Federal Aviation Administration

Airborne In Situ Weather Observations

Presented to: Friends and Partners of Aviation Weather

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Airborne In Situ Weather Observations

- **Overview**
  - Terminology
  - US program/MDCRS
- **FAA Turbulence Detection/EDR Program**
  - Delta Airlines EDR Proof of Concept Demo
  - Turbulence Forecasting/GTG2 Development
- **Water Vapor Sensing System II**
- **Future Plans**

Airborne In Situ Weather Observations
Terminology

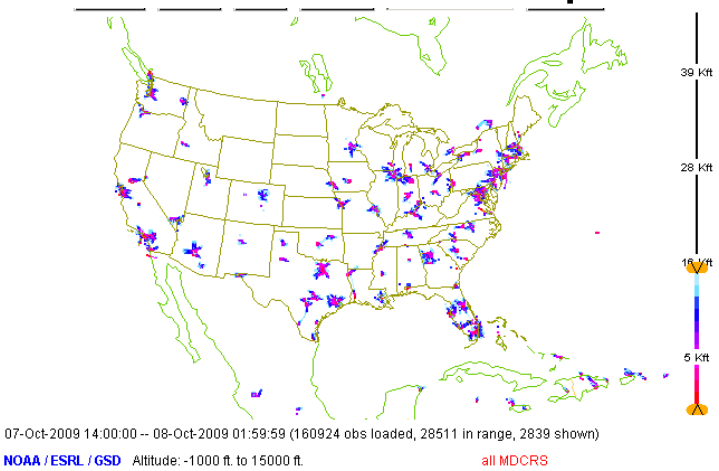
- **AMDAR** – Aircraft Meteorological DAta and Relay: A WMO-sanctioned international program of nations with air carriers that provide automated weather observations.
- **MDCRS** – Meteorological Data Collection and Reporting System: US analog of AMDAR, a private/public partnership.
- **ACARS** - Aircraft Communications, Addressing, and Reporting System: The name of a datalink service provided by Aeronautical Radio, Inc. (ARINC) that sends information between aircraft and ground stations.
- **TAMDAR** - Tropospheric Airborne Meteorological DAta Reporting: "AirDat's network of patented airborne sensors…which provide a continuous stream of real time observations….". (http://www.airdat.com/./index.php)

Airborne In Situ Weather Observations
MDCRS

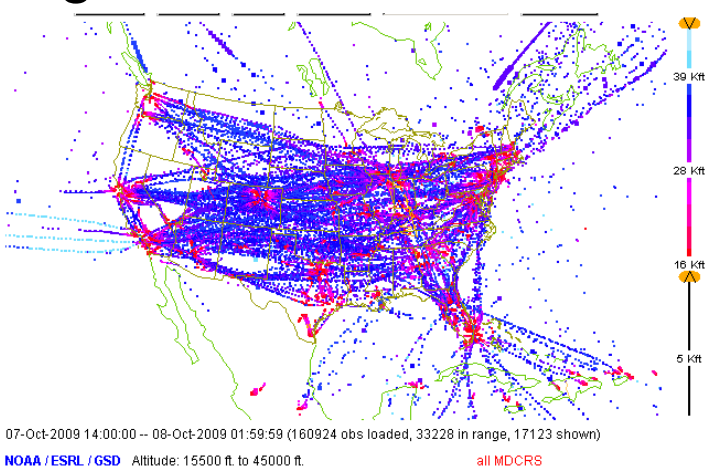
- Participants
  - AAL, SWA, FedEx, UAL, UPS, DAL/NWA
  - NOAA, FAA
- > 1500 reporting aircraft
- > 100,000 observations/day, >3 million/month
- Much more cost effective than individual radiosonde soundings

MDCRS Optimization

Spatial Coverage



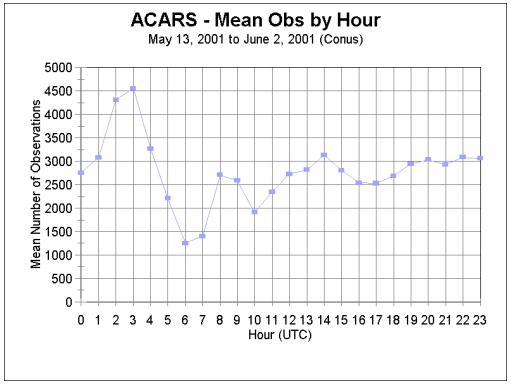
SFC-FL150



FL150-400

- The selection of specific aircraft to obtain the data required to meet the government's forecasting needs while reducing redundant or unnecessary observations that increase communications and processing costs.

Temporal Coverage



Airborne In Situ Weather Observations
Turbulence Detection/EDR Program

- FAA Aviation Weather Research Program developed EDR algorithms
- Current Deployment
  - UAL: Accelerometer-based algorithm on ~19 737's and ~97 757's
  - DAL: Improved winds-based algorithm on ~80 737-700/800's
  - SWA: Winds-based algorithm currently on 8 737-700's for testing. Planned 2010 deployment on 340 total aircraft.
- UAL and DAL EDR data displayed on Aviation Digital Data Service (ADDS) In Situ Turbulence Viewer
  - Access restricted to participating airlines at this time

Airborne In Situ Weather Observations

Delta Airlines EDR Proof of Concept Demo

- Goals
  - To document how EDR usage results in increased airspace capacity by minimizing unnecessary deviations around turbulence
  - To gain experience with the data integration and dissemination issues that the NextGen era will present
  - To verify and document improvements in airline operations
- Demo kick-off in May 09, operational data collection begun Sep 09
- Anecdotal evidence of positive impact on NAS capacity and flight ops
  - 10/6/09: B757 experienced choppy conditions. Pilot requested change in altitude, ATC provided recommendation. EDR data showed smooth air 4000 ft closer to target altitude than ATC recommendation, dispatcher relayed to pilot. *Result - 30 minutes shorter time off target altitude*

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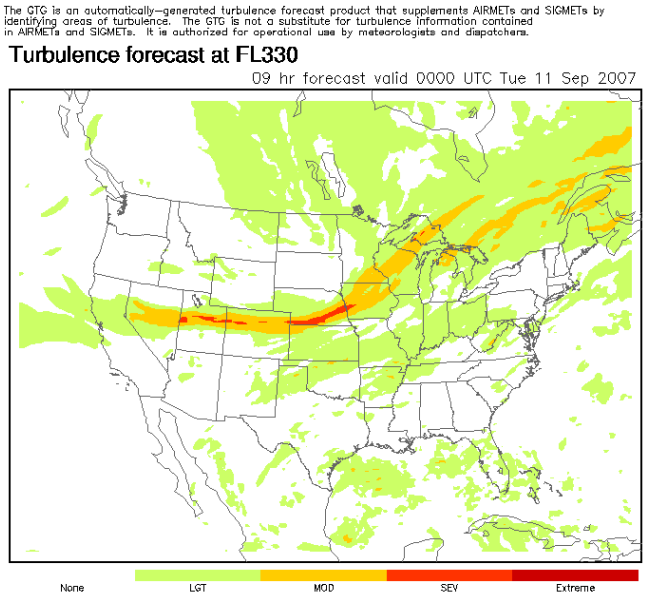
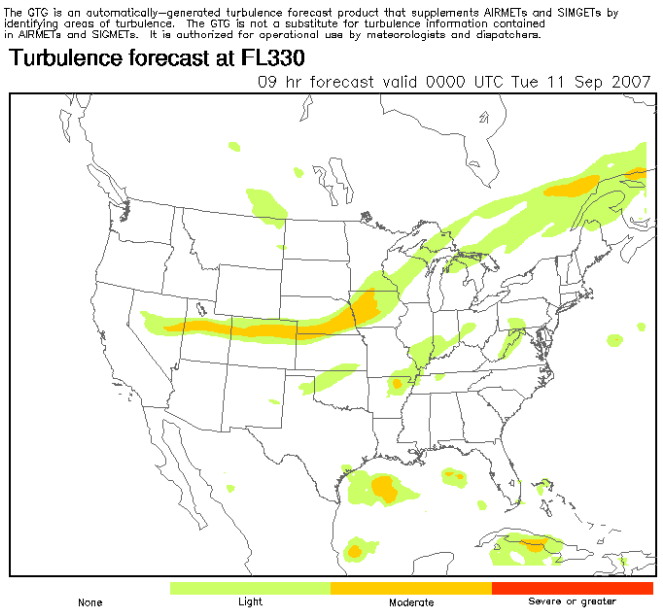
GTG2 Development

GTG



GTG2



- GTG2 incorporates EDR observations
- GTG2 expected operational at AWC early 2010

Airborne In Situ Weather Observations
Water Vapor Sensing System II

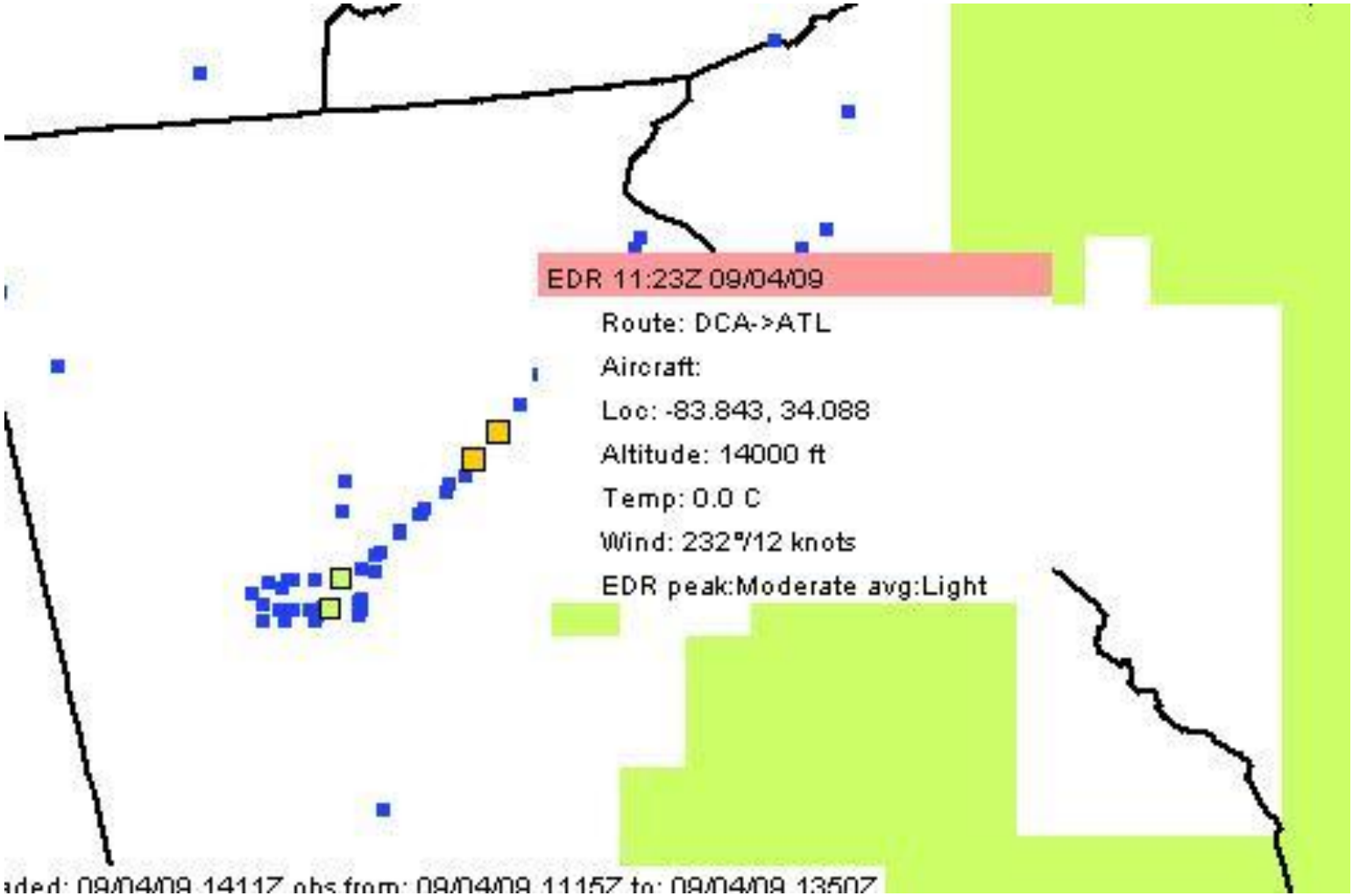
- Sensor re-design in 2008
- UPS: Replacement of old sensors on 757s on-going, ~5 new sensors flying
- SWA: Awaiting certification to proceed with implementation
- Field test scheduled for late October 2009
- Long-range goal – 400 sensors flying by 2016

Airborne In Situ Weather Observations
The Future

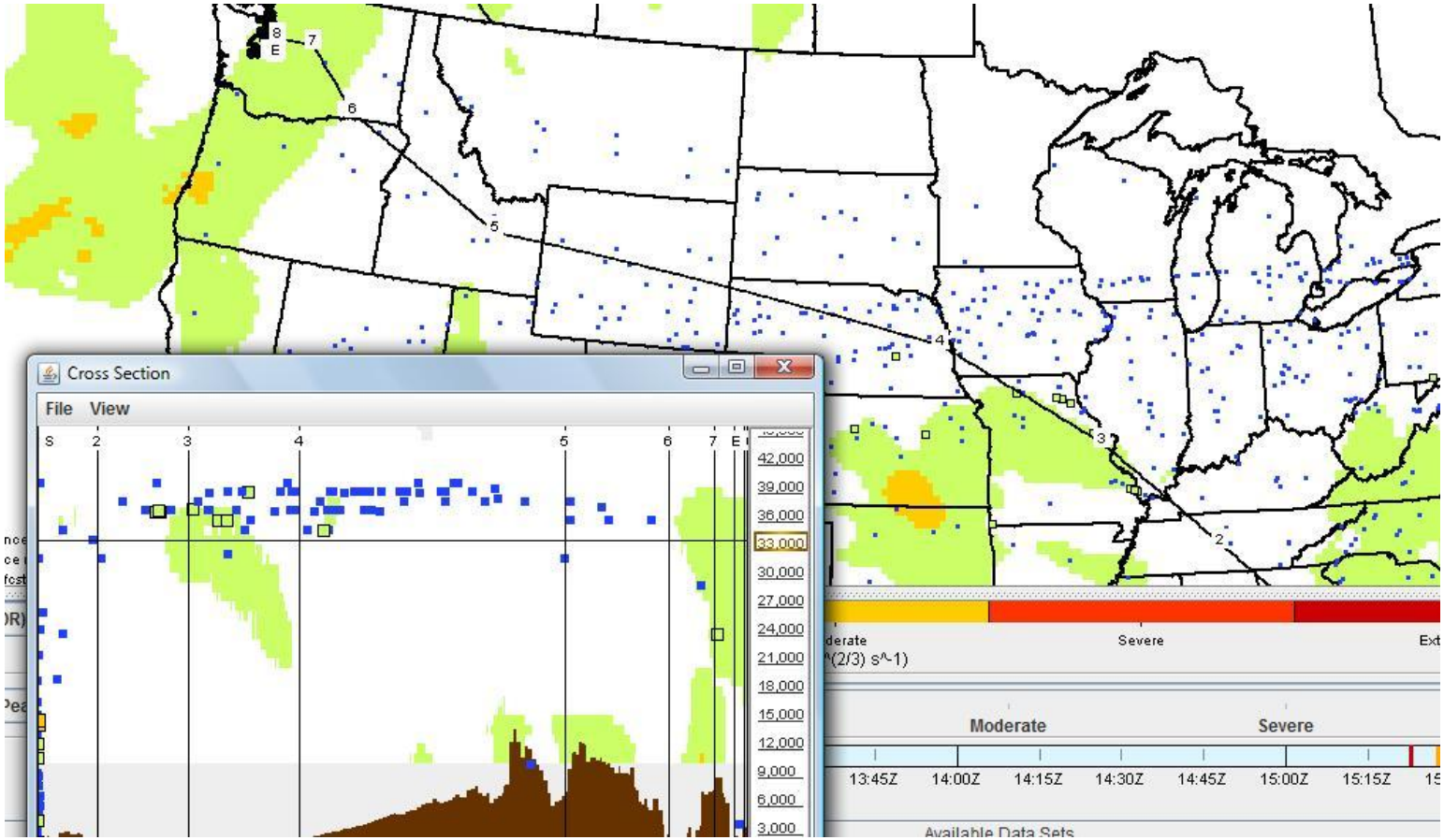
- In Situ Strategy Plan is work in progress
  - MDCRS Management Team
    - Government (FAA/NOAA)
    - Airlines, Aviation Industry
- Issues
  - Optimization
  - Goal of free and open data access
  - Standardization of formats
  - Accommodation of new data types and sources
  - Funding (government vs. industry)

- **Back Up Slides**

ADDS In Situ EDR Viewer



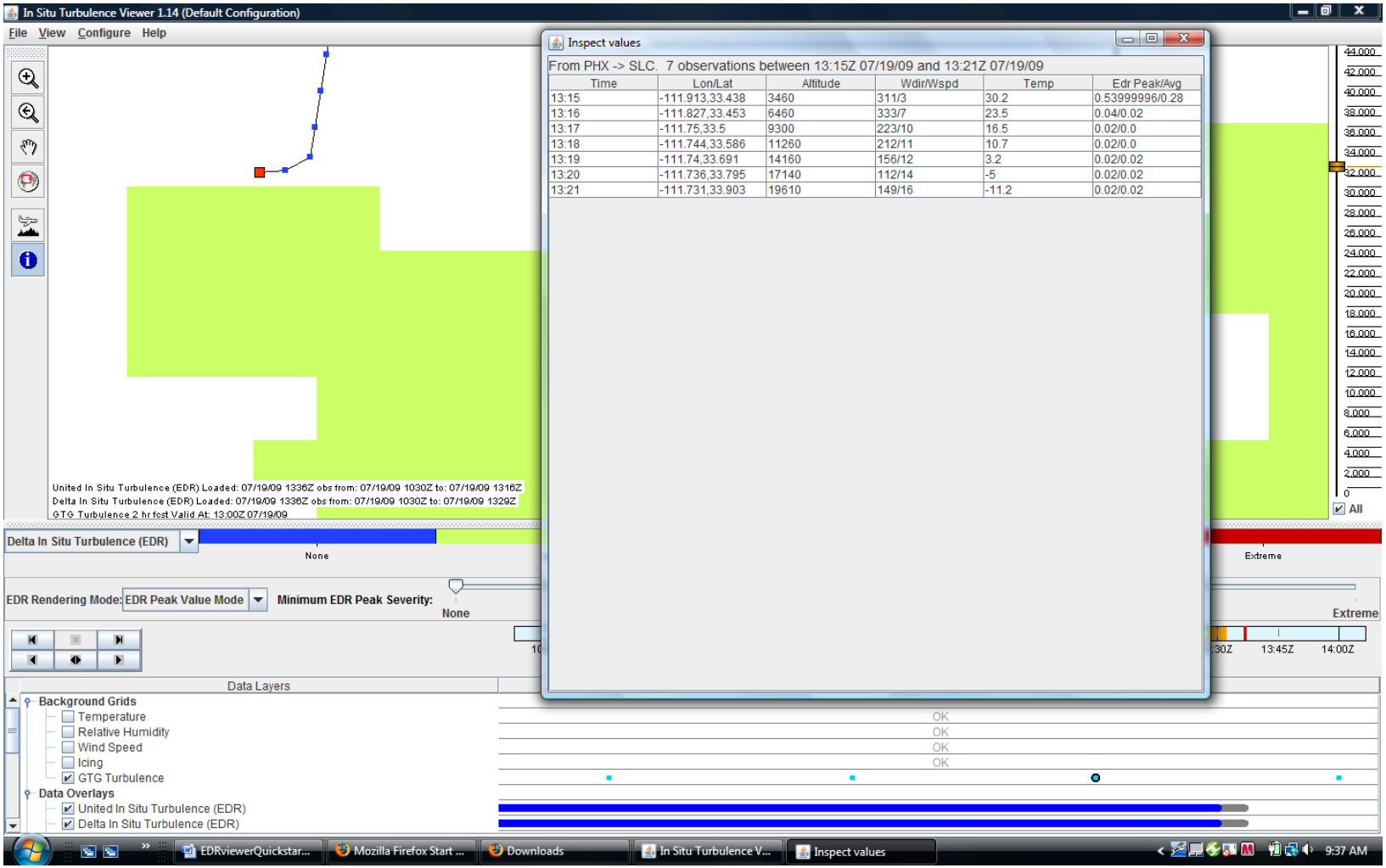
EDR Viewer Flight Path Tool



DAL Dispatch EDR Feedback Form

Flight #/ Aircraft type	Date/Time	Target Altitude	Flt Altitude Change	Distance/time off alt. & Comments	Impact of EDR on altitude change
Flt# _____ A/C Type _____	Date: _____ Time: _____		þ Pilot requested change þ Pilot reported change þ Flight plan change by OCC þ Change observed by OCC		Requested alt. change not needed after EDR info reviewed Alt. change closer to target alt. (How much closer? _____ft) Shorter time/distance off altitude (How much shorter? _____) Alt. change during flight planning EDR info had no impact on altitude change.

EDR Wake Vortex Incident



Projected GTG releases – next 7 years (updated)

Version	Capabilities	Op. date
GTG1	Upper levels RUC20	3/2003
GTG2	Improved GTG1 Mid levels Uses in situ	Early 2010
GTG3a	Improved GTG2 RUC-based MWT Optimized insitu	????
GTG3b	Improved GTG3a 13 km WRF RR (pre-impl 08, final early 10) All altitudes	FY11
GTGN1	NTDA2/DCIT in situ GTG3b > 10,000 ft	FY11
GTG4	Improved GTG3b Ensembles/Probabilistic forecasts out-of-cloud turb (CIT) forecasts	FY14
GTGN2	NTDA2 GTG5 all altitudes	FY14
GTG5	Improved GTG4 Ensembles/floating high res grids	FY16
GTG/TFO?	Global – GFS based	FY16

NextGen IOC versions

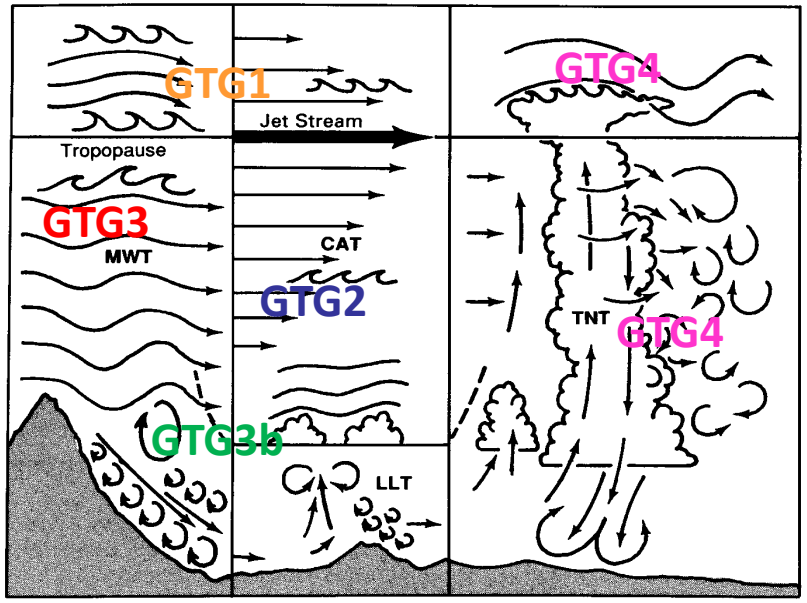
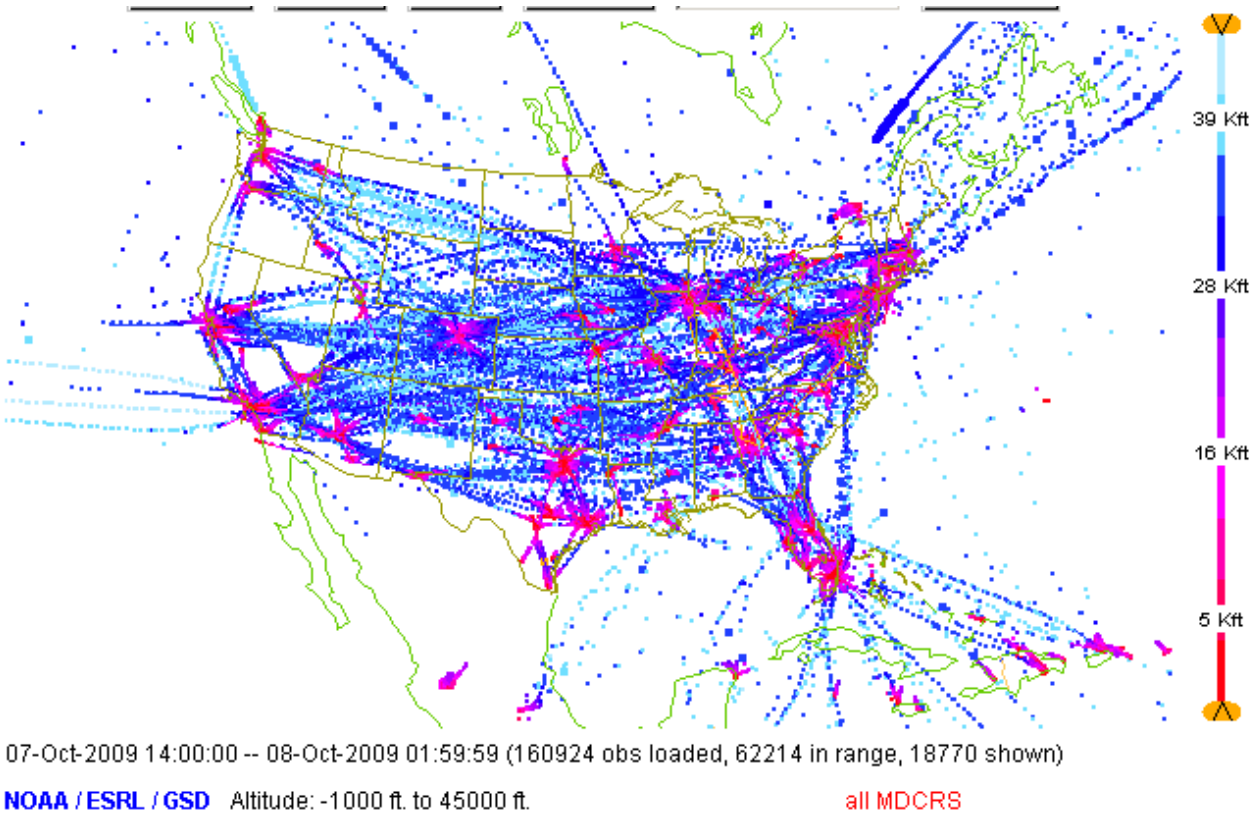


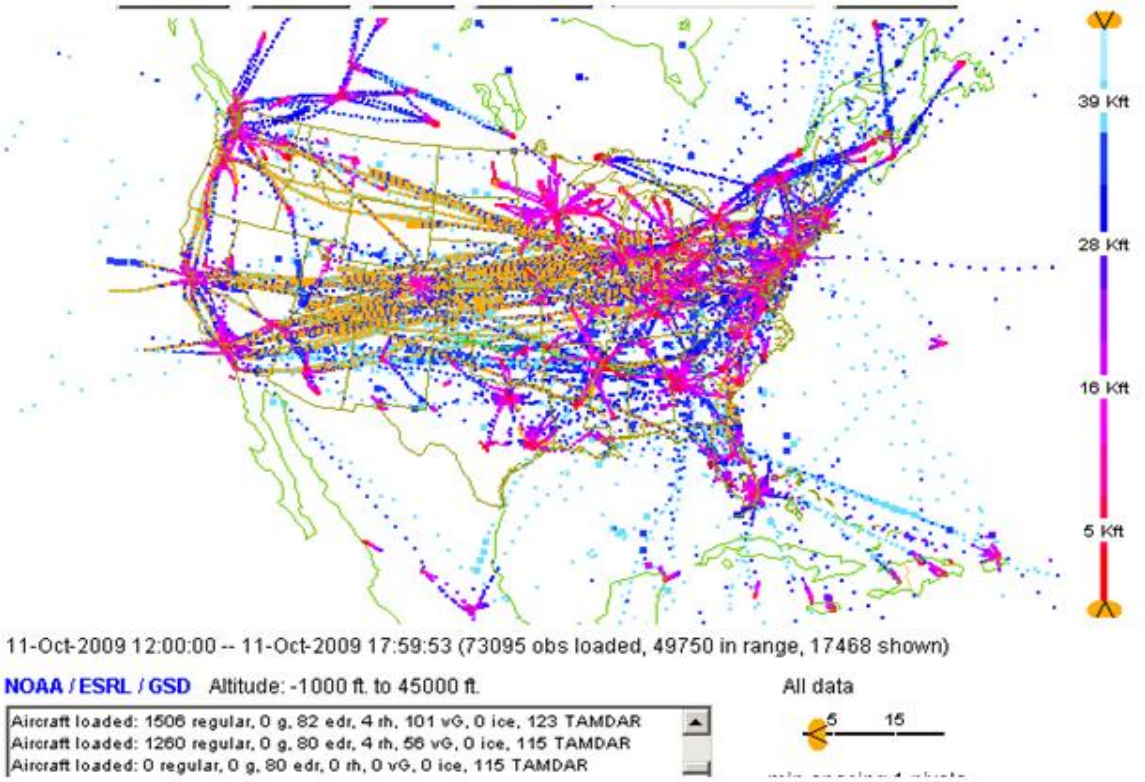
Figure 1-16. Aviation turbulence classifications. This figure is a pictorial summary of the turbulence-producing phenomena that may occur in each turbulence classification.

Source: P. Lester, "Turbulence – A new perspective for pilots," Jeppesen, 1994

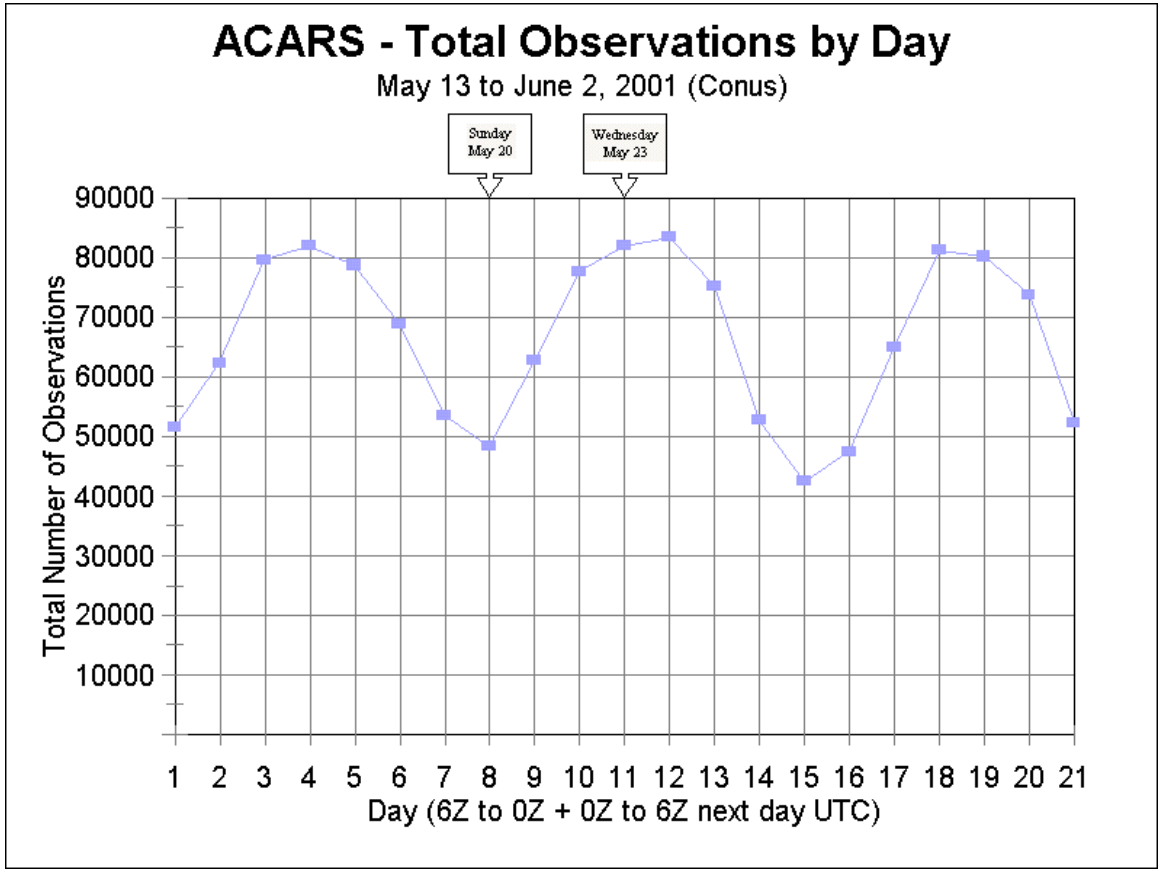
MDCRS Coverage



ACARS Coverage



MDCRS Temporal Coverage



Airborne In Situ Weather Observations

Current Use

Integrated Terminal Weather System (ITWS)

- Fully automated, integrated terminal weather information system
- Uses sophisticated algorithms to integrate data from FAA and NWS sensors, radars, weather models, and *from aircraft in flight*
- Users: FAA (TRACON, ATCT, ARTCC, ATCSCC), airport authorities, airline dispatch offices