Aircraft Weather Data – Outline

- US ABO Program
- Benefits of ABO Program
- Humidity reports
- MADIS AMDAR displays
- Summary
1980's, NOAA Research ins using Aircraft Obs in experimental numerical weather products

1993 NOAA Research stands up AMDAR website for QC and distribution.
http://amdar.noaa.gov

1996 US airlines allow direct access to data by NOAA’s NWS meteorologists for use in NWS operations

1996-2015 and beyond NOAA committed to sustainment and expansion of US ABO program

Weather Forecast Office Green Bay Wi
NWS operational forecasters use aircraft based observations daily for forecasts and warnings to protect property and save lives
• AMDAR is the core component of the Aircraft-based Observing System:
  • ~ 95% of all Aircraft Based Observations (supplemented by ICAO AIREPs, PIREPs and ADS)
  • Data derived from vertical profiles and enroute reports of meteorological parameters according to meteorological specification.
  • Over 650,000 observations per day
  • 38 participating airlines globally
  • Over 3000 participating aircraft
  • Data quality is equivalent to radiosonde
US NWS Aircraft Based Observation Program Strategies and Activities

• Aircraft Based Observations are a proven mechanism for adding valuable weather data into national airspace operations. The US ABO program is:
  • Strategic: Demonstrated improvements to Numerical Weather products
  • Tactical: Operation forecasting uses and emerging capabilities for cockpit utilization of real time hazard information (temperature, winds, humidity, turbulence, pireps and airreps.icing)
  • Potential in the future for real time crosslink of aircraft-derived turbulence and other ABO data
  • Ongoing NOAA/FAA/A4A US ABO management team
• Expand ABO turbulence (EDR) and Icing reports
• Joint FAA NOAA MDCRS and NWS WVSS programs sustain and expand
• NWS Aircraft Observation and Mesonet contracts in place to expand regional and global coverage of aircraft based observations
  • More aircraft observations in data sparse areas of globe
  • Expand number of participating regional airlines
  • Utilizing new downlink methods such as ADS-C
• Reduce redundant soundings at hubs (optimization)
• Some data becoming available in real time through MADIS
• More interaction with WMO RA-IV and RA3-III (Americas) partners - share experiences and knowledge workshop in Panama in August 2016
• Expand MADIS and AMDAR web sites in support of data stewardship real time QC, archiving and distribution of Aircraft based observations
madis.noaa.gov
Aircraft based observations – benefits real applications for improving forecasts and warnings

- Aircraft based observations have proven extremely useful in a wide variety of forecast and warning situations, including:
  - Improved information for aviation interests
    - Low level wind shear
    - Ceilings and visibilities
    - Icing and turbulence
    - fog
  - Winter Storms
    - Precipitation type
    - Lake effect snow
  - Thunderstorms
    - Convective initiation
    - Calculation of stability indices
  - Fire Weather
    - Mixing heights
    - Haines indices
    - Relative humidity forecasts
  - Marine Forecasts
    - Small craft and Gale Warnings
  - Hazardous Materials Support
    - AMDAR can be used to support HAZMAT teams
    - Can be input into local dispersion models
ABO benefits for Numerical Weather Prediction (NWP) – weather models

- Better forecasts – less weather delays due to NWP improved by Aircraft based observations
- NOAA HRRR/RAP weather model grids are the **backbone for most aviation hazard guidance products** for 1-18h duration, including
  - Turbulence and icing
  - Upper-level and terminal approach lower-troposphere winds
  - Ceiling/visibility, Terminal forecasts
- Skill of NOAA’s regional HRRR models is dependent on high-quality hourly observations over the US and North America.
  - Aircraft observations are the most single important observation source for 1-18h forecasts over the US; other obs type also add value
  - Forecast accuracy further improves with additional aircraft data and methodology (e.g., addition of expanded Alaska Airlines, WVSS-II, TAMDAR, ADS-C)
  - Ongoing effort within NOAA to improve assimilation of ABO into global scale NWP such as NOAA’s Global Forecast System (GFS) model
- New 2013 HRRR data denial study
  - Aircraft observations more dominant than in for 2011 RAP obs denial experiments
  - Now ABO is most important obs type also for moisture/RH in HRRR
Humidity Reports from Commercial aircraft

- A 2005 sensor (WVSS-II) employs a diode laser to measure water vapor mixing ratio.
- WVSS-II is installed on 25 UPS aircraft, 110 Southwest Airlines. Lufthansa has some aircraft equipped with WVSS-II.
- About 10,000 profiles per week being made available in real time through MADIS.
Data Dump - used for all data types
### Sample ABO Dump Using MADIS API

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MADIS AMDAR Display Sounding with moisture
MADIS AMDAR Display Winds
Summary

• **Avoidable** delays **caused by weather** cost the airline industry **billion per annum**.
• The US ABO AMDAR program contributes to upto 30 percent skill increase for NOAA’s High Resolution Rapid Refresh numerical weather model – most important data set for impact to regional model skill.
• The US ABO data coverage is currently at much less than 50% of what is potentially achievable.
• Desired expansion of aircraft reporting humidity. Currently TAMDAR (Panasonic) and WVSS-II on only a few hundred aircraft.
• Further expansion of FAA led EDR reporting for Global coverage – leading to improved and enhanced turbulence forecast products.
• Utilization of ADS-B and ADS-C meteorological data to supplement current methods of downlinking ABO data from airlines.
Questions

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