



World Meteorological Organization

Weather • Climate • Water

# ABOP Global Status: “What’s Now”

WMO CBS Expert Team for  
Aircraft Based Observing  
Systems (ET-ABO)

*July 17, 2018*

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## The WMO AMDAR Observing System

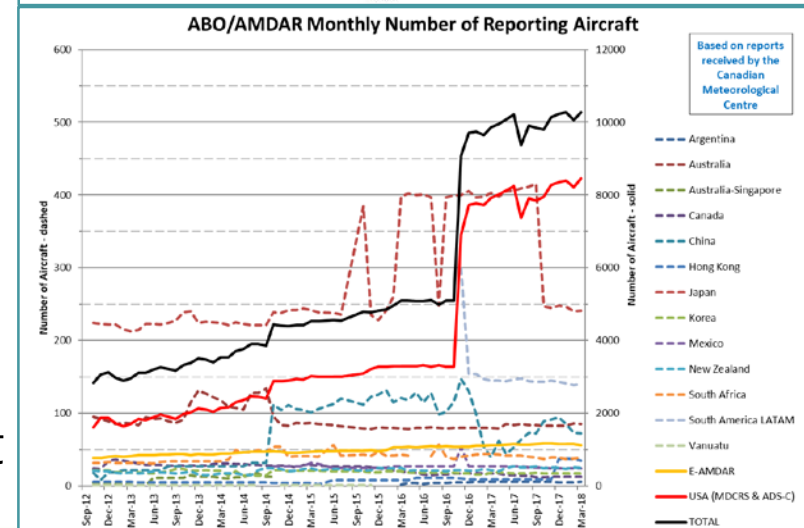
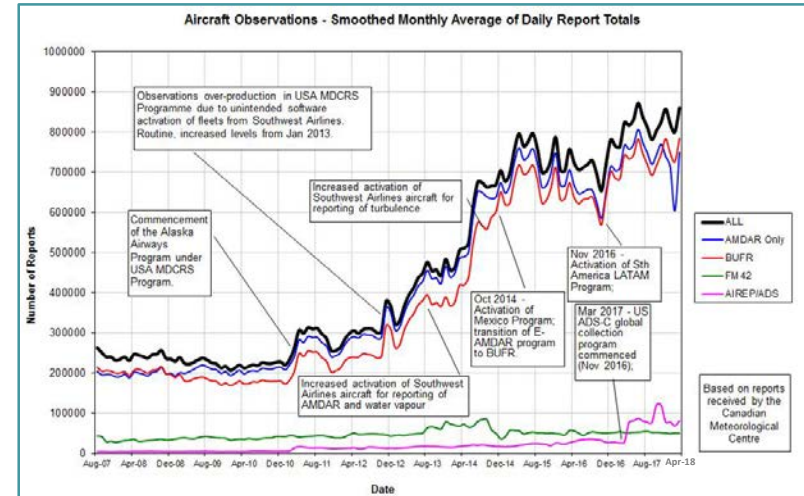




# WMO Aircraft-Based Observations Programme (ABOP)



- **WMO ABO from various sources**
  - AMDAR still ~95% of all ABO data
  - Supplemented by AIREPs & now ADS-C
  - And commercial data services
  - Data Quality Monitored and Controlled
- **Global ABO growing - but slowly**
  - 40 participating airlines
  - 5,000+ AMDAR aircraft (10,000 all ABO)
  - Over 850,000 observations per day
- **Turbulence and WVM - also slow**
  - Turbulence Reporting has increased at a few airlines
  - Quantity of Water Vapour Measurement data unchanged since 2016

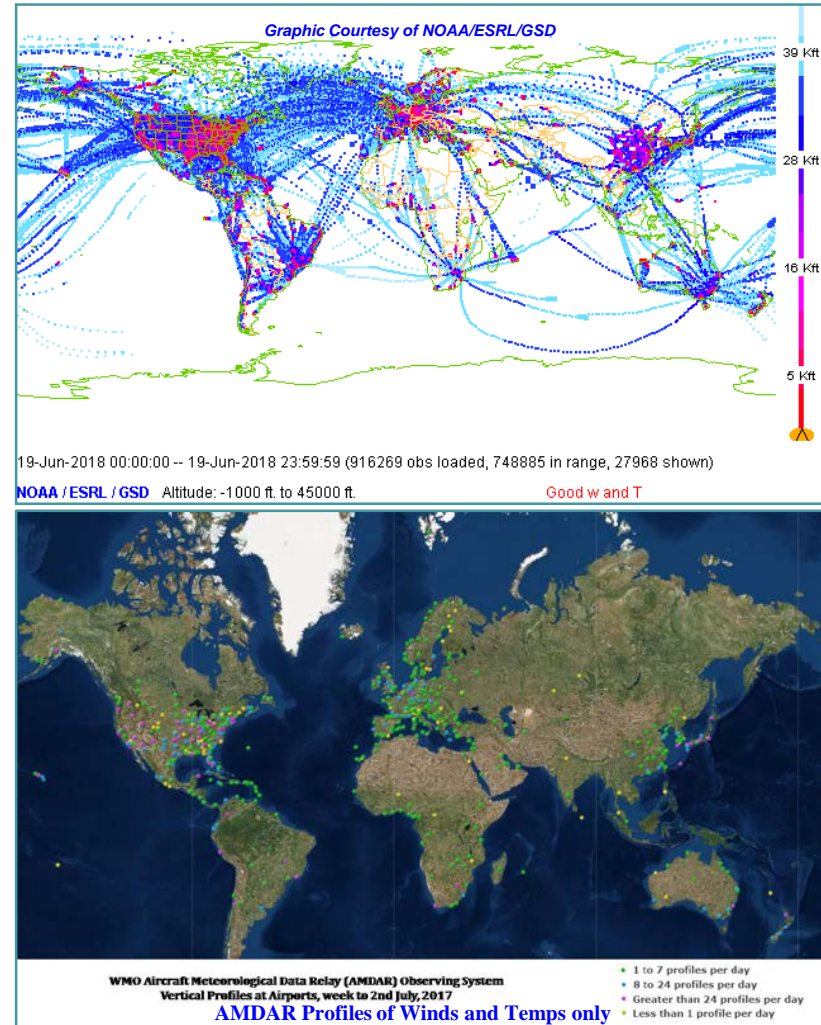




# WMO Aircraft-Based Observations Programme (ABOP)



- **Geographic Coverage Varies**
  - Good: USA, W. Euro, E. Asia, Australia, NZ, So. Africa
  - Moderate: So. Am., Cent. Am., Canada
  - Poor: E. Euro, No. & Cent. Africa, Mid-East, W. Asia, SE Asia, Cent. Asia, SW Pacific Islands
- **Profile Temporal Distribution is uneven in those areas**
  - Excellent: > 24 per day
  - Good: 8 - 24 per day
  - Minimum: 1 - 7 per day
  - Poor: <1 per day
- But not evenly spread in Time
- And mostly just Winds & Temps

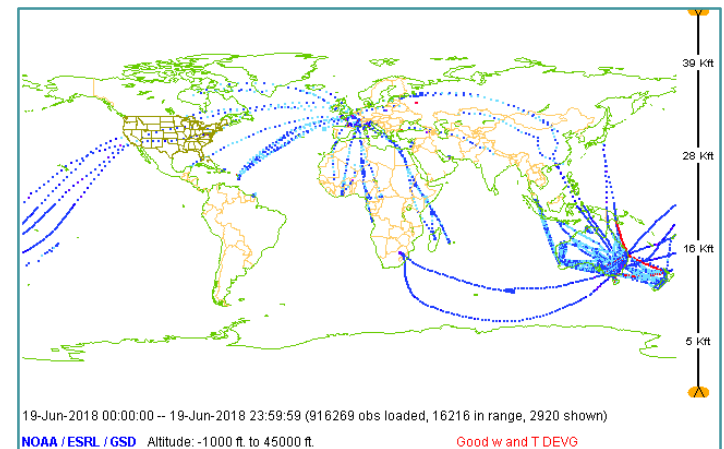
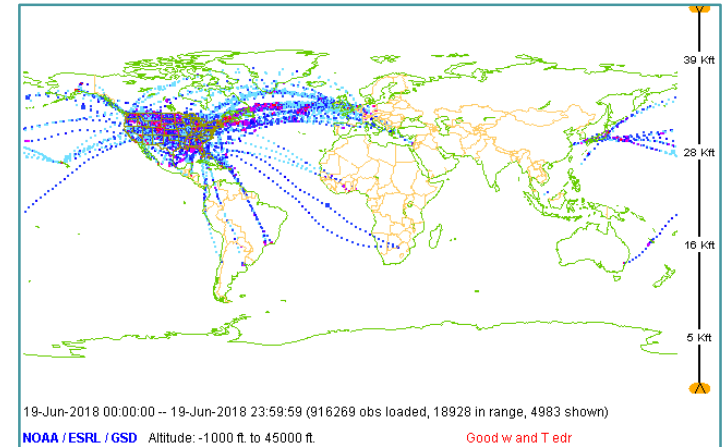




# Turbulence Monitoring



- **Eddy Dissipation Rate (EDR)**
  - ICAO standard for turbulence reporting (2001)
  - An average of about 160,000 reports per day
  - Over 950 aircraft report EDR worldwide
  - A significant increase since fall 2017:
    - Southwest Airlines deploying about 700 B737NGs
    - United Airlines deploying on 15 B777s
  - EDR software now available on B737NGs, B767-300/400, and B777
  - Collaboration underway with Delta, Qantas and Lufthansa Airlines to deploy on Airbus starting with A321 and A330
- **DEVG still reported by some**
  - An average of about 20,000 reports per day
  - More than 220 aircraft reporting worldwide



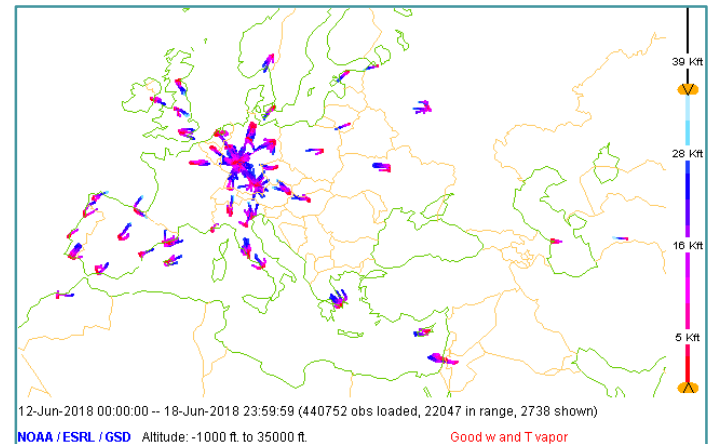
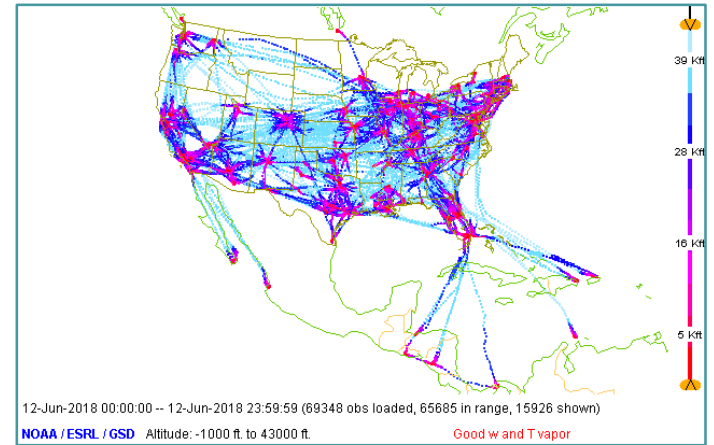
Graphics Courtesy of NOAA/ESRL/GSD



# Water Vapour Measurement



- **Region-IV NOAA/NWS WVSS-II Network**
  - Currently 139 aircraft reporting WVM
    - 25 at UPS Airlines (B757)
    - 114 at Southwest Airlines (B737)
  - Further expansion possible in 2018/2019
    - Via Data Purchase Program with Rockwell Collins
- **Region-VI E-AMDAR WVSS-II Network**
  - Currently 9 aircraft reporting WVM
    - 9 at Lufthansa (A321)
  - Expansion possible in 2018/2019
- **Further expansions being explored**
  - Region-V (SW Pacific)
  - Region-II (Asia)
  - Region-I (Africa)
  - Region-III (So America)



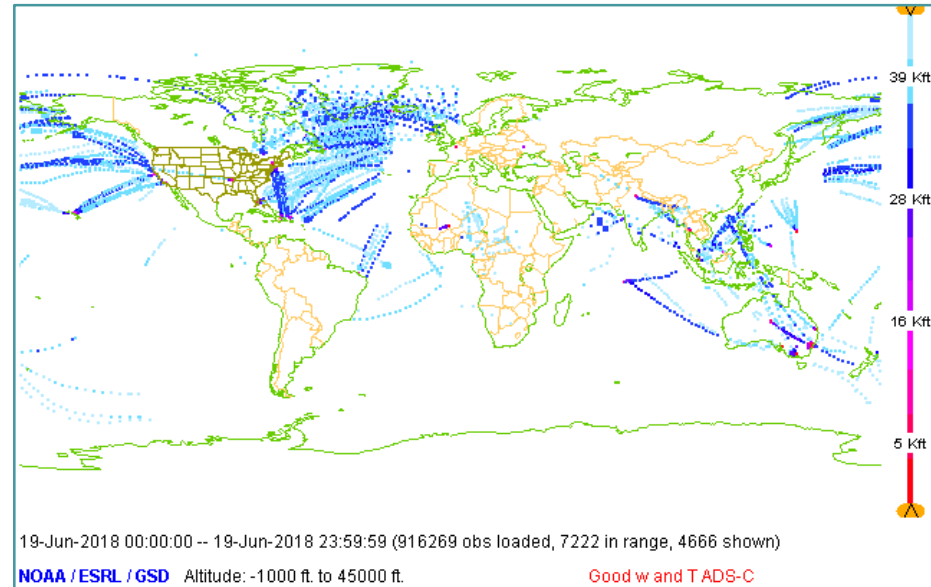
Graphics Courtesy of NOAA/ESRL/GSD



# Automatic Dependence Surveillance - Contract (ADS-C)



- **ADS-C (Automatic Dependence Surveillance - Contract)**
  - Data as specified in the Contract, via the Airline and a Service Provider
  - Can include Meteorological Data from aircraft systems, similar to AMDAR
  - But may not include Quality Control of the data
- **Reporting into ABO via NOAA/NWS**
  - Targeting specific data sparse areas
  - Over 5000 aircraft available to report
  - Via contract with Rockwell Collins
- **Data Quality Control is Important**
  - Early tests showed data Quality issues with available ADS-C data
  - Extra QC was implemented to prevent negative impacts to NWP
- **E-AMDR Evaluating ADS-C**
  - Discussing similar implementations



Graphic Courtesy of NOAA/ESRL/GSD



# Other Available ABO Sources

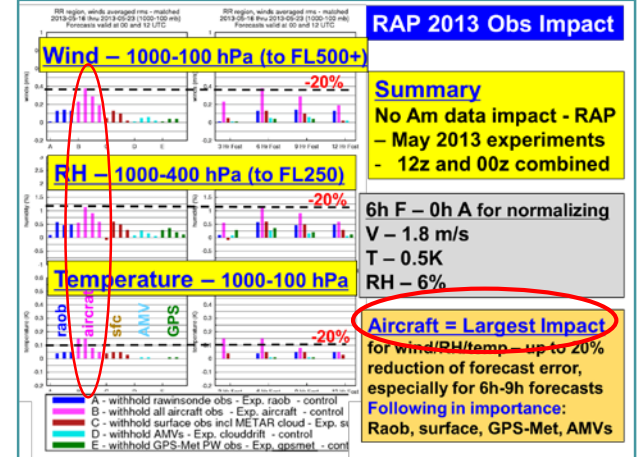
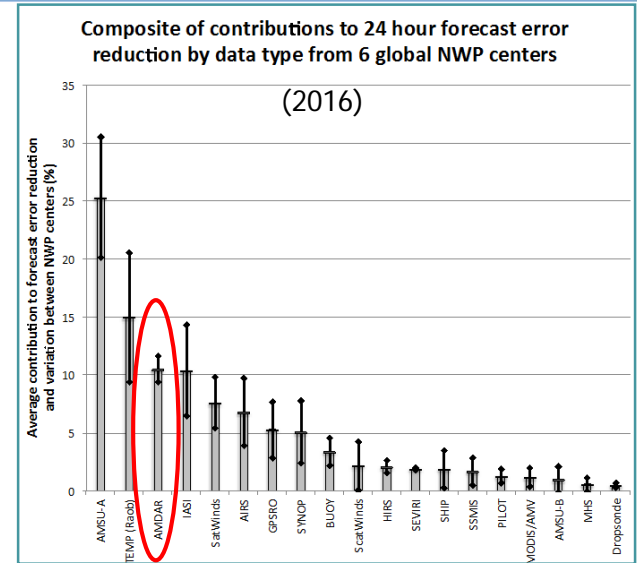


- **Panasonic - TAMDAR** (Tropospheric Airborne Meteorological Data Reporting)
  - Dedicated Wx Sensor Package (Prs & GPS Alt, Wind, Temp, RH, Icing, Turbulence)
  - SATCOM based datalink, coupled with IFE
  - Contains an active data Quality Control programme
  - U.S. NOAA/NWS acquiring data via the National Mesonet Program
- **FLYHT - AFIRS** (Automated Flight Information Reporting System)
  - SATCOM based streaming of FDR and other aircraft data
  - Can optionally include ABO Wx data
  - Receiving ABO data from Skytraders (Australia), processing by Australian BoM
  - WMO collaborating for 2-6 month trials in Caribbean and Papua New Guinea
- **“Soon” ADS-B Wx** (Automatic Dependence Surveillance - Broadcast)
  - Anticipate many aircraft will not produce data meeting quality requirements
  - Requiring significant Quality Control to avoid negatively impacting models
  - While only a small % may meet requirements, the volume should be of value

# AMDAR Benefit to Numerical Weather Prediction (NWP) Forecast Models



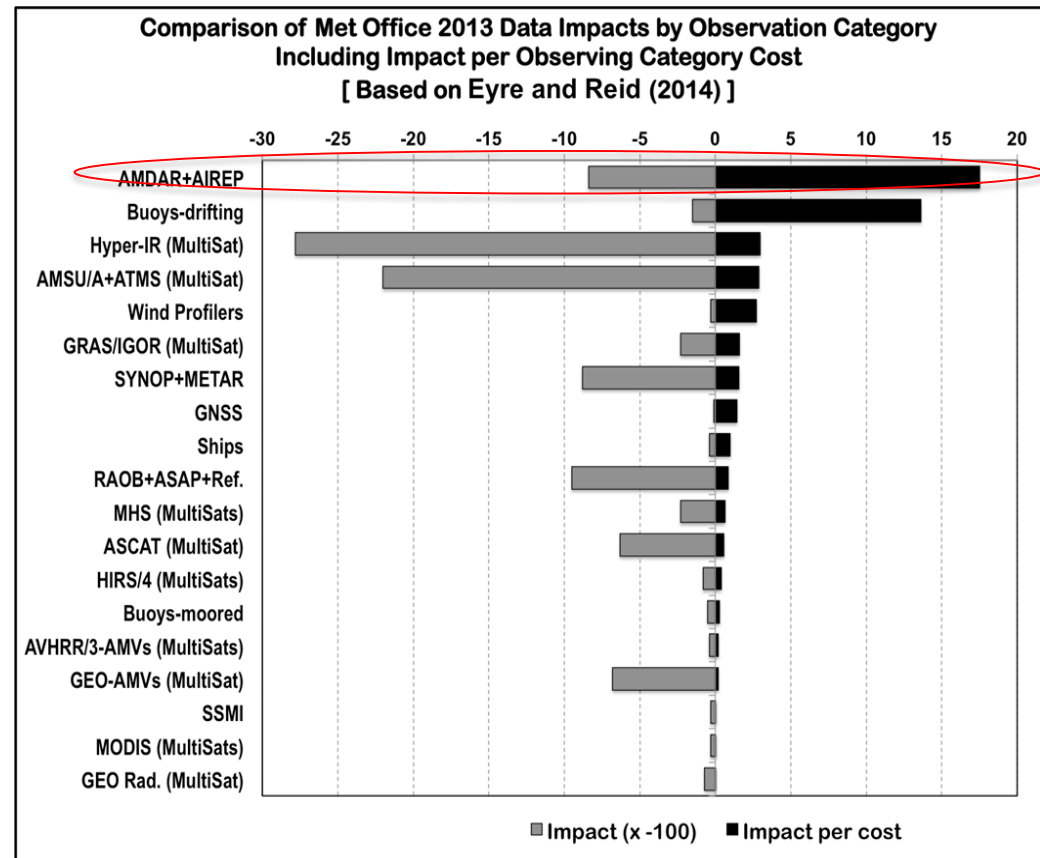
- 3<sup>rd</sup> in GLOBAL NWP Forecast Improvement
  - AMDAR 3<sup>rd</sup> in reducing Global forecast error
  - Behind only satellite sounders & radiosondes
  - Even with limited global coverage
- 1<sup>st</sup> in High Res NWP Forecast Improvement
  - Aircraft ranked #1 impact for U.S. RAP in 2013
  - RAP/HRRR is the main U.S. model for Aviation
  - High Res models benefit rapidly with more ABO
- But still room to Improve all NWP
  - More high quality ABO, with all parameters
  - Benefiting NWP models at all scales
  - ABO benefits are NWP is reproducible in new areas
- Improving all Aviation Weather Support
  - Resulting in Fewer Unexpected Weather Impacts
  - Improved Operational Efficiency
  - Improved Safety





# AMDAR Benefit to Cost Ratio for Global NWP

- **Satellites provide**
  - High volume & global coverage
  - But with less accuracy
  - At a very high cost
- **RAOBs provide**
  - Good accuracy when available
  - But poor space/time coverage
  - At a high recurring cost
- **ABO/AMDAR Provides**
  - Growing global spatial coverage
  - Much higher temporal coverage than radiosondes
  - Better accuracy than satellites
  - Lowest cost of these systems
  - At very low implementation risk



**ABO achieves the Highest Benefit/Cost Ratio**



# IATA-WMO Collaboration on AMDAR (IWCA)



- **IATA-WMO Collaboration on AMDAR (IWCA)**
  - To Expand AMDAR Globally, with a focus on Data Sparse areas
  - To Expand Water Vapour Measurement Globally
  - To Expand Turbulence Monitoring Globally
- **IWCA will seek to:**
  - Encourage Airline participation in global AMDAR
  - Simplify Program Agreement Process
  - Simplify Technical Implementation Solutions
  - Simplify Program Operations Process
  - Standardize Costs and Remunerations to Airlines



# ICWA Timeline - Progress



- Dec 2016 - WMO and IATA met in Geneva - Agreed on benefits of collaboration on AMDAR
- Jan 2017 - CBS and IATA began work on principles, concepts of IATA-WMO collaboration
- May 2017 - EC-69 approved document and [Decision 12.2\(2\)/1](#)
- May 2017 - Discussed at CBS/ET-ABO-3 - endorsed proceeding
- July 2017 - IATA-WMO Working Arrangement established
- Dec 2017 - First draft of Concept of Operations
- Jan 2018 - RA VI-17 [Resolution 3.2\(5\)/1 \(RA VI-17\)](#)
- Mar 2018 - CBS-TECO, Formation of Task Team on IWCA
- May 2018 - First draft of Terms of Reference/Principles of IWCA
- Jun 2018 - [ICWA Information Event](#) at WMO EC-70
- Jun 2018 - EC-70 Decision 7.4(1)/1, Task Team IWCA reports to EC



# ICWA Timeline - Next Steps



- TT-IWCA to develop IWCA documents and framework - 2018
- Decisions for RA III and RA V sessions - 2<sup>nd</sup> half 2018
- Resolution of WMO Congress-18 - mid-2019
  - Principles
  - Terms of Reference
  - Concept of Operations
  - Implementation Plan
- IATA-WMO Agreement on AMDAR - July 2019
- IATA-WMO Summit on ABO - Q1 or Q3 2019
- IWCA Commence Development (Region VI) - 2019
- IWCA Commence Operations (Region VI) - 2020



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Thank you for your attention