



Joint Center for Satellite Data Assimilation: Research-to-Operations-to-Research

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September 13, 2011

Silver Spring, MD



Overview



- JCSDA Background
- COPC – JCSDA Relationship
- JCSDA Role in Data Acquisition for Assimilation
- Summary



JCSDA Background



- § Partners, Mission, & Vision
- § Modes of “Operation”
- § Science Priorities
- § Major Accomplishments
- § Current Activities

JCSDA is a Research-To-Operations (R2O) Center:

Primary function to undertake research in various aspects of satellite data assimilation, demonstrate maturity fo operational use, then help transition it to an operational environment in one or multiple JCSDA operational partners.



JCSDA Partners, Vision, Mission



Vision:

An interagency partnership working to become a world leader in applying satellite data and research to operational goals in environmental analysis and prediction

Mission:

...to accelerate and improve the quantitative use of research and operational satellite data in weather, ocean, climate and environmental analysis and prediction models.



JCSDA Modes of Operation



✓ **JCSDA partner's in-Kind Research**

- § Research undertaken independently by partners, overlapping with JCSDA priorities
- § Results/deliverables made available and shared with/between partners

✓ **Directed research (short-term return-on-investment expected)**

- § Carried out by the partners
- § Mixture of new and leveraged funding

✓ **External research (near-term return-on-investment expected)**

- § Grants awarded following proposals submitted (administered in rotation by NOAA, NASA, and DoD on behalf on JCSDA)
- § Open to the broader research community
- § Funding awarded competitively, peer review process

✓ **Visiting scientist program (see www.jcsda.noaa.gov)**

- § Great way to initiate or strengthen involvement with the Joint Center
- § Wide-open to data assimilation scientists from everywhere
- § Short-term (a few weeks/months) and Long-term (a few years) VS



JCSDA Science Priorities



Overarching goal: Help the operational services improve the quality of their prediction products via improved and accelerated use of satellite data and related research

- ✓ Radiative Transfer Modeling (CRTM)
- ✓ Preparation for Assimilation of data from new instruments
- ✓ Assimilation of Data impacted by Clouds and precipitation
- ✓ Assimilation of Land surface observations
- ✓ Assimilation of Ocean surface observations
- ✓ Atmospheric Composition; chemistry and aerosol

***Driving the activities of the Joint Center since 2001,
approved by the Science Steering Committee***



JCSDA Past Accomplishments



- ✓ Community Radiative Transfer Model (CRTM) shared by all partners
- ✓ A common data assimilation infrastructure shared by NOAA, AFWA, NASA
- ✓ A common land data assimilation system shared by NOAA, AFWA, NASA
- ✓ Numerous new satellite data assimilated operationally, e.g.
 - § Microwave: AMSU and MHS (radiances, new QC,...), SSMI/S, Windsat, Jason-2,...
 - § AIRS and IASI hyperspectral IR radiances,
 - § GPSRO sensors (COSMIC, GRAS, GRACE, CNOFS, TerraSAR-X)
 - § MODIS (winds and AOD)
- ✓ Advanced sensors tested for operational readiness, e.g.
 - § ASCAT, MLS, SEVIRI (radiances)
- ✓ Improved physically-based SST analysis
- ✓ Adjoint sensitivity diagnostics



JCSDA Current Major Activities



✓ **DA Technique/Tools Readiness & Improvement:**

- § Readiness for data assimilation of New Sensors
- § On-Going Improvements for already-Assimilated Sensors
- § Radiative Transfer Modeling (CRTM)
- § Line-By-Line and Spectroscopy (supported external research)
- § Observing Systems Simulation Experiments (OSSE)
- § Data Denials Experiments
- § GPS RO Assimilation
- § Cloudy/Rainy Data Assimilation (Infrared and Microwave)
- § Understanding/Reconciling Radiance and Retrievals Assimilations
- § Land Information System (LIS)
- § Aerosol Data Assimilation

✓ **Facilitating Research-To-Operations Activities:**

- § Maturing External Research for future Operational Implementation
- § O2R: Establishing an Operational DA Environment for Research

✓ **Others**

- § Outreach and Training

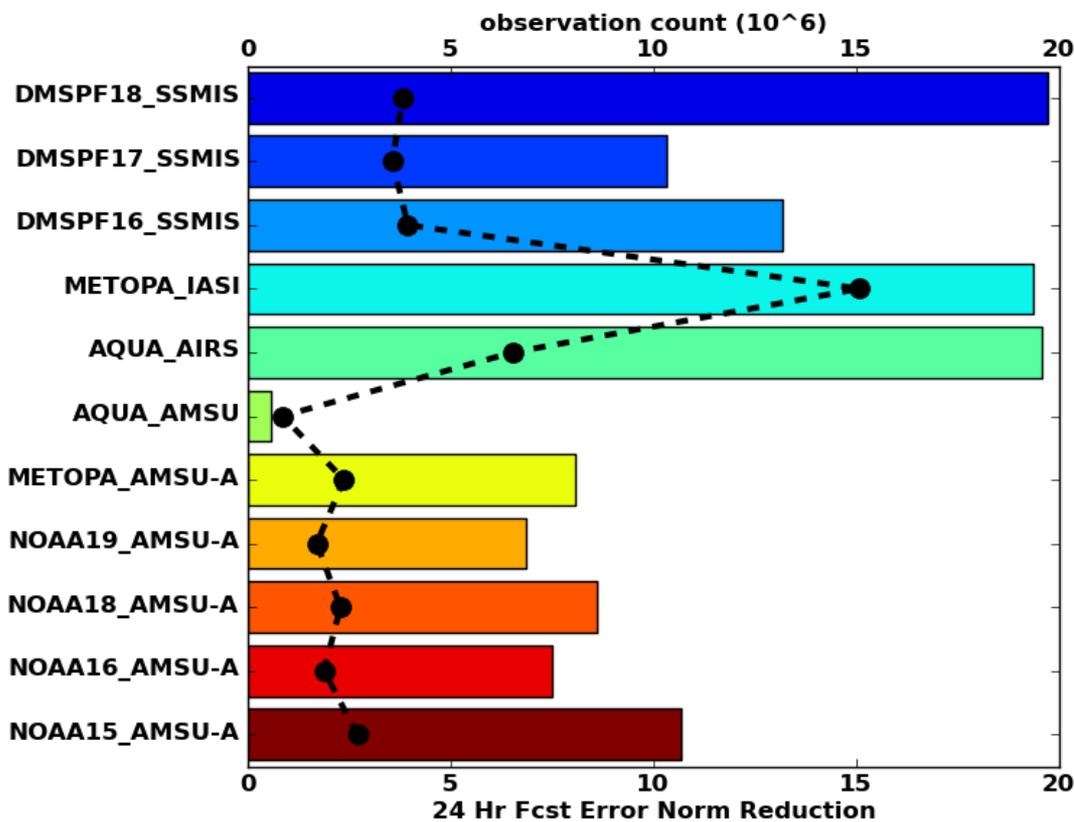


NAVY NAVDAS-AR Operational Radiance Assimilation Impacts



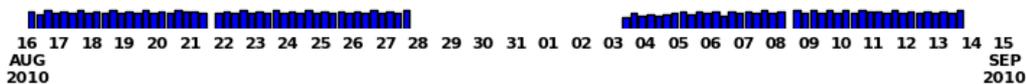
Observation Impacts by Sensor, 16 Aug – 14 Sep 2010

NAVDAS-AR Observation Sensitivity



Adjoint Sensitivity Method

Shows the impact an individual observing system, sensor or select channel had in reducing the 24-hour global forecast error as measured by a moist energy norm integrated over the troposphere and lower stratosphere (1000–150 hPa)

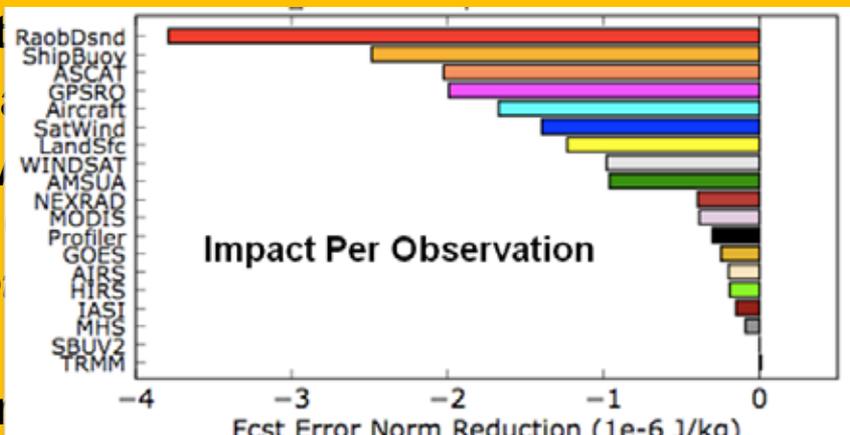
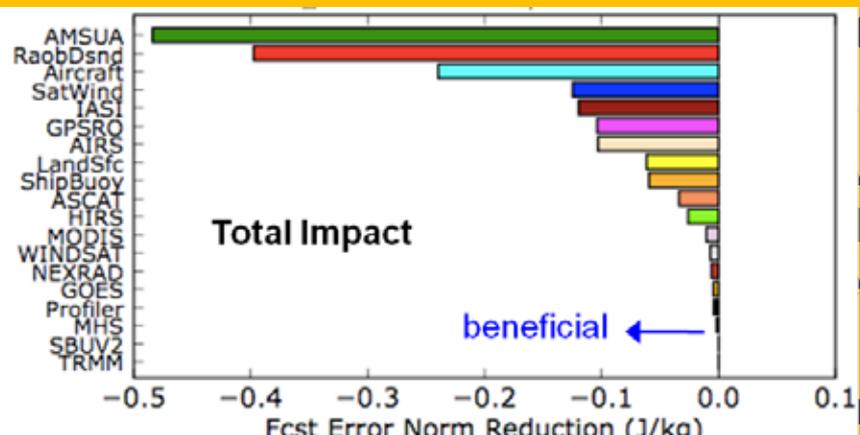




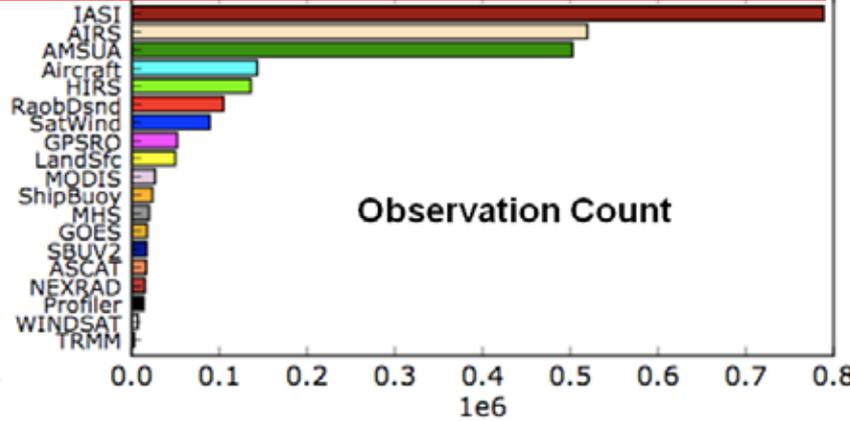
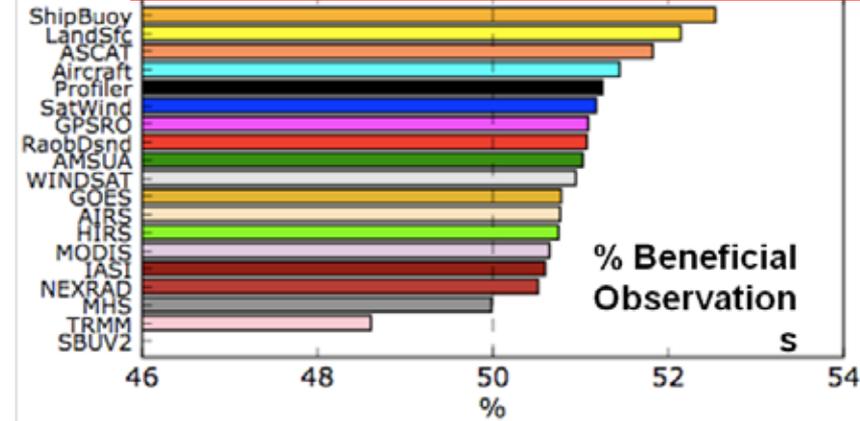
Observing Systems Evaluation (OSE) -Data Denials Experiments and Adjoint-



Experiments planned in the JCSDA, to assess contribution from (1) conventional and satellite data, (2) from individual satellites and (3) from individual sensors.



NOAA Example of current impact assessment using NASA Adjoint-based Estimates Using GEOS-5 Forecasts 10 Nov 2010 – 02 Jan 2011



Adjoint-based estimate of 24-hr global forecast error reduction in wind, temperature and surface pressure combined as energy (J/kg), from sfc-150 hPa (plot courtesy of R. Gelaro, NASA)



Readiness for Data Assimilation of New Sensors



- ✓ **Goal is to have operational users ready to**
 - § Assess data from new sensors from day 1
 - § Assimilate data from new sensors within one year from launch
- ✓ **Current activities include**
 - § NPP and JPSS: ATMS, CrIS, VIIRS, OMPS
 - § GOES-R: ABI, GLM
 - § FY-3 microwave sounders (MWTS and MWHS)
 - § AMSR-E/ASCAT/SMOS/AMSR2/SMAP (Soil Moisture)
 - § GPS-RO satellites: TerraSar-X (TSX), SAC-C, and C/NOFS
- ✓ **Planned activities for the future**
 - § Data Assimilation for GPM and Aquarius
 - § Data Assimilation NASA/SMAP
 - § GPS RO payload on: Oceansat-2(ROSA) and PAZ mission; COSMIC-2
- ✓ **Activities involve:**
 - § Preparation of proxy data
 - § BUFRization of data
 - § Modification/testing of satellite data assimilation system and tools



On-Going Improvements for Already-Assimilated Sensors



✓ Sensors including :

- § AIRS/IASI (channel selection, cloudy radiances, water vapor improvement, methodology, ...)
- § Use of cloudy radiance assimilation (both IR and Microwave)
- § GPSRO: COSMIC, GRAS, GRACE (methodology: bending angles vs refractivities, quality control improvements)
- § MODIS winds (data selection, QC)
- § OMI (observation operator, error covariance)
- § SSMI/S (calibration correction, QC, etc.)
- § AMSU, MHS (water vapor channels assimilation, quality control methodology, etc.)
- § MLS (methodology, impact testing, etc.)



Training and Outreach



✓ **JCSDA Annual Science Workshop**

- n Two or three day meeting taking place each May or June in the DC area
- n Typically 100-150 participants, including JCSDA management and funded investigators
- n Primary purpose is to report progress in JCSDA funded project and in-kind investigations done by partners
- n Is evolving into de facto premier national meeting on satellite data assimilation

✓ **Joint/International Scientific Workshops**

- n ECMWF-JCSDA Workshop on Clouds and Precipitation , Reading June 2010
- n JCSDA-HFIP Workshop on Satellite Data Assimilation for Hurricane Forecasting
- n Fifth *WMO Workshop on the Impact of Various Observing Systems on NWP*, May 2012 in Sedona, AZ, USA

✓ **Training future-generation DA experts** *(to account for Operational needs):*

- ✓ Collaboration with Academia on establishing satellite data assimilation expertise poles
- ✓ JCSDA Summer Colloquium (next one scheduled for summer 2012)
 - n Outstanding program of lectures given by world-renowned experts
 - n Co-Sponsored by all JCSDA partners
 - n **Open to all applicants**



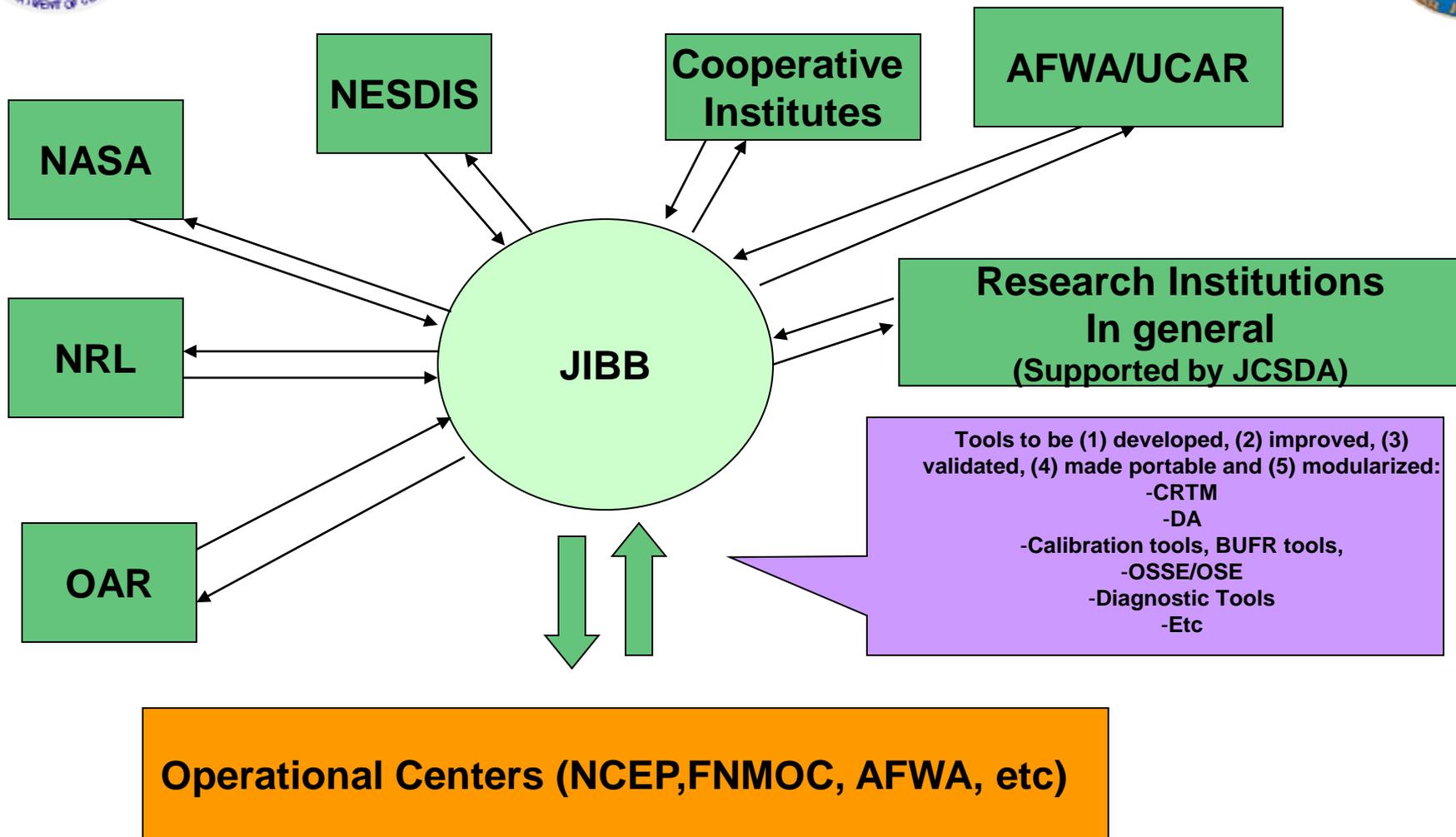
COPC – JCSDA Relationship



Agency/Office	Research & Development	Operations
US Navy	NRL	FNMOCC, NAVO
US Air Force		AFWA
NOAA/NWS	NCEP/EMC	NCEP/NCO
NOAA /NESDIS	STAR	OSPO
NOAA/OAR	ESRL, GFDL, AOML	
NASA	GMAO, SPORT	
External	CIs, Academia, DTC,UCAR	



O2R: Establishing an Operational DA Environment for Research





JCSDA Role in Data Acquisition



§ JCSDA Data Requirements

- Reflect those of Operational Partners
 - Note similarity to OPC satellite data lists
 - Need operationally used data
 - » To improve their use
 - » To provide relevant baseline for NEW data
- Can guide those of Operational Partners
 - Shared results, techniques can be used by OPCs to prioritize current and future data requirements for operations



Summary / Conclusion



- ✓ The JCSDA helps US operational centers to benefit from new satellite data as soon as possible after launch
- ✓ JCSDA activities have had clear impact on operational activities in all partners
 - § Joint systems and code (CRTM, LIS, ...)
 - § Additional sensors (AIRS, MODIS, COSMIC, IASI, SSMI/S,...)
 - § Ongoing improvements to assimilation methodology and diagnostics (observation operators, adjoint sensitivity,...)
- ✓ Increased collaboration both internally (between partners), nationally and internationally
 - § New JCSDA computing vehicles to strengthen collaboration