

CIMSS Activities Relevant to the Satellite Algorithm Testbed Concept

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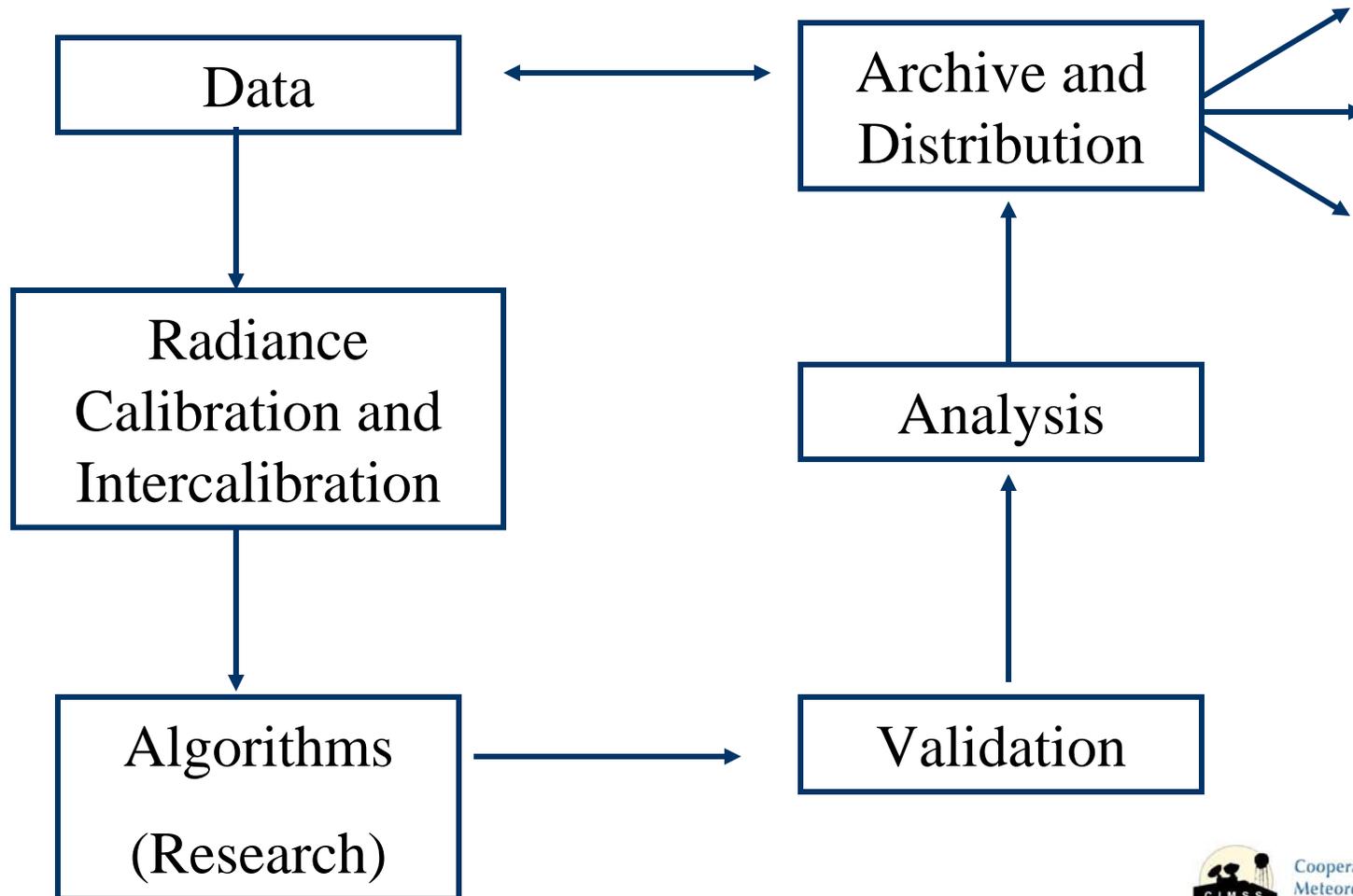
NOAA Satellite and Information Services

on behalf of the

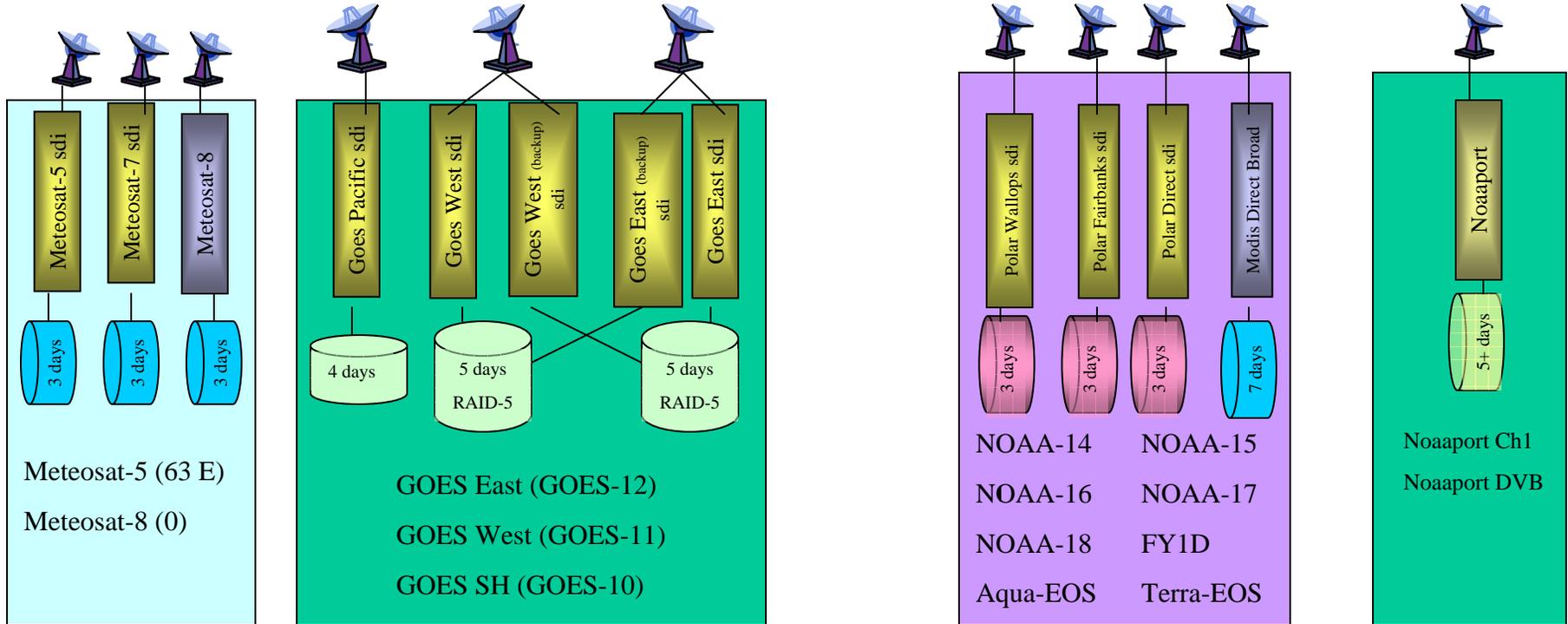
Cooperative Institute for Meteorological Satellite Studies

with input from Steve Ackerman, Paul Menzel, Chris Velden,
Allen Huang, and Liam Gumley

To what degree do we include each end-to-end processing component in SATB?



It starts with data: SSEC Data Center



Meta Database/inventory



3590 tape drive

Tape Archive and Tape Retrieval



3590 tape drive

Data QC Workstations

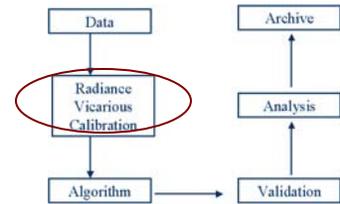
CIMSS Processing Computers

User Workstations



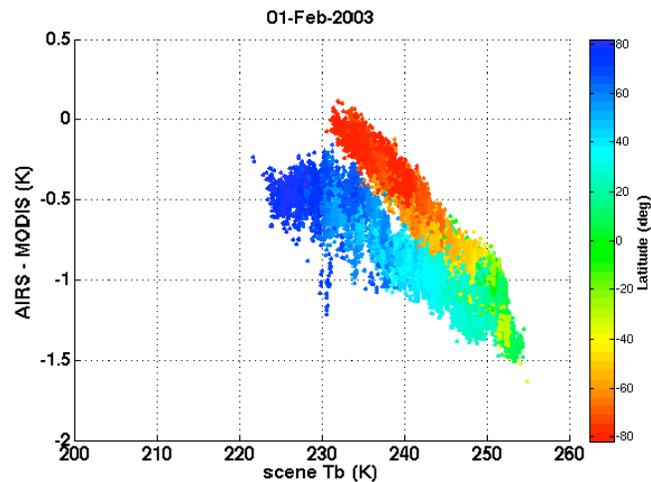
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(Inter)Calibration

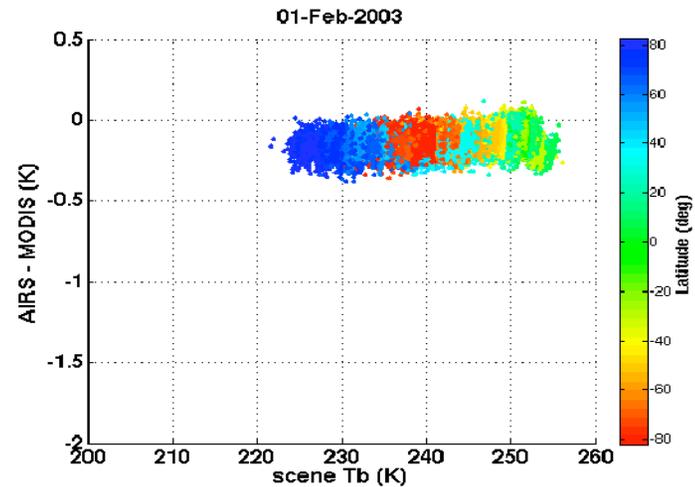


Routine satellite-to-satellite cross-calibration is an essential part of satellite data processing. We need tools for intercalibration (e.g., shifting response functions).

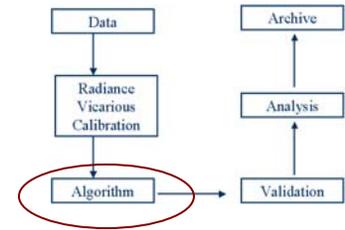
AIRS minus MODIS, Band 35



With 0.8 cm^{-1} SRF shift



Product Generation



Many existing satellite products use algorithms that have evolved to operate universally with new satellites/sensors. Sample algorithms and products that have achieved this include:

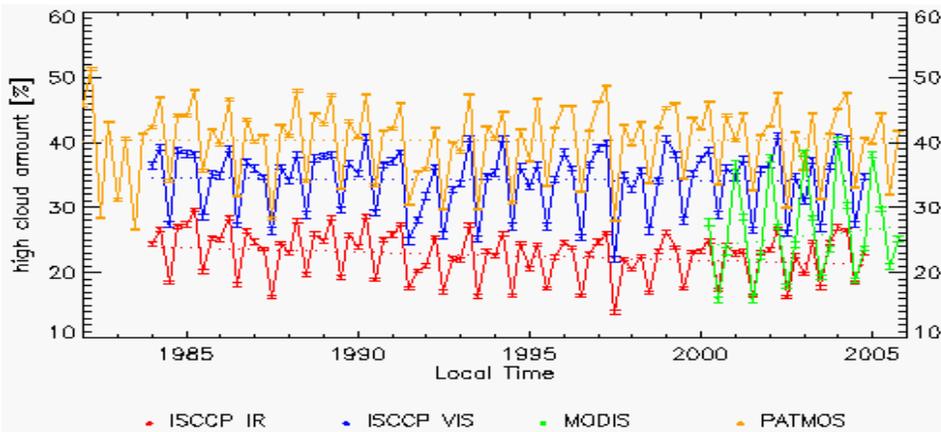
- Winds from GOES, MSG, MTSAT, AVHRR, MODIS
- HIRS cloud products (AIRS)
- AVHRR cloud products (MODIS)
- Biomass burning
- ITPP (AAPP)

Multisensor products must be explored. Some already exists, e.g., APP-x that uses AVHRR and TOVS for cloud and surface properties.

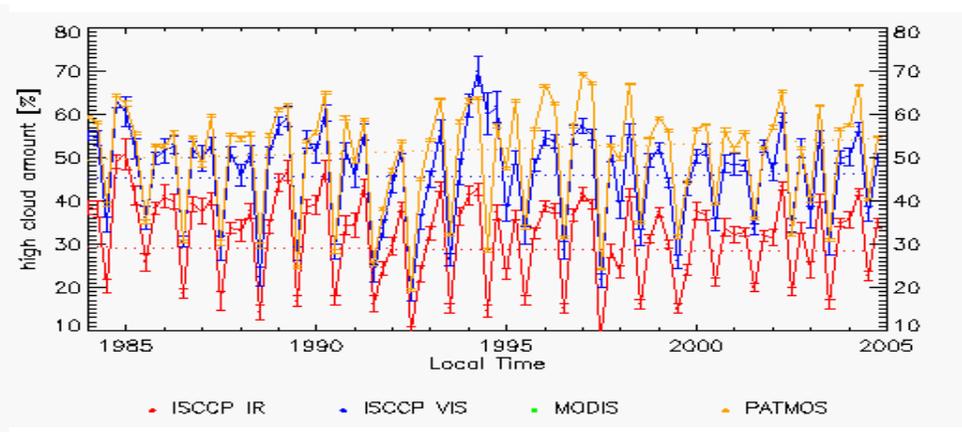
Comparison of Cloud Climatologies

Diurnal sampling and algorithmic differences influence heavily the time-series of cloud products. Time series of ISCCP (vis and IR), MODIS and PATMOS-x high cloud amount over land, illustrating the steps required to compare variation in each time series.

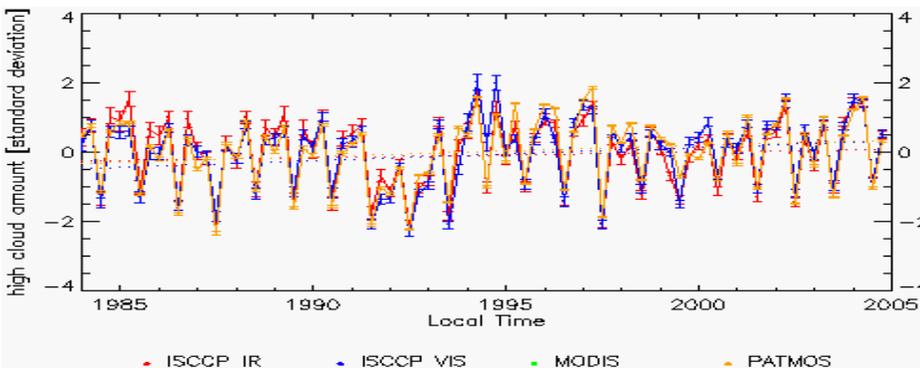
Raw Time Series



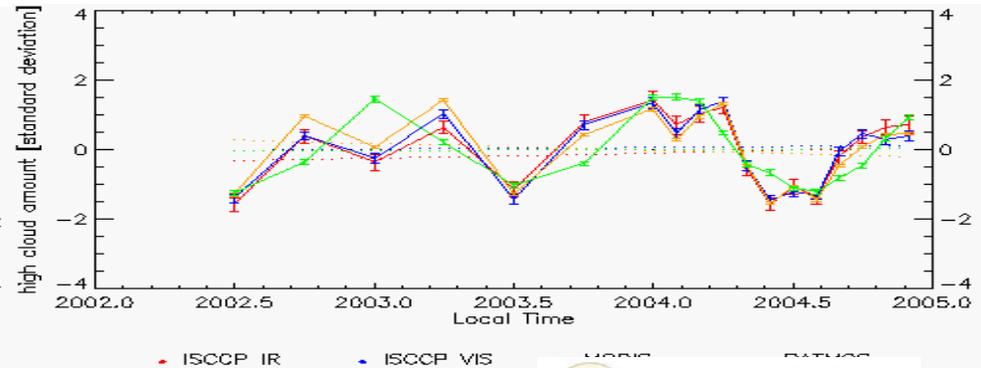
Adjusted for Sampling Differences



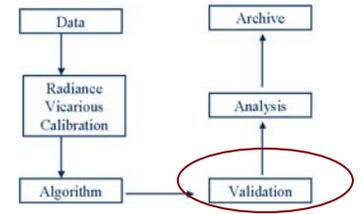
Normalized about the Mean



Including MODIS/AQUA (2002-2005)



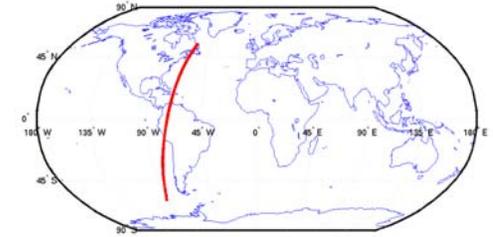
Validation



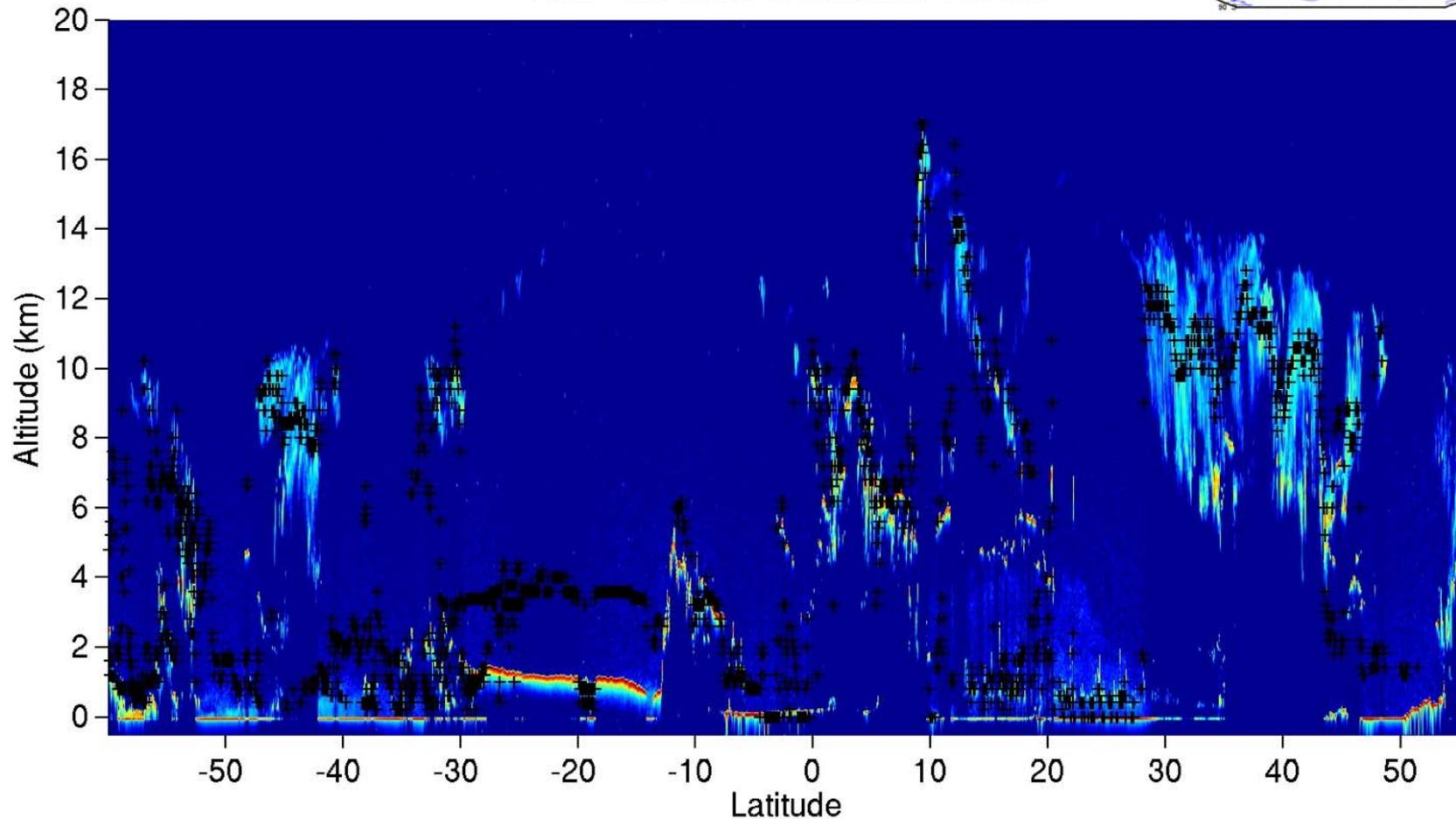
A key component of algorithm development and advancement is an ongoing program of validation to determine uncertainties. Proxy data, in situ, and other validation/verification data should be available.



CALIPSO/MODIS Comparison



Total Attenuated Backscatter 532 nm



Comparison is helping to understand performance of MODIS CO₂-slicing cloud altitudes. Black points are MODIS cloud heights.

Visualization is an important part of any algorithm development environment

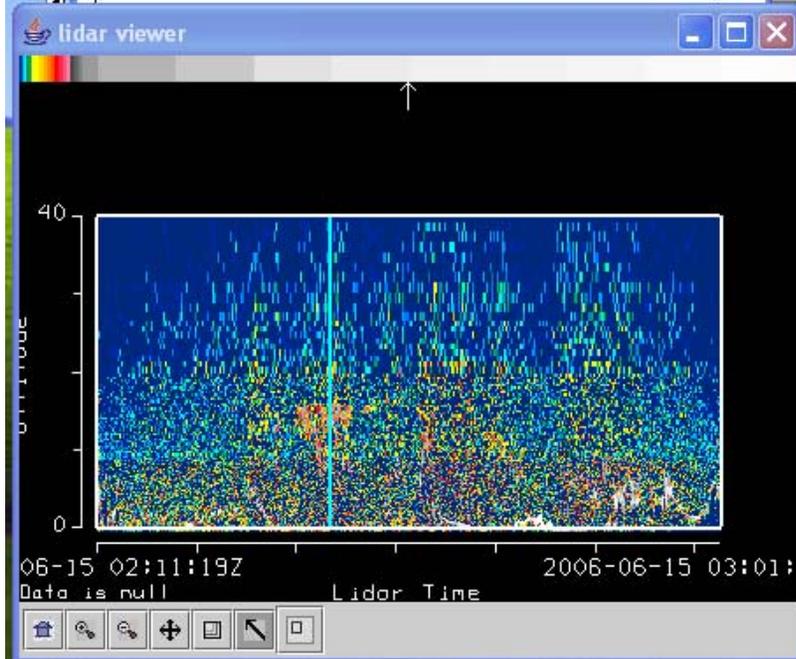
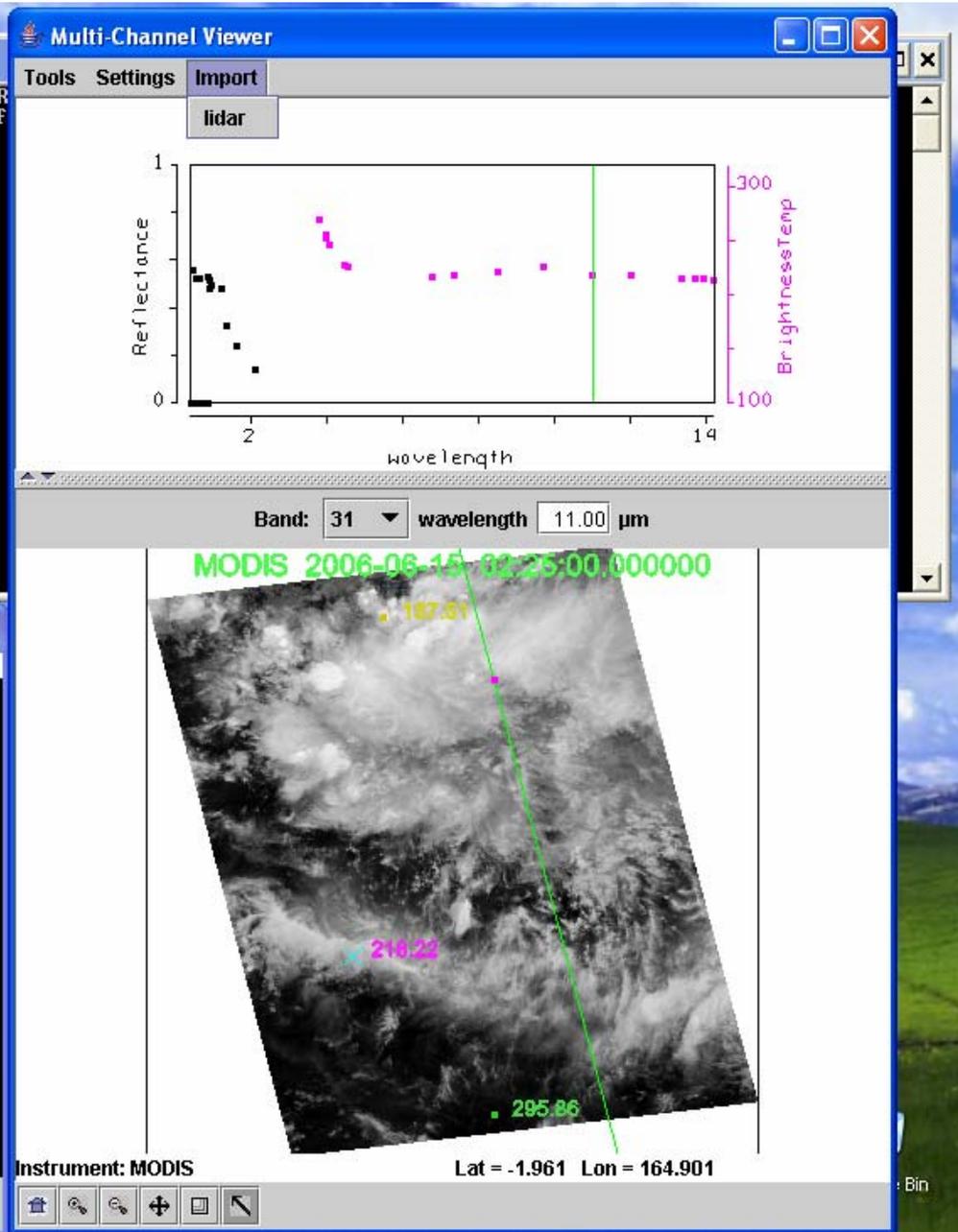
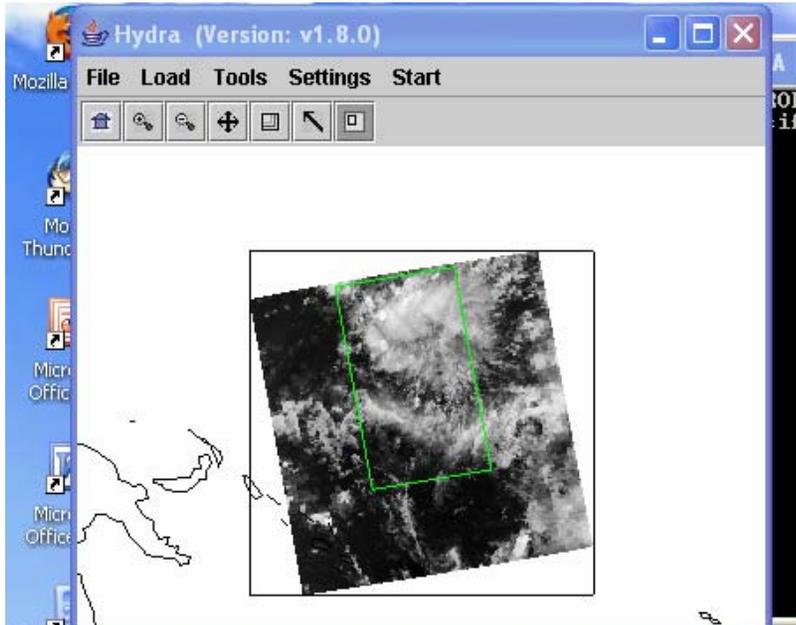
SSEC/CIMSS visualization systems include:

HYDRA

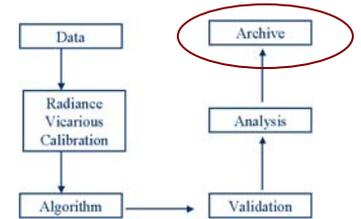
McIDAS-X

McIDAS-V

It is most useful if visualization tools are available to not only display data, but to explore it.



Archive



SSEC Data Center archive:

- Weather satellite archive holdings
 - GOES 26 Jan 1979 - present
 - GMS-5 9 Nov 1998 - 21 May 2003
 - MET-5 (Indoex) 9 Mar 1999 – present
 - MET-7 9 Mar 1999 - present
 - MET-3 1 Jan 1993 - 1 Jan 1995
 - MET-8 15 Mar 2004 - present
- Global products from web
 - Montage Apr 1997 - present
 - IR composites Apr 1997 - present



How does CIMSS fit into the SATB concept?

- Experience in the end-to-end process (previous slides).
- Basic research and algorithm development.
- System development, including
 - The Cloud and Surface Parameter Retrieval (CASPR) system (1995-present) 
 - Low Earth Orbit Cloud Algorithm Testbed (LEOCAT) and GEOCAT (*Covered earlier by Andy Heidinger*)
 - NPP Atmosphere Product Evaluation and Test Element (PEATE)
 - GOES-R Analysis Facility Instrument for Impacts on Requirements (GRAFIIR)

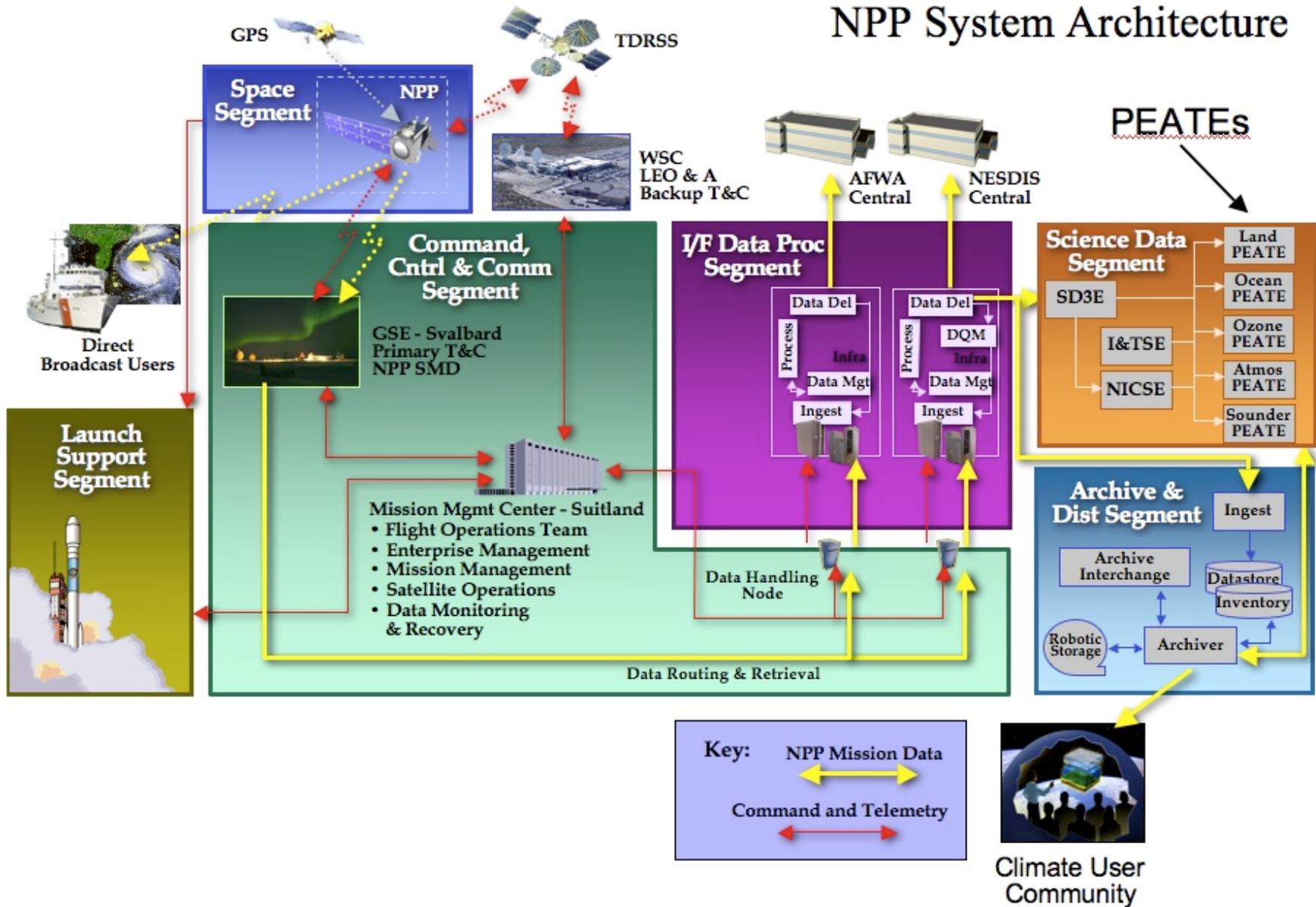
The Atmosphere Product and Evaluation and Test Element (PEATE) for the NPOESS Preparatory Project (NPP)

PEATE Role for NPP

- Provide an environment for pre-launch [testing and evaluation](#) of operational atmosphere Environmental Data Record (EDR) algorithms,
- Assist NPP Science Team in assessing the suitability of NPP atmosphere EDRs for continuing the climate record,
- Create infrastructure using available [validation](#) data to allow rapid assessment of NPP EDR products,
- Provide environment for [testing alternative algorithms](#) on climatologically significant samples of global proxy data,
- Assist NPP Science Team [in providing improved or alternative algorithms](#).



NPP System Architecture



Measurement-Based Product Generation Software

Old Paradigm at SSEC

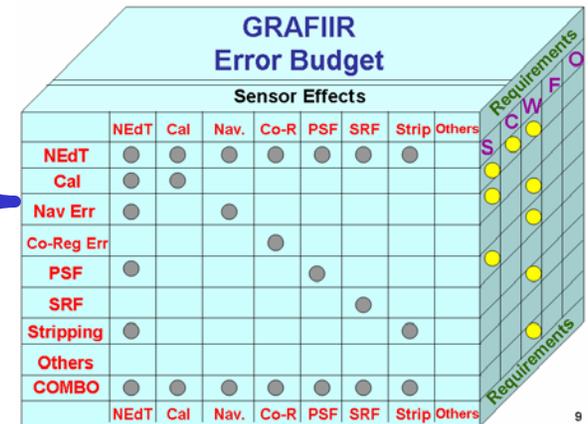
- Data from different sensors processed separately using separate science algorithms.
- Each algorithm used different ancillary (i.e., non-satellite data) sources, interpolation, filtering etc.
- Software in general was designed to work in specific compute environments (e.g., DAAC, McIDAS).
- Software was not available to the community for review, modification, and enhancement.

New Paradigm at SSEC

- Data from different sensors processed using common science algorithms and ancillary data.
- Software designed to work in generic environments (e.g., require only Linux and HDF4/5).
- Software is freely available to the community (e.g., SeaDAS).

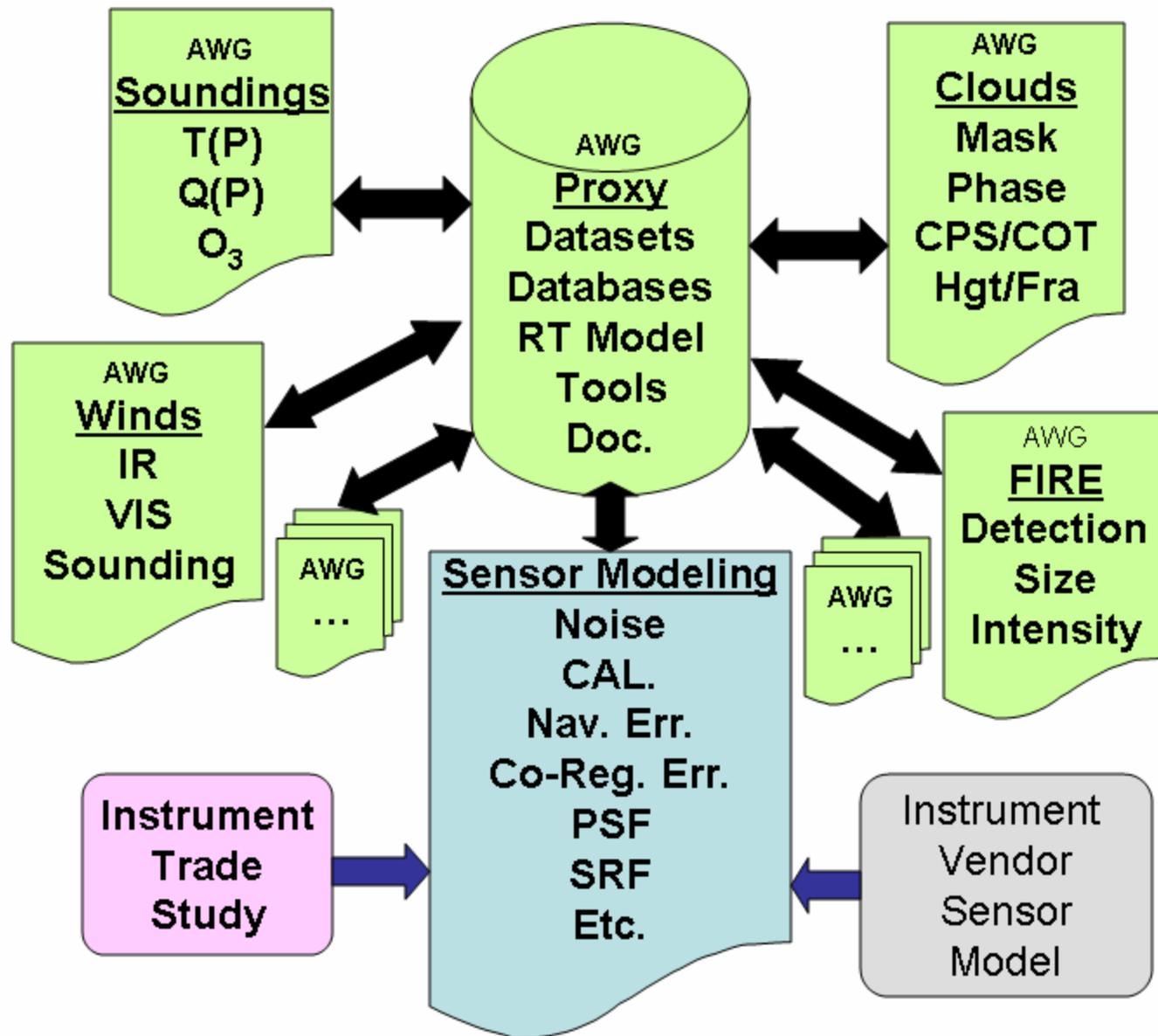
GOES-R Analysis Facility for Instrument Impacts on Requirements (GRAFIIR)

1. A facility to allow easy and consistent use of AWG application team proxy data and product algorithms.
2. An efficient approach to demonstrate multiple datasets simulated for the ABI with different specifications of sensor components such as noise, navigation, band-to-band co-registration, optical diffraction, stripping and other effects identified to be significant.
3. Generate ABI products such as cloud mask, fire, sounding, winds and others to demonstrate the effects of different sensor components on the products produced.
4. Document and analyze the processing results to identify sensor components that might significantly impact the product performance and specification requirement.



GRAFIIR

Connecting the Dots



Thoughts on the SATB Concept

- The idea of a **common programming interface** and tool kit is good.
- **Centralized processing might be functional**, but not in a government facility (cumbersome security).
- **Multi-sensor approaches** may be the only way to solve some problems. So breaking out of the instrument-specific funding stovepipes is desirable. But do we need a testbed concept to achieve this? Why not an initiative for innovative approaches to satellite product development?
- **Shared test and validation data** is desirable and efficient.

However:

- **Avoid too many constrictions**, taking away the freedom of algorithm developers and visionaries. The testbed should ultimately make the life of a developer easier, not more difficult.
- **Avoid overlap** with, or better yet leverage, existing activities that have testbed-like components (i.e., GOES-RRR & AWG).
- **There will never, ever be a single algorithm**, or model (cloud detection, NWP model, etc.). That is not a bad thing.
- Don't take money from existing programs for this.

Thoughts on the SATB Concept, cont.

We need to consider:

To what extent is this initiative for basic, innovative research versus system development?

- It is (in the white paper) the “Advanced Satellite Algorithm Research” initiative.
- Arguably the most attractive component is the cross-sensor and cross-satellite algorithm development.
- PSDI and Ground Systems are PAC funding, and not for research.

Is this simply another hardware/software system development project, or is it more?