National Environmental Satellite, Data, and Information Service

Advanced Instruments
Questions to the workshop breakout groups:

- In light of what you have seen and heard from oral and poster presentations during this workshop, how would you rate the JCSDA activities in your subject areas?
- What should be the top priority for your subject area if additional funding become available?
  - Internal?
  - External?
- Are there data types or subject areas where JCSDA is missing the boat?
- What is the role of your JCSDA working group?
- Workshop format:
  - This years format?
  - “old” one with most presentations in parallel sessions?
  - Another model?

In light of what you have seen and heard from oral and poster presentations during this workshop, how would you rate the JCSDA activities in your subject areas?

- More on satellite winds – geo and polar.
- More on contaminated radiance studies (e.g., precip, clouds)
- Assimilation of surface sensitive microwave

Workshop format:

- This years format? 6
- “old” one with most presentations in parallel sessions? 0
  - 5 abstaining
- Another model, ideas?
  - Add ½ day to length of meeting.
  - Put posters up at beginning, separate room
  - Longer poster session
  - More lead time on poster/presentation decision.
  - Location – too far from NOAA/NASA
    - Pro and con – far enough to be out of office, but close enough to draw attendance.
    - Metro accessible would be desirable.
    - On positive note – this was nice venue, convenient to airport

What should be the top priority for your subject area if additional funding become available?

- Internal and external (not in order of priority)?
  - OSSE's of new/proposed instruments
  - OSSE's for trade studies for conceptual instruments
  - Portability of essential codes (e.g., GSI) for external uses.
  - O2R capability
  - Stable research funds – computing power, etc.
    - Internal support for external efforts.
  - Visiting science capability/program
    - example of ESRL, ECMWF, and SPoRT w/ JCSDA exchange of information.

Are there data types or subject areas where JCSDA is missing the boat?

- Better exploitation of satellite winds – geo and polar.
- Space weather
- SWIR
  - Impact on retrievals has been shown by science teams
- Improved impact of microwave/MWIR Water vapor channels
- Assimilation of surface sensitive microwave and infrared channels
- Spatially aggregated imager scenes (e.g., MODIS on AIRS footprints).

What is the role of your JCSDA working group?

- Instrument issues on new instruments
  - Important to receive performance related information.
  - Important to have the working group make consensus statements.
- Communication between cal/val and impact studies – e.g., small bias corrections.
  - Provide correction packages (e.g., SSMIS bias correction)
- Project teams – ownership of specific problem
  - Physical or software , infrastructure
  - Data format and reader are accessible and uniform
  - Proxy data
- A forum to discuss problems and failed results that might not be worthy of open presentation/publication.
- If you don't have a JCSDA WG, should you
  - Working group for GRO
    - Don't have calibration issues so participation in other groups is not efficient
    - Working group would elevate the priority in other centers.
    - Engage space weather community

National Environmental Satellite, Data, and Information Service

Hyperspectral IR Working Group (JCSDA-IRWG) Report

John Derber and Chris Barnet

JCSDA 7th workshop on Satellite Data Assimilation

May 12, 2009

National Environmental Satellite, Data, and Information Service

Infrared Working Group membership

Tom Auligne	NCAR	303-497-8126
Chris Barnet	NOAA/STAR	301-316-5011
Kenneth Carey	Noblis	703-610-1933
John Derber	NOAA/NCEP	301-763-8000 x 7740
Jim Jung	Univ. of Wisc./NOAA	301-763-8204 x179
Emily Liu	NASA/GMAO	301-614-6161
Ben Ruston	NRL/MMD	831-656-4020
Brad Zavodsky	NASA/SPoRT	256-961-7914

Working Group Objectives

- Coordinate data transfer and data reformatting for hyperspectral radiance data across the JCSDA partners.
- Coordinate efforts on bias correction, data selection and Quality Control methods for hyperspectral radiance data.
- Interact with the JCSDA CRTM Working Group and make recommendations on new CRTM developments to benefit the use of hyperspectral radiance observations.
- Coordinate and assess impact experiments for IASI and AIRS.
- Coordinate scientific and technical work in preparation for CrIS as detailed in agreements between JCSDA and NPOESS Integrated Program Office.
  - Simulated and proxy datasets
  - Pre-launch and Post-launch cal/val
  - GOAL: Facilitate demonstrated impact within 3 months of launch.
- Review and assess alternative approaches to assimilation of hyperspectral observations
  - cloud-cleared radiances
  - physical retrievals
  - retrieved surface emissivity.
- Ability to discuss failed experiments and problems
  - Items that would not be discussed or presented in other meetings

1st (and only) meeting held on Jan. 30

- Discussion of web page and access to presentations.
  - Decision was made to only post those presentations that are pre-approved by the presenters to encourage a forum for discussion of new research rather than an archive of accomplishments.
- Discussion of activities with AIRS and IASI at GMAO, NRL, NCAR, NCEP, and STAR.
  - Research with variational bias correction
  - Use of adjoint tools for QC and channels selection.
  - Instrument monitoring.
- Discussion of charter and goals for this working group.
- Originally planned a meeting for late April, but schedule conflicts (HISE & ECMWF meetings, and JCSDA workshop) has delayed next meeting.

Other activities

- Request for information for JCSDA Program Plan
  - Compilation of steps required for transition of new sensor to operations.
    - Identified many steps inherent in STAR and instrument science teams.
    - Smaller number of steps relevant to JCSDA.
- Request for detailed information on identification of resources required for research to operations activities (STAR, OSDPD, JCSDA) for satellite instruments.
- Feedback to instrument teams
  - AIRS science team requested feedback on proposed change to on-orbit instrument noise modification.
  - NPOESS program requested feedback on waivers for the CrIS instrument.

Steps to transition a new sensor to operational data assimilation (pre-launch phase)

- Forward model preparation and testing.
- Covariance matrix preparation for all parameters in the assimilation control vector
- OSSE experiments using Nature run, to get ready for the assimilation of the sensor and assess impact (really necessary in concept/design phase)
- Preparation of the tools for preprocessing data, QC/flagging the data.
- Assess hardware and software requirements needed and plan accordingly
- Assess footprint averaging, thinning methodologies that are appropriate, for the specific sensor. Thinning is understood as spatially and spectrally.
- Select subset of channels (for hyperspectral instruments) to capture information content for temperature, moisture, and trace gases to reduce volume of data while maintaining information content (*i.e.*, remove redundant and contaminated channels). Document methodology and make lists of optimum channels.
- Obtain sample (BUFR) data and associated decoding codes
- Initial estimates of instrument noise and spectral correlation from data
- Simulation of a full data assimilation exercise on simulated data (sample files) and test using retrieval algorithms (part of the channel selection exercise above)
- Generation of a 24/7 flow of simulated data, based on proxy real data (*e.g.*, CrIS data based on AIRS or IASI data) with identical format as the expected real data
- Set up the ingest system, assess potential bottlenecks and fix issues. Goal: simulate the expected post-launch configuration, before the launch.

Steps to transition a new sensor to operational data assimilation (post-launch phase)

- Assess geo-location quality of measurements
- Assess instrument performance w.r.t. forecast models (NCEP, ECMWF) using both radiance and retrieval products.
- Monitor telemetry, noise NeDT, stability of gains, hot loads, cold loads, and other major parameters.
- Assess quality of measurements (by comparing to simulation based on forecast/analysis fields) (OB-BK)
- Assess QC/preprocessing tools (clear flag, convergence metric, etc)
- Intercompare sensors with legacy sensors (AIRS, IASI, HIRS, etc.)
- Intercompare radiances/products with in-situ measurements (aircraft, radiosondes, intensive scientific campaigns, etc.)
- Determine/monitor bias of measurements as well as RTM uncertainties
- Test/Adjust footprint matching & thinning methodology
- Perform parallel assimilation tests to determine impact on forecast skills (tailored to the type of sensor: an imager is not likely going to impact hugely the 500 hPa anomaly correlation factor.)
- Full operational implementation if tests positive.

Issues within the IRWG

- Improved communication between the JCSDA community and activities within instrument engineering & science teams and STAR is recognized as an important component of this working group.
  - Specific goal is too reduce time to transition NPOESS instruments.
- Needs of instrument teams is too detailed and tends to occur too early.
  - *E.g.* Pre-launch NPOESS detailed instrument requests are not a priority within the data assimilation community at this time.
- Many of the activities of this working group are redundant.
  - Microwave and infrared working group have common members and goals.
    - STAR IASI and AIRS processing systems also use co-located microwave.
  - Centers already discuss their results at scientific meetings and JCSDA annual meeting.
  - Many of the IRWG members are already members of the NPOESS cal/val and Sounder Operational Algorithm Team (SOAT)

Maybe the working group should be task oriented (suggested by Sid Boukabara).

- Focus on specific infrared issues
  - Use of SW channels for improved temperature
  - Use of 6 μm water channels
  - O_3 channels or products
  - CO_2 climatology
  - Surface emissivity
- Focus on specific experiments
  - Use of cloud cleared radiances or products.
    - Developing variational cloud clearing approach.
- All these would require support in terms of priority and funding.

Future of the IRWG

- For AIRS and IASI the working group does not have a unique role.
- For CrIS the working group may have a vital role, albeit somewhat redundant with SOAT and cal/val activities.
- Suggestion was made to combine the microwave and infrared working groups
  - Many members are already common and would eliminate multiple meetings.
  - But – we would lose the infrared focus.
- We will hold another IRWG meeting in the near future.
  - Discuss timing and content of future meetings
    - Recognize that meetings for IR may need to be less frequent and possibly event driven (*e.g.*, when new results are ready)