# NOAA PROducts Validation System (NPROVS)

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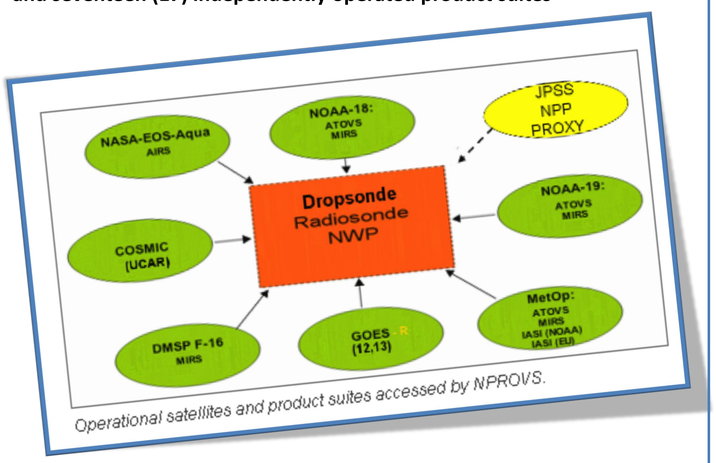
(NPROVS Web Site: http://www.star.nesdis.noaa.gov/smcd/opdb/poes/NPROVS.php)

## Background

The Noaa PROducts Validation System (NPROVS) operated by the Office of SaTellite Applications and Research (STAR) provides routine (daily) compilation of collocated radiosonde and derived satellite products (soundings) from a constellation of seven (7) environmental satellites and seventeen (17) independently operated product suites




**Advanced TIROS Operational Vertical Sounder (ATOVS)**
- NOAA-18, 19 and MetOp; AMSU and HIRS

**Advanced TIROS Operational Vertical Sounder (ATOVS) R&D**
- NOAA-19 and MetOp; AMSU, MHS and HIRS

**Microwave Integrated Retrieval System (MIRS)**
- NOAA-18, 19 and MetOp; AMSU and MHS
- Defense Meteorological Satellite Program (DMSP) F-16, SSMIS

**Microwave Integrated Retrieval System (MIRS) and R&D**
- NOAA-19 and MetOp; AMSU and MHS
- Defense Meteorological Satellite Program (DMSP) F-16, SSMIS

**Geostationary (GOES)**
- GOES 11 and 13; Infra-red sounder

**Atmospheric InfraRed Sounder (AIRS)**
- NASA-Earth Orbiting Satellite (EOS) Aqua; AIRS and AMSU

**Infrared Atmospheric Sounding Interferometer (IASI) NOAA**
- MetOp-A; IASI and ATMS

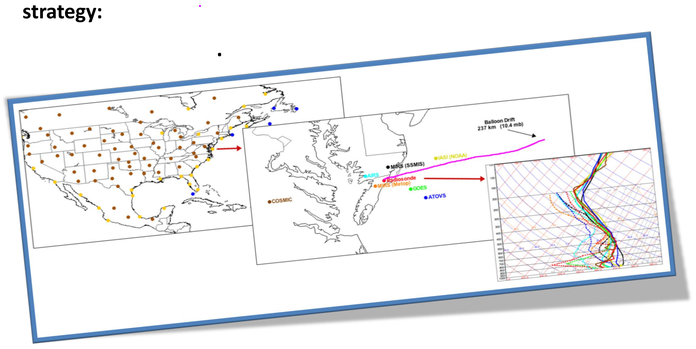
**Infrared Atmospheric Sounding Interferometer (IASI) EUMETSAT**
- MetOp-A; IASI

**Constellation Observing System for Meteorology Ionosphere and Climate (COSMIC) UCAR**
- Formosat-3

NPROVS began operation at STAR in April 2008 with over a million collocations stored (and available upon request)

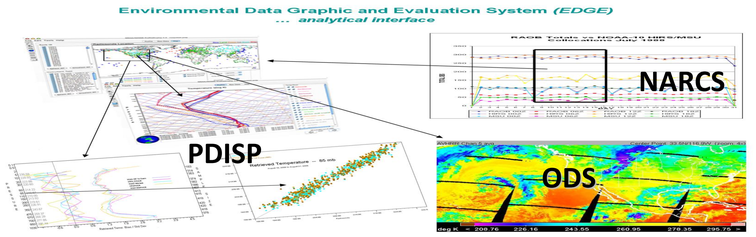
## Collocation Strategy

The immediate goal is to provide routine, consistent protocols for collocating and inter-comparing derived product suites from operational environmental satellites with conventional radiosonde and dropsonde observations. This begins with a unified collocation strategy:



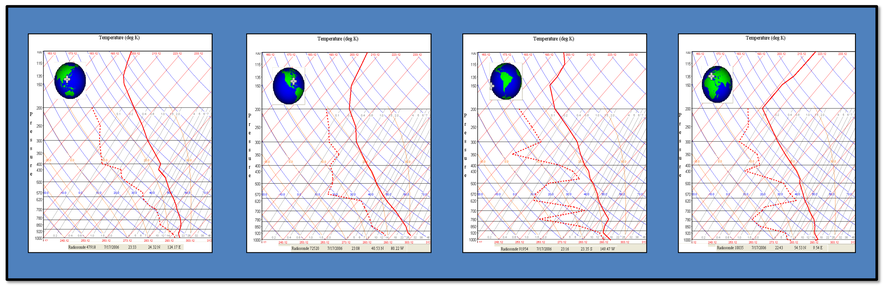

Each satellite product suite is collocated with conventional sondes; key points:
- 150 km (250 km for COSMIC) and +/- 6 hours space and time windows
- *single, closest* satellite profile data record from each product suite retained
- ancillary includes cloud, terrain, QC, screening tests, sonde drift
- co-located NWP (forecast, analysis, re-analysis) retained as available
- sensor data retained as available

## Product Monitoring

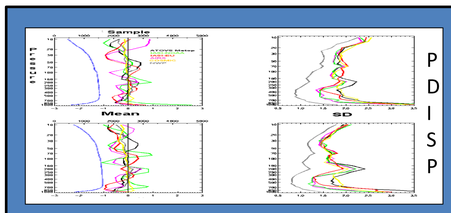



NPROVS 3-prong analytical interface, 1) Profile Display (PDISP), 2) NPROVS Archive Summary NARCS) and 3) Orbital Display System (ODS) provide monitoring and troubleshooting tools ranging from routine ensemble statistics to individual platform deep dive analysis.

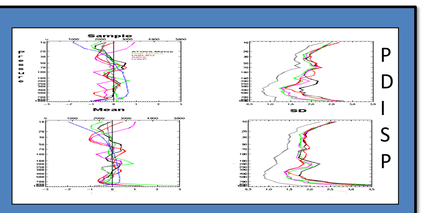
Radiosonde screening includes analysis for abrupt changes in moisture profile



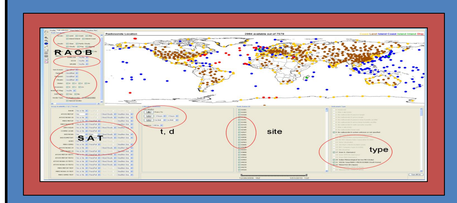
## RESULTS




Sat-minus-sonde T for Winter (top) vs. Summer (bottom) using common denominator samples (CDS)



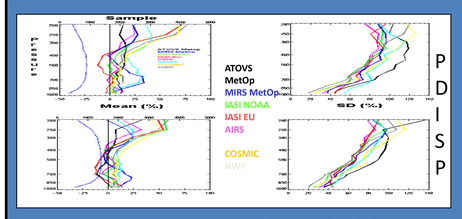

Sat-minus-sonde T for Winter sondes without (top) and with (bottom) T inversions using CDS



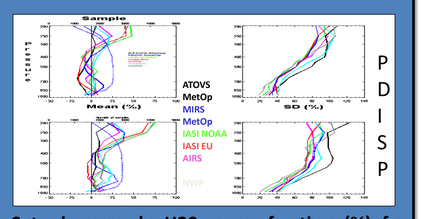

PDISP sampling option interface for display and analysis

| System | None | QC | QC + Sea | QC + Clear |
|---|---|---|---|---|
| 1,2 | .90 | .94 | .08 | .62 |
| 3,4 | .80 | .25 | .07 | .67 |
| 1,2,3, | .76 | .58 | .07 | .40 |
| 1,2,3,4 | .76 | .25 | .05 | .61 |
| 1,2,3,4,6,7 | .51 | .23 | .02 | .23 |
| 5,6,7 | .26 | .73 | .02 | .29 |
| All * | .20 | .22 | .01 | .28 |

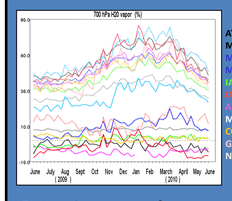
CDS sample yield ratios for systems vs. constraint

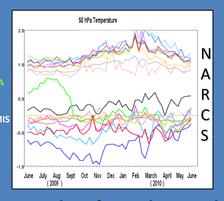



Sat-minus-sonde H20 Vapor fraction (%) for Winter (top) vs Summer (bottom) using CDS




Sat-minus-sonde H20 vapor fraction (%) for Summer profile scores of 0, 1 (top) and 2+ (bottom)




Sat-minus-sonde annual trends for denoted parameters and product suites using Independent Samples

| System | None | QC | QC + Sea | QC + Clear |
|---|---|---|---|---|
| 1 - ATOVS (MetOp) | .98 | .95 | .10 | .61 |
| 2 - MIRS (Metop) | .91 | .97 | .18 | NA |
| 3 - IASI NOAA | .80 | .58 | .10 | .44 |
| 4 - IASI EU | .98 | .32 | .09 | 1.0 |
| 5 - COSMIC | .35 | .97 | NA | NA |
| 6 - AIRS | .91 | .74 | .02 | .29 |
| 7 - MIRS (SSMIS) | .73 | .96 | .18 | NA |

Independent sample yield ratios vs constraint

## Research

Sun, B., A. Reale, D. J. Seidel, and D. C. Hunt, 2010; Comparing radiosonde and COSMIC atmospheric profile data to quantify differences among radiosonde types and the effects of imperfect collocation on comparison statistics, *J. Geophys. Res.*,115, D23104, doi:10.1029/2010JD014457.

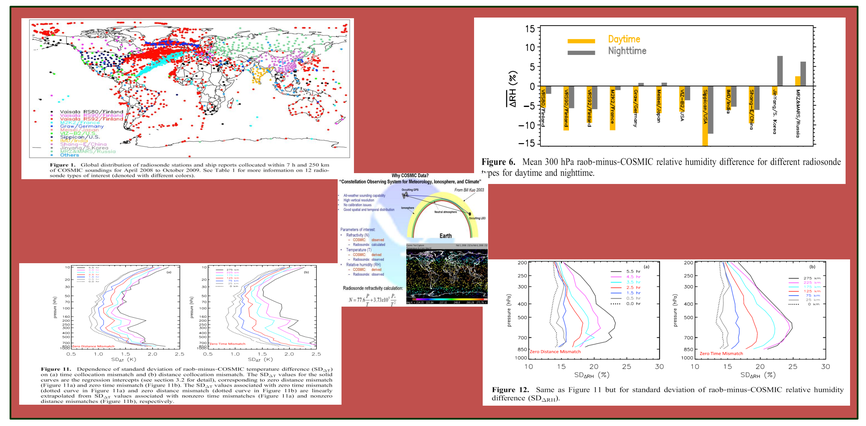


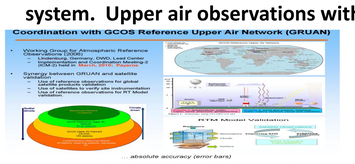

Figure 1. Global distribution of radiosonde stations and ship reports collocated within 7 h and 250 km of COSMIC soundings for April 2008 to October 2009. See Table 1 for more information on 12 radiosonde types of interest (denoted with different colors).

Figure 6. Mean 300 hPa raob-minus-COSMIC relative humidity difference for different radiosonde types for daytime and nighttime.

Figure 11. Dependence of standard deviation of raob-minus-COSMIC temperature difference ($SD_{\Delta T}$) on (a) time collocation mismatch and (b) distance collocation mismatch. The $SD_{\Delta T}$ values for the solid curves are the regression intercepts (see section 3.2 for detail), corresponding to zero distance mismatch (a) and zero time mismatch (b). The $SD_{\Delta T}$ values associated with zero time mismatches (dashed curve in Figure 11a) and zero distance mismatch (dotted curve in Figure 11b) are linearly extrapolated from $SD_{\Delta T}$ values associated with nonzero time mismatches (Figure 11a) and nonzero distance mismatches (Figure 11b), respectively.

Figure 12. Same as Figure 11 but for standard deviation of raob-minus-COSMIC relative humidity difference ($SD_{\Delta RH}$).

***GRUAN*** (www.gruan.org) is an evolving international reference measurement network designed to meet climate requirements and fill a major void in the current global observing system. Upper air observations within GRUAN will be used to:

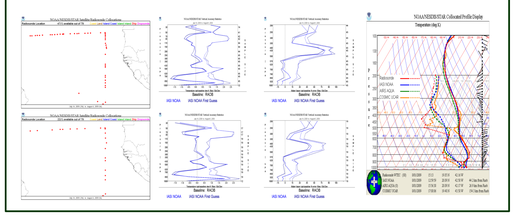


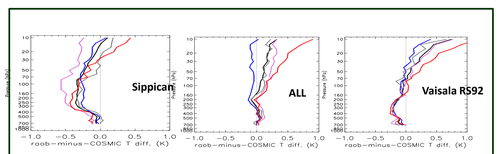

- provide long-term, high quality climate records,
- constrain and validate space based sensors and (RT) models
- provide accurate data for studying atmospheric processes.

Among the topics of discussion at the 2nd Implementation-Coordination Meeting (ICM-2), Payerne, Switzerland, March 2010), NPROVS was identified as a useful tool to help promote, compile, display and analyze planned reference radiosonde and ancillary (ground and satellite) observations at GRUAN sites (also see Seidel, D.J. et al., 2010, Global radiosonde balloon drift statistics, *JGR-Atmospheres*, accepted with condition).

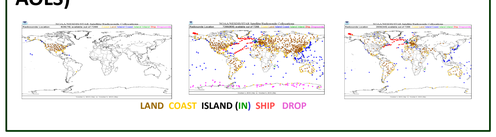
The ultimate goal is to fully characterize the properties (uncertainty budget) of the atmospheric column. Six (6) task teams operating under specific terms of reference (ToR) were established to begin meeting this goal. ICM-3 is scheduled for March 2011 in New Zealand at the Lauder Station GRUAN site.

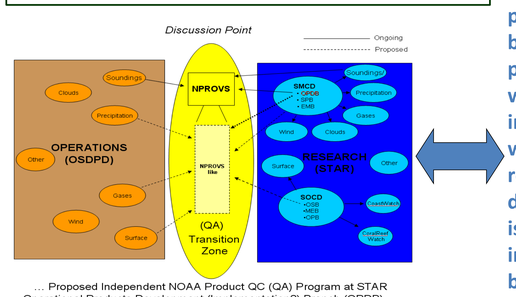
Atlantic Aerosol and Ocean Science Expedition (AEROSE) radiosonde and satellite products comparisons (N. Nalli; Dell, NOAA/STAR)





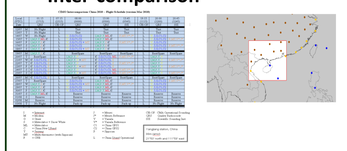

Increased Raob-minus-COSMIC warm bias in stratosphere for higher sun angles (Red) suggests an instrument type dependent radiation correction problem, a subject of future NPROVS research (also see Sun et al., 2011, using GPSRO to examine radiation induced bias … 15th IOAS-AOLS)




… Proposed Independent NOAA Product QC (QA) Program at STAR Operational Products Development (Implementation?) Branch (OPDB) …

WMO C I M O Radiosonde Inter-comparison



NPROVS coordination with WMO Commission for Instruments and Methods of Operation (CIMO) Radiosonde Inter-comparison China 2010 at Yangjiang Station (X) will provide routine graphical display and analysis of results including against available collocated satellite derived weather product suites and neighboring (white) observations

STAR and OSDPD represent the research and operational arms with respect to environmental sensor data and products at NOAA. As STAR seeks to consolidate the NOAA product QC monitoring for the multitude of sensors and product suites currently processed, the notion of an independent QA program to insure continued high quality products and services at NOAA is beginning to emerge. Such a program, although operated from within STAR, would function independent of (but in consultation with) the respective STAR branches responsible for satellite product development and research. NPROVS is a good example of such a function in the area of derived products QC, but expansion to embrace other products and services as feasible is needed.

**Visit us at the NOAA Exhibit**

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