NPP Validation Program for the Cross-track Infrared Microwave Sounding Suite (CrIMSS)

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Overview

- The Cross-track Infrared Sounder (CrIS) and the Advanced Technology Microwave Sounder (ATMS) are the two sensors that make up the **Cross-track Infrared Microwave Sounder Suite (CrIMSS)** onboard the Joint Polar Satellite System (JPSS) NPP Satellite.
- CrIMSS measurements will result in three **Environmental Data Records (EDRs)**
  - Atmospheric Vertical Temperature Profile (AVTP)
  - Atmospheric Vertical Moisture Profile (AVMP)
  - Atmospheric Vertical Pressure Profile (AVPP)
- The AVTP and the AVMP are both JPSS **Key Performance Parameters (KPPs)** used for initialization of high-resolution NWP models, atmospheric stability, etc. AVPP is derived from AVTP and AVMP and requires independent validation.
- The **CrIMSS EDR Algorithm** has been developed, implemented and the EDR performance has been assessed and characterized with the simulated global synthetic data sets.
- The **NPP CrIMSS EDR Validation Plan** is to ensure the data products comply with the requirements of the sponsoring agencies.
- **Pre-launch phase work is currently underway** – see Posters #642 (*Zhou et al.*), #587 (*Guo et al.*), and #571 (*Divakarla et al.*)

Validation Plan Overview

- Given the long-term successful heritage of legacy systems, **the basis of our approach is to draw on lessons learned from validating the AIRS/AMSU and IASI/AMSU/MHS sounding systems** and to focus on those activities that have had the most impact in their respective validation efforts. This approach will leverage "user community" cal/val efforts and experience as much as possible.
- Typical validation methods characterize the performance of the EDRs in various ensembles of cases. **A "roll-up" of regional assessments will serve to determine whether the EDRs have met their global performance specifications**. Specifically, this will involve stratifying the specs according to various bins:
  - day/night
  - latitude bands (*i.e.,* polar, midlatitude, tropical)
  - land/ocean/ regional
  - (possibly) altitude and surface characteristics
- The **EDR validation will include assessments of current capabilities using heritage sensors and associated algorithms**. Most significant will be to use the ATOVS (HIRS/AMSU) operational products as part of our validation efforts to demonstrate the value of the hyperspectral measurements to the user community.
  - NOAA/NESDIS has decades of experience with the operational ATOVS and has performed detailed assessments of hyperspectral products (AIRS/AMSU, IASI/AMSU/MHS) against these ATOVS legacy products.
- Heritage hyperspectral sounding systems (AIRS/AMSU and IASI/AMSU/MHS) have a number of **scientific users** that are currently exploiting those data products for weather, air-quality, and climate applications. **We expect that user requirements will become more sophisticated over time**; therefore, part of the validation efforts will be to characterize the CrIS/ATMS EDR products for those applications in the same manner as AIRS and IASI products are currently characterized.
- In the EDR Products section below, tables of the **Integrated Operational Requirements Document –II (IORD II)** and NPP contractor **specification performance requirements** are given. These requirements will be replaced by JPSS documents.

EDR Products

Atmospheric Vertical Temperature Profile – AVTP

Parameter	IORD-II	NGAS SY15-0007
AVTP Partly Cloudy, surface to 300 mb	1.6 K/1-km layer	0.9 K/1-km ocean, 1.7 K/1-km land/ice
AVTP Partly Cloudy, 300 to 30 mb	1.5 K/3-km layer	1.0 K/3-km ocean, 1.5 K/3-km land/ice
AVTP Partly Cloudy, 30 mb to 1 mb	1.5 K/5-km layer	1.5 K/3-km
AVTP Partly Cloudy, 1 mb to 0.5 mb	3.5 K/5-km layer	3.5 K/5-km
AVTP Cloudy , surface to 700 mb	2.5 K/1-km layer	2.0 K/1-km
AVTP Cloudy, 700 mb to 300 mb	1.5 K/1-km layer	1.5 K/1-km
AVTP Cloudy, 300 mb to 30 mb	1.5 K/3-km layer	1.5 K/3-km
AVTP Cloudy, 30 mb to 1 mb	1.5 K/5-km layer	1.5 K/5-km
AVTP Cloudy, 1 mb to 0.05 mb	3.5 K/5-km layer	3.5 K/5-km

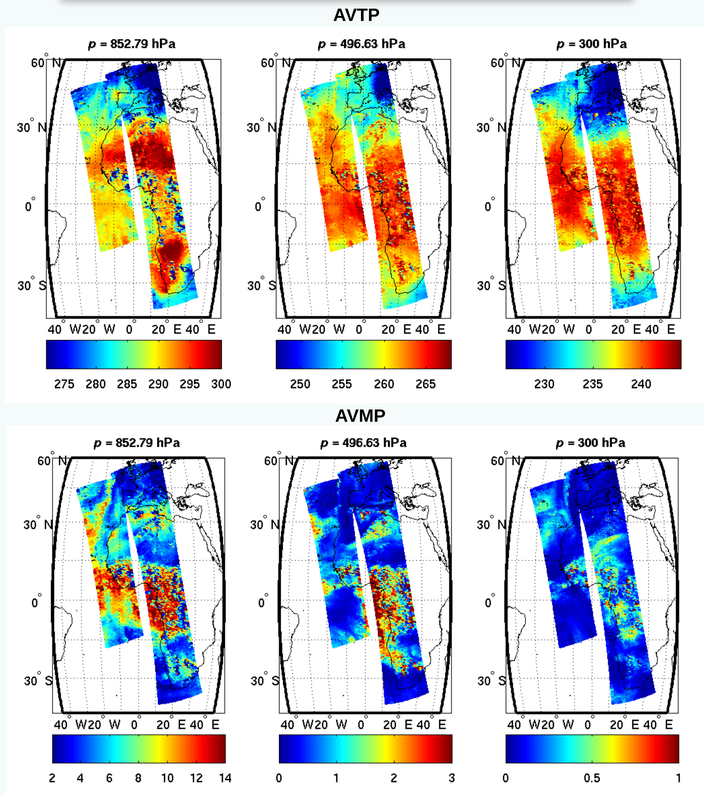
Atmospheric Vertical Moisture Profile – AVMP

Parameter	IORD-II	NGAS SY15-0007
AVMP Partly Cloudy, surface to 600 mb	Greater of 20% or 0.2 g/kg	14.1% ocean, 15.8% land and ice
AVMP Partly Cloudy, 600 to 300 mb	Greater of 35% or 0.1 g/kg	15% ocean, 20% land and ice
AVMP Partly Cloudy, 300 to 100 mb	Greater of 35% or 0.1 g/kg	0.05 g/kg ocean, 0.1 g/kg land and ice
AVMP Cloudy, surface to 600 mb	Greater of 20% of 0.2 g/kg	15.8%
AVMP Cloudy, 600 mb to 300 mb	Greater of 40% or 0.1 g/kg	20%
AVMP Cloudy, 300 mb to 100 mb	Greater of 40% or 0.1 g/kg	0.1 g/kg

Atmospheric Vertical Pressure Profile – AVPP

Parameter	IORD-II	NGAS SY15-0007
Pressure Profile	4 hPa threshold, 2 hPa goal	3 hPa (with precip and Psurf error exclusions)
CH4 (methane) column	1% precision, ±5% accuracy	CO and CH4 are experimental (P^3I) products derived by science community from SDRs (not part of Program funded Cal/Val program).
CO (carbon monoxide) column	3% precision, ±5% accuracy	

CrIMSS EDR Retrieved from Proxy Data – Focus Day 19-Oct-07



CrIS/ATMS EDR Validation Team

Name	Organization	EDR
Chris Barnet	NOAA/NESDIS / STAR	Lead
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Steven English	UKMET	CrIMSS SDR
William Bell	ECMWF	CrIMSS SDR
Steve Freidman	NASA/JPL	AVTP/AVMP
Steve Swadley, Ben Rustin	NRL	CrIMSS SDR

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SOAT Members
- M. Divakarla, G. Guo (NOAA/STAR)
- X. Liu, S. Kizer (NASA/LaRC)
- B. Blackwell (MIT)

EDR Validation by Cal/Val Phase

PRE-LAUNCH
- Derive **proxy data** from legacy systems (AIRS/AMSU, IASI/AMSU) and *in situ* correlative data (RAOB).
- Use proxy data to test concepts and exercise the CrIMSS EDR algorithm.
- Participate in field campaigns of opportunity (e.g., AEROSE).

EARLY ORBIT CHECK-OUT (EOC)
- Compare forward models, sanity checks on differences between observations and calculations.
- Use **Simultaneous Nadir Overpass (SNO)** and **double differencing** methods (as used for AIRS/IASI).
- Intercompare CrIMSS SDRs/EDRs with operational AIRS and/or IASI products.

INTENSIVE CAL/VAL (ICV)
- Compare early EDRs to operational products from AIRS & IASI to diagnose issues and find solutions.
- Compare SDRs w/ AIRS and IASI via SNOs and double differences to separate SDR and EDR issues.
- Principle Component Analysis and instrument monitoring to verify noise, random and systematic components, and monitor instrument health.
- Assess performance against operational and dedicated RAOBs.
- Participate in **intensive field campaigns** using **aircraft-based FTS** (e.g., NAST-I or S-HIS) for definitive assessment and analyze specific issues.

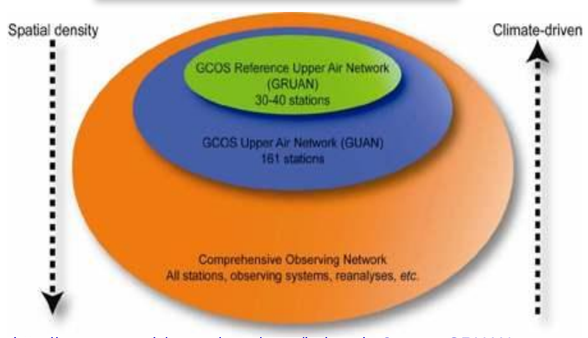
LONG-TERM MONITORING (LTM)
- Continuously monitor and analyze long-term performance via comparison to heritage products and *in situ* correlative data.
- Analyze effects of instrument changes on EDRs.

Correlative Data

Sources

NPROVS (global RAOB), **GRUAN**, **AEROSE,** ECMWF, NAST-I, NAST-M, S-HIS, WAVES, START, HIPPO, ARM, GFS, ESRL/GMD Carbontracker, Suominet, CERES

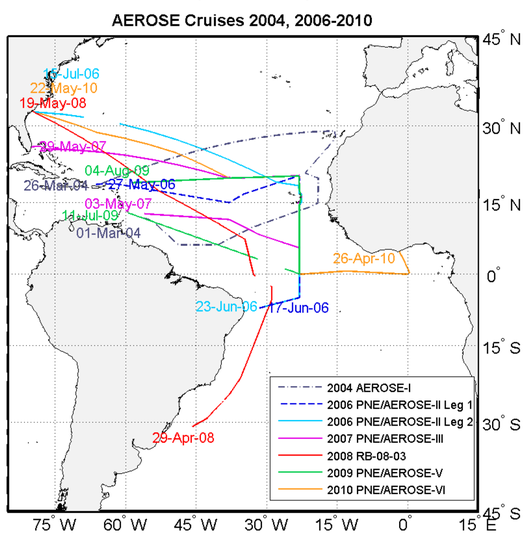
GRUAN Cascade of Networks



http://www.wmo.ch/pages/prog/gcos/index.php?name=GRUAN

NOAA AEROSE Campaigns

See Poster #632 (*Nalli et al.*)



AMS 2011 #633