Preliminary Validation of SUOMI-NPP Sounding Products using the NOAA Products Validation System (NPROVS)

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AIR Science Team Meeting
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Greenbelt Md
1) Long-Term Monitoring

2) Performance Validation:
   CrIMSS
   NUCAPS
   MiRS

3) Links to “Reference” Observations
   GCOS Reference Upper Air Network (GRUAN)
NOAA Products Validation System (NPROVS)

Centralized Radiosonde and Collocation Processing

- NASA-EOS-Aqua AIRS
- NOAA-18: ATOVS MIRS
- NPP Metop-B
- NOAA-19: ATOVS MIRS
- COSMIC (UCAR)
- DMSP F-16 MIRS
- GOES (11,13 ... R)
- MetOp: ATOVS MIRS IASI (NOAA) IASI (EU)

Collocated radiosonde and multiple satellite products dataset

- NWP: GFS 6-hr CFSR CFSR (Back) Other

Single Closest

April 2008 ...
NOAA Products Validation System (NPROVS) Schematic

- **MetOp-B**
  - ATOVS, MIRS, IASI, IASI (EU)
  - GRAS
- **JPSS-NPP**
  - CrIMSS (2)
  - MIRS
- **NASA-EOS-Aqua**
  - AIRS
- **FORMOSAT-3,4**
  - COSMIC (UCAR)
- **DMSP F-16,17,18**
  - MIRS
- **NOAA-18**
  - ATOVS, MIRS
- **NOAA-19**
  - ATOVS, MIRS
- **MetOp-A**
  - ATOVS, MIRS, IASI, IASI (EU)
  - GRAS
- **GOES-11,13,12**
  - IR Soundings
- **Plan**
- **Yes**
NOAA Products Validation System (NPROVS)
(Analytical Interface)
NOAA Products Validation System (NPROVS)

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

Monthly Summaries (to 2008):
• Vertical Profile Statistics
• Level Trends (daily)

Long-term Trends

Download User Interface Clients (JAVA) and Datasets
• PDISP
• NARCS

Publication:
Reale, Sun, Pettrey and Tilley, “The NOAA Products Validation System (NPROVS); IJRS, 2012
Long-term Monitoring

NPROVS ARChive Summary (NARCS)
300 mb water vapor Fraction (%)

- Bias / Std Dev
- Mean
- St. dev

... NWP independent of Raob

Product-minus-Radiosonde
NPP Validation Example using PDISP

Oct 14-18, 2012

... preliminary demonstration of capability to access / validate projected operational data-streams
2700 Collocations containing Suomi-NPP CrIMSS, NUCAPS and MiRS … 3 days
QC Definitions

**CrIMSS (3):**
- High (IR + MW) ... 15%
- Low (MW only) ... 65%
- Poor (non-converge) ... 20%

**NUCAPS (3):**
- Pass ... 20%
- Fail ... 80%

**MiRS (1):**
- Pass ... 0
- Fail ... 100

*no land T*

**IASI (3):**
- Pass ... 55%
- Fail ... 45%

**AIRS (3):**
- Pass ... 55%
- Fail ... 45%
Baseline + NUCAPS QC (pass) (500)
Baseline + IASI QC (pass) (700)
Baseline + AIRS QC (pass) (950)
Baseline + CrIMSS QC (high (IR + MW)) (400)
Baseline + NUCAPS QC (pass) + CrlMSS QC (high (IR + MW)) (100)
Microwave Only:
CrIMSS (MW only)
*MiRS
(* sea only)

… should not compare MW to IR
appropriate validation dataset for MiRS
Baseline + CrIMSS (MW only) + sea only (180)

... appropriate validation dataset for MiRS
... inappropriate validation dataset for MiRS

Baseline + CrIMSS QC (high (IR + MW))
(400)
NOAA Products Validation System (NPROVS)

October 14, 2012 to October 18, 2012

... appropriate validation dataset for MiRS

RAOB CFSR Forecast
CRIMSS NPP Microwave (IP)

MiRS NOAA-19
MiRS NPP TEST

CRIMSS NPP
GCOS Reference Upper Air Network (GRUAN)

http://www.gruan.org

15 sites ... current
30-40 sites ... planned
Priority 1: Water vapor, temperature, (pressure and wind)
Establishing Uncertainty

Concept:

• The "true value" of a physical quantity is no longer used
• Error is replaced by uncertainty
• A measurement = a range of values
  – generally expressed by $m \pm u$
  – $m$ is corrected for systematic effects
  – $u$ is (random) uncertainty
Collocations of COSMIC, GRUAN Sonde and GTS Sonde; 2011
**Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC)**

- All-weather sounding capability
- High vertical resolution
- No calibration issues
- Good spatial and temporal distribution

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**From Bill Kuo 2003**

\[ N = 77.6 \frac{P}{T} + 3.73 \times 10^5 \frac{P_w}{T^2} \]

- **Dry term**: \( \frac{P}{T} \)
- **Wet term**: \( \frac{P_w}{T^2} \)

**P**: pressure  
**T**: temperature  
**Pw**: water vapor pressure

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**Cosmic Test Capture**  
Feb 5, 2008 23Z to Feb 6, 2008 23Z  
Temperature (6.4 km) [deg K]
COSMIC vs GRUAN vs GTS Raob

Mean                  St dev

UTLS

NWP wet

IASI Retrieval

...vicinity of Lindenberg

... combining GRUAN, GPSRO, NWP ...
NOAA Products Validation System (NPROVS)

Temperature (deg K)

RAOB
CFSR Forecast
CFSR Analysis
GRUAN RAOB
IASI NOAA

... including IASI
Vaisala RS92
difference from COSMIC T

Raob-minus-COSMIC … raob warm or COSMIC cold?
Seasonal variation in bias is bigger at nighttime: Summer relatively warmer than winter? GRUAN interest …
Publications


NOAA Products Validation System (NPROVS) Schematic
Summary

• NPROVS background

• Examples of long (4 yr) term trends in selected operational sounding products

• Preliminary results for CrIMSS, NUCAPS and MiRS operational data streams sorted by QC designation

• Examples of “special” access/analysis of GRUAN / ARM datasets in context of satellite and ground profile validation … GPROVS

• Future target products include re-processed AIRS, COSMIC, (IASI?) and NWP (MERRA, ECMWF …) and GPSRO anchored collocations …