know about the training for this comb. It has lots of training struggle courses on this but.

01:13:53.750 --> 01:14:09.570
Walter Rogers (Guest)
That, it's it's there's a question about how easy it is to identify the environment. When you're preparing

for a pre flight or you're in flight as a pilot jets, particularly in general aviation pilot. Other Mountain Wave Related National Weather Service forecast. I'll address that.

01:14:10.500 --> 01:14:17.080
Walter Rogers (Guest)
What about severe mountain wave downdrafts they're usually smooth and lamb inner versus turbulence?

01:14:18.610 --> 01:14:19.660
Walter Rogers (Guest)
And a

01:14:20.680 --> 01:14:27.020
Walter Rogers (Guest)
And Downer Flying Mountain Wave phenomenon from a high resolution operational NWP point of view, I'll talk about that.

01:14:27.810 --> 01:14:32.020
Walter Rogers (Guest)
Sailplanes and glider pilots had been using mountain waves for many years.

01:14:32.650 --> 01:14:34.340
Walter Rogers (Guest)
Come to come.

01:14:35.010 --> 01:14:39.510
Walter Rogers (Guest)
Do you record flying and distance flying I will show examples and then last?

01:14:40.250 --> 01:14:48.310
Walter Rogers (Guest)
General aviation accidents related to severe downdrafts some examples and I'll wrap up.

01:14:50.390 --> 01:14:51.080
Walter Rogers (Guest)
So.

01:14:51.900 --> 01:15:02.270
Walter Rogers (Guest)
To identify a mountain wave you look at UC lenticulars you see rotor clouds cap clouds. Those of us who are in Atmospheric Sciences know what that is, and that's easy for us.

01:15:03.410 --> 01:15:19.360
Walter Rogers (Guest)
But if you're a pilot there or anyone really it's difficult to directly identify the mountain wave phenomena. If there's no lenticulars. It's invisible you have to use surface wind gusts and the leave mountain ranges or satellite imagery like the goes R Series.

01:15:20.100 --> 01:15:42.540
Walter Rogers (Guest)
Uhm sounding analysis to see the stability in the lower atmosphere and increasing wind with height. All of this. I think is asking too much of pilots to build a conceptual model and our biggest improvement that I think will be coming in. In there in future products will be using in WP high resolution models to give them an overview of where the mountain waves are.

01:15:43.950 --> 01:15:47.030
Walter Rogers (Guest)
So here's an example from.

01:15:48.360 --> 01:16:17.540
Walter Rogers (Guest)
2. Uh models the GTG graphical turbulence guidance. I apologize Bob and Julia for picking one of the combined turbulence forecasts. I mean, this graphic on the left, I should have selected mountain wave but my point was it's to show a few days ago. We had a a nice mountain wave in Italy of the Sierras as depicted on this right hand diagram, but the GT GT reliance graphic and turbulence.

01:16:18.480 --> 01:16:34.750
Walter Rogers (Guest)
Edr rates or only moderate to severe and this doesn't really tell. You too much about the mountain way from looking at that type of product, but the graphic on the right which comes from a commercially supported model used for soaring called Sky site.

01:16:35.550 --> 01:16:44.960
Walter Rogers (Guest)
Clearly shows the vertical velocity up downdrafts in the Lee of the Sierras and I think this is a lot more useful for getting that situational awareness.

01:16:48.570 --> 01:16:53.360
Walter Rogers (Guest)
What about the the discussion of aviation turbulence versus?

01:16:54.420 --> 01:17:07.160
Walter Rogers (Guest)
Mountain wave smoothed down drafts that are quite hazardous, especially for lower performing GA aircraft. There's a lot of investment in turbulence prediction both in research and and products.

01:17:07.860 --> 01:17:09.130
Walter Rogers (Guest)
71%.

01:17:09.900 --> 01:17:11.250
Walter Rogers (Guest)
I'll be airline accidents.

01:17:11.300 --> 01:17:19.610
Walter Rogers (Guest)
Some weather cost US airline accidents and they'll 20,000 to 2011 time frame. We're due to turbulence.

01:17:21.230 --> 01:17:22.590
Walter Rogers (Guest)
This takes away.

01:17:24.730 --> 01:17:50.020
Walter Rogers (Guest)
In the past production of products from National Weather Service and FAA for producing something that's hazard is these severe downdrafts from gravity waves and mountain waves. It's probably due to the fact that the occupants in airliners are not restrained minute. Many of them and therefore there's a lot more injuries in statistics to support research and development of those products.

01:17:51.060 --> 01:17:52.610
Walter Rogers (Guest)
That's the point of this graphic.

01:17:54.340 --> 01:18:01.320
Walter Rogers (Guest)
Now identifying mountain way from Alma with high resolution. NWP models is really fairly easy.

01:18:02.880 --> 01:18:04.350
Walter Rogers (Guest)
Since about 2010.

01:18:04.990 --> 01:18:05.410
Walter Rogers (Guest)
Uh.

01:18:06.340 --> 01:18:20.650
Walter Rogers (Guest)
From the point of view of operational meteorology. We've been using these high resolution rapid update models. The war frameworks, and glider pilots first began using this around 2014 when the experimental her vertical blah city.

01:18:21.150 --> 01:18:51.910
Walter Rogers (Guest)
Uh mid mid troposphere became available and this is an example of it on the top right diagram here. It shows the red orange areas is vertical motion. The blue areas as Downdrafts and it clearly shows the Lee behave in the Sierras and many other trains alleyways off the mountains and the Great Basin, Utah and the Rockies. Now, this particular graphic here was for a downwind flight about glider that I did flight briefings and dispatch for that flew all the way to.

01:18:51.990 --> 01:18:53.300
Walter Rogers (Guest)
Northeastern Wyoming.

01:18:55.010 --> 01:19:02.720
Walter Rogers (Guest)
The graphic here in the lower right hand corner is from the Sky site framework for soaring forecasting it shows.

01:19:03.600 --> 01:19:09.940
Walter Rogers (Guest)
In the Bishop area and long pioneer of the Owens Valley strong updrafts. This was just 3 days ago.

01:19:11.730 --> 01:19:27.510
Walter Rogers (Guest)
Oh yeah, yeah, I believe that is November 6. I grabbed this and one of the features of Sky side is you can do a cross section to get the vertical motion. So this is readily available. Now it's commonly used by glider pilots all over the world to locate mountain wave action.

01:19:28.320 --> 01:19:34.060
Walter Rogers (Guest)
Sky sites become a defacto source for global soaring prediction here in the last couple of years.

01:19:37.210 --> 01:20:06.170
Walter Rogers (Guest)
A little word about Matthew Scudder, who developed this all I'm going to say here is that he's done a marvelous job of creating a 2 to 4 kilometer resolution. Worf models 14 regions of the world and 6 day forecast all each day initialized by a global by the Noah GFS model. It's it's incredible what it does just take a look at the website or the Facebook postings for some of the marvelous flights.

01:20:06.400 --> 01:20:09.290
Walter Rogers (Guest)
That have been conducted and using this framework.

01:20:10.790 --> 01:20:24.730
Walter Rogers (Guest)
Providers have used mountain waves to fly long distances for many years, starting with Doctor Kutner from end car get the first 600 kilometre down when flight in 1952. Since then we've had other flights.

01:20:25.230 --> 01:20:37.380
Walter Rogers (Guest)
The The last of which in 2014. I was the flight forecaster flight dispatcher for using satellite phones to update and then we also have crosswynd flights.

01:20:37.670 --> 01:20:52.300
Walter Rogers (Guest)
Uh I'll North and South along the Sierras as many laps as you can make as fast as you can go and I'll show you an example of this with Jim Payne, who who set the online contest world record 2908 kilometres.

01:20:54.160 --> 01:20:56.890
Walter Rogers (Guest)
Jim is in our audience. I believe he's listening to this.

01:20:58.870 --> 01:21:08.990
Walter Rogers (Guest)
Back in March of 1985 Doctor Kuttner wrote an article about using the 2000 kilometer flight downwind and outline what it would take to do that.

01:21:11.560 --> 01:21:32.090
Walter Rogers (Guest)
These are the flights that have been done downwind. All the way to North Eastern Wyoming and just across the border into Texas. Starting all from the League of the Sierras anywhere from Minden, Reno area to a Mojave or California city near Tehachapi, where they climb and do a succession of climb glides.

01:21:36.120 --> 01:21:44.310
Walter Rogers (Guest)
The North South Records. There are easier to accomplish because you have long streets like freeways of updrafts.

01:21:46.190 --> 01:21:50.360
Walter Rogers (Guest)
This record of Jim Payne in 2015 shows a?

01:21:51.720 --> 01:22:17.690
Walter Rogers (Guest)
2908 Kilometre Triangle, which was I believe I'm a combination of 3 laps that lasted 12 hours in fluid an incredible 250 kilometres per hour. This her model output. I don't. I believe this was from the experimental website at ESRL or whatever. They call it now and it shows a train of waves all the way from the southern end of the Sierras into the Rocky Mountains.

01:22:19.160 --> 01:22:31.260
Walter Rogers (Guest)
The point of all this is sailplanes have been using the mountain wave products from NWP for quite awhile and it's it's working quite well to identify the tracks sometimes fairly precisely.

01:22:32.580 --> 01:22:48.140
Walter Rogers (Guest)
This is Jim pains a 2908 kilometre flight from a place called India, Kern, East, North of Los Angeles. Up to Reno as I said he did 3 laps and the altitude track here was between 5070 500 meters.

01:22:48.920 --> 01:22:55.600
Walter Rogers (Guest)
Yes, he did get special clearances from 80 and ATC to fly in the Class A airspace.

01:22:58.790 --> 01:23:20.340
Walter Rogers (Guest)
I should say one more thing about gem pain, he he's also set the world altitude record, and obvious part of that team and then in 2018 to 76,000 feet in their L calefati Argentina. I'm not going to get into that much, except this. I have some supplementary sides. If you're interested in what it looked like on that world record day.

01:23:22.810 --> 01:23:23.380
Walter Rogers (Guest)
Now.

01:23:24.270 --> 01:23:33.260
Walter Rogers (Guest)
The issue of safety for generally aviation and and business aircraft are the downdraft accidents from a mountain wave strong severe mountain waves.

01:23:34.550 --> 01:23:37.520
Walter Rogers (Guest)
In my 30 years at the air traffic Control Center.

01:23:38.620 --> 01:23:40.750
Walter Rogers (Guest)
I uh excuse me, I uh.

01:23:41.530 --> 01:23:59.470
Walter Rogers (Guest)
Have anecdotal memories of several accidents. Unfortunately, I don't have a lot of documentation on them. But they were interesting in describing this Cherokee Piper, PA 28 and Brown, 1983, was flying from the Mojave Desert Northwest.

01:24:00.100 --> 01:24:30.920
Walter Rogers (Guest)
Into the San Joaquin Valley I'd structure with a student at night encountered a downdraft and crashed in mountainous terrain now at that time, we really didn't have many tools for predicting the mountain wave. However, in a training session 2 weeks before that, I'd trained a group of pilots. One of which was that flight instructor on how to recognize the mountain wave and the need to turn around 180 degrees when you're.

01:24:31.150 --> 01:24:56.660
Walter Rogers (Guest)
It's slowing down trying to climb out of a downdraft. That's unattainable. It calls it just points out the need for more education. A similar accident in 19963 fatalities. A Cessna 172 and a very mild downdraft East of San Diego at a famous Julian Vors. Vulcain mountain were been numerous general aviation accidents due to come down Graphs Mountain Wave.

01:24:57.500 --> 01:25:05.730
Walter Rogers (Guest)
I was on a court case on that one, but this last one here. the Piper Malibu, which is a fairly high performance retractable.

01:25:06.250 --> 01:25:14.930
Walter Rogers (Guest)
A single engine aircraft just earlier this year in February of 2021 and that's The One I want to spend the time on here.

01:25:16.490 --> 01:25:21.280
Walter Rogers (Guest)
This Piper Malibu or the pilot took off from Camarillo near Oxnard.

01:25:22.190 --> 01:25:27.930
Walter Rogers (Guest)
And headed North towards the the Sierra Airport of Mammoth Lakes.

01:25:28.750 --> 01:25:30.330
Walter Rogers (Guest)
He encountered a strong.

01:25:31.060 --> 01:25:39.060
Walter Rogers (Guest)
But I own draft and the Lee of the Tehachapi Mountains. Specifically, a place called double in Tehachapi Mountain, which I'm intimately familiar with.

01:25:39.830 --> 01:25:44.250
Walter Rogers (Guest)
Encountering what looks like from the modeling of about 2000 feet a minute.

01:25:44.840 --> 01:25:59.680
Walter Rogers (Guest)
The flight aware track showed his airspeed, dropping from 140 knots 28070 and then it looks like he was unable to maintain altitude and crash at about 5500 foot level in the terrain just downwind of the mountains.

01:26:01.100 --> 01:26:07.940
Walter Rogers (Guest)
In a moment I'll show you some of the model output, but it appears a strong vertically propagating mountain wave.

01:26:08.860 --> 01:26:16.000
Walter Rogers (Guest)
Low level winds at 7300 feet of 80. Not so when he tried to climb into it. His groundspeed virtually stopped.

01:26:18.170 --> 01:26:41.550
Walter Rogers (Guest)
Bop Sharman has a preliminary analysis that showed about a 0.5. EDR value that for turbulence probably severe trigger points, although where he encountered the downdraft was likely lamb and are we don't really know for sure. But the the wavelength was about 40 kilometres. So the Rotor was welded, the southeast out in the Mojave Desert.

01:26:42.280 --> 01:26:44.660
Walter Rogers (Guest)
Here's what the some of the graphics looked like.

01:26:46.320 --> 01:27:08.940
Walter Rogers (Guest)
February 13th about 4:27 PM. The Red Circle. Here is the accident site. The winds are blowing from North from the northwest upper left to lower right and the cap cloud on the mountains was pretty close to where it was dissipating in the where I estimate to be the severe downdraft the blue dotted line.

01:27:10.030 --> 01:27:28.530
Walter Rogers (Guest)
The edge of the lenticular is over here, well to the East or Eastern Mojave. Maybe closer to rosemond or on the edge of the Northwest Edgware Edwards Air Force Base and the rotors owned down here is probably where they were calculating. Edr 's of 0.5 and the severe turbulence.

01:27:31.280 --> 01:27:35.300
Walter Rogers (Guest)
This is what the Sky site the mountain wave forecast showed.

01:27:36.610 --> 01:27:39.520
Walter Rogers (Guest)
The strong downdraft near the client has side and blue.

01:27:42.570 --> 01:27:46.790
Walter Rogers (Guest)
And a cross section using the war framework within the Sky site.

01:27:49.120 --> 01:27:52.260
Walter Rogers (Guest)
Showed in blue here at 10:00 on downdraft.

01:27:54.730 --> 01:27:59.610
Walter Rogers (Guest)
Near pretty close to the accident site followed by strong updrafts out in the desert.

01:28:00.490 --> 01:28:04.330
Walter Rogers (Guest)
With his longer wavelength of vertically propagating mountain wave.

01:28:06.710 --> 01:28:11.080
Walter Rogers (Guest)
Here's another look at what the her model was forecasting at that same point in time.

01:28:11.670 --> 01:28:15.760
Walter Rogers (Guest)
Uh discoloration right here in the center of the Red Circle is in.

01:28:16.680 --> 01:28:22.960
Walter Rogers (Guest)
Downdraft up between 7 and a half and 10 meters per second. That's about 1500 to 2000 feet a minute.

01:28:24.540 --> 01:28:36.830
Walter Rogers (Guest)
Now NTSB hasn't released a full report on this yet and some of those people may be listening. On this presentation. So I don't know what the conclusion was, but it looked pretty obvious what caused the accident.

01:28:36.890 --> 01:28:41.090
Walter Rogers (Guest)
Uh uh from meteorological conditions that were present.

01:28:44.210 --> 01:28:51.210
Walter Rogers (Guest)
Bob Sharman did a pre analysis and points out in here, he has another short presentation, which he's done.

01:28:51.680 --> 01:28:56.150
Walter Rogers (Guest)
Uh just for calculation purposes showing the Strong Mountain Wave.

01:28:56.820 --> 01:29:09.720
Walter Rogers (Guest)
Here we're looking at, I believe vorticity tropopause and blew the East West Cross. Section is on the graphic on the left and then North South Cross section on the right, I believe.

01:29:11.450 --> 01:29:18.090
Walter Rogers (Guest)
Yep, that's right and uh bladder disturbances in the stratosphere, but if you look carefully.

01:29:18.830 --> 01:29:38.150
Walter Rogers (Guest)
Uh and the lower very lower bottom of that both of these graphics. You see a red tiny red circle. It's probably a hard to see but I send tropes indicating the severe downdraft right down there at the immediately of the mountain and that's probably where we got the the strong down graphs and the.

01:29:38.870 --> 01:29:41.550
Walter Rogers (Guest)
So gusty surface winds near the ground.

01:29:43.950 --> 01:29:45.190
Walter Rogers (Guest)
So, in summary.

01:29:45.400 --> 01:29:51.130
Walter Rogers (Guest)
Uh I'm a strong supporter of developing a operational.

01:29:52.230 --> 01:29:55.740
Walter Rogers (Guest)
And WP product for mountain wave activity.

01:29:57.460 --> 01:30:01.420
Walter Rogers (Guest)
Vis fatalities from general aviation continue to occur.

01:30:02.330 --> 01:30:19.730
Walter Rogers (Guest)
And it's quite obvious from my first hand experience that identifying the mountain wave is very challenging for most pilots because even though they had training on it. They don't recall and they're fairly rare events when they do occur and putting all the pieces together is very difficult to identify it.

01:30:20.730 --> 01:30:25.790
Walter Rogers (Guest)
Glider pilots are spending a lot more and more obsessive about Meteorology and.

01:30:26.390 --> 01:30:42.490
Walter Rogers (Guest)
Finding lift for their record flights so they've understood this much better for a longer period of time and consequently, the flights that you've seen that I've I've talked about. We still need better training and education for the rest of the pilot community and ongoing.

01:30:43.150 --> 01:30:46.830
Walter Rogers (Guest)
And one other question is, do the National Weather Service warning products.

01:30:47.930 --> 01:31:15.670
Walter Rogers (Guest)
Really predict this and the answer is a sensually no there's only one advisory that predicts mountain waves and that's the center Weather Service unit center weather advisory which I have issued in the those units had issued but those offices are only off on open less than 24 hours a day and even they don't have the tools to adequately identify these severe downdraft areas, so my my recommendation is that.

01:31:19.760 --> 01:31:22.130
Walter Rogers (Guest)
That National Weather Service FAA.

01:31:23.600 --> 01:31:54.740
Walter Rogers (Guest)
Develop a guidance product for mountain wave structure, even though we can't predict the details of where the turbulence will be and the exact locations of the down and updrafts. The overall phenomena is predicted quite well and and I would like to hear from Doyle Doctor Doyle and others on my assessment of that it does a pretty these models were pretty good job of identifying the overall condition and this would go along way along with the education to reduce fatal accidents for general aviation.

01:31:55.510 --> 01:31:58.720
Walter Rogers (Guest)
So that's the end of my presentation, I'd like to encourage discussion.

01:31:59.190 --> 01:32:01.020
Walter Rogers (Guest)
Uh if if there's any questions.

01:32:02.650 --> 01:32:11.400
Wiebke Deierling (Guest)
Thank you very much fault for a very interesting talk, we do have some time for a quick comments.

01:32:12.290 --> 01:32:15.220
Wiebke Deierling (Guest)
If if there are any UM.

01:32:16.520 --> 01:32:19.260
Bob Sharman (Guest)
Well, I have one this is Bob Sherman.

01:32:21.200 --> 01:32:34.140
Bob Sharman (Guest)
Well, it looks like from your slides that really what you need is all in the her there. Her can give you a pretty good idea or at least give you some guidance.

01:32:34.970 --> 01:32:50.970
Bob Sharman (Guest)
Uh for your needs so is it just a matter of repackaging her output for your needs or do you think you need yet higher resolution or some other modifications to her that would?

01:32:51.930 --> 01:32:52.730
Bob Sharman (Guest)
Then you would need.

01:32:52.290 --> 01:33:08.160
Walter Rogers (Guest)
But well my impression is that the repackaging of what's already there would be a great start. A huge improvement over? What's available now right now, the commercial product. Sky side is doing a pretty good job of it and.

01:33:09.240 --> 01:33:30.680
Walter Rogers (Guest)
This would give the the guidance the background for a pilot to start looking when we see the strong area is now a second thing that could be done would be to develop some algorithm for looking at the hot spots for this severe downdrafts and stronger mountain waves and create some kind of an advisory type product that could be automated and point out these regions.

01:33:31.180 --> 01:33:42.690
Walter Rogers (Guest)
Uh as far as research and development for uh improvements to the model or output. I I don't have any specific suggestions and I. I'd like to hear from the rest of you what you think of this.

01:33:47.870 --> 01:34:01.540
Wiebke Deierling (Guest)
And I think this would be really good to to actually pick up back in the discussion session that we have at the end, so maybe maybe we could we could do it then.

01:33:58.030 --> 01:33:58.630
Walter Rogers (Guest)
Like really.

01:34:02.020 --> 01:34:02.720
Wiebke Deierling (Guest)
Uhm.

01:34:03.420 --> 01:34:08.860
Wiebke Deierling (Guest)
I think this was a this would be really good to follow up on a man.

01:34:09.820 --> 01:34:16.150
Wiebke Deierling (Guest)
We we do have a We are running a little bit behind, so uhm.

01:34:16.900 --> 01:34:21.940
Wiebke Deierling (Guest)
I think in the interest of time, maybe let's take a quick break.

01:34:22.540 --> 01:34:25.890
Wiebke Deierling (Guest)
And then also please if there are any.

01:34:26.300 --> 01:34:30.010
Wiebke Deierling (Guest)
Uh discussion points or or questions for Walt.

01:34:30.480 --> 01:34:50.070
Wiebke Deierling (Guest)
Uh please post them in the chat so that we can pick them up and wild. Uh maybe maybe you can also answer them in the chat in the meantime, but at the end of the set up this whole day. We do have some time slots reserved for open discussion. I think it would be good to pick it up then.

01:34:51.420 --> 01:35:05.050
Wiebke Deierling (Guest)
Thank you very much again for your talk and let's break. For now for 10 minutes and then reconvene at in in 10 minutes at 10:00 to the hour.

01:35:18.710 --> 01:35:22.840
John Williams (Guest)
Ivica it's John I'm wondering if I can test my presentation.

01:35:23.750 --> 01:35:25.100
Wiebke Deierling (Guest)
Uh yes.

01:35:25.890 --> 01:35:27.130
Wiebke Deierling (Guest)
And actually.

01:35:28.600 --> 01:35:32.770
Wiebke Deierling (Guest)
Walt could you stop sharing your presentation?

01:35:36.300 --> 01:35:36.870
Wiebke Deierling (Guest)
Thank you.

01:35:38.060 --> 01:35:43.670
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Because this is jungle? Can I also test before the session will start?

01:35:44.200 --> 01:35:44.700
Wiebke Deierling (Guest)
Yes.

01:35:45.470 --> 01:35:46.010
Wiebke Deierling (Guest)
Uhm.

01:35:45.790 --> 01:35:46.500
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
OK, thank you.

01:35:47.540 --> 01:35:48.800
Wiebke Deierling (Guest)
Let's do John first and then.

01:35:47.890 --> 01:35:51.030
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Please go ahead and post porch on and then? Yeah.

01:35:51.730 --> 01:35:52.340
Wiebke Deierling (Guest)
Perfect.

01:35:57.180 --> 01:36:06.680
John Williams (Guest)
OK, I I'm gonna need to quit and come back in apparently to have the permissions to do so. So Jeong Hoon? Why don't you go ahead and I will rejoin?

01:36:07.970 --> 01:36:09.550
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
OK great let me try.

01:36:12.720 --> 01:36:14.210
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Can you see me?

01:36:17.540 --> 01:36:19.160
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
OK let me try this.

01:36:21.520 --> 01:36:24.070
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Can you see my slide from your point?

01:36:24.320 --> 01:36:29.940
Wiebke Deierling (Guest)
And yes, we can uh you're not quite we're not not in presentation mode yet.

01:36:27.480 --> 01:36:28.200
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
OK, so.

01:36:30.630 --> 01:36:31.740
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
OK, how about this.

01:36:31.910 --> 01:36:33.090
Wiebke Deierling (Guest)
Perfect yes.

01:36:33.610 --> 01:36:39.290
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Great thank you, yeah, let me quick and then Johnny Restart.

01:36:37.110 --> 01:36:39.300
Matt Fronzak
And and Jeong Hoon.

01:36:39.910 --> 01:36:48.530
Matt Fronzak
Jeong Hoon this is Matt would you would you go back into presentation mode share one more time please and let us see if your cursor is available?

01:36:40.460 --> 01:36:40.920
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Hi.

01:36:46.270 --> 01:36:46.650
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
OK.

01:36:49.370 --> 01:36:51.540
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh OK, let me try one more time.

01:36:50.550 --> 01:36:51.110
Wiebke Deierling (Guest)
Script.

01:36:52.140 --> 01:36:52.900
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Sorry about that.

01:36:53.940 --> 01:37:05.510
Matt Fronzak
A lot of the speakers were talking as if their cursor was available when in fact, it was not available and it was very confusing to have them reference. This figure here we don't know where here is.

01:37:06.710 --> 01:37:07.820
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
OK gotcha.

01:37:09.270 --> 01:37:09.930
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
So.

01:37:12.640 --> 01:37:13.650
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Let me see.

01:37:15.280 --> 01:37:16.160
John Williams (Guest)
That's good tip.

01:37:17.320 --> 01:37:20.190
John Williams (Guest)
Uh can I try again or?

01:37:17.650 --> 01:37:20.980
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
OK can you yeah? Yes, please go ahead?

01:37:21.040 --> 01:37:23.820
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh why I'm working on this.

01:37:22.210 --> 01:37:25.960
Wiebke Deierling (Guest)
OK and and Uh John.

01:37:27.360 --> 01:37:29.230
Wiebke Deierling (Guest)
We see you OK never mind.

01:37:30.520 --> 01:37:33.150
Wiebke Deierling (Guest)
Yeah, go ahead, so we see your slides.

01:37:36.910 --> 01:37:37.820
John Williams (Guest)
You do see them.

01:37:38.440 --> 01:37:38.950
Wiebke Deierling (Guest)
Yes.

01:37:39.590 --> 01:37:40.980
Wiebke Deierling (Guest)
But not in presentation mode.

01:37:41.320 --> 01:37:42.310
John Williams (Guest)
Right OK.

01:37:42.980 --> 01:37:49.600
John Williams (Guest)
That's interesting I got a warning message but that's good, so I'm now in presentation mode.

01:37:44.360 --> 01:37:46.400
Matthias Steiner (Guest)
This stuff looks familiar John.

01:37:50.940 --> 01:37:51.500
John Williams (Guest)
Is that?

01:37:52.270 --> 01:37:53.310
John Williams (Guest)
What are you seeing?

01:37:53.480 --> 01:37:56.320
Wiebke Deierling (Guest)
Yes, now, it's in presentation mode.

01:37:57.400 --> 01:38:01.160
Matt Fronzak
Can you move your cursor around John so we can see if we if we can see it?

01:38:01.670 --> 01:38:04.240
John Williams (Guest)
Alright I'm moving, it back and forth across my name.

01:38:04.640 --> 01:38:05.710
Matt Fronzak
I do not see it.

01:38:06.330 --> 01:38:08.300
John Williams (Guest)
How about if I do it on this screen?

01:38:09.940 --> 01:38:11.210
Matt Fronzak
I still do not see it.

01:38:11.410 --> 01:38:12.570
John Williams (Guest)
OK, good to know.

01:38:16.470 --> 01:38:18.740
John Williams (Guest)
Alright I've gone out of presentation mode.

01:38:20.090 --> 01:38:21.080
Wiebke Deierling (Guest)
Now we can see it.

01:38:21.970 --> 01:38:23.930
John Williams (Guest)
And how do I go out of sharing mode?

01:38:24.510 --> 01:38:29.120
Matt Fronzak
Uh hit that same icon that you hit the share originally in that will unshare you.

01:38:32.670 --> 01:38:35.120
John Williams (Guest)
Alright the window has gone away.

01:38:35.830 --> 01:38:37.170
John Williams (Guest)
I'm glad I'm practicing.

01:38:38.840 --> 01:38:42.610
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
I think you, you need to reopen it, I guess.

01:38:39.280 --> 01:38:41.310
John Williams (Guest)
Alright I see it reduced.

01:38:45.280 --> 01:38:47.720
Matt Fronzak
Yeah, and you're you're back out now John that's good.

01:38:45.780 --> 01:38:46.100
John Williams (Guest)
And.

01:38:47.630 --> 01:38:49.090
John Williams (Guest)
OK, OK very good.

01:38:50.530 --> 01:38:54.520
⌧⌧⌧
After June I I will try again in my presentation.

01:38:56.070 --> 01:38:56.990
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
OK, please go ahead.

01:38:58.280 --> 01:39:02.020
⌧⌧⌧
Alright yeah after after your presentation test.

01:39:01.720 --> 01:39:03.810
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Oh really OK, let me try first.

01:39:02.880 --> 01:39:03.520
⌧⌧⌧
Ah, OK.

01:39:11.360 --> 01:39:14.770
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Can you see my screen because or map?

01:39:13.880 --> 01:39:14.510
Wiebke Deierling (Guest)
Yes.

01:39:14.470 --> 01:39:14.850
Matt Fronzak
Yes.

01:39:15.500 --> 01:39:15.930
Wiebke Deierling (Guest)
Yes.

01:39:15.680 --> 01:39:23.670
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
OK let me move on to the full screen mode and let me try to make my pointer laser pointer to see.

01:39:24.470 --> 01:39:29.430
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
If you guys can see or not you see my screen and pointer as well.

01:39:26.240 --> 01:39:26.780
Wiebke Deierling (Guest)
Yes.

01:39:26.420 --> 01:39:27.760
Matt Fronzak
Yes, we did yes.

01:39:29.920 --> 01:39:30.420
Matt Fronzak
Yes.

01:39:30.570 --> 01:39:32.840
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Walking out OK great thank you.

01:39:34.030 --> 01:39:41.100
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
John I think you uh you need to use a laser pointer when you are in a full screen mode. I guess better have.

01:39:40.540 --> 01:39:44.150
John Williams (Guest)
Alright, where where do I find that is it? What it's one of the icons.

01:39:48.200 --> 01:39:56.550
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
I think you can use the right click, and then you can select a laser pointer.

01:39:57.470 --> 01:39:59.410
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
In your fruits full screen mode.

01:40:00.750 --> 01:40:07.170
John Williams (Guest)
OK, when I'm in the screen mode, OK alright I'll either do that, or try to be very descriptive.

01:40:09.850 --> 01:40:18.430
Matt Fronzak
Yeah, you know, John I I always think that a day like this. When I learn a new trick in PowerPoint is is a successful day and I should just hang it up at this point.

01:40:20.780 --> 01:40:21.470
John Williams (Guest)
I hear you.

01:40:24.940 --> 01:40:27.790
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Alright thank you. I'm done Anna Maybe.

01:40:28.700 --> 01:40:30.340
Wiebke Deierling (Guest)
Hey young would you like to?

01:40:29.660 --> 01:40:31.270
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
So Hey Young, John music right.

01:40:41.250 --> 01:40:41.470
☒☒☒
K.

01:40:41.520 --> 01:40:43.610
☒☒☒
Can you see my presentation file?

01:40:44.210 --> 01:40:50.360
Wiebke Deierling (Guest)
No, we see UM just the Microsoft Teams window.

01:40:45.490 --> 01:40:46.070
☒☒☒
No.

01:40:48.150 --> 01:40:48.740
☒☒☒
Oops.

01:40:50.630 --> 01:40:55.440
☒☒☒
Oh is it problem is OK, I will try again.

01:41:13.120 --> 01:41:18.770
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
I think you can I try to share not the entire screen like the window.

01:41:16.110 --> 01:41:16.630
☒☒☒
Can you

01:41:20.660 --> 01:41:22.730
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
So that we can see the screen.

01:41:23.860 --> 01:41:24.770
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
The PowerPoint.

01:41:27.390 --> 01:41:30.360
☒☒☒
can you see see my presentation file?

01:41:30.460 --> 01:41:34.340
Wiebke Deierling (Guest)
No, we still see the the Microsoft Teams.

01:41:31.280 --> 01:41:31.720
☒☒☒
No.

01:41:33.730 --> 01:41:34.370
☒☒☒
Oops.

01:41:35.010 --> 01:41:35.810
Wiebke Deierling (Guest)
Window.

01:41:35.500 --> 01:41:35.910
☒☒☒
Wow.

01:41:43.410 --> 01:41:47.880
Matt Fronzak
I think Jeong Hoon was had the the the correct tip for you.

01:41:48.890 --> 01:41:53.510
Matt Fronzak
But I I don't know how to say it quite in Korean so maybe he can.

01:41:54.020 --> 01:41:55.180
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
OK let me have.

01:41:56.370 --> 01:41:59.100
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Jackie Aprile share tray years or?

01:42:00.120 --> 01:42:02.420
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Desktop window yeah.

01:42:00.130 --> 01:42:02.450
☒☒☒
Tom come on Tom come on, you get.

01:42:04.830 --> 01:42:06.900
☒☒☒
She couldn't they eating me cook.

01:42:09.100 --> 01:42:10.860
☒☒☒
Case 2 that you got in there.

01:42:13.670 --> 01:42:14.780
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Or colon?

01:42:13.940 --> 01:42:15.720
☒☒☒
Your presentation they eating meat.

01:42:15.780 --> 01:42:16.590
☒☒☒
Montgomery mall.

01:42:16.650 --> 01:42:16.970
☒☒☒
Luther.

01:42:17.030 --> 01:42:17.690
☒☒☒
No, that's all.

01:42:18.590 --> 01:42:19.040
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Yeah.

01:42:18.610 --> 01:42:19.130
☒☒☒
Gay.

01:42:20.300 --> 01:42:23.590
☒☒☒
Konane, Georgia dining gardening guy go Turkey hunting.

01:42:24.340 --> 01:42:27.590
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
All conditions cleaner works Alright well, she.

01:42:26.750 --> 01:42:31.590
☒☒☒
Oh, Chromeo Junkermann screening fighters.

01:42:27.760 --> 01:42:28.300
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Oh, OK.

01:42:29.410 --> 01:42:30.640
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Yeah, still.

01:42:31.640 --> 01:42:33.070
☒☒☒
You go do not go down.

01:42:34.700 --> 01:42:40.220
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Yeah, so clean shell do potent originals, or window to grow clicker.

01:42:40.400 --> 01:42:41.840
☒☒☒
Hi Monique, or Chinese.

01:42:42.660 --> 01:42:45.170
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Tongue tongue click on PowerPoint.

01:42:44.360 --> 01:42:44.820
Matt Fronzak
People.

01:42:44.560 --> 01:42:46.330
☒☒☒
Or tunnel deal man.

01:42:46.990 --> 01:42:47.440
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Video.

01:42:48.600 --> 01:42:49.670
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Or you know without you know.

01:42:48.810 --> 01:42:50.870
☒☒☒
Tony Tony I got lonely.

01:42:49.600 --> 01:42:50.220
Matt Fronzak
There it is.

01:42:51.440 --> 01:42:52.970
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
But how maybe they did not mean that? Yeah.

01:42:54.600 --> 01:42:59.530
☒☒☒
I could data collection, there can you see my presentation file now?

01:42:56.680 --> 01:42:57.850
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
I don't even know now.

01:42:59.860 --> 01:43:00.460
Wiebke Deierling (Guest)
Yes.

01:42:59.910 --> 01:43:00.400
Matt Fronzak
Yes.

01:43:00.190 --> 01:43:00.500
☒☒☒
Yeah.

01:43:00.550 --> 01:43:01.340
Matthias Steiner (Guest)
This.

01:43:01.190 --> 01:43:05.260
⌧⌧⌧
Uh can you see the the uh?

01:43:06.330 --> 01:43:07.060
Matthias Steiner (Guest)
Yes.

01:43:06.690 --> 01:43:08.530
⌧⌧⌧
Errors I mean, it's a?

01:43:08.480 --> 01:43:10.500
Matthias Steiner (Guest)
It's like a hand moving around.

01:43:10.700 --> 01:43:15.550
⌧⌧⌧
OK then I think it's OK. Maybe it's going to yes.

01:43:10.820 --> 01:43:11.280
Matt Fronzak
Yes.

01:43:13.610 --> 01:43:13.950
Matt Fronzak
Yep.

01:43:18.070 --> 01:43:25.910
Matt Fronzak
Yeah, all you want to do is is make that right side. Uh collapse to the right. Yep, Yep, Yep perfect.

01:43:18.390 --> 01:43:18.970
⌧⌧⌧
OK.

01:43:26.570 --> 01:43:28.000
⌧⌧⌧
OK, thank you.

01:43:37.450 --> 01:43:38.800
Domingo Munoz-Esparza (Guest)
Should I try mine now OK?

01:43:39.180 --> 01:43:39.760
Wiebke Deierling (Guest)
Uh sure.

01:43:42.910 --> 01:43:46.820
Domingo Munoz-Esparza (Guest)
And then we can like get ready, yeah, I can share.

01:43:47.690 --> 01:43:55.120
Matt Fronzak
You know uh Vika I have a vested interest in making sure that all these presenters can can do their own thing, so I don't have to do anything.

01:43:56.020 --> 01:44:01.750
Wiebke Deierling (Guest)
That sounds good. Actually could you check with Domingo? I need to go to the just a quick break.

01:44:02.220 --> 01:44:09.000
Matt Fronzak
Yeah, yeah. Yes, yes, indeed OK Domingo I see your screen, not in presentation mode, but I see your screen.

01:44:04.680 --> 01:44:04.910
Wiebke Deierling (Guest)
Like.

01:44:07.910 --> 01:44:08.540
Domingo Munoz-Esparza (Guest)
Moving.

01:44:08.990 --> 01:44:10.380
Domingo Munoz-Esparza (Guest)
If I leave you now.

01:44:11.290 --> 01:44:15.880
Matt Fronzak
I see your screen now can you move your cursor I see your cursor moving to your good?

01:44:16.780 --> 01:44:17.730
Domingo Munoz-Esparza (Guest)
OK, perfect.

01:44:20.340 --> 01:44:22.030
Domingo Munoz-Esparza (Guest)
I just stopped for a second.

01:44:23.480 --> 01:44:23.960
Domingo Munoz-Esparza (Guest)
There we go.

01:45:46.260 --> 01:45:49.450
Wiebke Deierling (Guest)
OK, welcome back everybody, UM.

01:45:51.270 --> 01:45:53.930
Wiebke Deierling (Guest)
So 2 to the second part.

01:45:54.650 --> 01:45:56.480
Wiebke Deierling (Guest)
Uh after days talks.

01:45:57.880 --> 01:46:02.670
Wiebke Deierling (Guest)
And the the first speaker will be.

01:46:02.720 --> 01:46:06.700
Wiebke Deierling (Guest)
We uh Domingo when you're so sparser who's a scientist.

01:46:06.930 --> 01:46:13.920
Wiebke Deierling (Guest)
Uhm at the evaluation applications program within a 10 car and the research applications lab.

01:46:14.590 --> 01:46:16.570
Wiebke Deierling (Guest)
And come here.

01:46:17.020 --> 01:46:25.640
Wiebke Deierling (Guest)
Uh his area of expertise is eviation metrology as well as boundary layer meteorology and he will be presenting.

01:46:26.130 --> 01:46:33.090
Wiebke Deierling (Guest)
Uh maybe some results about wind and turbulence predictions within the urban environment.

01:46:33.720 --> 01:46:36.090
Wiebke Deierling (Guest)
And so uh Domingo.

01:46:37.810 --> 01:46:39.150
Wiebke Deierling (Guest)
The floor is yours.

01:46:39.870 --> 01:46:47.330
Domingo Munoz-Esparza (Guest)
Thank you very thank you for the introduction and thank you again. Bob and Tammy for inviting me to present at the workshop.

01:46:48.500 --> 01:46:55.230
Domingo Munoz-Esparza (Guest)
So I just said that yeah, I'm going to be uh briefly sharing with you guys, some of the recent developments with with made.

01:46:55.280 --> 01:47:19.460
Domingo Munoz-Esparza (Guest)
Yeah, it took over new model capable of forecasting wind and turbulence prediction within the urban environment and why that's a big important at low level area operation or Urban Air mobility material with alluding to before moving on, you would like to acknowledge my Co author and colleagues. I think our team, and they have been made this work possible so.

01:47:19.520 --> 01:47:25.700
Domingo Munoz-Esparza (Guest)
So many of you may know in the other series of wide range of scales that are actually.

01:47:26.020 --> 01:47:33.590
Domingo Munoz-Esparza (Guest)
During interacting across the entire energy spectrum, so that's kind of what I've tried to simplify here or Salmonella Cymatic way.

01:47:34.200 --> 01:47:45.480
Domingo Munoz-Esparza (Guest)
So we go from whether she turned out to mess with Kate Saunders Thurman ultimately in the end to the micro scale and and street scalar or building kind of a urban environment.

01:47:46.080 --> 01:47:56.260
Domingo Munoz-Esparza (Guest)
So depending on the actual scale that we are trying to simulate and you've heard a lot already over. Those 2 days about global and Regional Medical weather models.

01:47:56.310 --> 01:48:07.460
Domingo Munoz-Esparza (Guest)
Uh, which will be more for weather prediction of latter case had massive scale down to arrange a few kilometers, but to do Michael Cal bundler turban prediction.

01:48:09.060 --> 01:48:25.100
Domingo Munoz-Esparza (Guest)
We're gonna employ then Michael Kay models and those are more research elective simulation code like for example, fast daily then I'm going to be talking to you in a second, but so with while that very, very interesting approach, which has some advantages as I'm trying to

01:48:25.500 --> 01:48:33.730
Domingo Munoz-Esparza (Guest)
uh synthesized in there, so you can have an explicit representation of turbulence, so no more need for parametrisation or or inference model that.

01:48:34.390 --> 01:48:39.110
Domingo Munoz-Esparza (Guest)
Not only to learn but also some other microscale drivers, including terrain, urban cloud.

01:48:39.230 --> 01:49:09.300
Domingo Munoz-Esparza (Guest)
But the limitation is that conventional CPU based model. They are not efficient for performing real time prediction beyond something around 100 meter even for the largest supercomputers in the world, but also let the prediction or forecasting side of things IE alone. Also, the speed of those model when you go to find resolution slow. It's also the pace of scientific operation undercover E and ultimately informing.

01:49:09.360 --> 01:49:20.950
Domingo Munoz-Esparza (Guest)
And we've element of permutation in there and some other models. So they were kind of one of the main reasons why we, we are anchor. I have been developing a book called fast daily moral.

01:49:21.770 --> 01:49:25.400
Domingo Munoz-Esparza (Guest)
And and that we know and effort that started nearly 5 years ago.

01:49:26.360 --> 01:49:38.290
Domingo Munoz-Esparza (Guest)
So actually one of the key main features of 530 is that instead of rain on CPU. It will be it from scratch to run a fully run in GPU then that would be cool.

01:49:38.350 --> 01:50:05.750
Domingo Munoz-Esparza (Guest)
My GPU resident model so it would no actually and then some from AAD further. Some other problem that I in fact, GPU can perform computation much more fast faster than the CPU and I want to get into details of a comparing those but you can see tell him there in the left panel figure here comparing different generations of CPU versus GPU performance so Indian fast 3 D as I said.

01:50:06.210 --> 01:50:14.670
Domingo Munoz-Esparza (Guest)
Yeah, it, it, it on the frig model for simulating boundary layer flow and it had actually potential to provide real time forecast at meter scale.

01:50:15.320 --> 01:50:22.400
Domingo Munoz-Esparza (Guest)
And that he particularly it incorporates explicit urban modeling capability, which are of relevant for a lower level.

01:50:22.790 --> 01:50:25.460
Domingo Munoz-Esparza (Guest)
Add aircraft and I have the Asian.

01:50:27.070 --> 01:50:30.750
Domingo Munoz-Esparza (Guest)
Operations so that they give you one more little hint here.

01:50:31.370 --> 01:50:40.390
Domingo Munoz-Esparza (Guest)
With one GPU we can actually see the same performant that at that I conventional CPU code will will get with 256 acres.

01:50:41.040 --> 01:51:12.250
Domingo Munoz-Esparza (Guest)
So it into something more and now the city to the urban environment modeling and low level turbulence, so this is the way we add up. The summary light on how we model buildings within the first 30 model. So we use? What's called in my body force method. I VFM which it will develop a really by channel each and a smaller cabbage. Separately, a bug in 2007 and then we have recently extended to handle thermal effects, and to be scaling dependent.

01:51:12.530 --> 01:51:21.060
Domingo Munoz-Esparza (Guest)
So would that mean that we can impose buoyancy effects in the in the flow, according to build in temperature and also that it can be applied to a?

01:51:21.440 --> 01:51:37.960
Domingo Munoz-Esparza (Guest)
Yeah, and then we tried agreed site which is at desirable feature so here on the left side you can see every simple example of flow over an isolated, economical flow over an isolated building and you can see typical roof point you may have seen in books on that.

01:51:38.210 --> 01:52:04.440
Domingo Munoz-Esparza (Guest)
Uh and the pair of counter rotating vortices around the left side of the building flow goes from left to right and then those volumes have been rendering red and why these they are heightening kinetic energy region and then you can see also very clearly. The Big Horseshoe Book Vertex upstream of building so kind of Canonical feature and this emerged method without getting I'm much more interested.

01:52:05.030 --> 01:52:35.350
Domingo Munoz-Esparza (Guest)
Still, but it give you what you would expect with that as evil city inside building and then control temperature will you see on the animation playing there so we've done some verification and validation value brooch and within 530 or how much time to get into the details there. But you can look at at that at that reference and this is one of the cases. We simulated wind tunnels parameter also under Frick scale. So you're looking at the 3 velocity component there an animation of flow over downtown Oklahoma City.

01:52:35.620 --> 01:52:43.550
Domingo Munoz-Esparza (Guest)
A 2 meter resolution which we use for uh validating fast 30 winter turbulent dispersion.

01:52:43.750 --> 01:52:50.450
Domingo Munoz-Esparza (Guest)
You could do it campaign back in 2003 joint urban uh so.

01:52:51.420 --> 01:53:06.450
Domingo Munoz-Esparza (Guest)
Actually, you can see that now when we move into a more realistic environment. Even building layout. You can see how they have very intricate and complex. I flow pattern developing in Yeah, within the urban canopy. There are unsteady and actually or very.

01:53:06.510 --> 01:53:14.800
Domingo Munoz-Esparza (Guest)
Uh uh even if you look complex, it using a very simple weather, forcing simplified static idealized weather so.

01:53:15.660 --> 01:53:39.920
Domingo Munoz-Esparza (Guest)
No actually what we've been working on recently with we moved into more a more realistic scenario. So what we've done is we've developed capability to couple for telling the world, so and you can see that kind of shown in the upper part of the slide so for example, we've been focusing on dwarf fast daily so you can see here typical multidomain.

01:53:40.370 --> 01:54:00.000
Domingo Munoz-Esparza (Guest)
Uh work computer vision 27, 9 to 3 kilometer actually at the same resolution purposely said at the higher uses operationally and then we've got 3 kilometer, then we can have an embedded domain that it's have run with the lattice simulation with fat 30. We represent building so you can see, there the building.

01:54:00.060 --> 01:54:23.060
Domingo Munoz-Esparza (Guest)
Uh building layout over a year since early 5 by 5 kilometer grid, which will be yeah, not even 2. Red points on the higher or you can say how much detail right. You can be able to represent when you go down to a 5 meter read spacing and there are some details on how we do that coupling and we need to resolve create or integrate resolved turbulence in the largest simulation model.

01:54:23.970 --> 01:54:48.150
Domingo Munoz-Esparza (Guest)
So for those of you that are injured, yeah, you complete those papers. I I don't have time here to liberate in there, so it does show couple of a of example here So what you see on the very busy multi planner at the bottom left, but I'm trying to point with my with my cursor. So, we, we did at at Primanti. With that framework to show for the same time of the day to have local time in downtown Dallas.

01:54:49.300 --> 01:55:11.200
Domingo Munoz-Esparza (Guest)
In January 2018? How would the wind speed and travel in the tradition would look like for that exact same time of the day different days of the month and you can even see from a very high level perspective, but don't look quite different and I actually. They even look more different. I just start looking at small details right so this is just to show or illustrate here how.

01:55:12.670 --> 01:55:33.000
Domingo Munoz-Esparza (Guest)
Weather prevents streetscape radiation, they they have a really strong day-to-day variability and and and and they're very tightly, coupled together, so that kind of takes away the notion of trying to find a typical representative day to inform some of those fine scale operations in the urban environment, so that might actually be totally reading and.

01:55:33.050 --> 01:55:33.400
Domingo Munoz-Esparza (Guest)
Uh.

01:55:34.130 --> 01:55:52.740
Domingo Munoz-Esparza (Guest)
Only country, yeah, they're very complex interaction between the urban layout and strict liability and and some of the large scale weather component. That Ultra fundamental key aspects of the urban flow such as building where exact Canyon flows and their NNN region, not only in terms of.

01:55:53.410 --> 01:55:59.610
Domingo Munoz-Esparza (Guest)
Location and intensity prosody timing of those uh and spreadable regions so.

01:56:01.090 --> 01:56:04.470
Domingo Munoz-Esparza (Guest)
Now going to actually get to kind of show one application.

01:56:04.580 --> 01:56:10.030
Domingo Munoz-Esparza (Guest)
Uh uh the the richness of that type of information and and and the the the.

01:56:10.090 --> 01:56:20.860
Domingo Munoz-Esparza (Guest)
It's a value that we can get out of it. So now in that very same example of the Holidays. In January, we, we did some hypothetical flying.

01:56:20.920 --> 01:56:50.960
Domingo Munoz-Esparza (Guest)
Uh they have small UAV so you can see that represented here on on that translator going a through be simple. One area very well generally chosen A at a given height there to kind of illustrate what you can see here on those panels so that the vehicle flights from a TV which takes about 25 minutes. You can see on the top panel every Gray line. It's one of the different. Yeah, different days are we different weather. Venus period and we are highlighting here for typical label.

01:56:51.160 --> 01:56:58.340
Domingo Munoz-Esparza (Guest)
Flag and then the larger tke underwear TV funding cases in in red and blue so you can see this.

01:56:58.390 --> 01:56:58.570
Domingo Munoz-Esparza (Guest)
Like.

01:56:59.730 --> 01:57:06.550
Domingo Munoz-Esparza (Guest)
Very wide range of viability even more so when you're going into a traveling kinetic energy.

01:57:07.240 --> 01:57:14.760
Domingo Munoz-Esparza (Guest)
You can switch it displayed here in the log scale. You can see that there can be actually differences of up to 2 orders of magnitude.

01:57:16.430 --> 01:57:34.590
Domingo Munoz-Esparza (Guest)
Depending on their different days, but not really different depending on the actual section of the of the city that at the UAV flying through and normally intensity. But you can see the different scales of Trubel, representing all different modes and in those signals. So pretty goblin picture and the.

01:57:34.940 --> 01:58:01.910
Domingo Munoz-Esparza (Guest)
Uh pointed to everywhere else, it unique and actually we need to be able to inform operator with with this kind of a a information detail and we actually did one further example. Here exercise on that team came which was to plug a very simple model for what will be the binary drainage at the UAV will be flying through our translator, so ideally if you don't period.

01:58:01.970 --> 01:58:32.330
Domingo Munoz-Esparza (Guest)
That uh moderate 2 flat or or even severe you should be able to fly 25 minutes and then make it a degree. But you can see actually if that, depending on the Triple A level that you can be consuming that at battery much faster and this is what I'm showing on the bottom left histogram here. It's so typically it. It actually will require for that flight 1.68. I'll more battery, but you can actually even get to to be something like 3 times, so some meaning if you're trying to accomplish.

01:58:32.390 --> 01:58:38.830
Domingo Munoz-Esparza (Guest)
That mission survey data or delivery whatever that is with the UAV that particular one Friday through it.

01:58:39.570 --> 01:58:48.660
Domingo Munoz-Esparza (Guest)
Then you made it to top like a 3rd of the way so again. Those are details that cannot be captured with their with typical missile Cal or or weather model.

01:58:48.710 --> 01:59:18.980
Domingo Munoz-Esparza (Guest)
Uh and like her or or or or worth more. Generally speaking, and actually those very high Fidelity, simulation or their meetings. Kaylor I made for that and they kind of a good one more step in. In terms of challenging I was showing you the scenario of the different days of the month I as static weather till full weather warfare. Driven fast daily simulations of whenever environment, but they can get even more complicated than uh actually my dear.

01:59:19.100 --> 01:59:48.910
Domingo Munoz-Esparza (Guest)
Yeah, same here little bit of work here with this slide showing because I I dimensions, so, so we simulated so there can be cases where you have rapid weather changes right and and I perfect sample of that. It's a cold front so we simulated cold front passing through downtown Dallas on November 11th 2019 and over the span of 3 hours. You can see wind changing by order 150 degree wind speed, increasing vitamin every second temperature, dropping by 15 curving and I tell you too, too.

01:59:49.250 --> 02:00:19.540
Domingo Munoz-Esparza (Guest)
Show a little bit of that very local local effect. Some variability within the urban canopy. We put 3 stations here. So you have vertical velocity panel on the left and then horizontal wind speed on the right and then you add on the bottom panel. You are seeing wind speed wind direction tooling kinetic energy and potential temperature how they work overtime or those 3 station and now I'm going to quickly animated GIF. You you've seen the ability for but you can see early on, and and given the actual payment of those sensor there or hypothetical.

02:00:19.610 --> 02:00:38.720
Domingo Munoz-Esparza (Guest)
OK so you don't get too much different. But as soon as they are little bit of wind rotation, with time to pick up you can see that those started presents in very, very different condition. The daughter represented with the higher or war, freaking amateur model BC and and you know it. It may give you something that it's a overall.

02:00:38.930 --> 02:01:08.920
Domingo Munoz-Esparza (Guest)
At reasonable for the average but it's not actually good for any of the Pacific location and you can see how you can help us stimulating flows you can have a very Pacific unique local anesthetic condition that are required that at that very explicit modeling as I was saying so there to conclude a whole bunch. I've been able to convince your or showing some evidence that we and turbulent distribution. The urban environment. There are actually quite a quite complex on that day that very intricate.

02:01:10.370 --> 02:01:23.120
Domingo Munoz-Esparza (Guest)
Interaction between large scale weather local tilletti effects. Urban canopy, which makes it a well number one, not able to be predicted by by typical weather model because if I add resolution issue.

02:01:23.780 --> 02:01:31.480
Domingo Munoz-Esparza (Guest)

Yeah, but at the same time, Michael came along wouldn't get the job done so we need to have a bullet came earlier strategy, which is?

02:01:32.390 --> 02:01:45.540
Domingo Munoz-Esparza (Guest)
In the end if we can push that before cutting mode. That's only feasible with every accelerated. GPU models as sort of fast daily and as you mentioned before and and I think there was some allusion to do that in some of the other talks.

02:01:45.590 --> 02:02:15.880
Domingo Munoz-Esparza (Guest)
The University of GPU is it that with moderate resources we can get the job done so. Now we can think about doing ensemble prediction right and then look at uncertainty quantification, but Indian will have all moral and morale by definition. There are wrong. But some of them can be useful and that's a definitely we need to look at Unsampled and do all those things so in 2 very quickly wrapped it up. We are now next as next steps are pushing to deploy that workflow framework were faulty.

02:02:15.920 --> 02:02:42.530
Domingo Munoz-Esparza (Guest)
Had the cloud so we can do things that are not yeah, which will need to run our supercomputer or on a GPU cluster better also extending factory capability to include drawn generated noise estimation capability, which can be also useful and we are also getting into developing artificial intelligent machine learning reduced order models trained with high Fidelity. Fast theory for Ultra failed predictions of winds and turbulence in your environment.

02:02:44.110 --> 02:02:47.980
Domingo Munoz-Esparza (Guest)
That's everything I got thank you and I'll be happy today. Give me any quitting from here.

02:02:49.330 --> 02:02:54.910
Wiebke Deierling (Guest)
Thank you very much Domingo Steve I think we have some time for questions.

02:02:56.160 --> 02:03:01.440
Steve Abelman
Yes, excuse me, yeah, yeah, some pretty spirited discussion going on about the previous.

02:03:02.950 --> 02:03:27.270
Steve Abelman
On the previous talks so please take a look if you're interested in that I do see one Commission question for you, Domingo from? What Rogers what about using the Les 5 to 10 meter resolution models to virtually fly. Ultra low speed aircraft. UAV 's like the arrow environment shapes to determine aircraft response is. It practical to get the voluminous data sets to do such simulations.

02:03:28.630 --> 02:03:41.590
Domingo Munoz-Esparza (Guest)
Yeah, so that that's a really good point. Uh yeah, definitely they can add a lot of value for for Baker

reports and we've been doing some work with that. Yeah, actually Larry Korman have been involved in some of those efforts at the same time.

02:03:42.210 --> 02:04:13.830
Domingo Munoz-Esparza (Guest)
Uh Yes, there is a lot of data that gets generated. However, we can do some more or many of the calculation in schedule or or or or what we call on the flight. So I'll be running the model. We could derive those metrics. If we know what they are a priority so for the reset failed. Yes, we output. The huge data set but when we know exactly where. We are after we could actually help that virtual flying drone. I will run the simulation and then we wouldn't even need to output any data so that that's something we are kind of trying to get into in situ.

02:04:13.970 --> 02:04:23.290
Domingo Munoz-Esparza (Guest)
Uh uh put processing of data in C 2 product as we run. Yeah, every time you write today is that penalizing view on the speed of computation.

02:04:25.090 --> 02:04:30.470
Steve Abelman
OK thanks a couple more for samples at this scale? What is the best approach.

02:04:31.350 --> 02:04:36.510
Steve Abelman
Uh musing ensembles from the driving model or per debating at the scale of the of the model.

02:04:31.890 --> 02:04:32.440
Domingo Munoz-Esparza (Guest)
Well.

02:04:37.400 --> 02:04:39.930
Domingo Munoz-Esparza (Guest)
I think so, yeah, I don't have an answer for you.

02:04:39.990 --> 02:05:00.660
Domingo Munoz-Esparza (Guest)
Program that's very good point that we don't know yet there are different factors one being large scale for us in different large scale for saying it and make huge impact, but there are also a epistemic uncertainties in the actual lattice. Simulation model from from building layout to inclusion of trees and canopy that actually also could could.

02:05:00.710 --> 02:05:19.200
Domingo Munoz-Esparza (Guest)
That could lead to some some relevant ensemble spread and that's something that we definitely will we would like to get started working on pretty soon and and that we are pushing too. But yeah, I'll have an answer for that, yet, but I would assume a combination of both but large scale where the frame place probably even a major role so.

02:05:21.130 --> 02:05:22.100
Domingo Munoz-Esparza (Guest)
A great point? Yeah.

02:05:21.320 --> 02:05:25.390
Steve Abelman
OK, we've got we've got a couple more questions of each and how we do with time.

02:05:31.840 --> 02:05:36.400
Steve Abelman
OK, I'll go I'll go ahead and move on to one more question looks like because, on another.

02:05:37.120 --> 02:05:46.210
Steve Abelman
Chat right now, so uh from Jim Doyle do fast. Eddie do fast. Eddie resent boundary layer clouds and microphysics if not are there plans to include it?

02:05:47.110 --> 02:05:55.400
Domingo Munoz-Esparza (Guest)
So I tell you the answer to that is yes. So we recently incorporated moist dynamics and clouds and a simple precipitation so we're working on those.

02:05:55.450 --> 02:06:20.620
Domingo Munoz-Esparza (Guest)
Uh with TJ to add radiation and the land surface and which are the next 2 things that we're going to be working on and and at that point, it would be a full full numerical weather prediction at the micro scale. But as you will probably know from your idealizing permits. I mean, you're neither of the physics. I component to get some of the things so we're getting there and yeah, definitely we have clouds and moisture and and rain included already.

02:06:22.630 --> 02:06:29.510
Wiebke Deierling (Guest)
Thank you very much and sorry. I technically I had operator error. I pushed the wrong button Steve.

02:06:30.010 --> 02:06:34.390
Steve Abelman
OK, I thought you were maybe having a side conversation or something that's good.

02:06:30.400 --> 02:06:30.810
Wiebke Deierling (Guest)
Ah.

02:06:34.320 --> 02:06:40.740
Wiebke Deierling (Guest)
No, I I put my camera on, but not I didn't didn't hit the mute button, unfortunately so.

02:06:42.120 --> 02:06:50.160
Wiebke Deierling (Guest)

I mute button, I guess umso, UM thanks so much. Domingo, a very nice talk. Let's move on to the next speaker.

02:06:50.930 --> 02:06:53.400
Wiebke Deierling (Guest)
Uh and uh, yeah, please.

02:06:53.600 --> 02:07:06.270
Wiebke Deierling (Guest)
Uh uh the discussion can continue in the talk, UM and we can again pick it up later also in the open discussion. So let's move on to the next Speaker John Williams.

02:07:06.950 --> 02:07:10.770
Wiebke Deierling (Guest)
Uhm John Williams was the head of the weather. I I server services.

02:07:10.840 --> 02:07:16.360
Wiebke Deierling (Guest)
Uhm uh IBM, the brother company, UM, he has been.

02:07:16.630 --> 02:07:26.140
Wiebke Deierling (Guest)
Uh also has a long track record of being in the field of aviation turbulence and without further ado.

02:07:26.190 --> 02:07:33.840
Wiebke Deierling (Guest)
You UM, John John is going to talk about probabilistic forecasting for eviation turbulence, the floor is yours.

02:07:35.180 --> 02:07:38.020
John Williams (Guest)
Thank you very much becaue I can you hear me OK?

02:07:39.340 --> 02:07:40.300
Wiebke Deierling (Guest)
Yes, very well.

02:07:40.620 --> 02:08:00.540
John Williams (Guest)
OK very good alright well, thanks so much to you and to the other organizers for inviting me to speak today about the use and misuse of probabilistic forecasting for aviation turbulence and know that there are many more qualified people on this call then I am to give this presentation, so I look forward to your feedback and discussion later.

02:08:01.450 --> 02:08:20.150
John Williams (Guest)
My goal in this talk is to argue that we now have the ingredients needed to provide forecasts of the turbulence distribution that aircraft may encounter in a region of airspace and that doing this opens the door to rigorous cost last analysis and improved potentially improved decisions.

02:08:21.980 --> 02:08:46.800
John Williams (Guest)
So many of you likely associate the weather company with our wet Weather Channel brand or weather.com website. But we also provide weather products to a number of industries, including aviation through RWSI brand and in particular, we have an operational turbulence forecast that produces global outlooks of turbulence intensity that we provide to airlines and others. VRR Fusion pilot brief and data products.

02:08:47.430 --> 02:08:59.550
John Williams (Guest)
In our turbulence forecast runs on our global 15 kilometre. NWP model based on the model for prediction across scales or impasse using a method very similar to dog.

02:09:01.720 --> 02:09:06.840
John Williams (Guest)
Our overall goal is better weather impacted decisions and.

02:09:08.100 --> 02:09:20.780
John Williams (Guest)
Nearly 30 years ago, Alan Murphy wrote that forecasts possessed no intrinsic value. They acquire value through their ability to influence the decisions made by users of the forecasts.

02:09:21.410 --> 02:09:26.380
John Williams (Guest)
So putting together the pieces of the decisions puzzle requires asking the question.

02:09:27.060 --> 02:09:36.000
John Williams (Guest)
Well could the weather be in the future. How does that weather and and available action translate into impacts that we care about?

02:09:36.840 --> 02:09:46.540
John Williams (Guest)
What is the value of that impact that outcome and what is the action or series of actions that maximizes the expected value.

02:09:48.140 --> 02:09:55.710
John Williams (Guest)
In the context of aviation turbulence. Our goal is to make optimal decisions to avoid or mitigate turbulence encounters.

02:09:56.520 --> 02:10:02.720
John Williams (Guest)
We ask what is the distribution of YDR that the aircraft could encounter in a region of airspace.

02:10:03.530 --> 02:10:06.380
John Williams (Guest)
And what are the winds and other hazards as well?

02:10:07.410 --> 02:10:18.530
John Williams (Guest)
How does each possible edr encounter translate into the aircraft response say the root mean squared G load given the aircraft type Wade altitude and flight conditions.

02:10:19.450 --> 02:10:27.390
John Williams (Guest)
How does that response translate into a cost a possible injury perhaps or they need to take the aircraft out of service for inspection.

02:10:28.510 --> 02:10:35.450
John Williams (Guest)
And finally what is the flight path and cabbage management strategy and other strategies that minimize the expected cost?

02:10:38.760 --> 02:10:45.690
John Williams (Guest)
The nuanced information provided by probabilistic forecasts has the potential to enable better decisions.

02:10:46.880 --> 02:11:02.330
John Williams (Guest)
Uh for turbulence mitigation for example, consider a mid sized aircraft at cruising altitude. Entering a region of airspace where the edr is forecast to be 0.28 well into the moderate turbulence range.

02:11:03.190 --> 02:11:08.730
John Williams (Guest)
Should that aircraft take action to avoid that airspace at the expense of additional fuel in time.

02:11:10.010 --> 02:11:22.820
John Williams (Guest)
Here are deterministic rule of thumb say avoid forecast moderate or greater turbulence when reasonably possible may save say 30% of what the costs would be without that information.

02:11:24.380 --> 02:11:34.350
John Williams (Guest)
However, using more nuanced information from a probabilistic turbulence forecast one might save an additional 20% of the unmitigated unmitigated costs.

02:11:35.500 --> 02:11:47.860
John Williams (Guest)
This example is notional not based on a careful study, but Pierce Buchanan has done a study and argued that probabilistic turbulence forecasts have 25% greater value than deterministic ones do.

02:11:50.850 --> 02:11:53.320
John Williams (Guest)
Telestrat why this may be the case.

02:11:54.060 --> 02:12:02.360
John Williams (Guest)
Consider a mid sized aircraft at cruise say about to penetrate a region of GTG forecast edr of 0.28.

02:12:03.270 --> 02:12:28.470
John Williams (Guest)
Even though GTG provides the state of the art best possible forecast. It still has uncertainty due to a number of factors. NWP model forecast errors. The limits of NWP model resolution which may not capture the temporal or spatial scales of the turbulence. The linkage of the turbulence diagnostics that are used to the scales affecting the aircraft.

02:12:29.220 --> 02:12:58.700
John Williams (Guest)
Can homogeneity of the turbulence? Which may be quite patchy and the random nature of turbulence. In fact even idealized experiments. The timing and angle of an aircraft flight through a volume of simulated homogeneous turbulence can produce significant variability in the turbulence actually experienced by the aircraft and you think I think of the aircraft is transmitting a a jumble of eddies, which are constantly changing so each flight path is a little bit different.

02:13:00.350 --> 02:13:07.970
John Williams (Guest)
So the edr prediction of 0.28 may be totally correct in the mean but the experience turbulence will vary.

02:13:08.660 --> 02:13:20.020
John Williams (Guest)
If the distribution is narrow as on the left. Then they experienced DDR will be between 0.2 and 0.4 and it's severe encounter is very unlikely.

02:13:21.080 --> 02:13:27.450
John Williams (Guest)
If the distribution is wider has on the right the probability of a severe encounter, maybe 2%.

02:13:28.050 --> 02:13:35.110
John Williams (Guest)
As a tail of the distribution extends past the DDR threshold of say, 0.44 square craft of this size.

02:13:38.020 --> 02:13:43.220
John Williams (Guest)
So how does knowing that help well let's consider a simple cost loss analysis.

02:13:43.900 --> 02:13:58.600
John Williams (Guest)
Let's simplify the situation and say that the possible weather is either severe turbulence with the probability of 2% or benign with the probability of 98%, ignoring the intermediate turbulence possibilities for the moment.

02:13:59.740 --> 02:14:05.830
John Williams (Guest)
And let's suppose that a deviation will cost $300.00 in extra fuel and accounting for time.

02:14:06.760 --> 02:14:10.090
John Williams (Guest)
If you don't deviate, though, and a severe encounter.

02:14:11.330 --> 02:14:21.930
John Williams (Guest)
'cause Yeah, and you do encounter severe turbulence that would cost the airline say an average of $25,000.00. I have no idea if that's the right number, but for illustrative purposes.

02:14:23.090 --> 02:14:40.720
John Williams (Guest)
So you could calculate the expected cost of not deviating is 0.02, * 25,000 or $500.00, whereas the cost of the deviation was $300.00. So the airline could save an average of $200.00 per event by deviating in cases like this.

02:14:43.490 --> 02:14:59.180
John Williams (Guest)
Unfortunately, we have a lot of information that can be used to formulate probabilities so ugh methodology pioneered by Bob and others has a large number of turbulence diagnostics, which themselves comprise an ensemble of turbulence forecasts.

02:15:00.050 --> 02:15:12.110
John Williams (Guest)
And in fact, soon after, he introduced DTG Bob and others quickly derived a turban. That's probability from the fraction of diagnostics exceeding categorical thresholds.

02:15:12.810 --> 02:15:18.630
John Williams (Guest)
As well as he and others have used multiple NWP model ensembles.

02:15:21.310 --> 02:15:32.060
John Williams (Guest)
Now you can't necessarily use a raw ensemble. But there are statistical and machine learning algorithms like logistic regression or K nearest neighbors random forests.

02:15:32.690 --> 02:15:53.900
John Williams (Guest)
2 and other methods for post processing that can be used to combine and calibrate a combination of turbulence diagnostics and different models. And maybe even combined with satellite and radar data or lightning data to provide probabilistic now casts of convectively induced turbulence for instance, as illustrated here in the case study on the right.

02:15:56.310 --> 02:16:16.600
John Williams (Guest)

So we have a lot of ingredients multiple NWP models time lagged ensembles. Trump we can incorporate previous generation times to make those time lagged ensembles. We'd even take a window valid times, so the forecast for the previous hour and the the next hour to get off a whole bunch of different predictions.

02:16:17.360 --> 02:16:31.800
John Williams (Guest)
Observations can be incorporated into now casts via machine learning data Fusion algorithms and ensemble post processing algorithms can be used to create calibrated probabilistic turbulence nowcast and forecast grids.

02:16:34.570 --> 02:16:38.460
John Williams (Guest)
So what attributes do probabilistic forecasts need to be useful.

02:16:39.270 --> 02:16:54.510
John Williams (Guest)
Well, first of all they need to be clearly defined in other words. What is it the probability that they're measuring? Is it the likelihood of turbulence in a category per nautical mile or per minute of flight.

02:16:55.270 --> 02:17:05.660
John Williams (Guest)
If you don't define that you can't account properly for the turbulence volume or the size of duration that makes it a lot harder to do the kind of modeling and costs loss analysis that I just presented.

02:17:06.910 --> 02:17:23.460
John Williams (Guest)
They need to be calibrated the probabilities must be accurate, so in particular, they need to be reliable. If you say turbulence is going to happen with some likelihood then? It ought to happen with a frequency that matches that likelihood and and a number of similar cases.

02:17:24.140 --> 02:17:32.790
John Williams (Guest)
Or probability integral transform diagrams is showing the shown in the lower right? That's the distribution of verifying observations.

02:17:33.380 --> 02:17:35.440
John Williams (Guest)
Every percentile in your distribution.

02:17:36.080 --> 02:17:45.950
John Williams (Guest)
At your forecast distribution should have an equal chance of being close. The closest to the observation so in these pit diagrams on the lower left.

02:17:46.560 --> 02:17:54.540
John Williams (Guest)

That shows an uncalibrated forecast whereas the one on the right is flat and shows a better distribution across verifying percentiles.

02:17:56.060 --> 02:18:01.510
John Williams (Guest)
If you don't have calibration you can't do accurate cost loss estimates.

02:18:02.370 --> 02:18:14.570
John Williams (Guest)
And, of course, the forecast should be as sharp as possible, because more specific forecasts provide more information. And those are measured with low brier scores for instance, where low CR PS.

02:18:16.570 --> 02:18:20.010
John Williams (Guest)
Which is is similar to me for I mean absolute error?

02:18:20.430 --> 02:18:23.450
John Williams (Guest)
A continuous ranked probability score.

02:18:25.300 --> 02:18:28.370
John Williams (Guest)
Otherwise, you can have forecasts that are calibrated, but not useful.

02:18:29.110 --> 02:18:36.700
John Williams (Guest)
And then finally as I've alluded to a couple of times already it's really helpful. If you forecast the entire probability distribution function.

02:18:37.380 --> 02:18:48.010
John Williams (Guest)
That provides the probability for every edr the aircraft may encounter and allows you to translate to encounter cost for a variety of aircraft types weights and flight conditions.

02:18:49.880 --> 02:18:52.360
John Williams (Guest)
So to look illustrate that last point.

02:18:52.980 --> 02:18:58.730
John Williams (Guest)
Uhm PDF forecasts make translation to impacts for different aircraft easier.

02:18:59.480 --> 02:19:03.730
John Williams (Guest)
Consider 2 aircraft experiencing and DDR of 0.2.

02:19:04.450 --> 02:19:22.730
John Williams (Guest)
For the large aircraft that could be light or light to moderate turbulence and its impact for the smaller

one. It could mean moderate turbulence or even higher and be much more significant so saying that the probability of EDR greater than 0.2 is 15% could have very, very different implications for these 2 aircraft.

02:19:23.480 --> 02:19:39.760
John Williams (Guest)
Fortunately, Bob and Julie and others have provided formulas for converting edr to root mean squared G load, which is a metric for the impact of turbulence on the aircraft. The plot on the right also shows how different DDR values correspond to different turbulence, severity categories for different sized aircraft.

02:19:40.460 --> 02:19:48.110
John Williams (Guest)
So PDF forecast includes probabilities for Continuum of the edr thresholds that may have relevant impacts.

02:19:50.630 --> 02:20:24.090
John Williams (Guest)
To see this concretely consider the calibrated PDF forecast on the left with a mean edr prediction of 0.2 for a large and a small aircraft that distribution of edr translates to distribute do the distributions of root mean squared G load shown in the middle 2 plots. I've illustrated a notional translation of the cost of an encounter with each RMSG value as shown by the solid lines on those plots bigger RMSG levels have bigger costs. But the shape of the curves may be somewhat different for the different.

02:20:24.140 --> 02:20:24.630
John Williams (Guest)
Aircraft.

02:20:25.290 --> 02:20:37.960
John Williams (Guest)
So then each cost has a probability and a second translation produces a distribution of costs that the aircraft will experience allowing decisions based on expected costs and risks.

02:20:38.640 --> 02:20:54.010
John Williams (Guest)
In this case, the expected costs were the smaller aircraft is over $1000.00 suggesting the importance of not penetrating the region, whereas the larger aircraft hasn't expected impact of just $20.00 so much might be much more but benign for that aircraft.

02:20:56.220 --> 02:21:25.160
John Williams (Guest)
So far I've talked just about simple deviation decision, but flight planning is another important application. Of course, and it's one example and the work illustrated here led by Manuela, South sour hazard regions are identified based on exceedance of certain thresholds, allowing them to be displayed as 3 D obstacles the user can then evaluate whether a planned flight will intersect one of these regions and automated route. Optimization tools can find the minimum fuel route to avoid them.

02:21:25.640 --> 02:21:35.430
John Williams (Guest)
Jeong Hoon, Kim and others have used probabilistic turbulence, then winds to create wind optimal routes using sort of the greater new wants of the probabilistic forecasts.

02:21:38.050 --> 02:22:01.960
John Williams (Guest)
So PDF for turbulence forecasts allow translations into turbulence encounter costs that allow route selection for each route. Of course, you can add up. The expected costs to get an estimate of the total cost of that route, including hazard impact also you can incorporate fuel and delay costs or you could optimize at the fleet level by complaining comparing playbooks each of which has a set of flights.

02:22:03.000 --> 02:22:24.020
John Williams (Guest)
PDF forecasts also allow comparisons to climatological means different thresholds to characterize the relative risk of any level of turbulence or one could even create Maps. Planview Maps that translate the PDF forecast. Each pixel into an expected cost for your particular aircraft at its weight and in flight conditions.

02:22:24.980 --> 02:22:28.020
John Williams (Guest)
Add to that would I think greatly simplify.

02:22:28.200 --> 02:22:58.950
John Williams (Guest)
Uh you know the decision making process, there are a number. I've alluded to the fact. There are number of methods for doing post processing and creating PDF forecasts. One is Bayesian model averaging also headers to get asked extended logistic regression. A deep learning and AI method has been used recently and on the on the right hand side here. I've illustrated how Bayesian model averaging can be used to represent a number of different forecasts as as sort of Gaussians with.

02:22:59.010 --> 02:23:04.780
John Williams (Guest)
With different Heights with different weights and combine them into some sort of a combined distribution.

02:23:07.190 --> 02:23:17.400
John Williams (Guest)
So, in summary numerical weather prediction model and turbulence diagnostic ensembles offer rich uncertainty information that can be really useful if we harness it.

02:23:18.170 --> 02:23:35.980
John Williams (Guest)
The post processing can be used to produce calibrated probabilities and the turbulence PDF forecast can support optimal decision. Making translation to aircraft response and encounter costs relative risk and cost Maps route selection deviation decisions, cabbage management.

02:23:36.570 --> 02:24:07.520
John Williams (Guest)
And and so forth on the other hand, in the misuse category uncalibrated poorly defined or inaccurate. Probabilities can be misleading, so going back to this plot on the right. We've talked about how to take the edr into the response into the cost and finally into the flight path or decision, that minimizes the expected cost of course I've slept a lot of things under the rug, including some of the complexities of of turbulence observations, but I I hope this framework has some.

02:24:07.580 --> 02:24:07.960
John Williams (Guest)
Value.

02:24:08.710 --> 02:24:12.630
John Williams (Guest)
And with that I will finish and be happy to take any questions that there's time.

02:24:13.420 --> 02:24:18.270
Wiebke Deierling (Guest)
Thank you very much John I think we have time for maybe one or 2 questions.

02:24:20.590 --> 02:24:21.380
Wiebke Deierling (Guest)
Steve.

02:24:20.660 --> 02:24:21.180
Steve Abelman
Hey.

02:24:22.200 --> 02:24:28.010
Steve Abelman
Hey John, comma couple questions from Matt one dish and I'm gonna try to put it together Matt.

02:24:29.430 --> 02:24:44.610
Steve Abelman
So when we discuss value of forecasts in the costs to last sentence. It is important to note that range of cost of loss ratios where that increased value is realized and how that Maps to estimates of actual user costs a lot Cheerios.

02:24:48.180 --> 02:24:50.140
John Williams (Guest)
Was that a comment or question?

02:24:51.590 --> 02:24:54.840
Steve Abelman
That may have actually just putting it so let me go to his second question.

02:24:51.770 --> 02:24:52.340
John Williams (Guest)
Uhm.

02:24:55.550 --> 02:24:56.070
John Williams (Guest)
OK.

02:24:56.560 --> 02:25:06.390
Steve Abelman
Guarding AML approaches is there a reason to prefer using turbulence diagnostics as inputs to the EM algorithms, rather than raw model output or perhaps gradients of Roblox.

02:25:09.790 --> 02:25:12.220
John Williams (Guest)
I'm sorry I was, I was reading could you say that again.

02:25:12.870 --> 02:25:13.300
Steve Abelman
Sure.

02:25:13.860 --> 02:25:16.090
John Williams (Guest)
As trying to find it over here.

02:25:14.330 --> 02:25:14.610
Steve Abelman
Or.

02:25:15.800 --> 02:25:24.890
Steve Abelman
Regarding ML approach is is there a reason to prefer using turbulence diagnostics its inputs to the algorithm rather than raw output model that's gradients abroad.

02:25:25.540 --> 02:25:53.890
John Williams (Guest)
Yeah, OK, yeah, very good question. I think that my experience of machine learning. Algorithms has been very often if you can give them a leg up by finding features or or things that are known to be physically relevant to the problem that you're solving you can often get faster better, more robust results. But some of these new methods like deep learning are very good at taking raw model data and.

02:25:54.070 --> 02:26:12.180
John Williams (Guest)
Finding those features and and finding those abstractions and and using them so I think it's it's a great it's an insightful question Madden probably an interesting area of research that could could we take raw model data and and do as well. Or maybe even find out some things that we hadn't suspected in the data.

02:26:14.350 --> 02:26:15.900
Steve Abelman
OK, a lot of comments.

02:26:17.230 --> 02:26:21.030
Steve Abelman
You know commenting mostly about how good this talk was.

02:26:22.680 --> 02:26:24.850
Steve Abelman
I think I'll pass it back onto.

02:26:25.780 --> 02:26:28.180
Steve Abelman
To you so we can keep moving.

02:26:28.930 --> 02:26:32.460
Wiebke Deierling (Guest)
Sounds good OK, thanks so much John UM.

02:26:32.130 --> 02:26:32.660
John Williams (Guest)
Thank you.

02:26:33.180 --> 02:26:34.690
Wiebke Deierling (Guest)
And then

02:26:35.500 --> 02:26:42.980
Wiebke Deierling (Guest)
uh let's move on to the next speaker a professor here young son from Yonsei University.

02:26:43.560 --> 02:26:51.610
Wiebke Deierling (Guest)
Uhm shiism been performing research in the field of aviation turbulence for a very long time.

02:26:52.410 --> 02:26:56.730
Wiebke Deierling (Guest)
Uh and then she is going to present to us.

02:26:56.780 --> 02:27:05.100
Wiebke Deierling (Guest)
Some uh atmospheric turbulence estimation using high vertical radio Harry vertical resolution radius one data.

02:27:05.640 --> 02:27:08.520
Wiebke Deierling (Guest)
And he hung up the floor is yours.

02:27:09.310 --> 02:27:11.800
☒☒☒
Can you see my presentation file?

02:27:11.430 --> 02:27:14.530
Wiebke Deierling (Guest)
Yes yes very well and we can hear you very well too.

02:27:12.540 --> 02:27:12.920
☒☒☒
OK.

02:27:13.620 --> 02:27:31.170
☒☒☒
OK, thank you. Thank you for inviting me to this nice workshop and today I like talk about atmospheric table on estimation using high body collaboration. Lady agenda data in USA and this work is done with my student hand, Tango and I acknowledge it.

02:27:31.230 --> 02:27:36.170
☒☒☒
Either pop shaman identical for providing the flight data.

02:27:38.030 --> 02:27:53.530
☒☒☒
Outline of my talk is following after a brief introduction to the atmospheric turbulence. I will talk about soap method and data and then I'll show the characteristics and potential associates or of the estimated top loans.

02:27:53.910 --> 02:28:04.790
☒☒☒
Ah, it's based on recently published the paper and then I will compare this regard with the Institute flight edr and finally I summarize my talk.

02:28:06.240 --> 02:28:16.140
☒☒☒
Ah, it's we know that most predictable learns plays an important role in momentum and energy exchange between different scales of atmospheric motions.

02:28:16.680 --> 02:28:27.040
☒☒☒
Ah, but the understanding the atmosphere turbulence is considerable challenging due to the localized intermittent and sporadic nature of turbulence.

02:28:27.730 --> 02:28:36.280
☒☒☒
An observation I had trouble on studies in the free atmosphere had been done using data aircraft and local observations.

02:28:36.860 --> 02:28:54.910

⊠⊠⊠

But the geographical coverage of those instrument is highly limited and recently the table on estimation based on the sort method using operational Lady Agenda Data with one second is Russian. I have been conducted over based regions.

02:28:56.770 --> 02:29:27.020

⊠⊠⊠

This shows the maximum number of labels populated underreport here. The popular color are represented data more than 3000 per one day so it's one second data, mostly in the European countries and the Oceania continent. But since 2015. There are more stations archived one second data, including Korean station and Japan and China station so.

02:29:27.310 --> 02:29:57.330

⊠⊠⊠

Always some more higher resolution data is available now, I briefly described the throw professor. It's originally in the ocean study using the object density profile. Yeah, the object property of density is publicly displaced by turbulent motion from a basic stable proper without time for significant molecular diffusion so this is resulted density properly just put.

02:29:57.390 --> 02:30:27.210

⊠⊠⊠

Yeah, or sings it decreases with height and in the atmosphere, the potential temperature can be used since class and cancer 2008. So the Red Copper is the observed potential temperature and blue copies so resorted potential temperature and this method is applied to the free atmosphere and here is the case of the object potentially temperature again in the red color and.

02:30:27.530 --> 02:30:49.530

⊠⊠⊠

The Blue is resulted temperature so this, the locations go to the GS in the resulted profile. So the difference between these 2 is defined as the throughput displacement and this is like this and the this root mean square of this value.

02:30:50.010 --> 02:31:13.400

⊠⊠⊠

Uh in the detected tabloids layer is the 3rd scale, something like that. And this is the overturning body. Cascade overtop loans and these soaps care is correlated with daughter. Middle scale and using the linear correlation coefficient. C we end up the edit this patient date in terms of stroke scale.

02:31:14.040 --> 02:31:37.060

⊠⊠⊠

Hit the CK disease care and in the original paper by class and cancer user 0.3. But in the recent researches. It's using 1.0 based on the comparison with the radar data or more final resolution pollen data so in this study, we also use the 1.0.

02:31:39.140 --> 02:32:08.770

⊠⊠⊠

In this study, we used operational lady down the station data at 68, US stations, so one second data twice a day 0012 UTC for 60 years and this shows the time series of data type for each stations. Here, the blue curve is absorbed from the Lockheed Martin.

02:32:08.830 --> 02:32:39.190

⊠⊠⊠

Instrument and red color is the by Sarah 's 92 and this recent study by Galleria dairy showed that the transition of radio on the instrument can significantly affected our table on estimation. So the upper panel is some case without the transition and low calories. Jacksonville Florida case with the transitions so after changing the instrument.

02:32:39.230 --> 02:32:46.040

⊠⊠⊠

The reality is quite different so, based on this study, we used only.

02:32:46.180 --> 02:32:56.110

⊠⊠⊠

Yeah, uh data are measured by Lockheed Martin because the number of log piles are much larger than the visor object data.

02:32:57.980 --> 02:33:06.470

⊠⊠⊠

This shows the occurrence number of log Epsilon in the troposphere and stratosphere and low panels and sickness.

02:33:07.250 --> 02:33:20.070

⊠⊠⊠

Uh the more strong turbulence occurs in the troposphere, then in the stratosphere, and largest in JJ in the troposphere, but this is not.

02:33:20.570 --> 02:33:50.040

⊠⊠⊠

Uh clearly evidence in the stratosphere regarding the sickness are the mean and medium thickness is about twice larger in the tropics appeared in the stratosphere, and the largest value is in JJ when sickness is less than 1000 meter. But in the DJF when the sickness is larger than subject matter and in the stratosphere, DJ app is large.

02:33:52.040 --> 02:34:02.520

⊠⊠⊠

This shows the horizontal distribution over layer means sickness of turbulence layer. We consider the 3 kilometer they are beans.

02:34:03.090 --> 02:34:21.750

☒☒☒

Uh this is increasing, with height below Twitter kilometer. It's like this, but decrease above trip kilometer and in the below table kilometer. The sickness is larger in defend.

02:34:21.960 --> 02:34:40.530

☒☒☒

Mm-hmm, but uh above 15 kilometer. It's large value is in disarray at near the mountain area. So it's a Western Mountain region and southeastern region is 2 major region for sick sickness of turbulence layer.

02:34:41.340 --> 02:34:48.280

☒☒☒

Uh they shows the horizontal distribution overlay, I mean over 10 Epsilon this structure is.

02:34:48.340 --> 02:35:20.390

☒☒☒

So it's a kind of opposite to the Cygnus future and this is somewhat unexpected because the layer mean log 10 accidents large in the stratosphere. And this is likely, because the number of cases for top lines in each 3 kilometer. Beanies much less in the stratosphere than in the troposphere. So we found that this simple layer mean does not properly presented the characteristics of a top.

02:35:20.620 --> 02:35:53.990

☒☒☒

See Nietzsche layer so we kind of include the particle portion of turbulence occupation in each bin so we define the new quantity layer mean effective Epsilon is combining topless intensity and sickness of problems. So we define the East such like this so it's a G is the layer depths. It's a 3 kilometer in this study, and then we multiple the Epsilon or multiple by sickness.

02:35:54.330 --> 02:36:06.550

☒☒☒

So for example, in the 3629 kilometer being there are 3 turbulence layers with this values, then we kind of calculate it like this.

02:36:07.410 --> 02:36:32.300

☒☒☒

Uh the right panel shows the horizontal distribution of our layer mean effective. Epsilon, which he has much reasonable structure with a strong value in the stratosphere, and low value in the troposphere and the low battery in the stratosphere with the maximum near the Western Mountain area.

02:36:34.120 --> 02:37:02.750

☒☒☒

Now we examine the potential sources of our age. We already estimated turbulence using enough. I've realized data. The original legislation is 0.25, 5.25 and it's we use hourly data for the same 6 year period.

Although the either 5,000,000. This data is find a solution data. But the body Calculator spacing is not quite good above.

02:37:03.410 --> 02:37:20.570

⊠⊠⊠

Say, a 10 kilometre so for example, the 21 kilometer is the particle grid. Spacing is a streak in more than 3 kilometer so in this calculation. The reader to the below only 221 kilometer are shown.

02:37:21.170 --> 02:37:34.130

⊠⊠⊠

Uh we consider the 4 or turbulence indices. Brondby setup frequency and bodyguard. Windshear and all over epic rap web drag and then convective precipitation.

02:37:36.590 --> 02:37:48.680

⊠⊠⊠

This shows the horizontal distribution of N Square and body car windshield in every 3 kilometer. Everyone and the bottom 3 to 6 kilometer the?

02:37:50.210 --> 02:38:08.560

⊠⊠⊠

In this case, the smallest in western mountain region is specially in JJ and from 6 to 15 kilometer. It's more like data to dinner based is increased with higher latitude.

02:38:08.810 --> 02:38:39.730

⊠⊠⊠

I left a tooth until here, but the values are small in JJ but in 18 to 21 kilometer. The large values in the lower attitude. Then in the Hydrate Itude and this is because the latitudinal temperature structure is opposite in this height in the middle latitude in the particle. Windshear hits the large value in eastern USA.

02:38:39.780 --> 02:38:43.770

⊠⊠⊠

In most latitude and season because it's the.

02:38:44.500 --> 02:38:47.460

⊠⊠⊠

Strong jet stream in the eastern United States.

02:38:47.970 --> 02:39:03.040

⊠⊠⊠

Uh the 18 to 21 kilometer. The particle wins this year is much smaller than other height and this is also it's a smaller body color variation of large scale wind in the middle latitudes stratosphere.

02:39:05.620 --> 02:39:36.800

⊠⊠⊠

These shows are ugly pig ripped away with drag uh so as we expected. It's a strong values in the Western mountain regions and secondary pig is in eastern mountain area and it's clear seasonal variation. It's a strong in DJF and weekend JJ and also it's increase with height by density reduction and convective precipitation. It's kind of like this, it's a strong balance in JJ.

02:39:37.040 --> 02:39:43.040

⌧⌧⌧

And Narratively strong values along the West coast of the United States.

02:39:44.800 --> 02:39:55.100

⌧⌧⌧

Uh once we obtained this layer mean structure. We calculated the correlation between monthly mean or we eat and the tabloids indices.

02:39:55.750 --> 02:40:25.960

⌧⌧⌧

Uh in most regions at the Y and the enska is negatively correlated with maximum value. In 1912 kilometer and 12 to 15 kilometers and it's a positively correlated with precipitation. But the particle windshield and cracked web drag is correlated under specific conditions and certain location, so it's a particle Windshear is apart.

02:40:26.200 --> 02:40:39.370

⌧⌧⌧

Waiting correlated under strong stability region in the stratosphere, and in the orographic lift away is positively correlated in the Western Mountain area.

02:40:40.620 --> 02:40:41.420

⌧⌧⌧

Ah.

02:40:42.430 --> 02:41:12.510

⌧⌧⌧

Once we obtained this HV RRD data. We compare with the Institute Friday are the data is the same 6 year period is provided from anchor on the the research collaboration between UNC University and anchor the number of data is quite significant. United air their time and Southwest Airlines and this shows number of instinct.

02:41:12.810 --> 02:41:32.770

⌧⌧⌧

We are below 20 K bit, it's a concentrated mostly near the airport and the soccer is 30. Biggest eus airport and right panel is in 20 to 50 K feet is a major flight loot in this case.

02:41:34.330 --> 02:41:51.300

⌧⌧⌧

And this is the same few guys beautiful and this is the 1 + -1 hours from zero zero and 12 UTC absorbed data numbers and because the radio join their top launches estimates that the only at this time.

02:41:51.710 --> 02:42:07.120

☒☒☒

Uh we kind of defined the flight through our main fly to loot in this area. So we compare with these 2 data only in this domain so this include 33 stations.

02:42:09.680 --> 02:42:20.020

☒☒☒

This shows the edr comparison between the radio on the derived and instituted ER at different 3 different height range.

02:42:20.630 --> 02:42:50.460

☒☒☒

Uh the maximum HVR DDR is incomparable to fly DDR only in 20 to 30 kilo feet. But the above is much smaller and both data shows similar seasonal variations is mostly in the larger in JJ and smallest in DJ. Yep, in most regions and altitude here. The sharp drop of HBR ID in the small edr.

02:42:50.660 --> 02:42:56.630

☒☒☒

Is due to the minimum values of Lt and in this case?

02:42:58.830 --> 02:43:10.460

☒☒☒

This shows vertical distribution of each level over turbulences following shaman and Pearson. We categorize each River over tablones based on the edr values.

02:43:11.070 --> 02:43:41.790

☒☒☒

Uh because the number of flight, India is much larger than the HVR. DDR is a direct comparison is not straightforward. But when we see the emoji ratio is a dashed line and solid around the energy ratio. There is some similarities. So it's a pleasure or HPRD and Friday. Are is similar patterns so it's.

02:43:41.840 --> 02:43:49.870

☒☒☒

Minimum in 30 to 40 and then increase with height, so it's a left angle bracket type of things in them.

02:43:50.570 --> 02:43:56.220

☒☒☒

Am JDNSON and then in DJF is increase with height.

02:43:58.080 --> 02:44:04.800

☒☒☒

So this shows the horizontal distribution of energy ratio at 22:30.

02:44:04.870 --> 02:44:20.150

☒☒☒

Uh kind of fit the broker the maximum is around lock mountain regions and the Eastern Appalachian region and when we calculate the pattern correlation between these 2.

02:44:20.700 --> 02:44:23.350

☒☒☒

Uh it's a significant in.

02:44:23.870 --> 02:44:37.120

☒☒☒

Am JDN&SONA and uh when we see that of 30 to 40 kilometer. There are several local point at different season and different.

02:44:37.670 --> 02:44:45.220

☒☒☒

Uh regions uh but the significant correlation or codes only at in DJ.

02:44:45.950 --> 02:44:49.390

☒☒☒

Uh and 40 to 50 kilo feet.

02:44:49.630 --> 02:45:02.370

☒☒☒

Uh HBR DDR is largest with us over our local point. But unfortunately there is no significant pattern correlation between these 2 data.

02:45:03.590 --> 02:45:09.330

☒☒☒

When we see the emoji ratio, the general futures are generally similar to Aero Dilational.

02:45:11.030 --> 02:45:37.560

☒☒☒

But the significant correlation between these 2 data or cause only in 20 to 30 kilobytes in JJ and SON, but in Mbda value is 0.31. It's over 90% confidence level and and in the debates or tips to 50.31 and 0.25 it's relatively large values.

02:45:38.590 --> 02:45:56.450

☒☒☒

Let's summarize my talk. We estimated it is patient date in the free atmosphere based on the stop method using one second, hybrid collaboration. Lady agenda data for 6 years in USA and we also examined the potential sources of top loans.

02:45:56.840 --> 02:46:01.790
⌧⌧⌧
Uh using the E to vibrate and its data and then.

02:46:03.650 --> 02:46:34.930
⌧⌧⌧
This India Lizardi compared with in situ Friday, India and we found it particle distribution of ratio and horizontal distribution of eroge leisure specifically in 20 to 30 crop. It generally consistent with each other. But we need further investigation. Finally, I'd like to emphasize the edr estimated from HV Rd can be invariably source.

02:46:35.010 --> 02:46:39.760
⌧⌧⌧
4 at most predictable on research, including aviation top laundry service.

02:46:40.190 --> 02:46:49.520
⌧⌧⌧
Uh and this can be globally available in near future. Hopefully it's more operational later joined Eric I picked one second data.

02:46:50.270 --> 02:46:52.650
⌧⌧⌧
Thank you for attending.

02:46:53.760 --> 02:46:55.020
Wiebke Deierling (Guest)
Thank you very much.

02:46:55.070 --> 02:46:58.800
Wiebke Deierling (Guest)
Uhm this was an excellent talk, UM.

02:46:59.990 --> 02:47:02.060
Wiebke Deierling (Guest)
I think uh.

02:47:03.750 --> 02:47:09.460
Wiebke Deierling (Guest)
We are running a little bit behind and and uh.

02:47:10.380 --> 02:47:14.970
Wiebke Deierling (Guest)
I am wondering if it be good, too, for the audience please.

02:47:15.550 --> 02:47:27.390
Wiebke Deierling (Guest)

Uhm put questions in the chat and then maybe we can pick up pick them up, either through the chat or or in the discussion session.

02:47:34.580 --> 02:47:35.710
Wiebke Deierling (Guest)
So dumb.

02:47:36.480 --> 02:47:39.860
Wiebke Deierling (Guest)
Thank you very much hey, young, UM.

02:47:40.320 --> 02:47:41.230
☒☒☒
K thank you.

02:47:44.510 --> 02:47:47.840
Wiebke Deierling (Guest)
Let's move on to our last Speaker Jeong Hoon Kim.

02:47:48.710 --> 02:47:49.280
Wiebke Deierling (Guest)
Uhm.

02:47:50.400 --> 02:47:52.000
Wiebke Deierling (Guest)
So I'm hearing is a professor.

02:47:52.230 --> 02:47:56.720
Wiebke Deierling (Guest)
Uhm at the College of Natural Sciences at Seoul National University.

02:47:57.340 --> 02:48:03.380
Wiebke Deierling (Guest)
And he's been and field of evaluation turbulence for a very long time.

02:48:04.210 --> 02:48:06.270
Wiebke Deierling (Guest)
Come and uh.

02:48:06.670 --> 02:48:13.200
Wiebke Deierling (Guest)
So when will present a climatology of clear turbulence using the error 5 data?

02:48:13.950 --> 02:48:14.530
Wiebke Deierling (Guest)
Uhm.

02:48:15.260 --> 02:48:16.530
Wiebke Deierling (Guest)
The floors Yours Jungling.

02:48:18.270 --> 02:48:25.400
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
OK, thank you because I I'm not sure whether you can see my screen and uh my pointer is that OK.

02:48:26.630 --> 02:48:27.880
Wiebke Deierling (Guest)
Yes, we can see it very well.

02:48:28.840 --> 02:48:49.150
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Alright and thank you and and uh this is John game from our soul National University in Seoul, South Korea. Today I'm going to talk about the climatology or clear tablets using the error file data for this work. One of my student, 2, honey, she did a good job for supporting this work.

02:48:50.750 --> 02:49:00.350
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Before I start I'd like to introduce the clear turbulence and what is that of course, all of you guys already know that clear top lines is one of the issues for?

02:49:00.400 --> 02:49:15.550
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh uh aviation safety vision operations. Those are awkward in atmosphere due to the shear instability above and below the jet stream, region, as you can see because those are happening without any visible convictions or?

02:49:16.760 --> 02:49:47.150
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
So that it is really hard to predict it. Of course, because of a high accuracy of the numerical weather prediction model. Nowadays, we have a room to to focus forecasted and in advance. However, this upper level jet stream, 'cause not only the sharing disability, but also the other instabilities that also create this clear air turbulence. For example, and on the Anti Cyclone Shield side of the jet stream, it create the emotion instability via.

02:49:47.200 --> 02:49:58.790
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
The jobs are people just month or processes and also in the accident version of the jet stream, there are strong divergent flow, which also create the inertial gravity waves and also several.

02:49:58.840 --> 02:50:29.130
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh deformation field and for example, if there is a storm track along with this operator jet stream, I can also create a convective instability through the well developed convictions and these operable jet stream is highly modulated by the large scale variability like a clear climate change, so there's a 2 previous studies that is focusing on the client kept climatology using a previous version of the.

02:50:29.180 --> 02:50:41.570
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Anna 40 data and also recently from Paul Williams Group. They published a paper in nature about the particle initial trend via the Summerwind relationship.

02:50:43.840 --> 02:50:48.050
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
In the northern Atlantic region using the multiple reanalysis data.

02:50:49.660 --> 02:51:20.220
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
And this work is has a 3 goals. Those are in line with previous studies. But with some expansions first of all we're going to use the higher resolution of reanalysis data and second. One is to look at the climatology from multiple sources of the top lines and also a 3rd. One is using the long term trend in multiple regions in northern hemisphere, including East Asia.

02:51:20.280 --> 02:51:26.630
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
In northern Atlantic Vision and also eastern Pacific, which is close to the West coast of United States.

02:51:28.680 --> 02:51:37.140
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
The data that we use in here is terrified data that is ECMWF. We only see data 0.5 feature provide the hourly.

02:51:37.810 --> 02:52:07.840
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
I mean unless it's information, however, currently in here we are using only 4 day to day, which is good enough to resolve the largest kit flows or a private jet stream, and we focusing on the whole year. The 41 years of the data. With the 0.25% equity resolution of the data, which is quite a good resolution to capture or measure scale or synaptic fully synoptic scale.

02:52:08.020 --> 02:52:38.490
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
You know, I mean, those and now we are using the data that has a 12 isobaric levels between 105 100. Megabytes collaborate specially at cruising level between 203 100 levels or we have full isolated layers, which I believe is good enough to calculate the vertical initially we have used 2 different groups of the cat diagnostic. FirstGroup is empirical problems diagnostics called the top lines index that is.

02:52:38.680 --> 02:53:08.690
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Originally developed by Harold and arrow to index 123 and their components, including body commissioner and deformation divergent and divergent rental feature widely used for the acknowledging the cat caused by shear instability and emission of inertial radiates near a private jet stream, another group of indices kept the agnostic is conventional. They are non-stick or recharge number for Kevin Hammers instability.

02:53:08.750 --> 02:53:16.370
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
And on a scale brunt by seller frequency that is for convective instability and potential vorticity for symmetric instability.

02:53:18.390 --> 02:53:28.460
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Because we are using higher resolution of data with empirical indices or we need to determine the threshold of the chat on that we are focusing on.

02:53:30.490 --> 02:53:34.220
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Oldies we choose the values of the tough 5.

02:53:34.270 --> 02:53:41.120
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uhm I mean that 95% tired from the probability density problem PDF from.

02:53:41.900 --> 02:53:48.880
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh each diagnostic for 41 years at 2:00, 158 to pass collaborate in the mid latitude regions.

02:53:51.140 --> 02:53:54.910
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Here are the top 5 percentile is considered as a moderate or greater.

02:53:55.520 --> 02:54:01.280
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Intensity or clearer turbulence on the left shows the threshold that we use.

02:54:01.880 --> 02:54:11.820
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
In this study, and at the bottom there is a Q&P. Brianne Richards number that he is using some threshold based on the previous study.

02:54:14.580 --> 02:54:17.830
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
In order to confirm that this restaurant is working well.

02:54:19.080 --> 02:54:20.640
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
You look at the case study.

02:54:21.730 --> 02:54:27.480
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
At a time due to C 2 and I 11 UTC October 2012.

02:54:28.390 --> 02:54:36.030
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)

There was a 2 flight, I encountered an emoji later cleared problems at about 11 kilometers above the ground level.

02:54:36.670 --> 02:54:40.460
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
When they across the North Pacific Ocean.

02:54:42.020 --> 02:54:47.550
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
And here as you can see, there is a shear instability that is awkward.

02:54:47.600 --> 02:54:53.790
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh by the strong body community share with Richards number is smaller than one.

02:54:55.550 --> 02:54:57.390
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
But there is no convective instability.

02:54:59.570 --> 02:55:05.850
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh he changes noted in a very high values and I mean, the top 5 percentile of the values that we are using?

02:55:07.040 --> 02:55:10.390
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
In the T one to T 3 indices here.

02:55:12.030 --> 02:55:18.170
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
So that we can, we can use those fresh fruits or emoji cat or whole entire calculations.

02:55:19.310 --> 02:55:22.080
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
You're at the holding tank had climatology from.

02:55:23.920 --> 02:55:32.160
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
At a fight data in a Northern Hemisphere top 3 figures show the shadings of the probability. I mean, the occurrences of.

02:55:33.030 --> 02:55:33.940
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Jeff young losses.

02:55:34.110 --> 02:55:40.250
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh yeah, exceeding this threshold that we have selected and then.

02:55:41.460 --> 02:55:45.950
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
The bottom line is the trading of the probability for conventional.

02:55:46.000 --> 02:55:51.230
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh do you have a nasty include the N scale and reach us number MPB?

02:55:52.400 --> 02:56:12.960
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Here are 3 interesting features for us over at the top you can see, there's a 3 bruising of the high frequency in the East Asian region here and also it's some Pacific close to the West coast of the United States here and Northeastern United States in the northern Atlantic region here.

02:56:13.980 --> 02:56:14.690
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
As you can see.

02:56:14.740 --> 02:56:33.470
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Yeah, the one big spot in the eastern Asian region is caused by strong body community here in the entrance vision of the installation jet and then high values are in a an exit vision of the East Asian jet in the eastern Pacific region.

02:56:34.450 --> 02:56:39.590
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
And also actually reason of the jet stream in the Northeastern United States here.

02:56:40.540 --> 02:56:45.070
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
When you look at the T one and TI 3 TSV has uh.

02:56:46.150 --> 02:56:48.620
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
I Belgians transform which has a more.

02:56:49.560 --> 02:56:54.830
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Probability or Auckland sees in the active region of the the 2 jet streams here and here.

02:56:56.110 --> 02:57:01.020
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
And one of the other interesting feature is that we are using the high resolution data so that.

02:57:01.690 --> 02:57:04.790
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
They can capture some mounting it features here.

02:57:05.760 --> 02:57:06.900
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
In the rocky meeting.

02:57:10.710 --> 02:57:11.620
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
At the bottom.

02:57:12.710 --> 02:57:18.980
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
In the active region because the operator flow is really divergent, which means that.

02:57:20.630 --> 02:57:35.640
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
There's a strong convergence in the space so that the complexion can eligible can be eligible to to develop so that convective instability is occurred frequently in this area here here.

02:57:37.230 --> 02:57:45.040
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Because of that the Richards number or probability is also high in this area and then when you look at the PB.

02:57:46.180 --> 02:57:53.400
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
On the right side of the jet stream, there is a strong emotion instability due to anti cycling shoes here.

02:57:54.230 --> 02:58:00.260
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Open the gesture important I mean, yeah, so that the PB has a high probability over there as well.

02:58:01.870 --> 02:58:09.760
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
You know somewhat time, those features are so different because the upper level jet has been shifted to the lures and getting weak.

02:58:10.980 --> 02:58:17.790
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
So that in T 123. We still have a strong body composition in East Asian region here and.

02:58:18.970 --> 02:58:24.140
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
And then Northeastern United States and also there is a some spots in the uh.

02:58:25.040 --> 02:58:27.720
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
No Western European area as well.

02:58:29.020 --> 02:58:39.650
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)

And some of the convention can orko very rare in the isolation area depicted by this and scale and reach a sample is already well with N scale and.

02:58:41.490 --> 02:58:47.140
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Indices and PB is still shows some of the probability in extension area.

02:58:48.660 --> 02:58:52.090
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
This is a particle kept on climatology.

02:58:54.410 --> 02:58:58.260
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
As you can see we focused on the 4 different regions.

02:58:58.310 --> 02:59:02.120
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh one is in Europe, here and other one is in.

02:59:02.870 --> 02:59:07.110
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
It's easier here and another is eastern Pacific and Golden.

02:59:08.030 --> 02:59:09.680
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
It's likely vision here.

02:59:11.520 --> 02:59:40.950
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
In Europe, we have uh 2 jet stream in a lower altitude and a higher altitude here and then see I want to 3 indexes has a high probability in the below the jet stream, or jet core and cyclone is sheer size as you can see in here in East Asia. This is the entrance region of the East Asian jet so that the high probability is packed and confined in a just.

02:59:41.010 --> 02:59:43.360
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Blue and the above the jet core.

02:59:44.170 --> 02:59:45.280
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
And those are.

02:59:45.790 --> 02:59:46.760
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh where

02:59:48.460 --> 03:00:01.400
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)

consistent with the recharge number distributions. One of the interesting thing is that you can see, there is a high probability of people in ocean instability on the on the.

03:00:01.450 --> 03:00:06.800
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
The entire site mentions I don't know just stream and this is the Asian region.

03:00:08.010 --> 03:00:10.520
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
In the exit of the 2 jet stream in.

03:00:10.570 --> 03:00:16.110
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh Asian Pacific Eastern Pacific Vision and an Atlantic at the bottom.

03:00:16.170 --> 03:00:28.870
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh other regions of the high probability 40. I want to see is getting broader and and Decker because the the flow is actually really divergent.

03:00:30.170 --> 03:00:37.410
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
We just number uh has uh some high values in the core region of the jet stream over there.

03:00:40.390 --> 03:00:41.530
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
In summer time.

03:00:41.590 --> 03:00:54.350
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
I'm uh the areas or high probability depicted by this. TI want to share 3 has been shrunken because just stream has been shifted to the North with getting weekend.

03:00:55.940 --> 03:01:02.810
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
And those features are pretty much the same in all 4 regions as you can see in these figures.

03:01:05.170 --> 03:01:07.020
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Yeah, one of the interesting thing that.

03:01:09.150 --> 03:01:17.570
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
We're focusing on is trying to calculate the long term trend in cash climatology as followed by Paul Williams Group.

03:01:19.050 --> 03:01:26.100
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
So here are these 4 figure shows the shadings of annual mean temperature gradient in A and top left.

03:01:27.570 --> 03:01:34.650
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
And then we also calculate the annual mean trend of the temperature and here in B and.

03:01:35.270 --> 03:01:39.920
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
4,000,000 temperature readings in see at the bottom left and then.

03:01:40.200 --> 03:01:44.530
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Yeah, yeah for Jonah mean mean at the bottom right in deep.

03:01:45.430 --> 03:02:00.500
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
When you look at this video or 8 week. We understand that a really strong operator jet stream is highly related to the strong Meridian or temperature gradient below that jet core area.

03:02:01.570 --> 03:02:14.010
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
So let us through the thermal winter relationship, but there's a strong body community or there is a cream in East Asian region, as well as the northeastern part of the United States.

03:02:14.880 --> 03:02:37.180
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
When you look at the temperature mean trend what we can see is that there is a strong positive warming and signals that is happening from the lower latitude to the higher latitude region because of the global warming. One of the interesting feature that you can see in East Asian region is that there is a cooling.

03:02:37.810 --> 03:02:50.350
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
That is happening in the European continent, which can also provide a strong meridional temperature gradient conditions in East Asian region, so that we can have.

03:02:51.070 --> 03:03:09.160
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
A strong positive trend for wind speed in East Asian region and also in the eastern Pacific as well as Northeastern United States in the loading Atlantic region at these results are quite consistent with the result from.

03:03:09.880 --> 03:03:10.820
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Previous studies.

03:03:12.250 --> 03:03:23.570
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Let me check let the long term trend for the turbulence index that is join in this top left figures 41 in a here and Budget Committee Chair in here.

03:03:24.790 --> 03:03:35.010
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh you can also see it as a positive trend, which means that it is keep increasing from the early earlier years to the recent years.

03:03:35.700 --> 03:03:46.160
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
In especially in this we different regions in East Asia and eastern Pacific and also those Atlantic regions. Let me look at.

03:03:46.210 --> 03:04:01.540
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
The positive and negative trend, increasing mountain all problems indexes that we are focusing on 441 years on a winter time in East Asia in here and instant Pacific here and North Atlantic here.

03:04:02.290 --> 03:04:17.350
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
We understand that every cat young Gnostics from multiple sources are increasing in this area as time goes by, and bottom right figure here shows the Magic Deanna temperature gradient.

03:04:17.700 --> 03:04:21.610
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh trend, and also windows speed trend.

03:04:22.800 --> 03:04:44.570
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh we there are mean values of the annual mean values depicted by this pink line for MTG measure temperature gradient and Sky blue line or windows speed at cruising level 4 different 3 regions in East Asia, here and eastern Pacific here and Atlantic in here.

03:04:45.220 --> 03:04:47.050
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
What you can see is that from?

03:04:48.720 --> 03:04:52.300
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
1979 to 2019.

03:04:52.690 --> 03:05:22.780
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Other operating wind speed is keep increasing and because of that the probability of managing those are mainly caused by the melting temperature gradient or just below that level feature quite consistent in, not only in East Asia, but also in its own Pacific and Atlantic region but the East Asian the increasement in extension region is the quite more significant.

03:05:23.040 --> 03:05:23.730
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Among them.

03:05:25.370 --> 03:05:27.110
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
So finally we calculate.

03:05:27.170 --> 03:05:36.610
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
A PDF of the body coming this year and anti. One index from early stage of from my only 20 years.

03:05:36.980 --> 03:06:07.410
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh depicted by this red and also for late 20 years typically by this blue light So what you can see is that the whole PDF of the body condition and Taiwan has been shifted to the right side which means that we are getting a more stronger body cream initial and T one indexes in this East Asian region and they're increasement rate is about a 5%.

03:06:07.700 --> 03:06:10.070
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
You can see at the bottom table.

03:06:11.910 --> 03:06:42.090
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh in addition to look at Climatology as I mentioned briefly at this high resolution. We unless we organize. This data can capture some of the mounting made problems signals. So we are looking at the divergent term. Of course, that is not exactly the signals or a mountain wave conference. However, we kind of try to get an insight? How this is going to be how how the long term trend in this.

03:06:42.200 --> 03:07:02.660
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh index so we focused on the some of the high mountain regions in the world and especially in northern hemisphere first one, is Himalaya and second is East Asia, including Japan and South Korea. North Korea and eastern China and also rocky and herbs and Scandinavia in Europe.

03:07:03.810 --> 03:07:33.380
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
And what you can see is that as operable windows speed is keep increasing the Himalaya and East Asia. There are typos. Tom probability of the divergent storm is also keep increasing as time goes by, however, in rocky and carbs. There are diverse term. The trend of the divergent. Tom is not increasing significantly of course, we have to require more vigorous mountain wave problems.

03:07:33.600 --> 03:07:36.790
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Well, sticks, one is maybe the overpaid.

03:07:38.560 --> 03:07:43.300
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
So, please keep dragging parametrisation that professor John is mentioned before.

03:07:43.750 --> 03:07:44.420
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh.

03:07:45.520 --> 03:07:56.630
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
It is quite interesting to see some of the regions have a increasing trend, but another his not so this is the summary and conclusions and before I summarize.

03:07:57.030 --> 03:07:58.700
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh let me show this.

03:07:58.770 --> 03:08:00.140
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh Oh,

03:08:00.880 --> 03:08:23.240
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
first of all boil we found that there is a strong, gesturing there is located not only in the Northeastern United States between the US&R Europe, but also in East Asian region between the Asian continent and United States and those are having really strong high.

03:08:24.900 --> 03:08:27.640
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Trent I mean, the positive trend, which means that.

03:08:27.910 --> 03:08:58.440
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh it is keep increasing the the wind speed in this area is keep increasing to make us stronger vertical initial which can create a more frequent clear tablets or on the right hand side? What you can see is the recent armed edr data showing the traffic and traffic between the East Asian Region 2 and and the US United States as you can see, there's really high traffic that is offering in the South Korea.

03:08:58.500 --> 03:09:01.040
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Across the Japan and Northwestern.

03:09:01.460 --> 03:09:16.530
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh Pacific Vision or which is exactly the the places that this strong, gesturing is located and this high positive trend. It is located so that we should keep focusing on.

03:09:16.580 --> 03:09:25.490
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
Uh uh how the climate change is affecting the frequency in these areas. Thank you very much for your attention.

03:09:26.350 --> 03:09:29.320
Jung-Hoon Kim (Seoul National Univ., South Korea) (Guest)
I will take any questions from now thank you.

03:09:30.080 --> 03:09:31.640
Wiebke Deierling (Guest)
Thank you very much John Hogan.

03:09:32.830 --> 03:09:36.600
Wiebke Deierling (Guest)
There was a lot of information and a very nice talk.

03:09:37.300 --> 03:09:38.050
Wiebke Deierling (Guest)
Uhm.

03:09:39.190 --> 03:09:41.070
Wiebke Deierling (Guest)
So uhm.

03:09:42.180 --> 03:09:50.080
Wiebke Deierling (Guest)
Wondering actually if we if we can take a little break up and then.

03:09:50.740 --> 03:10:00.570
Wiebke Deierling (Guest)
Uhm Jung Hoon, he young John Domingo Bolt. Polar Jim Doyle and questions for for all the speakers.

03:10:01.400 --> 03:10:03.120
Wiebke Deierling (Guest)
Uh Matias also.

03:10:04.520 --> 03:10:06.220
Wiebke Deierling (Guest)
That haven't been answered her still.

03:10:06.270 --> 03:10:09.800
Wiebke Deierling (Guest)
So people might have.

03:10:11.510 --> 03:10:11.920
Wiebke Deierling (Guest)
Uh.

03:10:12.570 --> 03:10:16.460
Wiebke Deierling (Guest)
Could be put in the chat and we can address them after the break.

03:10:17.580 --> 03:10:19.920
Wiebke Deierling (Guest)
Uhm Tammy Bob What do you think?

03:10:20.910 --> 03:10:22.470
Wiebke Deierling (Guest)
We are running a little bit late.

03:10:23.220 --> 03:10:26.060
Bob Sharman (Guest)
Yeah, I think we should speed it up, however, we can.

03:10:34.950 --> 03:10:41.670
Wiebke Deierling (Guest)
OK, so then I I would say, Let's take a 5 minute break and A.

03:10:42.370 --> 03:10:54.330
Wiebke Deierling (Guest)
If there's questions for the previous speakers. Please put them in the chat and we can address them after the break. Let's reconvene 20 after the hour.

03:16:03.430 --> 03:16:06.620
Wiebke Deierling (Guest)
Great Hi everybody, welcome back UM.

03:16:08.260 --> 03:16:19.560
Wiebke Deierling (Guest)
Think if uh we have a little bit of time left, UM for some remaining questions and discussion points, so Steve Ellman.

03:16:20.580 --> 03:16:29.820
Wiebke Deierling (Guest)
If there are any questions that you spotted and are still there, please go ahead and and and bring them up.

03:16:30.660 --> 03:16:36.390
Steve Abelman
So actually maybe there's been a lot of there's been a lot of questions. But they've I think with almost out.

03:16:37.030 --> 03:16:41.150
Steve Abelman
Fault they've been responded to online already.

03:16:41.840 --> 03:16:42.370
Steve Abelman
Uhm.

03:16:43.700 --> 03:17:11.280
Steve Abelman
The last probably oh maybe half hour, 45 minutes of back and forth. There's really been talking about kind of this idea of cost loss and then FAA and routes and sort of that whole you know concept has been brought into play. Where there's been a lot of discussion about optimizing not only probabilities, but routes and taking some of this information so.

03:17:11.770 --> 03:17:12.320
Steve Abelman
Uhm.

03:17:14.050 --> 03:17:27.140
Steve Abelman
Unless I missed anything else that any you know, Matt or Tammy or anybody else can see that. Maybe. The The One area. We could have a little more discussion on of course, there was a lot of discussion and what Rogers.

03:17:28.710 --> 03:17:31.490
Steve Abelman
Just you know a lot of unwatched presentation again.

03:17:32.210 --> 03:17:39.100
Steve Abelman
Uh so, so there's yeah, there's several areas to go, but I don't see any unanswered questions. I don't think.

03:17:40.350 --> 03:17:41.800
Steve Abelman
There's a lot of back and forth, though.

03:17:42.270 --> 03:17:50.680
Wiebke Deierling (Guest)
OK, that's good yes. Uhm I wonder if the speakers would like to comment on or have any remarks.

03:17:57.010 --> 03:18:19.730
John Williams (Guest)
This is John I think one point that was made in the chat was that, considering the you know, FAA controller workload. You really did need to think about congestion as part of the decision making process when deciding for instance, whether to deviate or not, and you know, I I certainly agree with that and I think that can be factored into the the loss function.

03:18:20.430 --> 03:18:31.880
John Williams (Guest)
There was also a question about how you deal with extremes and that that's certainly a perennial problem and and I think it's made you know much more difficult by the the small scale, forcing of of some of the.

03:18:33.280 --> 03:18:46.180
John Williams (Guest)
The causes of turbulence accidents where for instance, you fly over to you know developing convective core an updraft. That's not easy to model that's not easy to account for in a meaningful way.

03:18:46.240 --> 03:19:16.280
John Williams (Guest)
They buy a probabilistic model, it arguably not even you know really turbulence and like it since we take thinking about that turbulence so and then there was a question about you know could we come up with some some thresholds for what the probability of turbulence would you know need to be in a general situation for for deviating and you know I think we certainly could do that. In some idealized situations that might be very interesting to to try to articulate some of the the the costs of of.

03:19:16.460 --> 03:19:47.770
John Williams (Guest)
You know the different RMS 's for instance, and then how you would translate that and and what and back back out what probability thresholds that you might use but I think one of the points that I tried to make is that it's it's really a complex situation in which the Prince. The shape of the distribution. The PDF or the predictive PDF can be very important in the the cost functions are very nonlinear so really to get the most information out of it. I think you. You need to carry it all the way to those cost distributions and make your.

03:19:48.120 --> 03:19:57.570
John Williams (Guest)
Your risk and an expected value decisions based on those so it's quick summary of some of the the very interesting points that were raised in the discussion.

03:19:59.100 --> 03:19:59.880
Wiebke Deierling (Guest)
Thanks, John.

03:20:01.000 --> 03:20:12.940
Bob Sharman (Guest)
Yeah, this Bob Sherman. I think the bottom line here is that this is not a trivial problem and it's going to take awhile before we get something that's going to be really useful to a wide range of users.

03:20:06.860 --> 03:20:07.400
John Williams (Guest)
Right.

03:20:15.180 --> 03:20:16.940
John Williams (Guest)
Yeah, I think my my uh.

03:20:18.370 --> 03:20:41.210
John Williams (Guest)
I pointed presenting this as to suggest a framework and to suggest that we should be to the extent we can moving toward PDF forecasts and you know, so, so not just forecasts of of certain thresholds, but

really trying to present to predict the entire PDF, but that'll give us the the most informative the most useful information downstream.

03:20:42.000 --> 03:20:49.310
John Williams (Guest)
For making the optimal decisions, but but yeah, so definitely a lot of work. I didn't mean to trivialize it by any means.

03:20:52.680 --> 03:20:56.440
Bob Sharman (Guest)
So how would you present the PDF?

03:20:57.420 --> 03:20:57.930
Bob Sharman (Guest)
Uhm.

03:20:59.000 --> 03:21:09.270
Bob Sharman (Guest)
So you want like you, you show something that a flight level either. It's deterministic or probabilistic value, but how would you show a PDF?

03:21:10.780 --> 03:21:11.880
Bob Sharman (Guest)
I don't know how you would.

03:21:11.380 --> 03:21:12.020
John Williams (Guest)
Yeah, I see.

03:21:13.920 --> 03:21:34.450
John Williams (Guest)
Yeah, I think part of the part of the point. Maybe is that you that the PDF is very useful for decision making it so if you think about a framework going from sort of a decision support, which is the you know presentation of information to decision services or decision, making or decision recommendations.

03:21:34.940 --> 03:21:46.330
John Williams (Guest)
From the PDF so loud that decision recommendations and and maybe offer some explanations for that, but but maybe don't support you know fully seeing the PDFs.

03:21:46.910 --> 03:21:58.390
John Williams (Guest)
But what you what you could do certainly the PDFs would support showing the probability of you know turbulence above any threshold of interest because they would contain that information.

03:21:59.190 --> 03:22:08.300
John Williams (Guest)
If you do your aircraft type, and waiting there speed. You could translate them to to RMSG distributions and so you could throw show the probability of.

03:22:08.890 --> 03:22:24.800
John Williams (Guest)
RMSG above a threshold for your particular aircraft type, and if you had the cost functions relating different edr or sorry RMSG levels to to an expected cost of uh through through an accident or whatever, then you could show on a map.

03:22:25.860 --> 03:22:29.740
John Williams (Guest)
The expected cost of flying through volume at that location.

03:22:31.830 --> 03:22:33.070
Bob Sharman (Guest)
Right right.

03:22:38.490 --> 03:22:43.260
Wiebke Deierling (Guest)
Yeah, and I'm seeing just a few comments from materials and Nathan.

03:22:43.990 --> 03:22:44.950
Wiebke Deierling (Guest)
Here, as well.

03:22:46.660 --> 03:22:53.690
Wiebke Deierling (Guest)
There is also a question about proper calibration of probabilities with data that are biased and there's sample.

03:22:54.980 --> 03:22:56.390
Wiebke Deierling (Guest)
Fires and

03:22:57.770 --> 03:23:03.160
Wiebke Deierling (Guest)
and Nathan are saying and not only the shape of the PDF but also how the PDF shape is trending overtime.

03:23:06.640 --> 03:23:32.990
John Williams (Guest)
Yeah, that's that's a another and I don't want to monopolize this session, but I think that's another really interesting point is that at some point you have to decide whether to act or not to act and you know when when do you you know go a little further and hope for better information or or when? Do you take action earlier? Maybe at that lower cost so that those are are difficult subtleties?

03:23:07.470 --> 03:23:08.100
Wiebke Deierling (Guest)
That's the point.

03:23:33.690 --> 03:23:35.800
Wiebke Deierling (Guest)
Right right that's a good point.

03:23:36.760 --> 03:23:38.520
Wiebke Deierling (Guest)
Uhm OK, Wild Rogers.

03:23:40.360 --> 03:23:41.510
Wiebke Deierling (Guest)
So you're you're on mute.

03:23:45.140 --> 03:23:46.290
Wiebke Deierling (Guest)
You're still on mute.

03:24:04.510 --> 03:24:05.150
Wiebke Deierling (Guest)
OK.

03:24:05.910 --> 03:24:07.400
Wiebke Deierling (Guest)
OK. Sorry.

03:24:08.650 --> 03:24:09.380
Wiebke Deierling (Guest)
Uhm.

03:24:11.630 --> 03:24:15.790
Wiebke Deierling (Guest)
Are there any other comments from from the audience?

03:24:25.990 --> 03:24:35.640
Wiebke Deierling (Guest)
Think if not, UM Tammy Bob and Matt do you have any remarks before we end the session?

03:24:39.820 --> 03:24:47.310
Bob Sharman (Guest)
Say it was a good session as the chat room showed there's a lot of questions and answers going back and forth so.

03:24:49.080 --> 03:24:52.860
Bob Sharman (Guest)
I'm guessing the participants found this interesting and stimulating.

03:24:57.540 --> 03:25:01.150
Wiebke Deierling (Guest)
Yes, thank you very much all for tuning in. UM.

03:25:01.580 --> 03:25:04.620
Wiebke Deierling (Guest)
Uh and we have one more day ahead of us.

03:25:05.470 --> 03:25:22.550
Wiebke Deierling (Guest)
Uh, which is tomorrow, we're starting early 10 to 15. It's going from 10:00 AM to 50. In 3:00 PM Eastern Time. Thank you very much to all the speakers for your excellent talks and.

03:25:22.610 --> 03:25:25.310
Wiebke Deierling (Guest)
Uh we hope to see you tomorrow.

03:25:25.960 --> 03:25:27.130
Wiebke Deierling (Guest)
Thank you very much.

03:25:33.760 --> 03:25:35.470
paola imazio (Invitado)
Thanks everyone goodnight.

03:25:39.330 --> 03:25:40.100
Bob Sharman (Guest)
Everyone.

03:25:42.590 --> 03:25:43.230
Didier Ricard (Invité)
Thank you.