Working Group/Observational Data
Fall 2017

Co-Chairs:

Mr. Vincent Tabor, NOAA/NESDIS

Mr. Jeffrey Ator, NOAA/NCEP

Exec. Secretary:

Mr. Anthony Ramirez, OFCM

Overview

- Scope of Responsibility
- Members
- Ongoing Activities
- Action Items
- Upcoming Activities

Scope of Responsibility

Facilitate the acquisition, processing, exchange, and management of observational data and metadata among the Federal Agencies, National Operational Processing Centers (OPCs), the World Meteorological Organization, and other related data centers. Primary focus areas:

- Meteorological, oceanographic, and space environmental data and metadata
- Provide an interface between the OPCs, their research and development partners in the Joint Center for Satellite Data Assimilation (JCSDA), and the other national data and prediction centers for the purpose of coordinating and satisfying national requirements for observational data
- Coordinate data formatting standards where practical and the implementation of approved data product enhancements and new data products
- Coordinate observational data issues that overlap related responsibilities of other OFCM committees and groups
- Ensure the OPCs and related data centers are provided the maximum quality and optimum quantity of observational environmental data streams required for assimilation into their respective processes

Member Agencies/Entities
NOAA Agencies

- National Environmental Satellite, Data, and Information Service/Office of Satellite and Product Operations (NESDIS/OSPO), Suitland, MD
  - National Centers for Environmental Information (NCEI)
    - Center for Weather and Climate (CWC) (formerly NCDC)

- National Weather Service (NWS), Silver Spring, MD
  - National Centers for Environmental Prediction (NCEP), College Park, MD
    - Environmental Modeling Center (EMC)
    - NCEP Central Operations (NCO)
      - NCO-Silver Spring (formerly Telecommunications Operations Center (TOC))
    - Space Weather Prediction Center (SWPC)
  - Office of International Affairs
  - Office of Observations
    - National Data Buoy Center (NDBC)
  - Office of Dissemination

- Office of Oceanic and Atmospheric Research (OAR)

Member Agencies/Entities DoD and other Agencies

- Air Force
  - 557th Weather Wing, (Air Combat Command) Offutt AFB, NE
    - 14th Weather Squadron, Asheville, NC
- Navy
  - Fleet Numerical Meteorology and Oceanography Center (FNMOC), Monterey, CA
  - Naval Oceanographic Office (NAVOCEANO), Stennis Space Center, MS
  - Naval Research Laboratory-Marine Meteorology Division, Monterey, CA
- Joint Center for Satellite Data Assimilation (JCSDA) (Headquarters), College Park, MD
- The U.S. Integrated Ocean Observing System (IOOS)

WG/Observational Data

Co-Chairs	Mr. Vincent Tabor, NOAA/NESDIS (Satellite) Mr. Jeffrey Ator, NOAA/NCEP (Conventional)
NOAA **NESDIS** -- OSPO -- NCEI/CWC **NWS** -- NCEP/EMC -- NCEP/NCO -- NCEP/SWPC -- Office of Intnl. Affairs -- Office of Observations --- NDBC -- Office of Dissemination **OAR**	 Mr. Vincent Tabor Vacant Mr. Jeffrey Ator Mr. Dennis Keyser and Mr. Christopher Hill Mr. Walter Smith Vacant Mr. Fred Branski Ms. Alix Rolph Vacant Vacant Dr. Stephen Piotrowicz
JCSDA	Dr. James Yoe
IOOS	Mr. Derrick Snowden

WG/Observational Data

NAVY	
NAVO	Mr. Danny Illich Mr. Bruce McKenzie
FNMOC	Mr. James Vermeulen Dr. Justin Reeves
NRL	Dr. Patricia Pauley
AIR FORCE	
557th Weather Wing	Mr. Mark Surmeier - Lead Mr. Al Zamiska Mr. Doug Wilkerson
--14th Weather Sq.	Mr. Randy Haeberle
OFCM Exec. Secretary	Mr. Anthony Ramirez

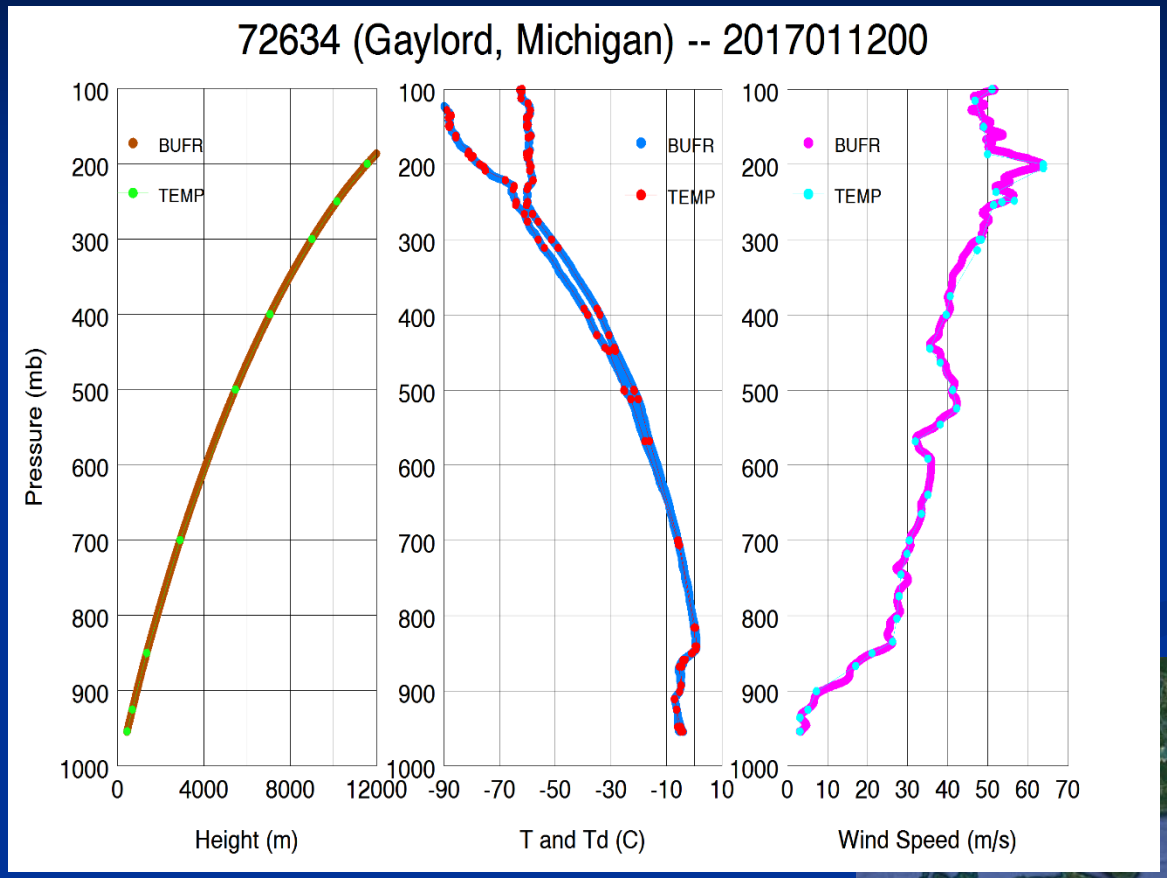
Ongoing Activities

Interagency implementation of WMO data management procedures

- BACKGROUND:
  - Two overlapping & concurrent WMO migrations
    1. WMO is migrating from Traditional Alphanumeric Code (TAC) forms to Binary Universal Form for the Representation of meteorological information (BUFR)
    2. WMO is implementing WIGOS and OSCAR/Sfc (from Pub 9 Vol A)

- TAC distribution was SCHEDULED to end in 2014, but…
  - TAC data counts are diminishing as countries discontinue TAC distribution
  - If production centers do not have replacement BUFR products, OPCs could experience negative impacts on model skill.
  - OPCs need to temporarily use BOTH TAC and BUFR data

The Status of High-Resolution BUFR

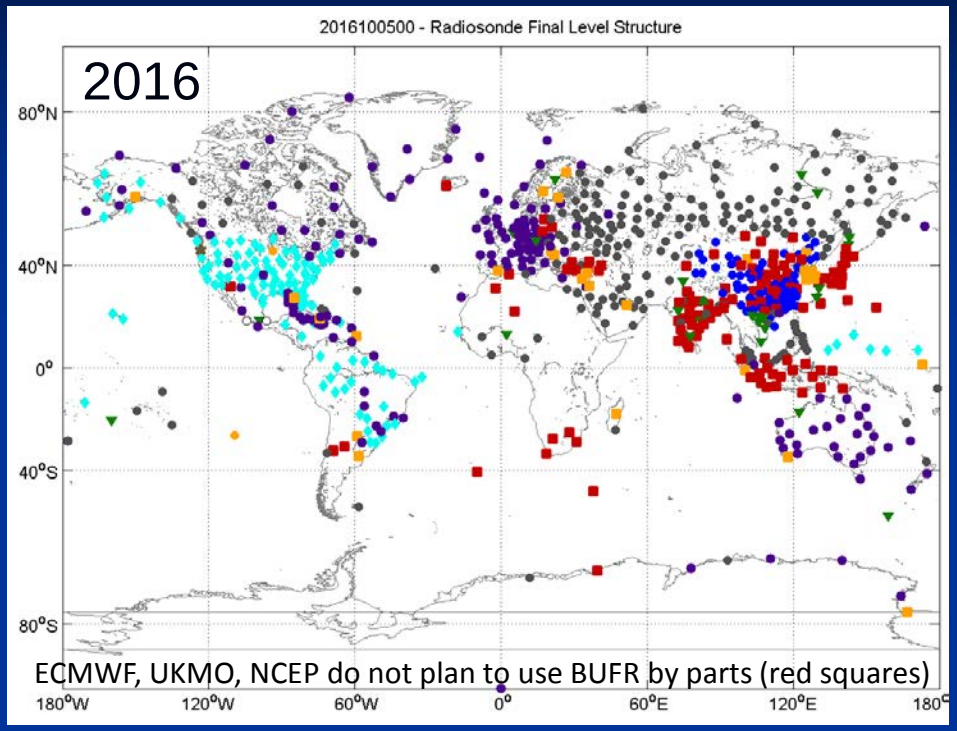


- 92 total WFO UA sites
- 72 providing high-res BUFR as of 18 Oct 2017, including Guam and Puerto Rico
- 11 of the 92 are TROS or autosonde sites that are not included in the software upgrade
- Most of the remaining sites are in Pacific Region
- Vaisala high-res BUFR is being received from the Kodiak, AK, autosonde site

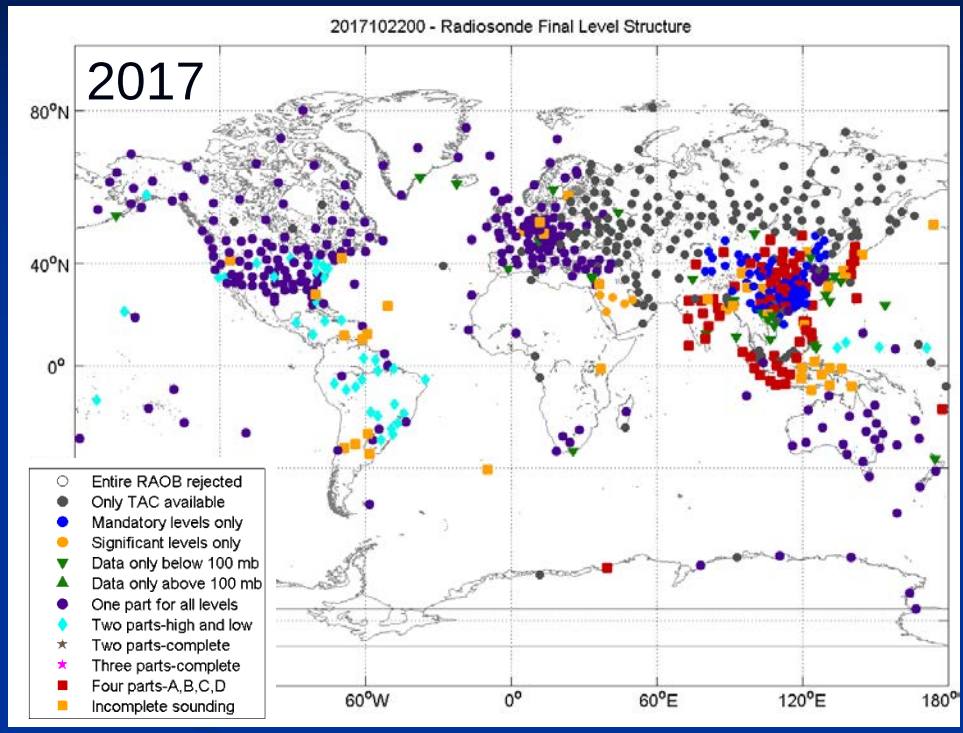
Operational high-resolution sounding for 72634 (Gaylord, MI) at 2017011200

- BUFR: 1-sec (~5 m) data with balloon drift and time, all variables at all levels

The Status of High-Resolution BUFR



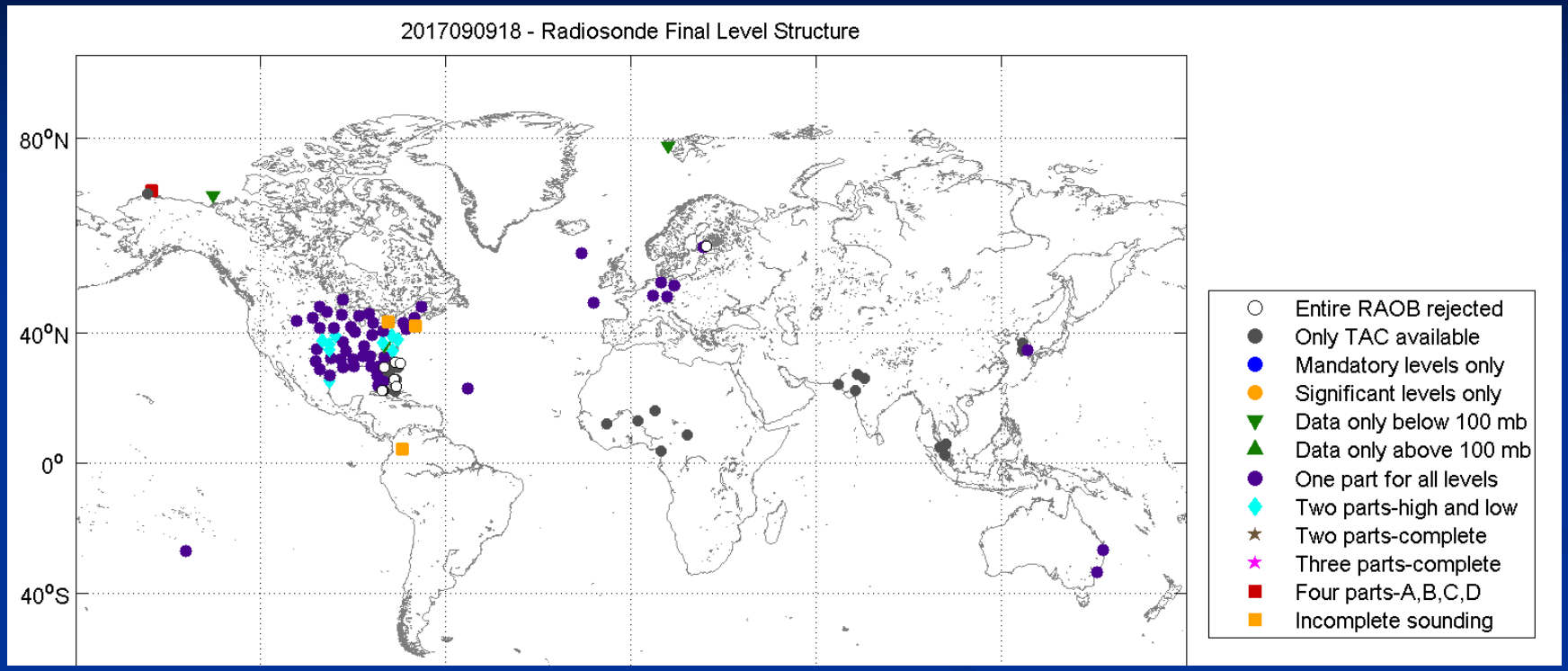
ECMWF, UKMO, NCEP do not plan to use BUFR by parts (red squares)



Structure of BUFR radiosonde data received at FNMOC

- "Proper" BUFR—one message containing the full sounding (purple dots)
- "BUFR by parts"—one message for each of the four TEMP parts (red squares)
- NCO's BMT BUFR provides multiple messages for the U.S., some of which are proper BUFR
- The new RWS Build 3.4 BUFR does provide proper BUFR
- BMT BUFR is re-formatted from TAC; RWS BUFR uses one-second data from the ground station like Europe, Australia, and some other locations

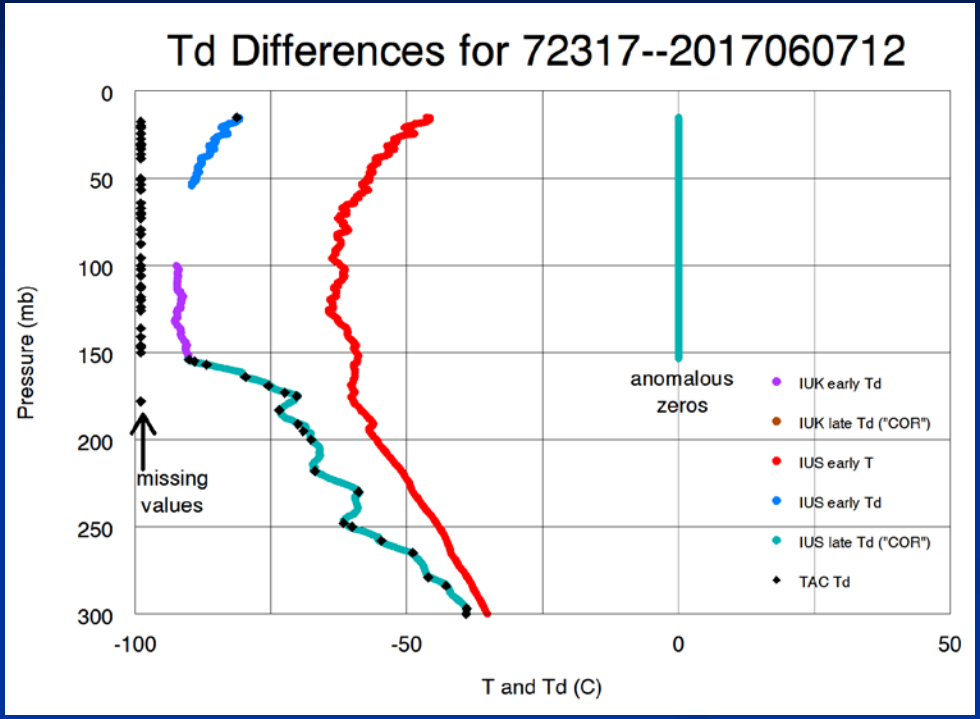
A Success Story



Radiosonde data received at FNMOC for 18Z 9 Sept 2017 (during Hurricane Irma)

- U.S. radiosondes rarely flown at "off times"—06Z and 18Z
- Special soundings in eastern U.S. requested to improve forecasts for Hurricane Irma
- High-res "proper" BUFR received for most U.S. special soundings (purple dots)
- High-res dropsonde data were not transmitted but were available 5-7 days later from UCAR
- BMT re-formatted dropsonde data rejected (open circles) but TAC dropsonde data used

But Not Without Problems



Some U.S. high-res soundings have anomalous dewpoint temperatures of 0°C

- The ground station software allows operators to "delete" suspicious data
- Deleted values of dewpoint depression show up in TAC messages as missing
- However, these deleted values show up in BUFR as dewpoint temperatures of 0°C
- Messages with the deleted values are sent as corrections ("COR")
- These 0°C dewpoint temperatures can be found by trapping for negative dewpoint depressions
- The problem was not introduced by the RWS Build 3.4 update, but was pre-existing
- The issue is being worked by the Office of Observations

BUFR Migration Monitoring and Collaboration

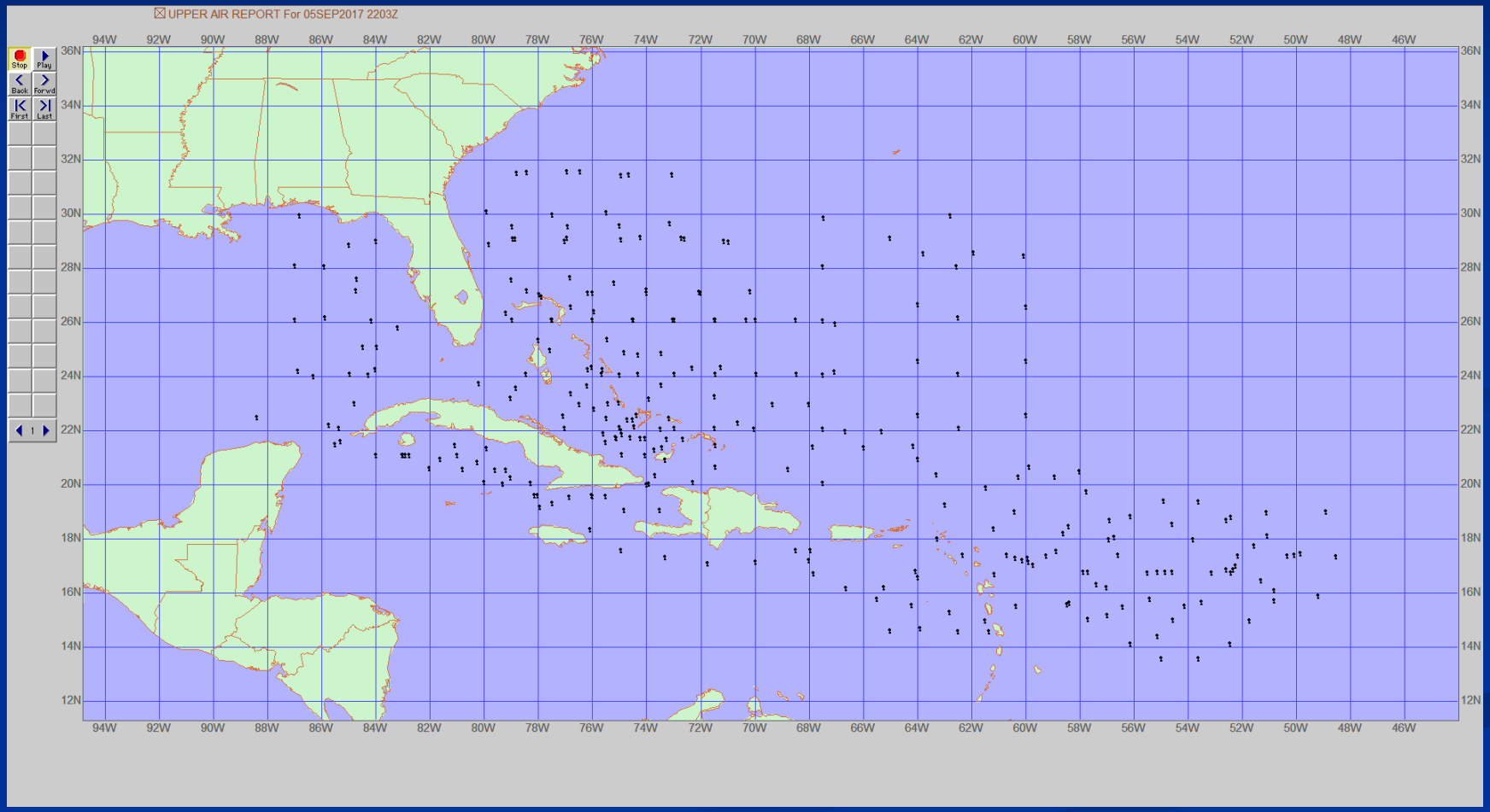
- FNMOC, NRL, NAVO, NCEP, 557 WW – Metadata Subgroup
  - Weekly conference calls continue – very active since January 2015
  - Coordinated with NCEP/NCO to remove the following products inserted onto the GTS:
    - Canadian TUABUFR radiosonde data (COMPLETE)
    - BMT radiosonde data for French station 78897 (COMPLETE)
    - SYNOP converted from BUFR to TAC for non-U.S. stations (IN PROGRESS)
  - Newly appointed Air Force OSCAR/Sfc sub-focal point

New High-Res BUFR Radiosonde and Dropsonde data

- Fire Wx soundings (obs of opportunity, < 200/yr)
  - Available in high-resolution BUFR in real time
  - Used in NWP operations at FNMOC
- Caribbean station radiosondes (CHUAS) (10 stations)
  - Developing network connectivity, GTS bulletin headers for high-res data
- Dropsonde data from NOAA and USAF aircraft
  - Established requirement for near real-time data that meets WMO BUFR guidelines
  - ASPEN software now capable of generating high-res BUFR messages
  - Successfully decoded 306 high-res BUFR messages collected by NOAA Hurricane Hunters during IRMA (non-real-time and not assimilated operationally)
  - With other OPCs, requested updated version of ASPEN to include "observation sequence number" in future BUFR messages (used in NWP DA)
  - ASPEN developers were working to implement requested changes and start inserting BUFR messages onto the GTS before 01 Nov 2017
  - Both TEMP DROP (ASCII) and BUFR will need to be included on the GTS for foreseeable future
- OPC-consolidated specification recommendations submitted for new radiosonde sensors (for NWS request for proposals)

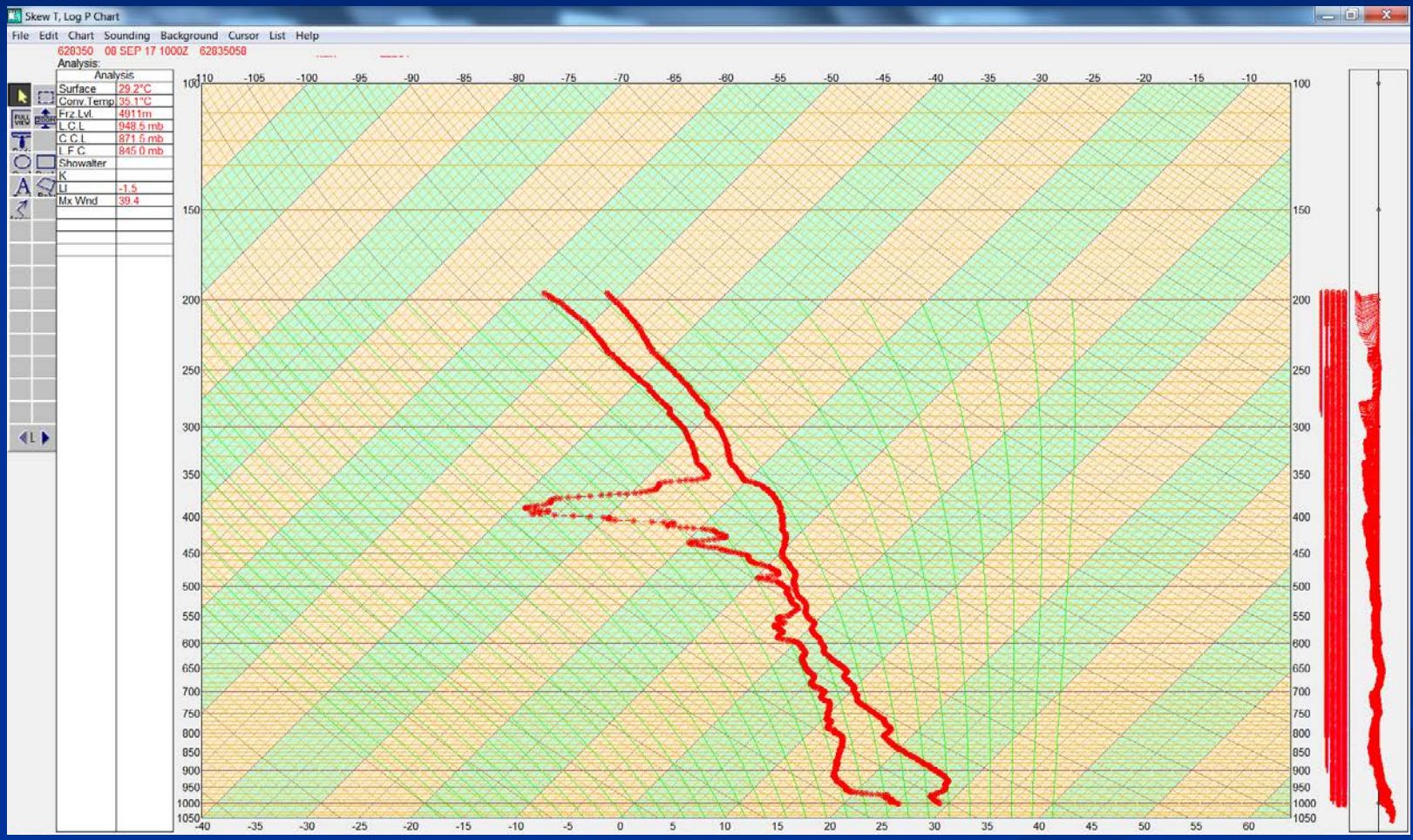
306 Native High Res Dropsondes collected during IRMA

(NOTE: Data was not available real-time)



1 of the 306 Native High Res Dropsonde collected during IRMA

(NOTE: Data was not available real-time)



Current Metadata Work

- Status of previously identified metadata errors:
  - Most of the metadata errors originally identified for OSCAR/Sfc have been successfully corrected.
  - Metadata errors identified for the BMT station list database are expected to be corrected with an update to the BMT currently being tested in dev by NCO.
    - Provided metadata corrections to NCO for PRISM/IBL and assisted with verification
- Identified a problem with dual location stations
  - Dual location stations are radiosonde and surface stations that share a single identifier but are not co-located.
    - Differences may be in horizontal location or elevation
    - Identified 20-25 dual location stations
  - U.S. criteria drafted for establishing separate entries in OSCAR/Sfc for each location at dual location stations – in coordination.
- Provided assistance to the National Science Foundation in terms of options for GTS distribution of Antarctic meteorological and ocean observations.

WIGOS and OSCAR/Sfc

- WMO Integrated Global Observing System (WIGOS)
  - Future observing framework in support of weather, climate, water and relevant environment services; a WMO priority
- Observing Systems Capability Analysis and Review tool (OSCAR)
  - Two components: OSCAR/Surface and OSCAR/Space
  - OSCAR/Surface includes station metadata: information historically in WMO Publication 9, Volume A: Observing Stations and WMO Catalogue of Radiosondes (the WMO stations catalog)
  - OSCAR/Surface became operational replacement for Vol. A in May 2016
    - Vol. A look-a-like to be produced from OSCAR/Surface during 2-year transition
    - Initial population from Vol. A had some errors/omissions that need correction
    - GUI is not user-friendly; NCO developing templates to gather requisite info

New U.S. WIGOS Station Identifiers

- Traditional WMO station IDs will transition to much longer WIGOS IDs
- WMO acknowledges a complicated transition
- OPC software changes will be complex
- NWS Offices of International Affairs and Observations are addressing first steps in the U.S. strategy for development of the new IDs

Key Action Items

- **2015-2.2** Develop an OPC-collaborative observational data quality control process (to include data error tracking spreadsheet):
  - Metadata error discovery, reporting, tracking, and correction (U.S. and Non-U.S.)
  - Other data related issues – data access, receipt, loss, bulletin drop-outs
  - Identify and list key NOAA, U.S. (other than NOAA) and WMO points of contact
  - Identify OPRs to fix data issues – both U.S. and Global
  - Data program managers (e.g. upper air) to pinpoint problems and find solutions
- **OPR:** FNMOC/NRL , NAVO, AF 557th, NWS/NCEP/NCO, NWS/Office of Observations

Key Action Items

- **2015-2.3** Develop a Conventional Data Technical Reference (similar to TR-1) that provides guidance in all aspects of conventional data management (e.g. acquisition, quality control, exchange)
  - Include key agency and WMO POC's and focal points
  - Include key references

- **OPR:** FNMOC/NRL , NAVO, AF 557th, NWS/NCEP/NCO, NWS/Office of Observations, NWS/Office of International Affairs

Key Action Items

- **2015-2.6** Track to implementation, High resolution BUFR radiosonde (RRS) data made available in real time on the GTS for U.S. stations. As of 18 Oct 2017, OPCs receiving 72 out of 81 WFO transition sites (incl. Guam & Puerto Rico)
  - NWS project ongoing to transfer High Resolution native BUFR files from WFOs directly to NCEP/NCO for dissemination globally via the GTS
  - OT&E completed 19 Apr 2017 w/recommendation to proceed (early May) to full deployment – expected completion: 30 Sep 2017
  - Project doesn't include U.S. military radiosonde sites (no RRS installed)
  - Project doesn't include 1 autosonde upgraded site (Kodiak, AK) or 10 Transitional Radiosonde Observing System (TROS) sites (sites that were changed to 403MHz transmission to avoid interference with GOES-16 downlinks)
  - Through participation in OT&E, OPCs have validated the data and are able to use it
- **OPR:** NCEP/NCO-SS and NWS/Office of Observations

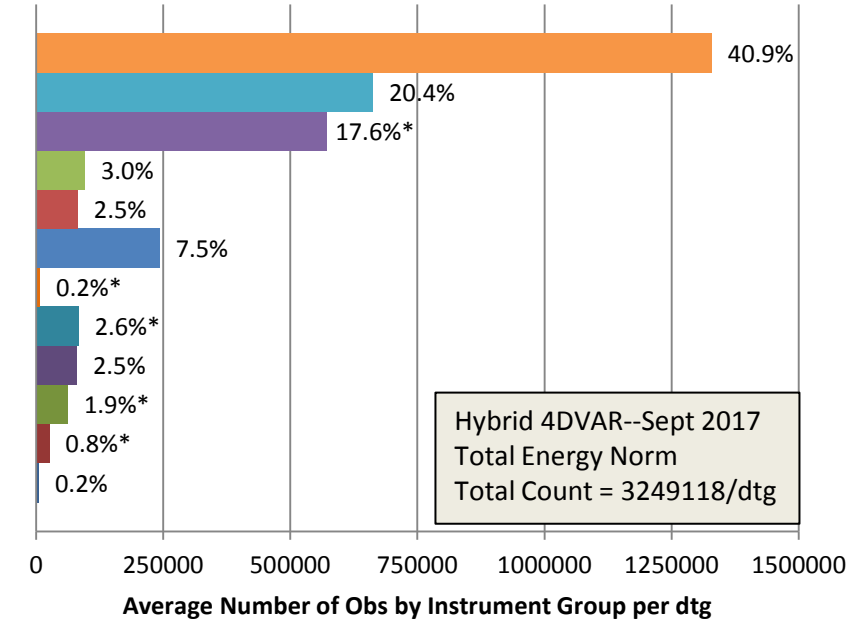
Next Steps…

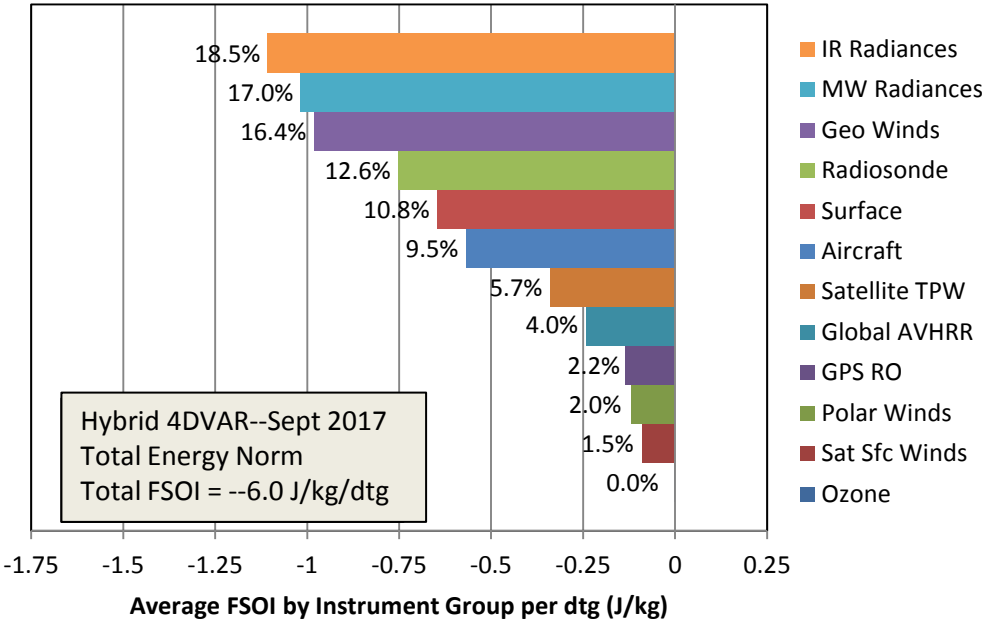
- Continue to resolve critical metadata errors in collaboration with NCEP/NCO and WMO
- Spring/Summer 2018 -- 2nd Observational Data Workshop
- GOES-16 Transition Plan to GOES-East

Houston... do we have a problem?

* GOES-16 Transition schedule as of 05 OCT as provided by James McNitt (NOAA)

Early-to-Mid-NOV	GOES-16 ground-system generated AMV products available via PDA (both "heritage" and "new" BUFR format) until GOES-16 maneuver begins on 30 NOV. (***Distribution of GOES-16 AMV products via GTS will start ~ 3 months later once geowind products reach provisional maturity (~23 FEB 2018)***) (Happy Thanksgiving!)
30 NOV*	Terminate GOES-16 imaging and product generation (instruments remain ON). Turn off GOES-16 raw data link and auxiliary COMM services. Start GOES-16 eastward drift from 89.3°W to 75.2°W (1.41 deg/day) (***No geowinds from GOES-16 will be available for almost two-weeks during this maneuver***).
07 DEC*	Begin early relay of GOES-13 GVAR through GOES-14. GOES-13 GVAR will be available through both GOES-13 & GOES-14 beginning 12/7/17.
08 DEC*	GOES-16 drifts to ~77.0°W. Near 77°W, drop the GOES-16 CDAS uplink, bring up GOES-16 ORTT&C uplink. Prevents uplink interference between GOES-16 and GOES-13.
11 DEC*	Stop GOES-16 drift at 75.2°W. Activate GOES-16 Raw Data (X-Band) Link. Return GOES-16 instruments to imaging operations. Data operations start-up (No GRB available).
12 DEC*	Perform GOES-16 magnetometer calibration.
13 DEC*	Activate GOES-16 GRB via terrestrial link to AWIPS (no GRB RF broadcast).
13 DEC*	Go/No-Go to initiate the GOES-16 GRB/GOES-13 GVAR transition.
14 – 20 DEC	Activate GOES-16 GRB. Terminate GVAR relay through GOES-13 (GOES-13 GVAR still available through GOES-14). Activate GOES-16 Aux COMM; Disable GOES-13 Aux COMM. GOES-16 officially becomes GOES-East. (**GOES-13 AMV products may be terminated once GOES-16 becomes GOES-East (Decision pending)**. ***Ground-system GOES-16 geowinds are available via PDA (only) in a non-operational capacity. OPCs' use of GOES-16 AMVs in operational NWP from 02 JAN – 23 FEB (~7 weeks) is at their own risk.***) (Merry Christmas!)
02 JAN*	**Suspend GOES-13 imaging operations**. Terminate GOES-13 GVAR relay through GOES-14. Start GOES-13 eastward drift from 75°W to60°W. Drift rate 0.7 deg/day. GOES-13 will be out of service on 1/2/18 and will be moved to its storage position during 1/2/18 - 1/22/18. (Happy New Year!)
22 JAN*	Stop GOES-13 drift at 60°W.
~23 FEB	GOES-16 geowind products reach provisional maturity and are cleared for operational use. (***GOES-16 AMV products are now inserted and disseminated on the GTS.***)

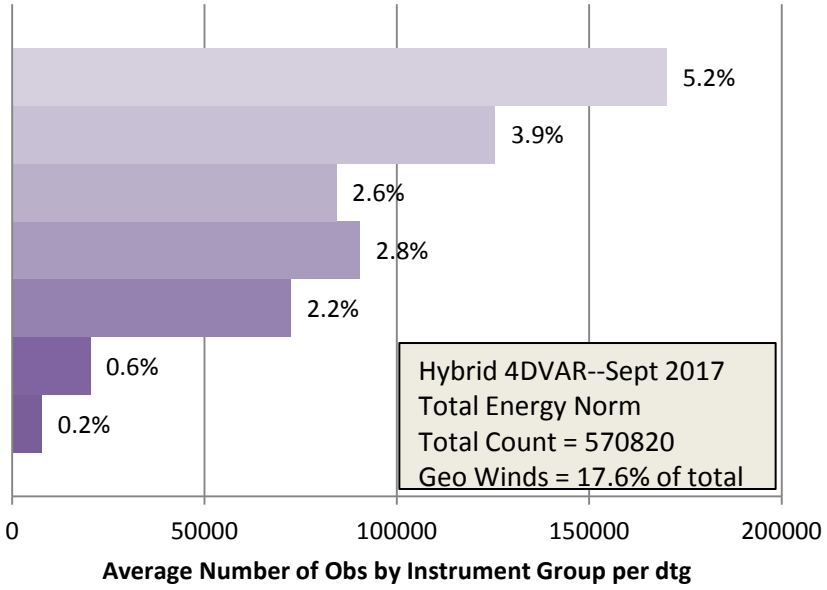


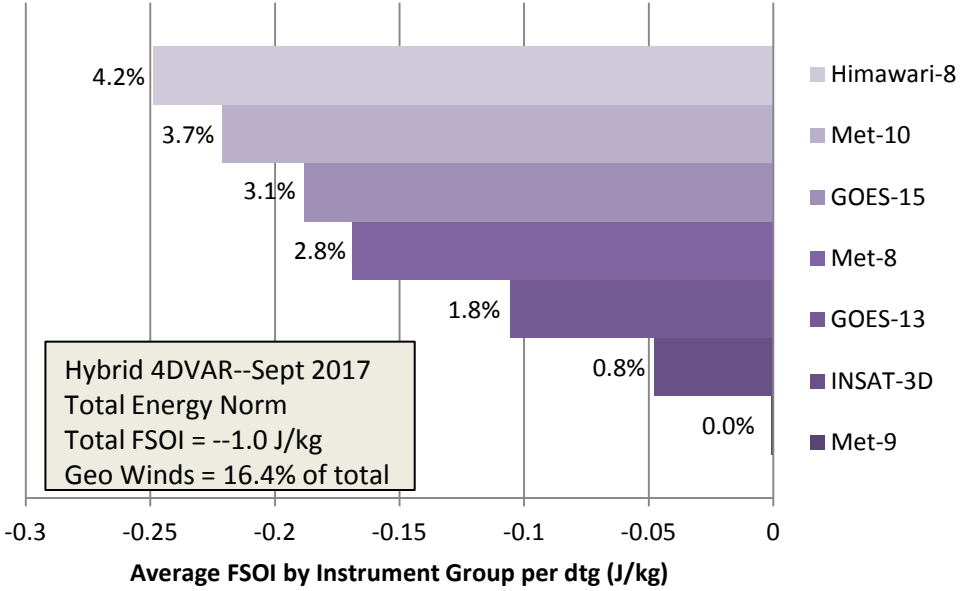


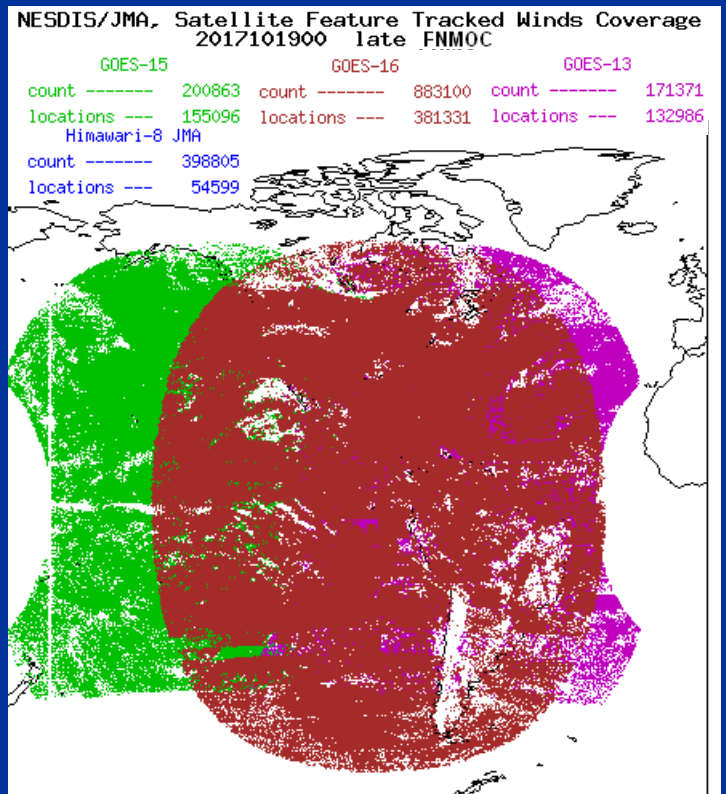
*NOTE: Counts are based on number of super-obs vice raw number of observations. Break-down for instrument categories (slide).

Geostationary satwinds (aka: FTW/AMV/DMV):

- 17.6% of the obs used in the U.S. Navy's global modeling system in Sept 2017
  - (Not Shown) Geostationary satwinds also used in the U.S. Navy's regional modeling system
- 16.4% of the error reduction (Forecast System Observation Impact--FSOI)
- Winds from GOES-13, GOES-15, Meteosat-8, Meteosat-9, Meteosat-10, Himawari-8, and INSAT-3D







GOES-13 satwinds:

- 2.2% of the total number of super-obs
- 10.7% of the number of geo winds
- 1.8% of the error reduction

What about GOES-16 satwinds?

- Roughly 5x as many satwinds as GOES-13 for this date-time group
- Greater horizontal coverage (especially to the south) and greater resolution
- New "nested tracking" algorithm should yield more accurate tracking with better height assignments
- Expect an increase in number of superobs and a likely increase in impact vs. GOES-13, as occurred for Himawari-8

GOES-13/16 Transition Questions/Concerns

- "Heritage" AMV BUFR Template vs "New" AMV BUFR Template (310067):
  - Currently, *all* GOES-13 and GOES-15 AMV products distributed via GTS use the "heritage" BUFR Template.
  - GOES-16 AMV products are planned to be produced and distributed via PDA (early-to-mid Nov) and GTS (late-Feb) using the "heritage" BUFR template as well as the "new" BUFR template.
    - FNMOC is requesting access to "heritage" BUFR data to identify problems (if any) prior to Nov 30th (satellite maneuver).
  - Both "heritage" and "new" GOES-16 AMV products will be distributed via GTS for one year after the provisional level is reached (after which "heritage" products will no longer be produced/distributed).
  - GOES-15 AMV products will likely continue to use the "heritage" template, possibly until they are replaced by GOES-S winds when it becomes the operational GOES-West satellite, scheduled for October 2018.
  - Possibly incomplete documentation for "new" AMV BUFR Template: BUFR Descriptor 0 01 032 is a locally generated (NESDIS) Code Table that lists the AMV generation application. FNMOC received it 26 Oct. When will this be distributed to national/international OPCs?

GOES-13/16 Transition Questions/Concerns (cont.)

- GOES-16 AMVs are expected to become available on the PDA in early-to-mid November:
  - These will be products processed by the ground station.
  - FNMOC and NCEP have only tested GOES-16 AMVs produced by NESDIS using the "new" AMV BUFR Template. Ground station products have not been tested/validated by NWP centers. Ground station AMV software was translated from FORTRAN to "C". During the conversion, bugs were introduced.
  - A bug fix for a problem identified in the ground station AMV software was implemented on 28 Sept, but another problem with wind dropouts was recently identified. This bug will be fixed ~21 Nov allowing roughly 4-5 business days to verify the code change before the GOES-16 satellite maneuver begins.

GOES-13/16 Transition Questions/Concerns (cont.)

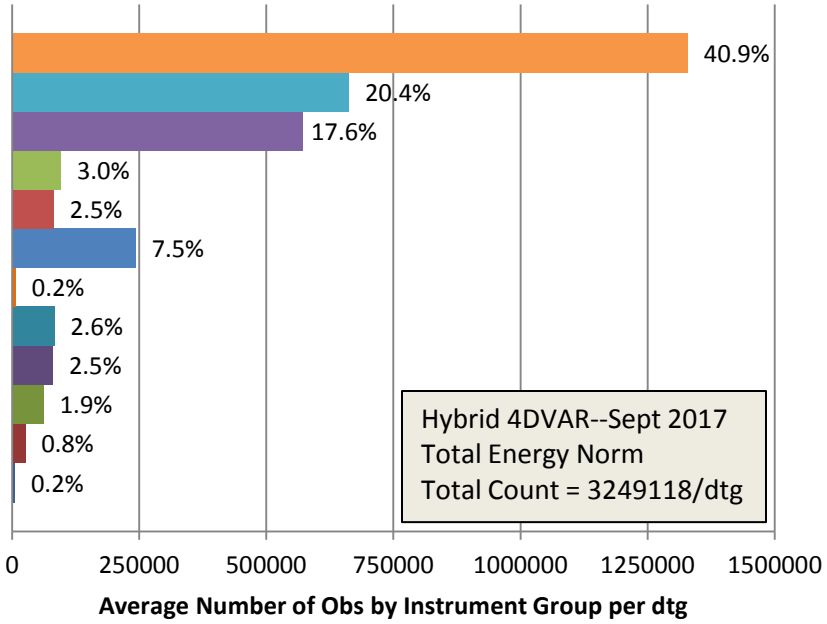
- Data Assimilation Concerns:
  - With great help from NESDIS, FNMOC started successfully decoding NRT GOES-16 AMVs ("new" template) ~Oct 23rd from NESDIS STAR.
  - FNMOC/NRL has yet to run this data through their Data Assimilation system.
  - GOES-16 AMVs represent a substantial (potential) increase in the number of AMV observations assimilated by OPCs.
    - How will the DA system perform?
    - What code changes are required?
    - Should the thinning/superobbing strategy be changed to reflect the increased density of the data? Or should the data be thinned/superobbed to the same density used for GOES-13?
    - Because of the upcoming holidays in November/December and the planned GOES-16 maneuver, there will be limited time and resources to test how the data performs in the operational models prior to GOES-16 becoming "GOES-East". Non-operational, real-time ground-station data *should* be available from PDA most of November (original estimate was mid-Nov), leaving the first half of December to assess performance and make any adjustments prior to GOES-16 becoming GOES-East on 14 Dec.

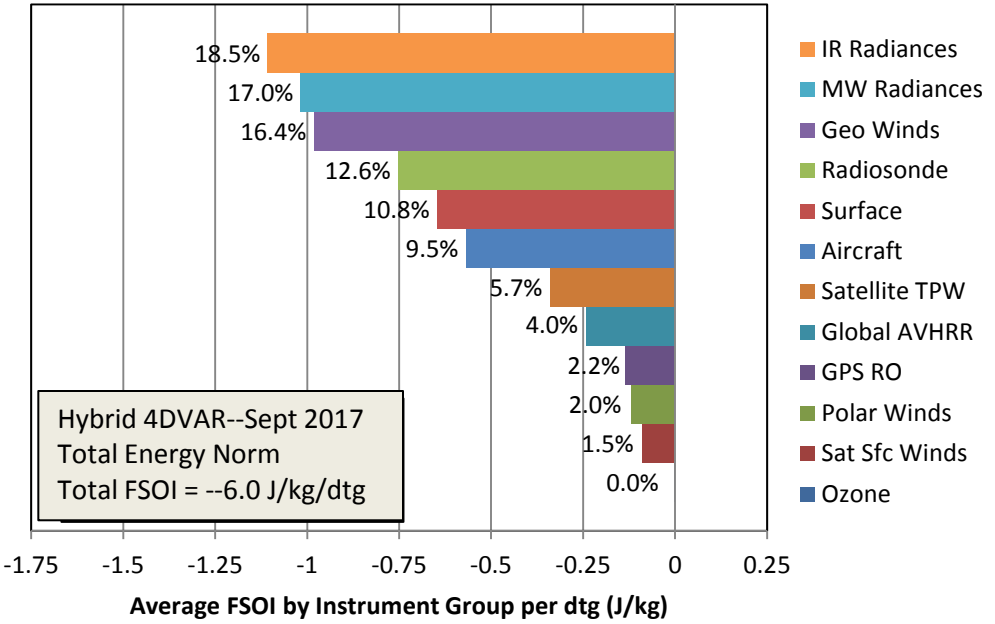
GOES-13/16 Transition Questions/Concerns (cont.)

- GTS / Data distribution concerns after GOES-16 becomes GOES-East on Dec 14th-20th:
  - GOES-16 products (i.e., heritage-format AMVs and CSRs) will use new/different WMO bulletin headers vice the WMO header used in legacy GOES-East products.
  - WMO Bulletin Headers for GOES-16 AMV GTS products [both "heritage" and the new BUFR Template (310067)] were only recently established (late-Oct).
  - Insertion of GOES-16 AMV products [both "heritage" and the "new" BUFR Template (310067)] on to the GTS is not expected until provisional maturity is reached (~23 FEB).
  - When will GOES-16 CSR (Clear Sky Radiance) products be available? One timetable said that they are not expected to be operational until Spring 2019, but other information suggests that they might be available much earlier?
  - Has all this information been communicated to the national/international OPCs?

Thank you -- questions?

Back-up Slides

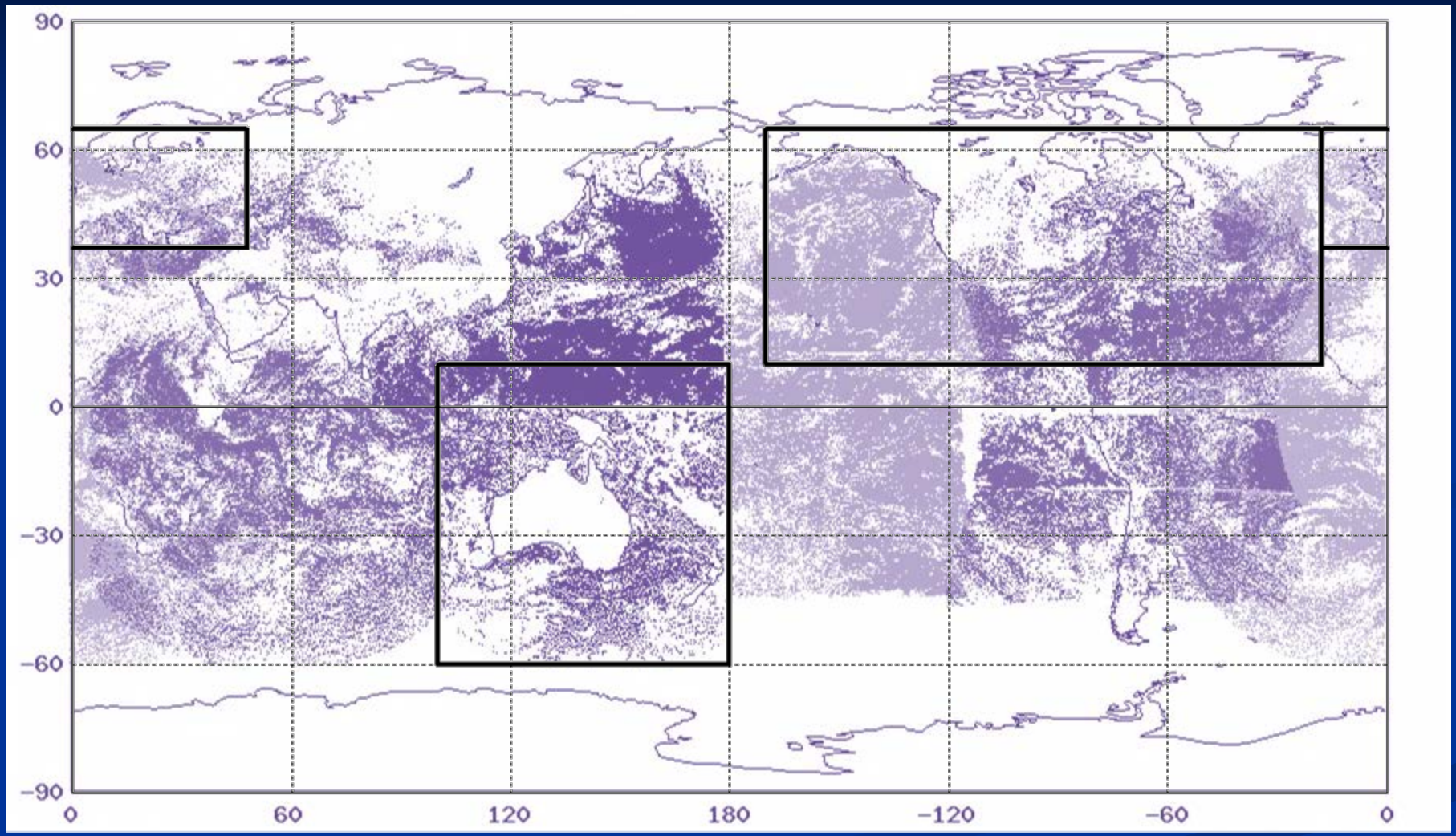




Groups of observations with % counts

- Infrared radiances
  - IASI (42.9%)
  - AQUA AIRS (24.6%)
  - CrIS (22.5%)
  - GeoCSR (10.0%)
- Microwave radiances
  - AMSU-A (48.5%)
  - ATMS (23.4%)
  - SSMIS (23.2%)
  - MHS (3.0%)
  - SSMIS UAS (1.9%)
- Geo Winds (See Slide)
- Surface
  - Land (68.3%)
  - Coast (14.4%)
  - Buoy (moored) (6.9%)
  - Buoy (drifting) (5.8%)
  - Ship (4.6%)
- Aircraft
  - WMO BUFR (85.7%)
  - Other AMDAR (9.7%)
  - AIREP (4.6%)
- Satellite TPW
  - SSMIS (80.4%)
  - WindSat (19.6%)
- Polar Winds
  - LeoGeo (34.9%)
  - AVHRR (31.9%)
  - MODIS (24.9%)
  - VIIRS (8.2%)
- Satellite Surface Winds
  - ASCAT (53.1%)
  - SSMIS speed (26.3%)
  - WindSat (20.5%)

Land Masking—Geostationary Winds



Winds at land points within the North America, Western Europe, and Australia latitude-longitude boxes are excluded from use.