

### Abstract

Satellite-derived winds are one of the most beneficial data categories in the U.S. Navy's Global Environmental Model (NAVGEM). As Atmospheric Motion Vectors (AMVs) from new sources become available, they are compared to existing sources and tested for beneficial forecast impact. This poster characterizes AMVs derived from three geostationary satellites and two polar orbiting satellite systems:

- COMS, Korea's Communication, Oceanography and Meteorology Satellite -1
- HW8, Japan's Himawari-8 satellite
- INSAT, the Indian National Satellite-3D (INSAT)
- MISR, NASA's sun-synchronous Earth Observing System TERRA satellite's Multi-angle Imaging Spectro-Radiometer (MISR), and
- Global AVHRR, Europe's polar orbiting Meteorological Operational Satellites MetOp-A and -B Advanced Very High Resolution Radiometer 3

We examine data quantity, location, and innovation characteristics for each source. Two of the sources, Global AVHRR and Himawari-8, have been activated into operations, while the remaining three have had assimilation capability transitioned, but are not activated.

### Questions

- Do the new sources provide significant benefit ?
- How do they compare to one another and to existing sources?
- What observation error estimates should be used?
- Are existing quality control measures still appropriate?

### Methodology

- Forecast Model: NAVGEM v1.4 (T425L60)
- Data Assimilation: NAVDAS-AR (NRL Atmospheric Variational Data Assimilation System – Accelerated Representer)
- Forecast Sensitivity Observation impact at 24 hours computed every 6 hours

### Global AVHRR and MISR Provide Polar Orbiter Coverage in Data Gap

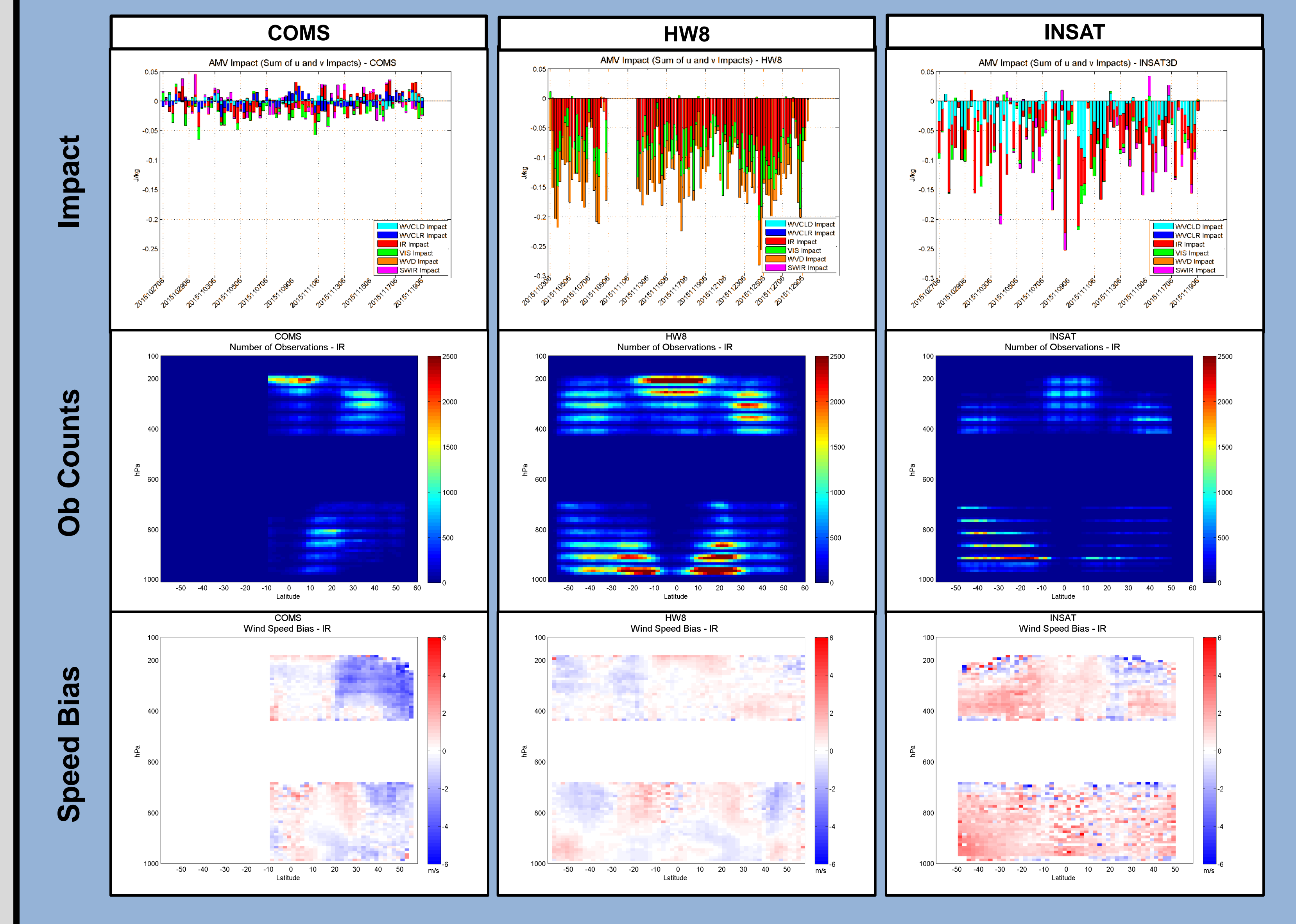
- Global AVHRR AMVs are IR; MISR AMVs are VIS.
- Both are beneficial, and of similar quality.
- An earlier developed MISR orbit-mean innovation QC check is still needed.
- An additional MISR cross-track innovation QC check should be added.
- QC assessment work called for examination of statistics before superobs are formed.

**MISR assimilation setup is part of NAVGEM v1.4, but is not activated.**  
**Global AVHRR became active February 2016.**

### COMS, HW8, and INSAT Comparison of Three New Sources

- Corrected SWIR channel misidentification.
- Compared error reduction due to each source and channel.
  - COMS AMVs were frequently non-beneficial.
  - OmB MVDs qualitatively match expectations of observation error (not shown).
- Zonal average cross sections show locations of differences in OmB MVD and biases.
  - Illustrations are for IR channel.
  - COMS has large innovations in northern hemisphere mid-latitudes upper troposphere.
  - COMS has noticeable slow bias (relative to NAVGEM) in northern hemisphere mid-latitudes upper troposphere
  - INSAT has noticeable fast bias (relative to NAVGEM) almost everywhere.

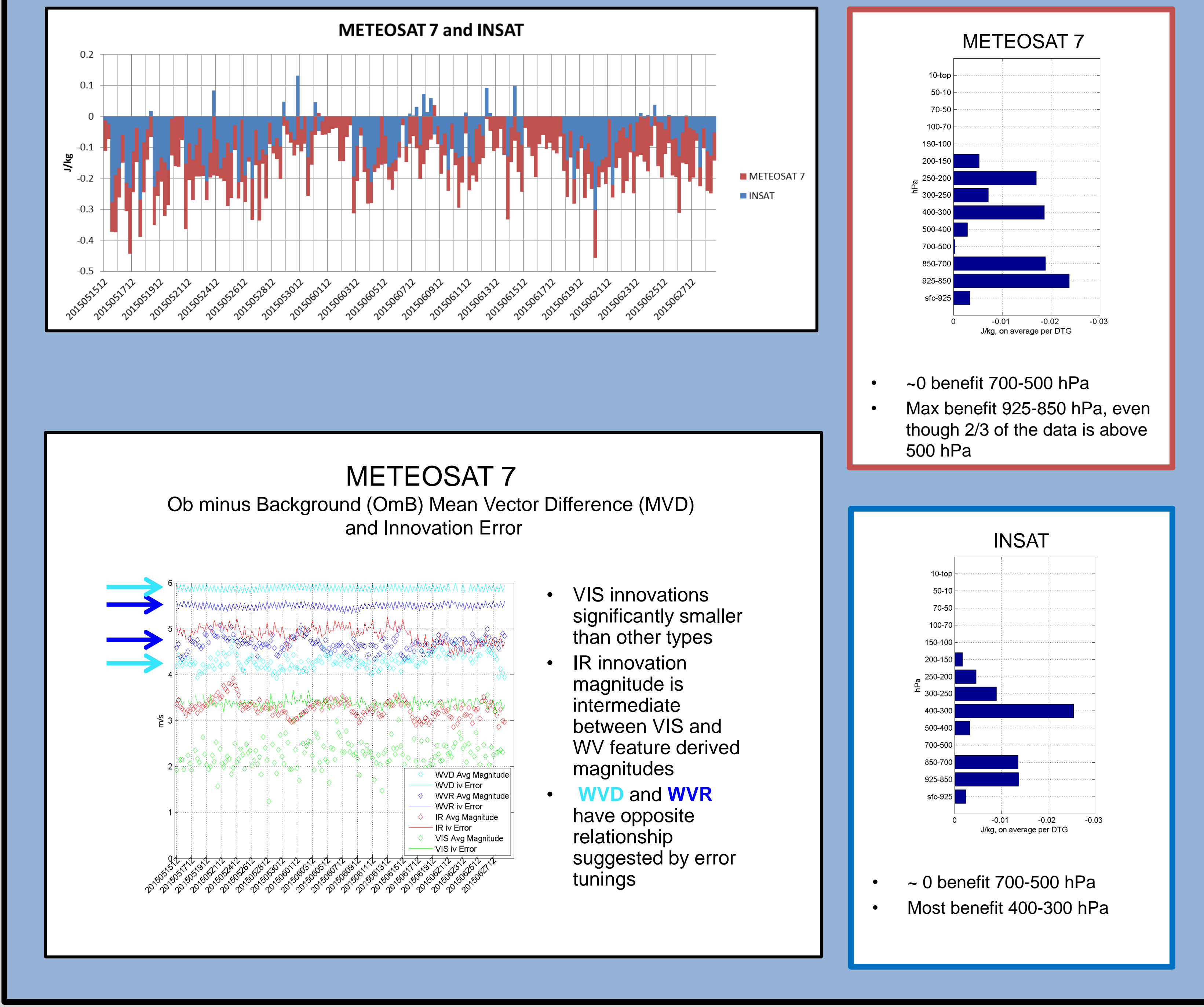
**COMS assimilation setup is part of NAVGEM v1.4, but is not activated.**  
**HW8 assimilation became active September 2015.**



### INSAT (New Source) Comparison with METEOSAT 7 (Established Source)

- Data are complementary.
  - Maximum benefit from Europe's METEOSAT 7 is at 925-850 hPa, even though 2/3 of the data is above 500 hPa.
  - Maximum benefit from INSAT is at 400-300 hPa.
- Data quality is good but there are some surprises.
  - AMV quality varied by time within data window.
  - AMV quality varied by analysis cycle (mainly due to VIS AMVs).
- Observation error tuning may need adjustment.
  - Compare OmB Mean Vector Difference (MVD) and Innovation Error.
  - Assigned observation error is realistic, but
  - MET07 water vapor channels OmB MVDs do not qualitatively match our expectations of observation error.

**INSAT assimilation setup is part of NAVGEM v1.4, but is not activated.**



### SatWind Data Quality Control: What is appropriate choice for observation error?

- Raw data is filtered through several quality control routines.
- First data is screened according to (included) quality indicators.
- Then other screening is applied:
  - Pressure level cutouts
  - Land masking (selected)
  - Innovation thresholds
- What is appropriate QC treatment?

**Global AVHRR Innovations (m/s)**

raw data  
data after Q1 filtering  
data after OmB VD thresholding  
Superobs  
This is the data sent to be superobserved.

### Next Steps

- Refine observation error variance
- Reexamine/remove vertical cutouts
- Revise innovation threshold cutoffs

### Acknowledgements

RES, NLB, PMP and BK gratefully acknowledge support from the U. S. Naval Research Laboratory under program element 0601153N.