

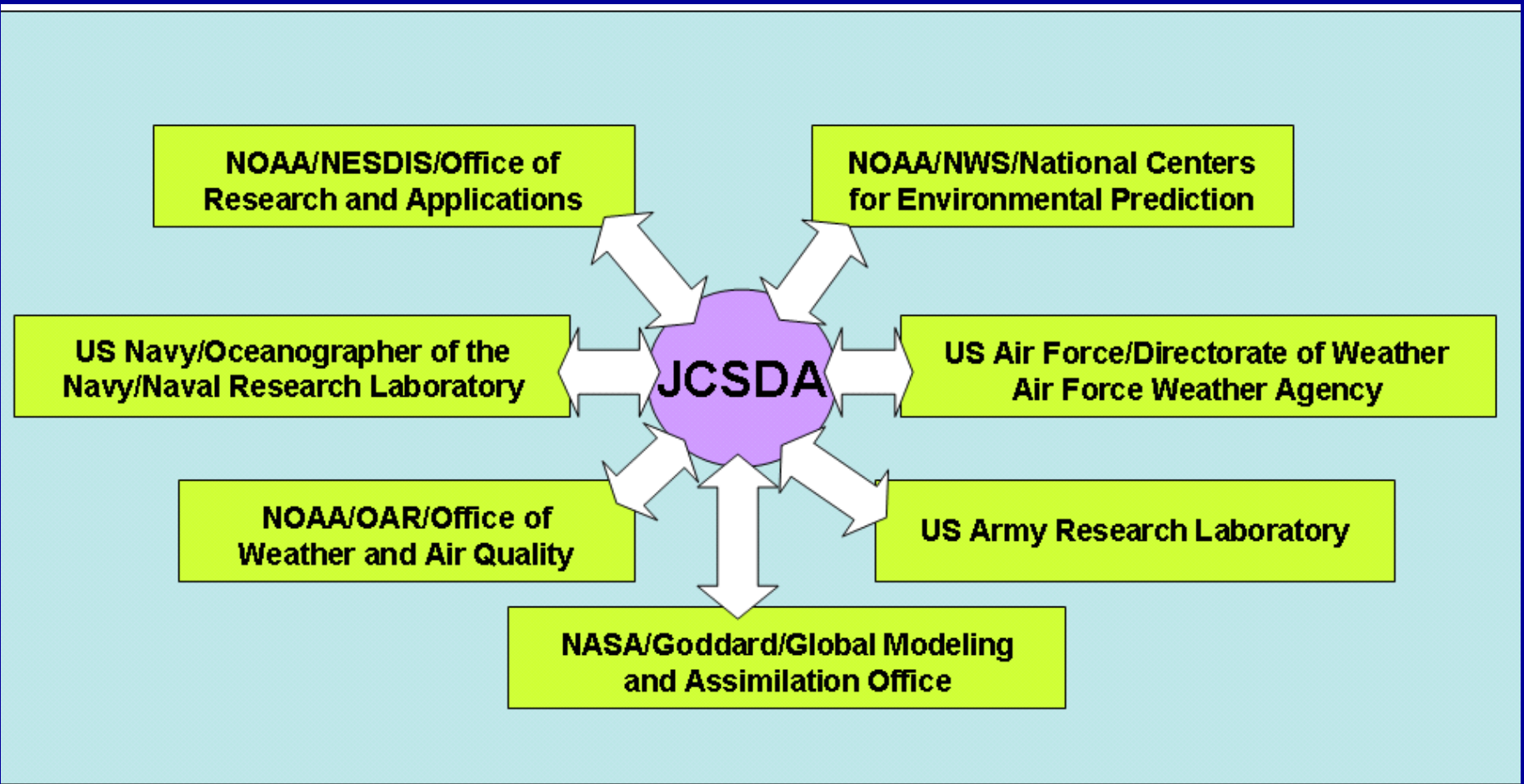
The Joint Center for Satellite Data Assimilation; Program Overview

Lars Peter Riishojgaard
Director, JCSDA

Overview

- JCSDA
- Accomplishments
- New short-term goal and focus areas
- Outlook

JCSDA Partners



Management Oversight Board

- Louis Uccellini, NCEP (Chair)
- Al Powell, NESDIS/STAR
- Franco Einaudi, GSFC ESD
- Simon Chang, NRL Monterey
- Col. Mark Zettlemyer, USAF
- Bob Atlas, OAR/AOML

JCSDA Executive Team

- Lars Peter Riishojgaard, Director
- Steve Goodman, NESDIS/STAR, Deputy Director
- Steve Lord, NCEP/EMC, Associate Director
- Michele Rienecker, GSFC/GMAO, Associate Director
- Pat Phoebus, NRL Monterey, Associate Director
- John Zapotocny, AFWA, Associate Director

- Wayman Baker, NCEP, Chief Admin. Officer
- George Ohring, Ken Carey, Consultants

JCSDA Vision

- Prior to June 2008 Executive Retreat:
 - *A weather, ocean, climate, and environmental analysis and prediction community empowered to effectively assimilate increasing amounts of advanced satellite observations from the evolving Global Earth Observing System of Systems (GEOSS)*
- Post Executive Retreat:
 - ***An interagency partnership working to become a world leader in applying satellite data and research to operational goals in environmental analysis and prediction***

JCSDA 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 Strategic Science Priorities

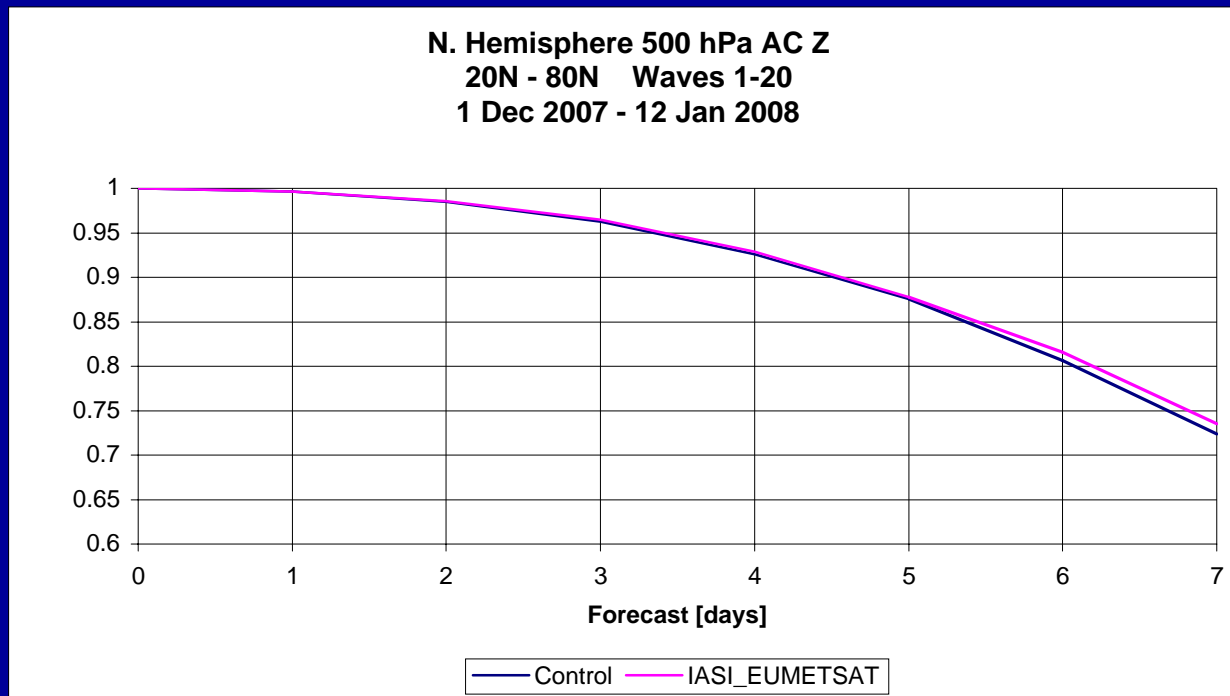
- Radiative Transfer Modeling (CRTM)
- Preparation for assimilation of data from new instruments
- Clouds and precipitation
- Assimilation of land surface observations
- Assimilation of ocean surface observations
- Atmospheric composition; chemistry and aerosol

JCSDA accomplishments

- Common assimilation infrastructure (NCEP/EMC, NASA/GMAO)
- Community radiative transfer model (all partners)
- Common NOAA/NASA land data assimilation system (EMC, GSFC, AFWA)
- Snow/sea ice emissivity model – permits 300% increase in sounding data usage over high latitudes (EMC)
- MODIS polar winds (EMC, GMAO, FNMOC)
- AIRS radiances (EMC, GMAO)
- COSMIC refractivity (EMC)
- Improved physically based SST analysis (EMC)
- Advanced satellite data systems such as DMSP (SSMIS), CHAMP GPS, WindSat tested for implementation (EMC)
- Data denial experiments completed for major GOS components (GMAO)

IASI impact assessment NCEP GFS

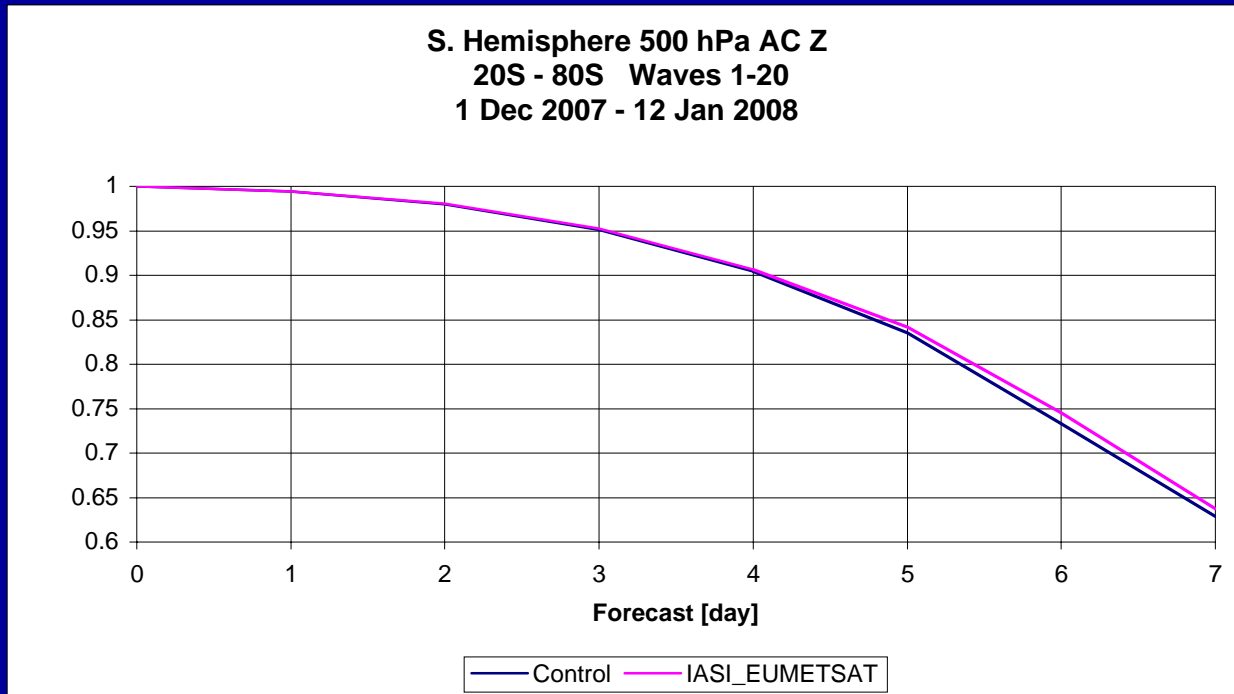
NH Dec 2007



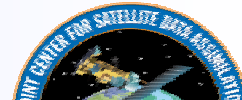
Jung, van Delst, Han, Derber, Treadon, Kleist, ...

IASI impact assessment NCEP GSF

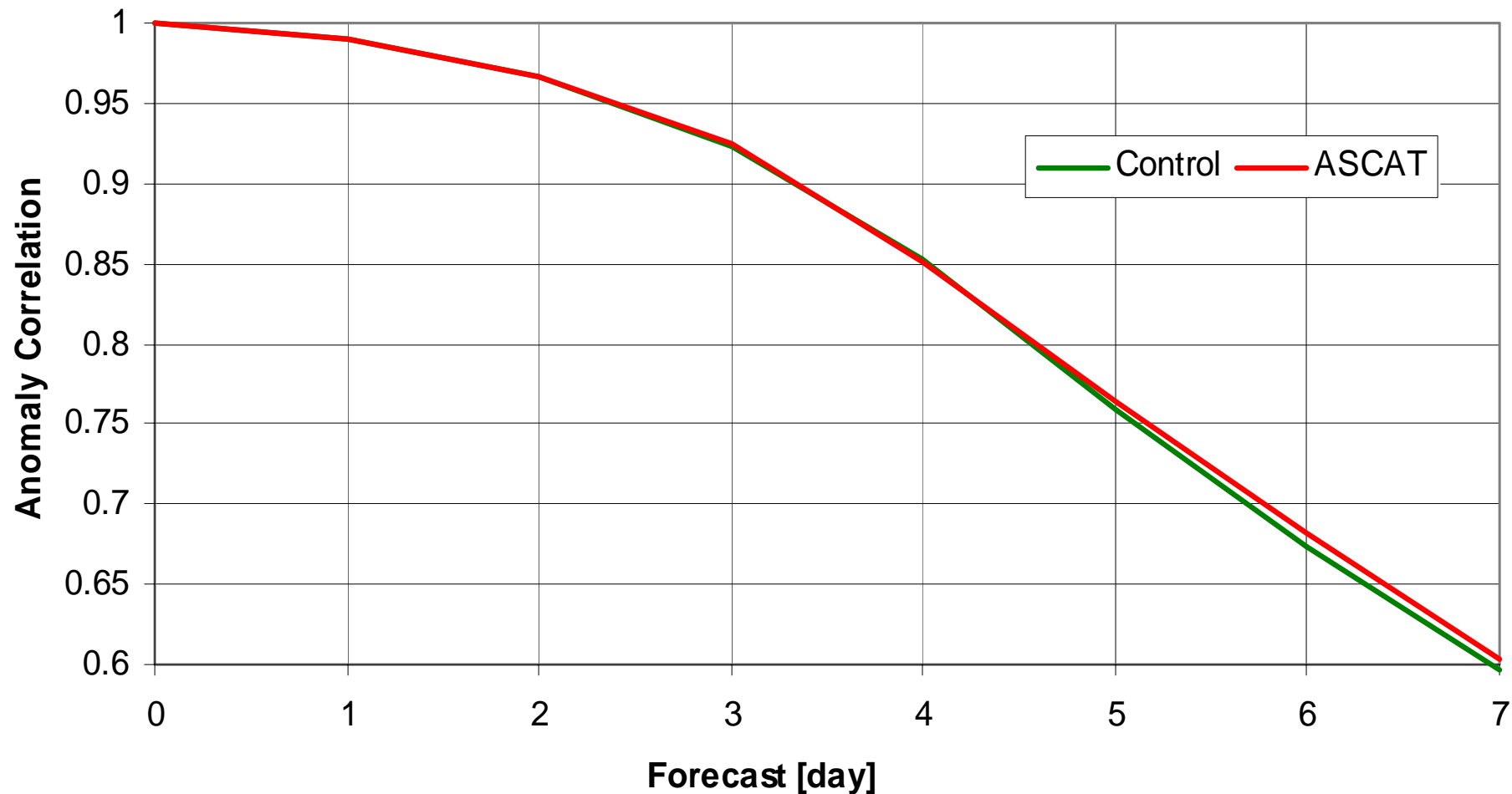
SH Dec 2007



Jung, van Delst, Han, Derber, Treadon, Kleist, ...

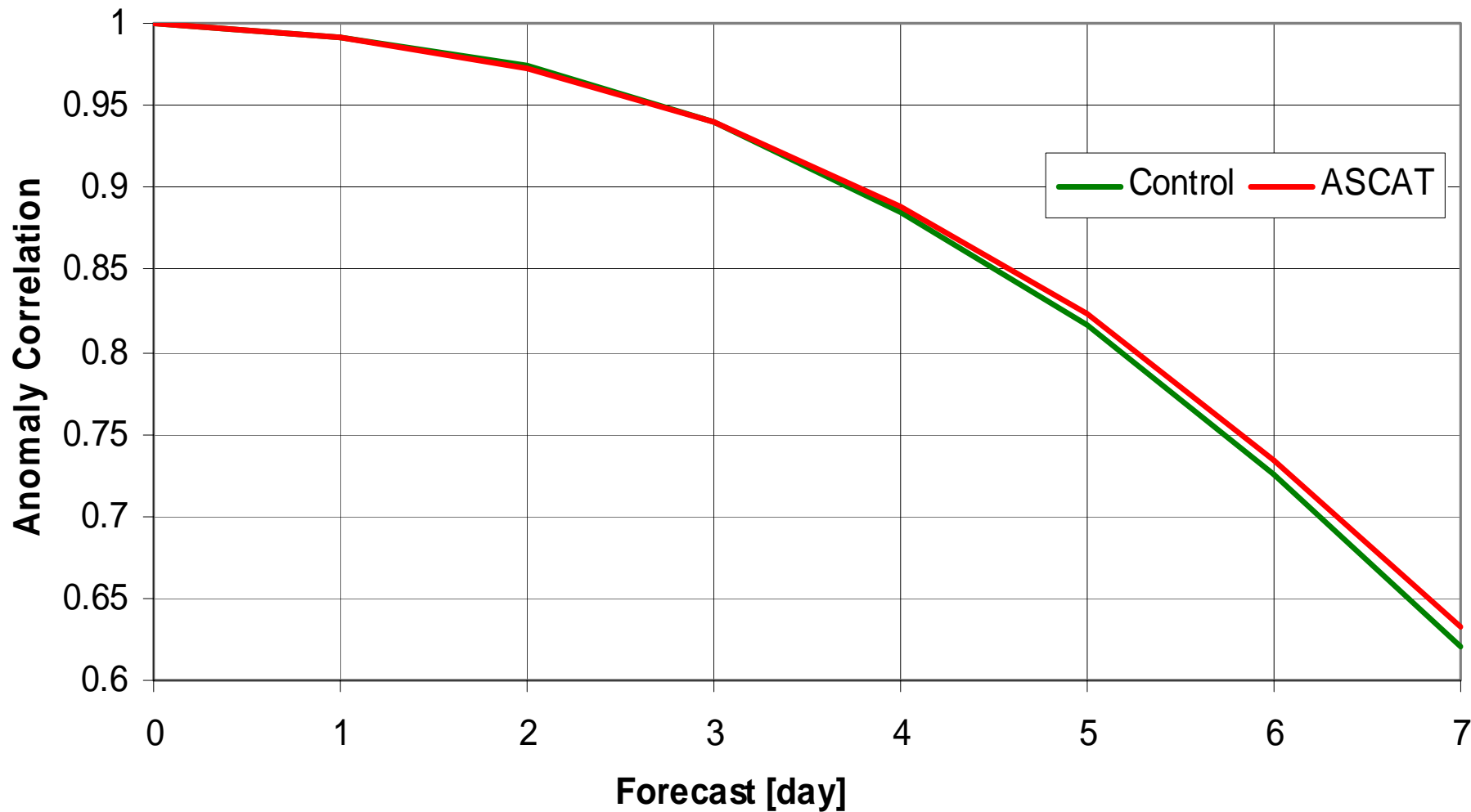


S. Hemisphere 1000 hPa AC Z 20S - 80S Waves 1-20 1 Aug - 31 Aug 2007

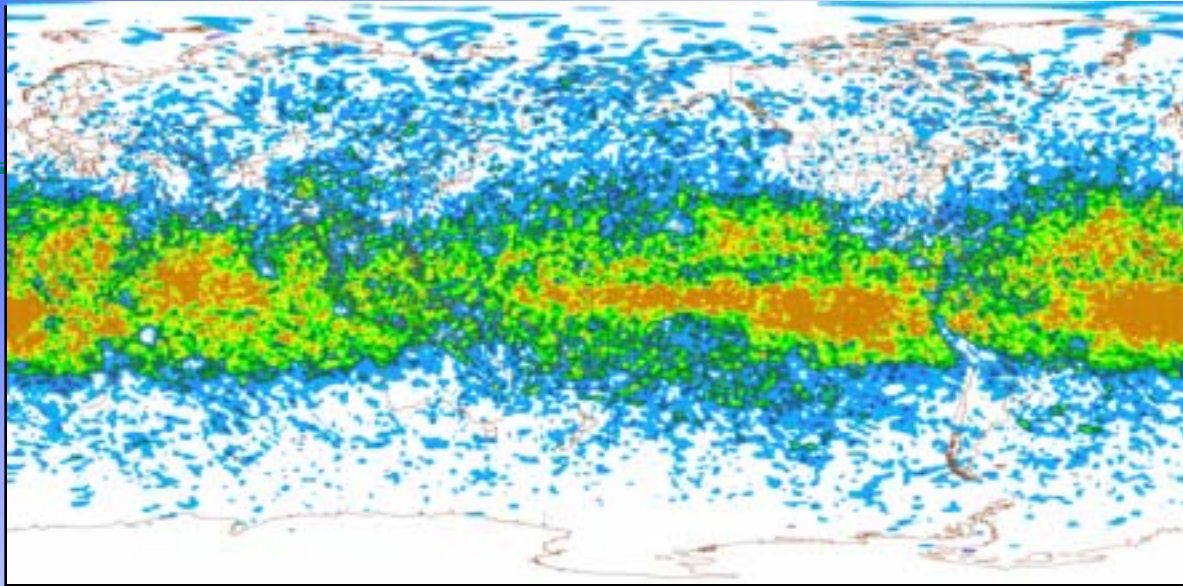


N. Hemisphere 1000 hPa AC Z 20N - 80N Waves 1-20

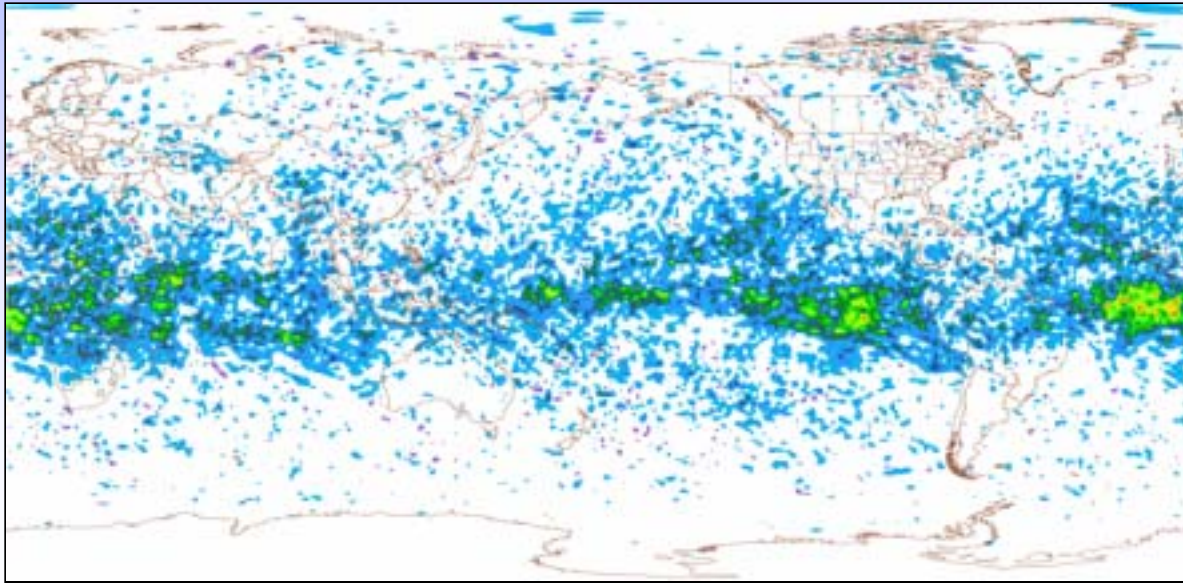
1 Jan - 31 Jan 2008



(a) 500hPa WIND SPEED FCST IMPACT [%] 6HR ASCAT 1-31 Aug 2007

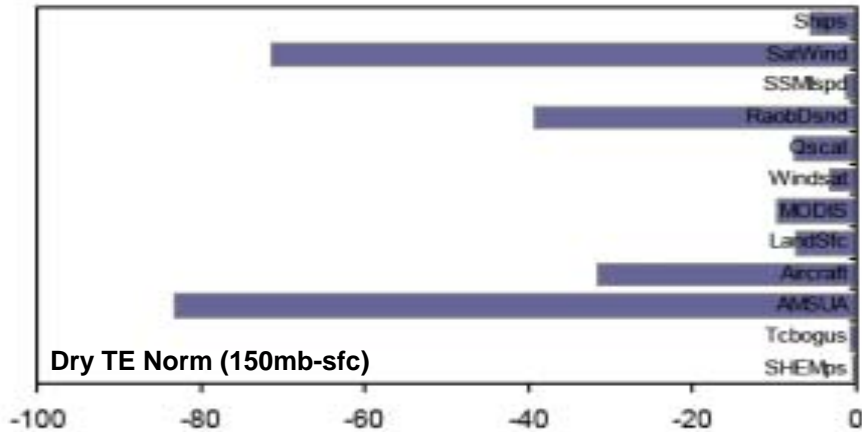


(b) 500hPa WIND SPEED FCST IMPACT [%] 24HR ASCAT 1-31 Aug 2007

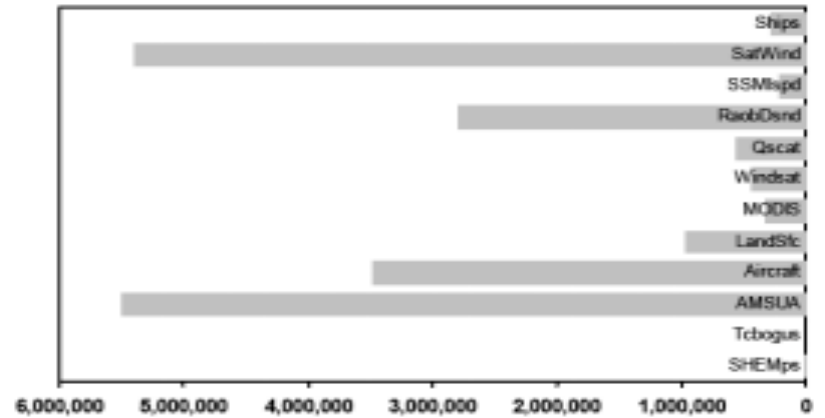


Total impact by instrument type – Jan2007

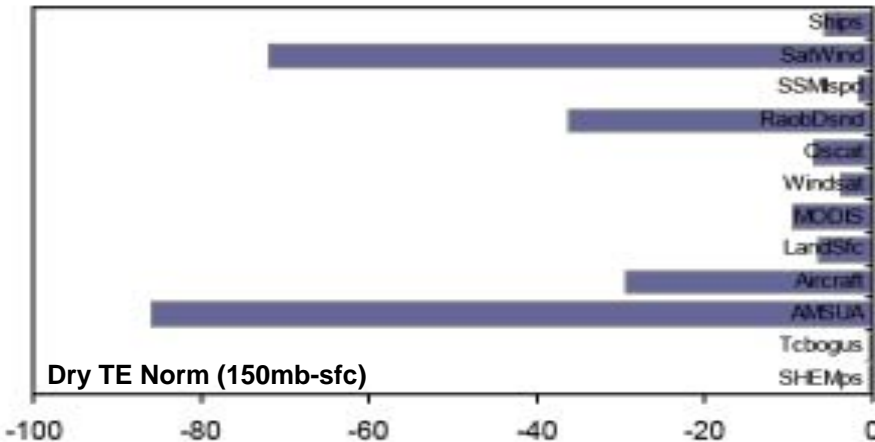
NAVDAS 24h Ob Impact Jan2007 00Z+06Z ($J\ kg^{-1}$)



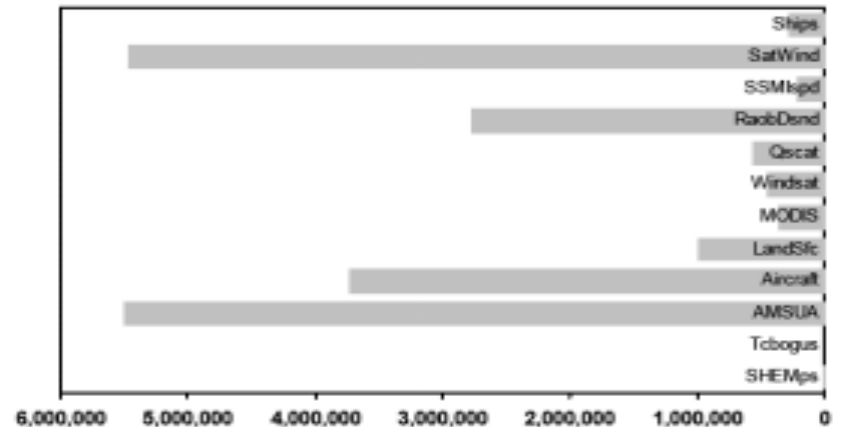
NAVDAS Ob Count Jan2007 00Z+06Z



NAVDAS 24h Ob Impact Jan2007 12Z+18Z ($J\ kg^{-1}$)

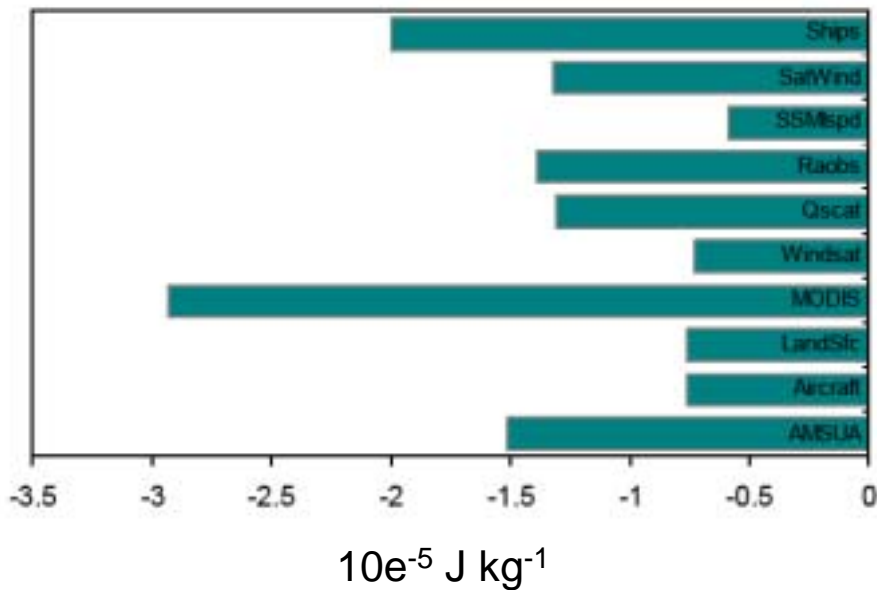


NAVDAS Ob Count Jan2007 12Z+18Z

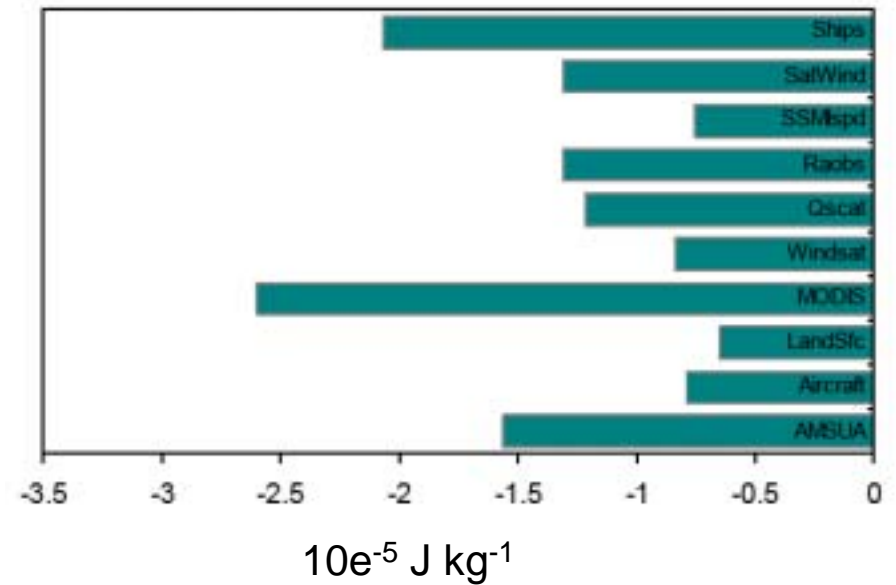


Impacts per-observation by instrument type

NAVDAS 24h Impact_perob Jan2007 00Z+06Z ($10^{-5} \text{ J kg}^{-1}$)



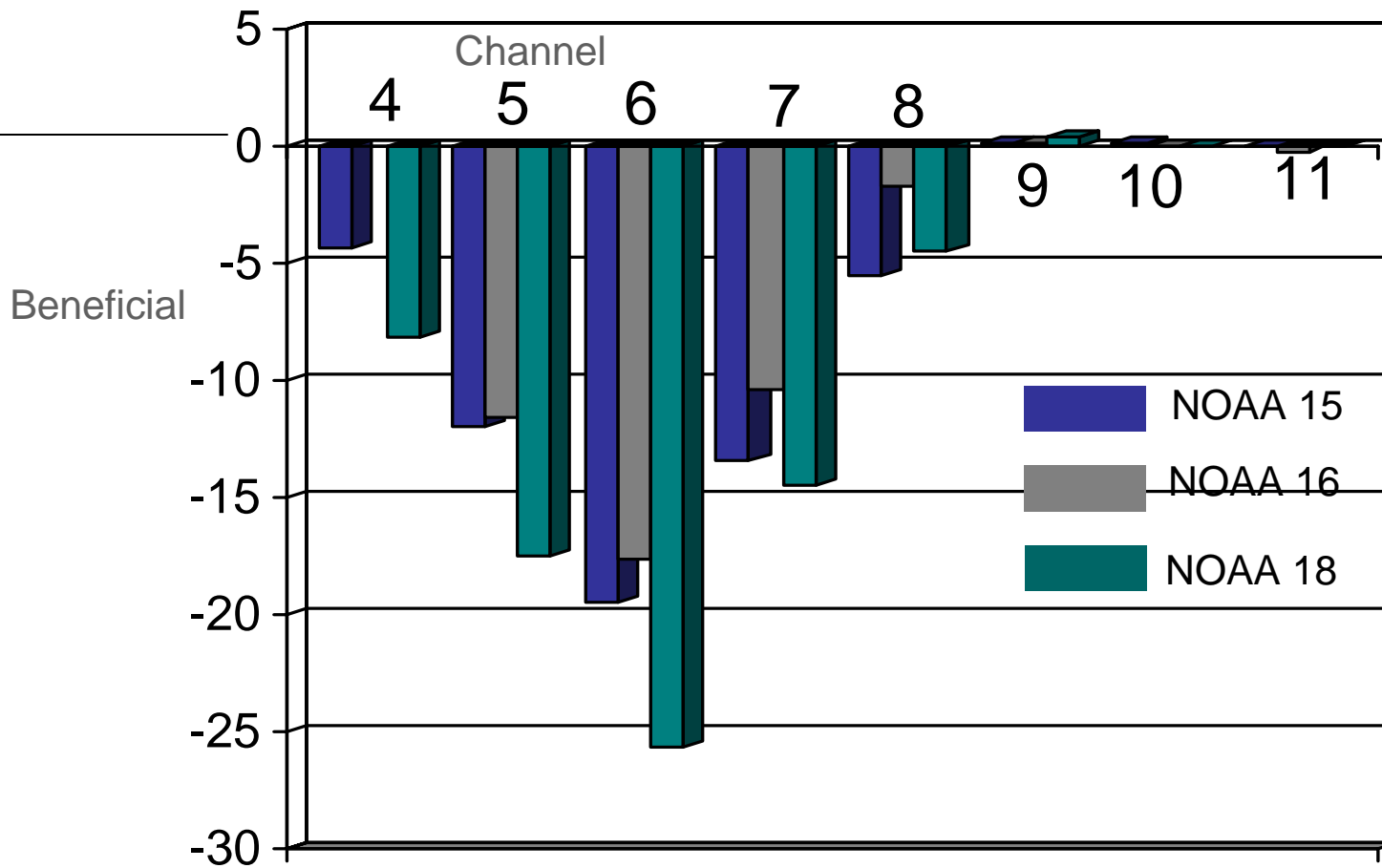
NAVDAS 24h Impact_perob Jan2007 12Z+18Z ($10^{-5} \text{ J kg}^{-1}$)



Impact for AMSU-A channels - NAVDAS-NOGAPS

Units of impact = J kg^{-1}

1 – 31 Jan 2007, 00,06,12,18 UTC



Ch. peak near

11: 20mb

10: 50mb

9: 90mb

8: 150mb

7: 250mb

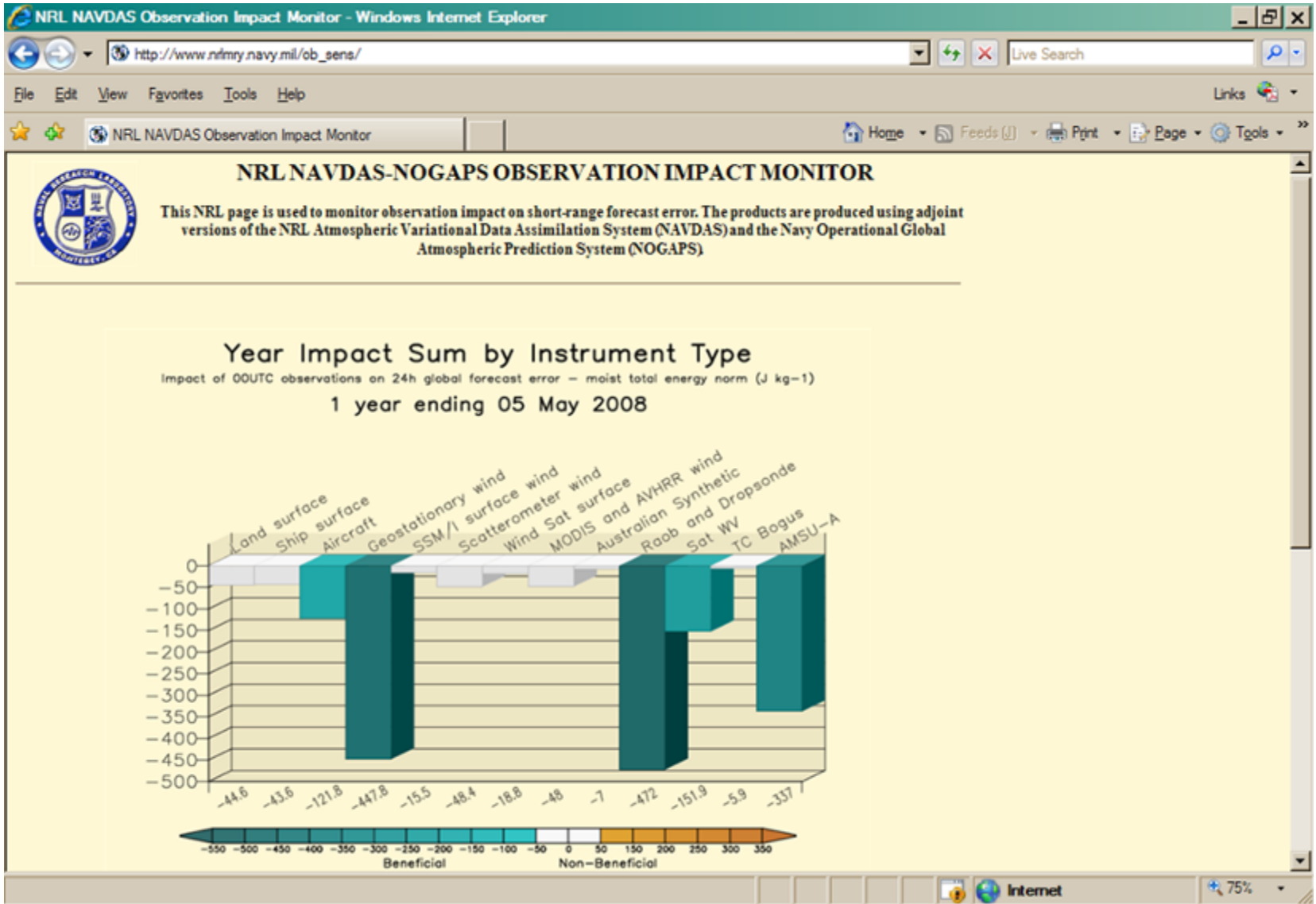
6: 350mb

5: 600mb

4: surface

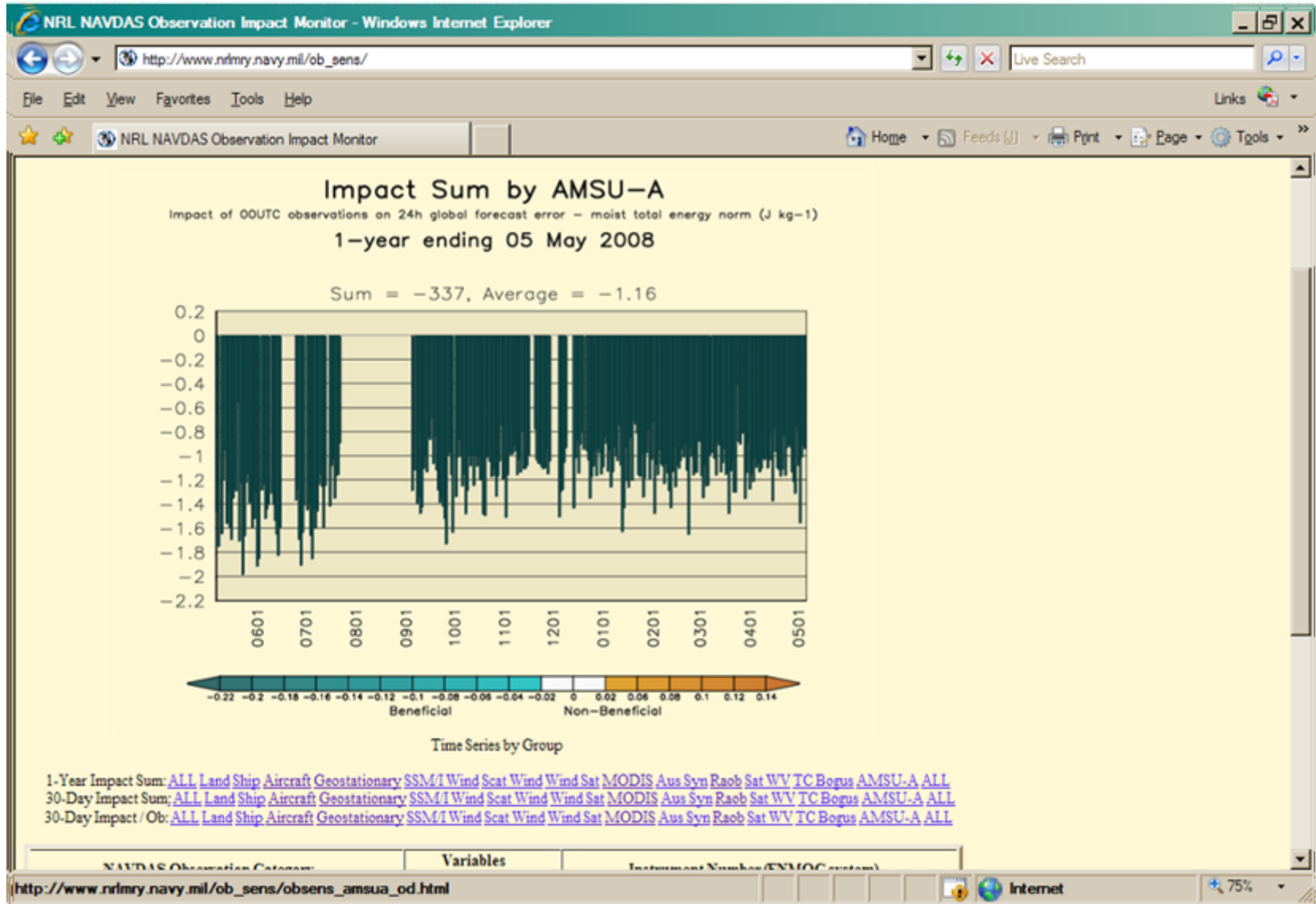
On-line observation Impact monitor

www.nrlmry.navy.mil/ob_sens/



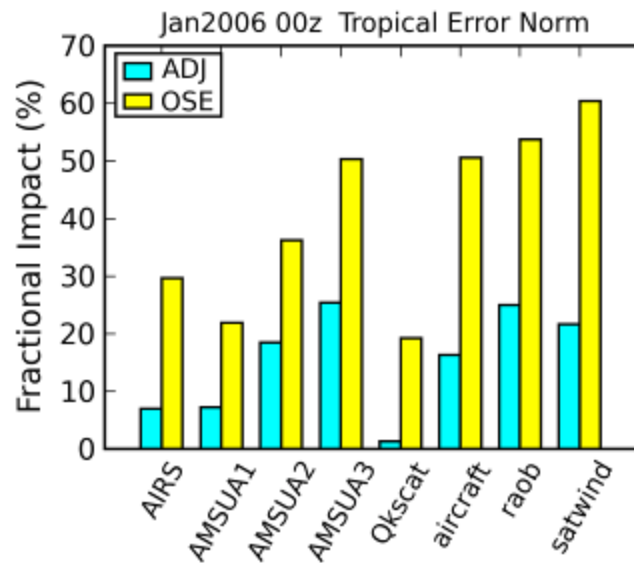
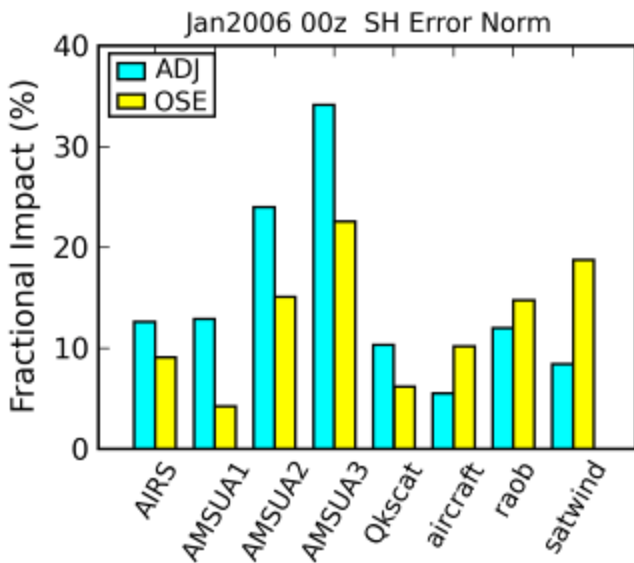
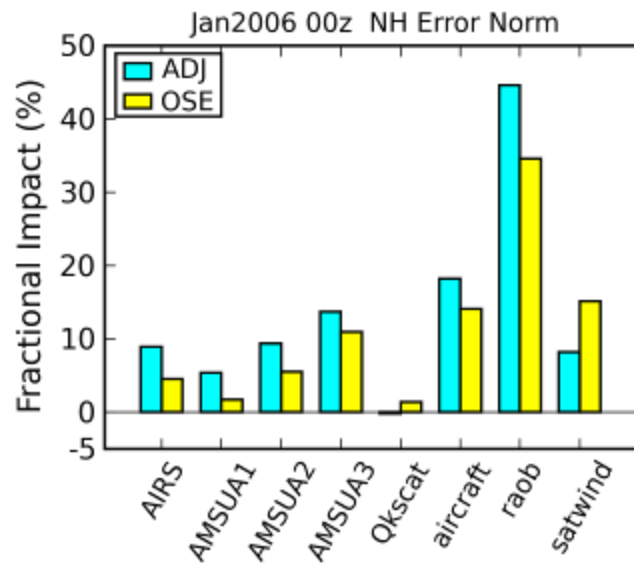
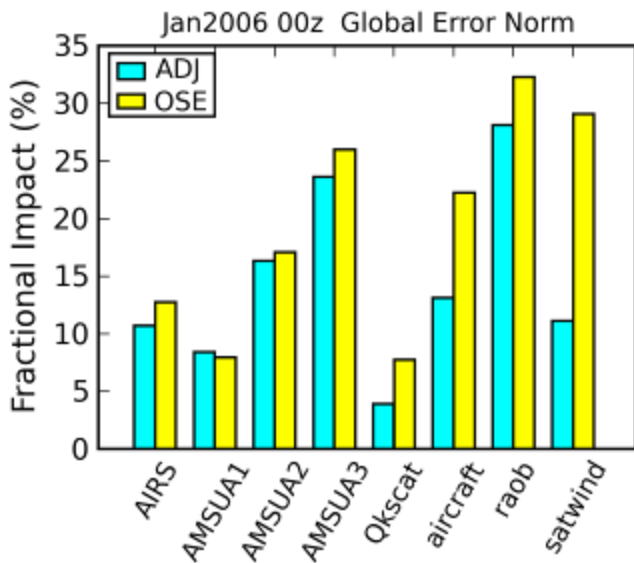
Time-series of observation impact

www.nrlmry.navy.mil/ob_sens/



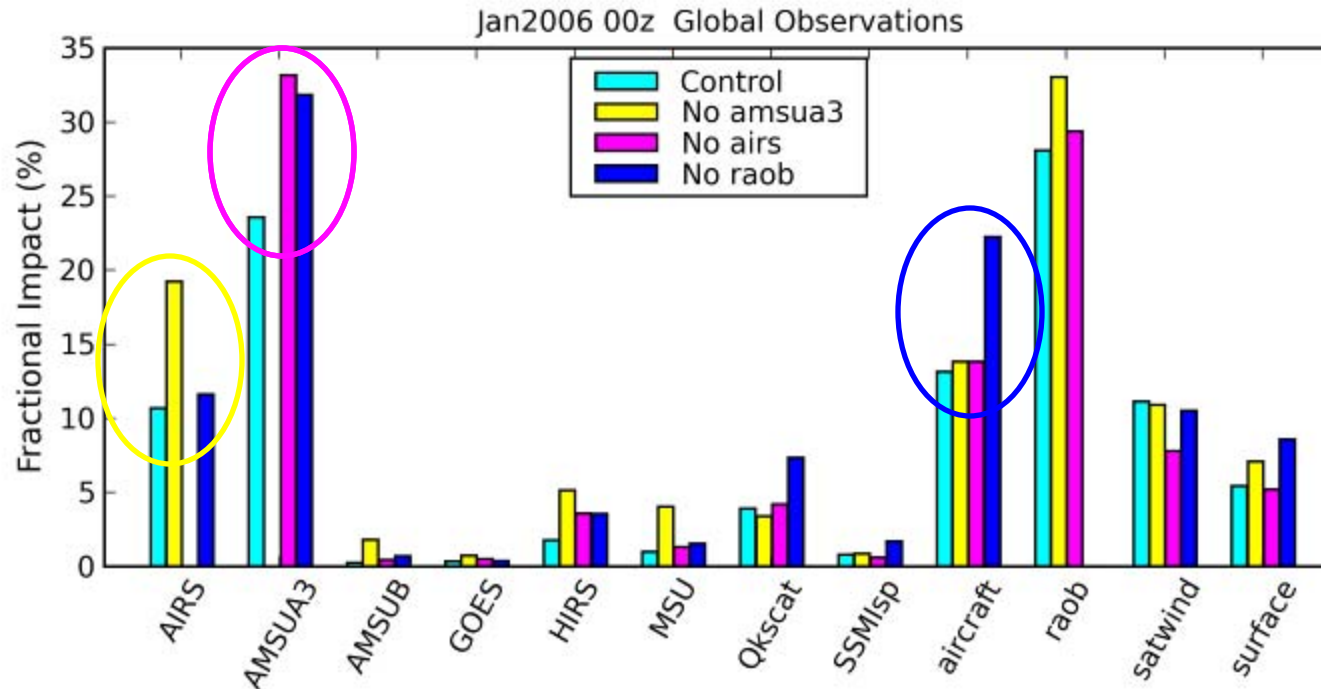
% Contributions to 24hr Forecast Error Reduction

January 2006



Combined Use of ADJ and OSEs

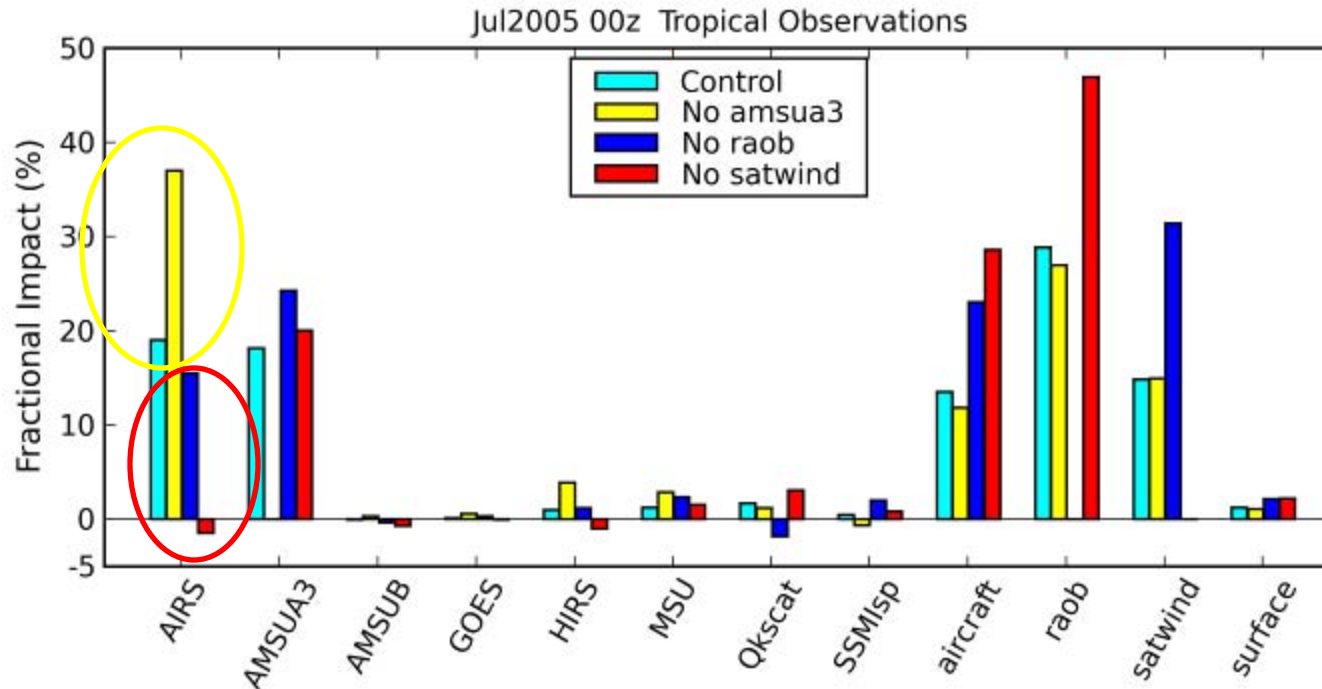
...ADJ applied to *various* OSE members to examine how the mix of observations influences their impacts



- Removal of AMSUA results in large increase in AIRS (and other) impacts
- Removal of AIRS results in significant increase in AMSUA impact
- Removal of raobs results in significant increase in AMSUA, aircraft and other impacts (but not AIRS)

Combined Use of ADJ and OSEs

...ADJ applied to *various* OSE members to examine how the mix of observations influences their impacts



- Removal of AMSUA results in large increase in AIRS impact in tropics
- **Removal of wind observations** results in significant **decrease** in AIRS impact in tropics (in fact, AIRS **degrades** forecast without satwinds!)

New (NWP-related) short-term goal for the Joint Center

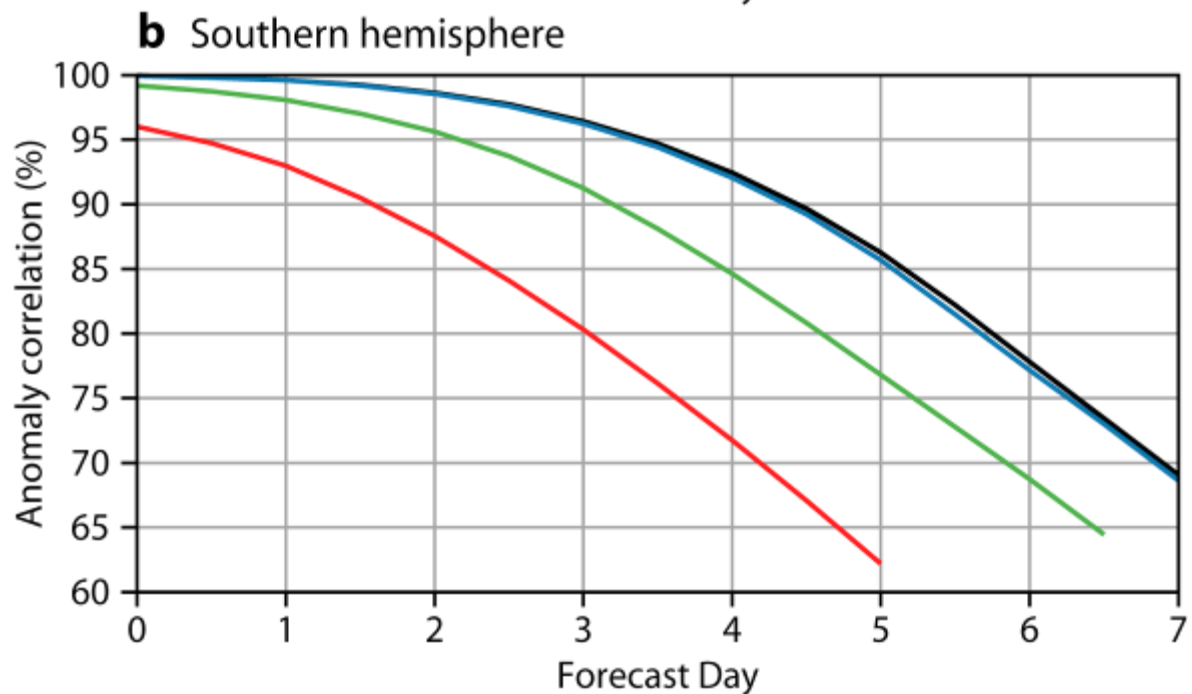
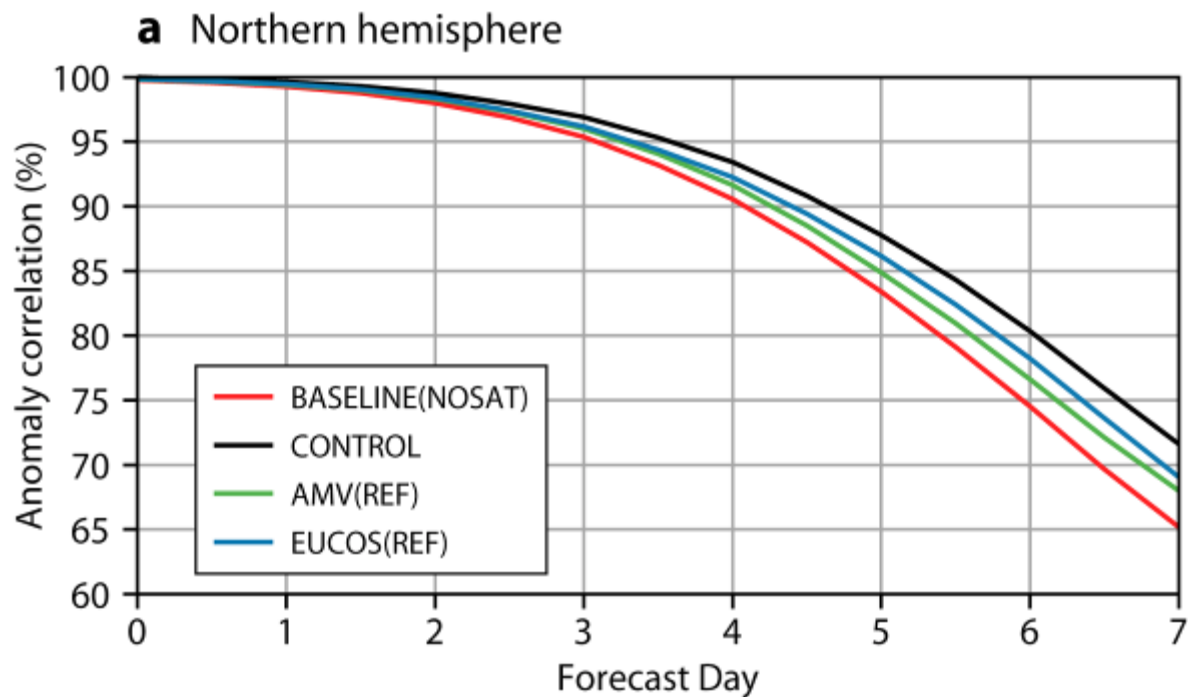
Why renewed NWP focus?

- Economic impact
 - Weather: \$2.5 trillion annual impact on US economy
 - Even modest advances in forecast skill lead to huge economic gains for sectors such as agriculture, aviation, energy
 - Avoidance of danger to life and property (hurricanes, severe weather, etc.)
 - “Total value to US economy of NWP activities ~\$200M per hour of useful forecast range per year”
- Impact on military operations
- US falling behind internationally in terms of NWP skill

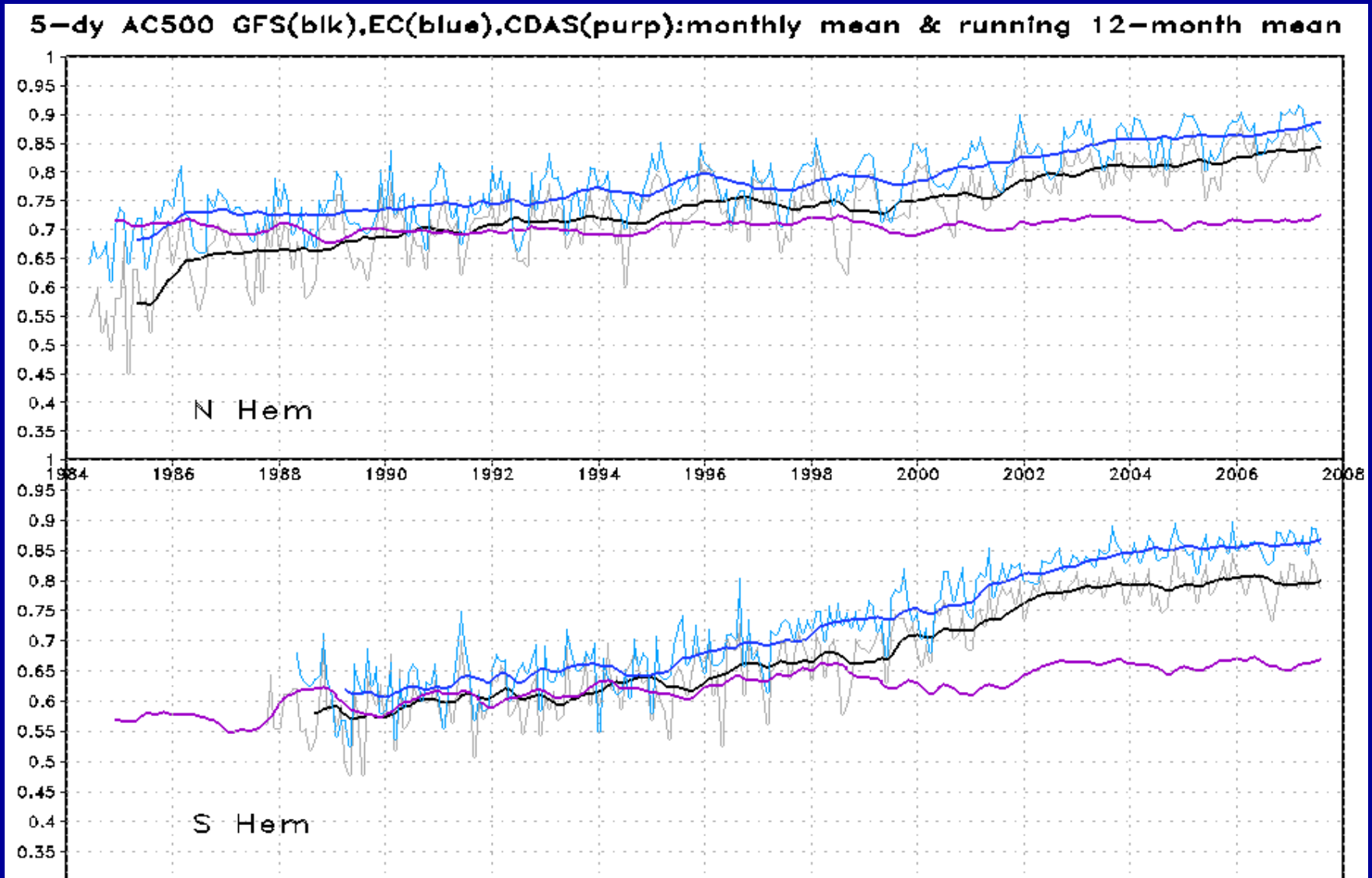
**Comparison of
EUCOS(REF) and
AMV(REF) with
BASELINE (NOSAT)
and *CONTROL***

(a) northern
hemisphere

(b) southern
hemisphere



NOAA/NCEP vs. ECMWF skill over 20+ years



Why is the US falling behind?

- Use of satellite data
 - JCSDA can help, *currently insufficiently resourced*
- Data assimilation system development; no unified US move toward next-generation (4D-VAR) data assimilation capability
 - JCSDA has no direct control over this, but can facilitate and coordinate collaboration on satellite data

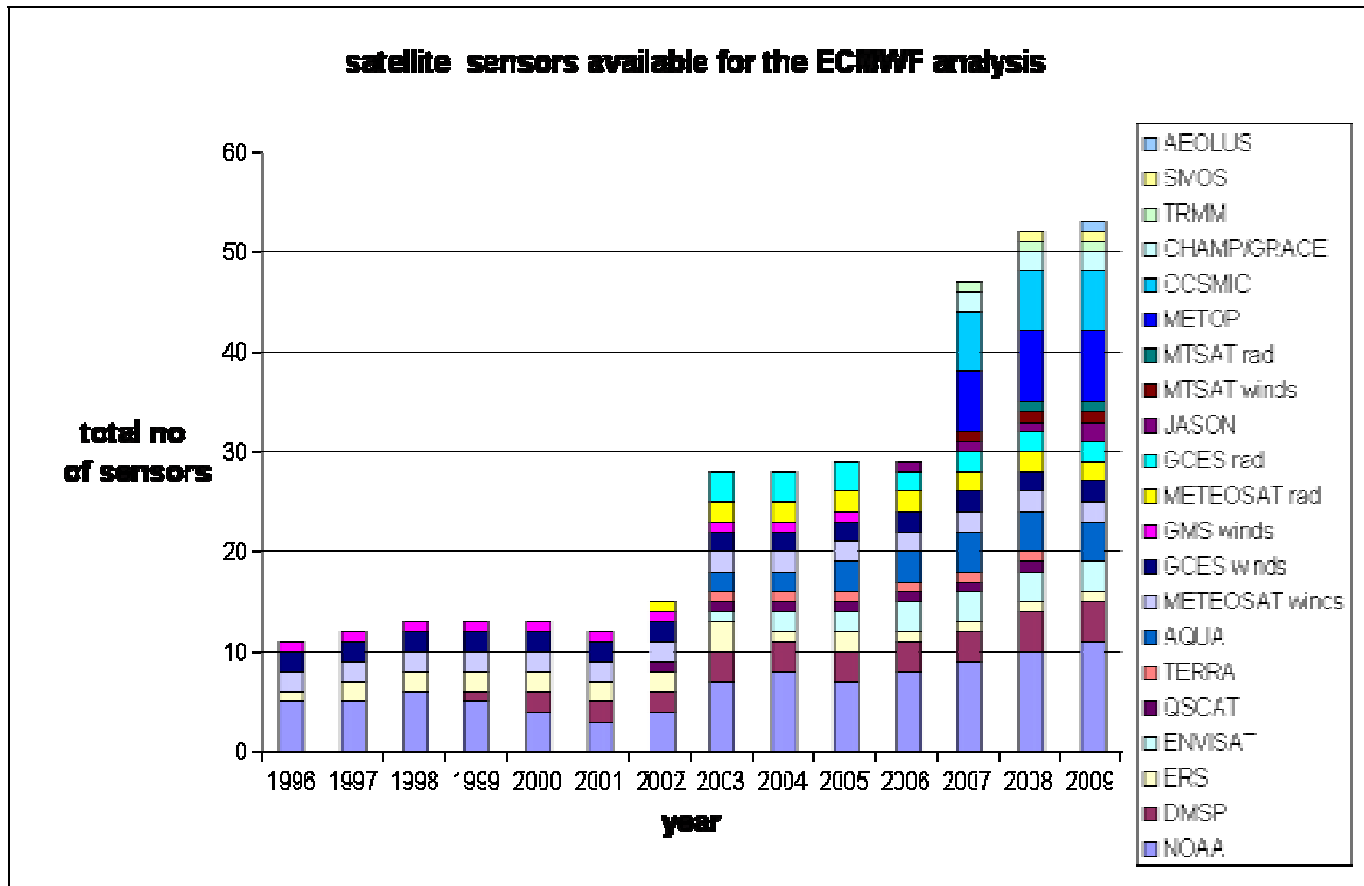


Satellite Data used in NWP

- **HIRS sounder radiances**
- **AMSU-A sounder radiances**
- **AMSU-B sounder radiances**
- **GOES sounder radiances**
- **GOES, Meteosat, GMS winds**
- **GOES precipitation rate**
- **SSM/I precipitation rates**
- **TRMM precipitation rates**
- **SSM/I ocean surface wind speeds**
- **ERS-2 ocean surface wind vectors**
- **Quikscat ocean surface wind vectors**
- **AVHRR SST**
- **AVHRR vegetation fraction**
- **AVHRR surface type**
- **Multi-satellite snow cover**
- **Multi-satellite sea ice**
- **SBUV/2 ozone profile and total ozone**
- **Altimeter sea level observations (ocean data assimilation)**
- **AIRS**
- **MODIS Winds**
- **COSMIC**

~33 instruments

Number of satellite sensors that are or will be soon assimilated in the ECMWF operational data assimilation.



Operational implementation plans (NCEP/EMC):

- Windsat 3rd Q FY08
- IASI 4th Q FY08
- ASCAT “
- COSMIC (bending angle) “
- OMI ozone “
- SSMI/S “
- GRAS (date still TBD)
- Sat winds EE screening “
- GOME-2 “

Meanwhile ...

- IASI, ASCAT operational at ECMWF on 06/12/2007
- IASI, ASCAT operational at the Met Office 11/28/2007
- JCSDA lagging by one to two years; inadequate planning and resource allocation
- JCSDA will have to invest heavily in NPP and ADM now in order to prevent this from happening again

New JCSDA short-term goal:

- *“Contribute to making the forecast skill of the operational NWP systems of the JCSDA partners internationally competitive by assimilating the largest possible number of satellite observations in the most effective way”*

JCSDA NWP metrics

- Two metrics will be tracked
 - One related to numbers of sensors and numbers of observations
 - One related to performance
- Goal is to have JCSDA overall metrics confirmed by next MOB meeting, (tentatively 08/2008)
- Details to be discussed during upcoming Executive Retreat (06/13)

JCSDA Activities in support of NWP goal

- Data impact assessment
- Radiative Transfer Modeling
- Monitoring and improvement of use of current data
- Preparation for new sensors

JCSDA Mode of operation

- Directed research
 - Carried out by the partners
 - Mixture of new and leveraged funding
 - JCSDA plays coordinating role
- External research
 - NOAA-administered FFO
 - Financial contributions from NESDIS, NPOESS IPO, NASA
 - ~\$1.4 M/year available => revolving portfolio of ~15 three-year projects
 - Open to the broader research community, which remains an essential resource for JCSDA

Federal Funding Opportunity (II)

- NASA contribution reduced by \$240K for FY 2008
 - The Joint Center can meet its commitment to projects started in FY 2006 and 2007
 - Funds for new starts in FY 2008 extremely limited; one new project (GPRAO) selected for partial funding during FY 2008 FFO
- FY 2009 FFO is in the pipeline
 - Text is realigned with new JCSDA short-term goal
- Future plans for FFO to be discussed with funding managers, by the SSC, and during subsequent JCSDA Executive Retreat

Summary

- JCSDA has recently adopted short-term forecast improvement goal
 - This will drive all JCSDA activities, both internal and external
- Contributions from outside research community remain important
 - Close links between external investigators and operational entities are critical
- Original six science focus areas remain unchanged strategic priorities
 - Expected to grow as resources become available