NESDIS/STAR Outlook

Al Powell
Ingrid Guch

STAR/CREST Technical Meeting

December 7-8, 2009

Welcome

- This is the first NESDIS/CREST Technical Meeting held in Silver Spring since 2001
  - What have we done since then?
  - What can we do in the future?
- The next slides show overall priorities for STAR in terms of science, strategies and missions
  - CREST will also present overall priorities
  - Comments and suggestions welcome, particularly related to potential synergies with CREST and/or other parts of NOAA
  - Specific Science Theme areas will be later in the agenda

STAR Priorities

- New satellite products / algorithms and transition to operations
  - Mission support: prototype data, Algorithm development and testing,
  - New / improved capabilities: nowcasting / nearcasting, data assimilation

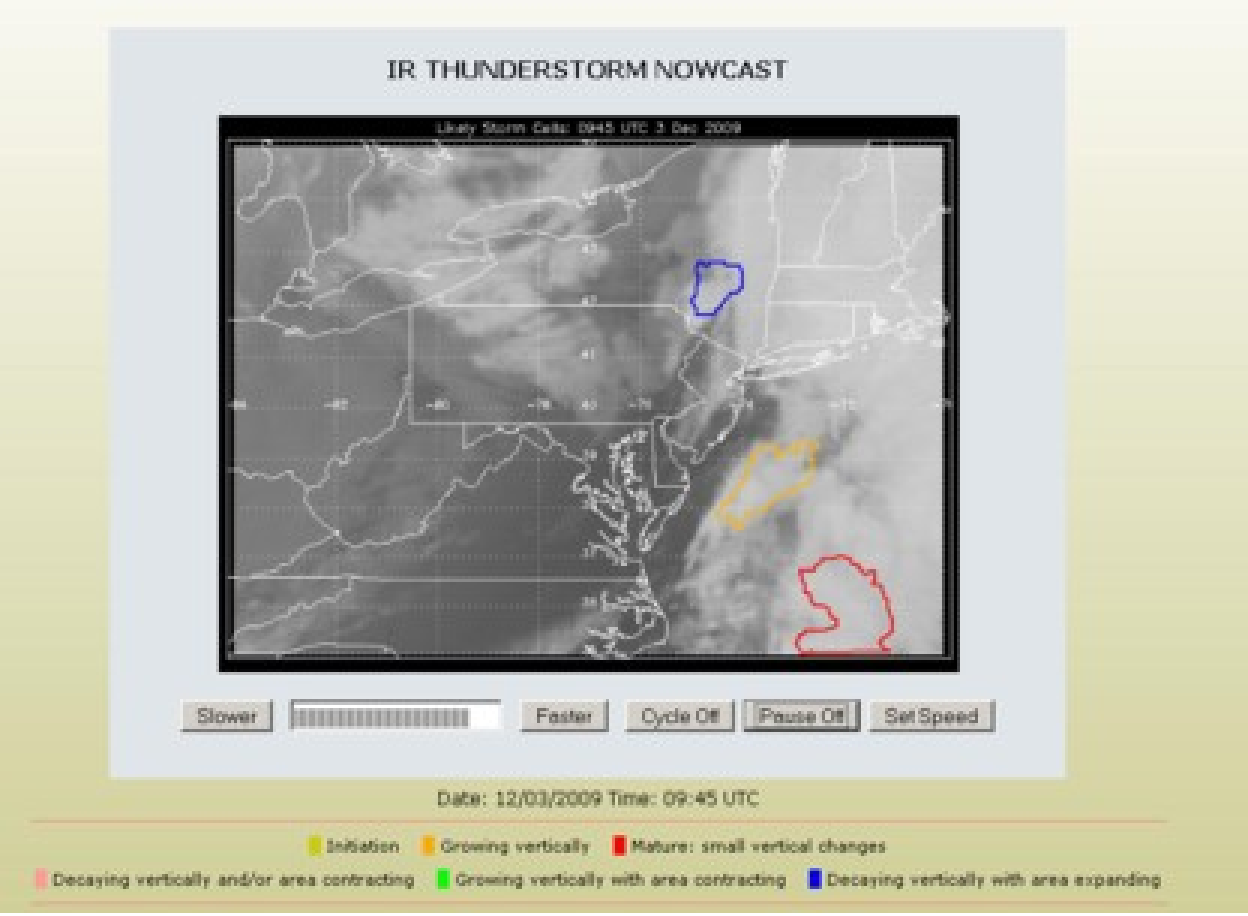


Figure: Snapshot from CREST Real-time NOWCASTING system website

STAR Priorities

- Instrument design and characterization
  - New instruments: hyperspectral sounder for GOES-R, geostationary microwave (long-term)
  - Characterization: calibration validation, performance analysis, National Calibration Center

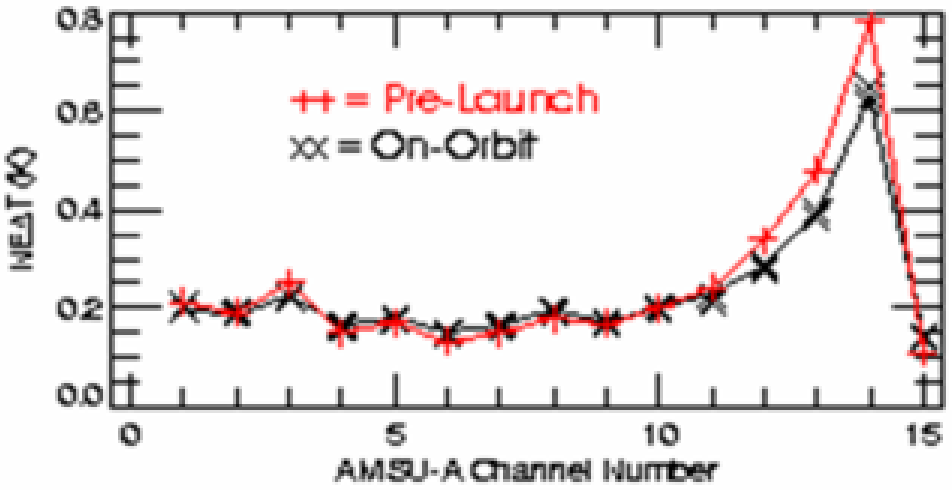


Figure: NESDIS/STAR website showing noise characterization for AMSU-A on NOAA-18

STAR Priorities

- Climate data and services
  - Calibration: re-calibration, stable sites
  - Climate analysis: Trends and their causes
  - Climate services: coordination with National Climate Service planning

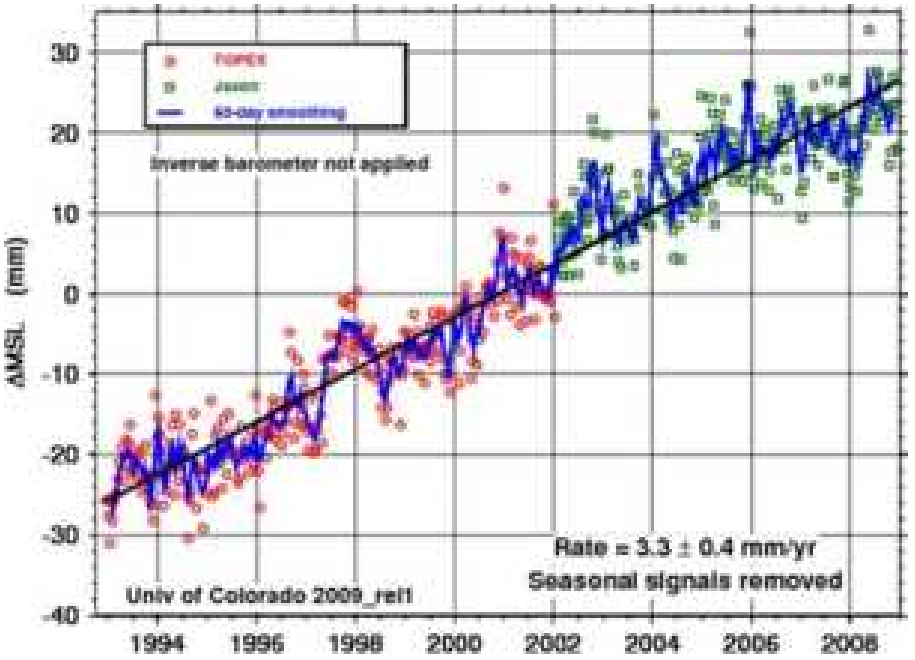


Figure: Sea Level Rise from Space-based altimeters. The signal of sea level rise is very small (3.3 mm per year) and requires extremely well calibrated microwave radiometer for water vapor correction in the path delay of the altimeter signal, which contributes to one of the largest uncertainties. After L. Miller and S. Wilson.

STAR Priorities

- Education, training, and partnerships (international, academic and industrial) to
  - Coordinate overall Earth observation
    - Analyze data for consistency
    - Blend products from numerous satellite and non-satellite sources
    - Validate satellite products

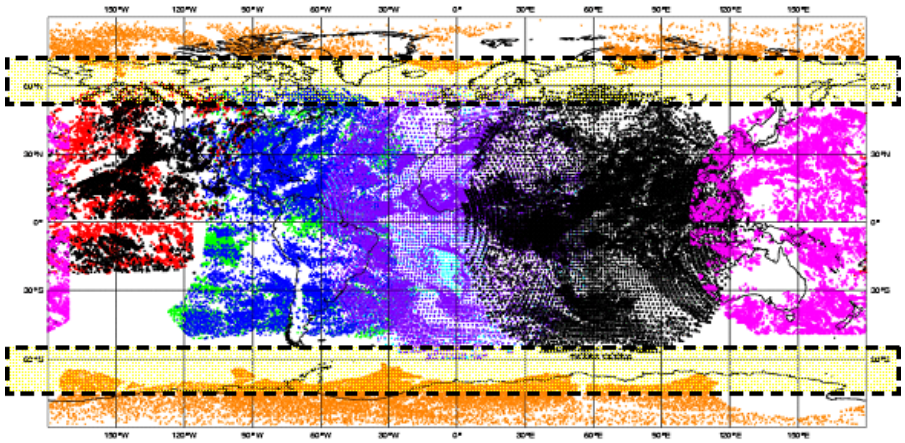


Figure: POES (orange) and GOES based wind vectors blended. The gap between in the mid-latitudes is shown in yellow. CIMSS and STAR personnel are currently working to fill it in with various techniques. This deficiency has been noted as a problem by NWP centers in that the dynamically active polar jet stream can be located in this latitudinal zone, and improper model initialization can lead to rapidly growing errors in the forecasts.

Satellites on the Horizon

- Upcoming missions of high interest (from STAR Strategic Plan)
  - All missions shown in following slides except current GOES/DMSP/Jason follow-ons and decadal missions with launch dates projected after 2014.

NPP
NPOESS C-1

- What?
  - Improve predictability of the onset, duration, and impact of hazardous and severe weather/water events
  - Accurate observations of the Earth's radiation

- How?
  - Makes available essential climate variables, extending climate data records
  - Provides for product continuity for MIRS, risk reduction; contributes to GPM Constellation
  - Provides for polar winds (VIIRS), global cloud properties (VIIRS), snow and ice (microwave), temperature and moisture profiles
  - Monitors ozone layer and interaction between the ozone layer and climate change (OMPS)
  - Provides for improved forecasts of diurnal atmospheric temperature and hydrological cycles uncertain, validation of some climate change hypotheses (CrIS/ATMS)
  - Provides for high resolution vertical profiles of atmospheric temperature and moisture (CrIS)

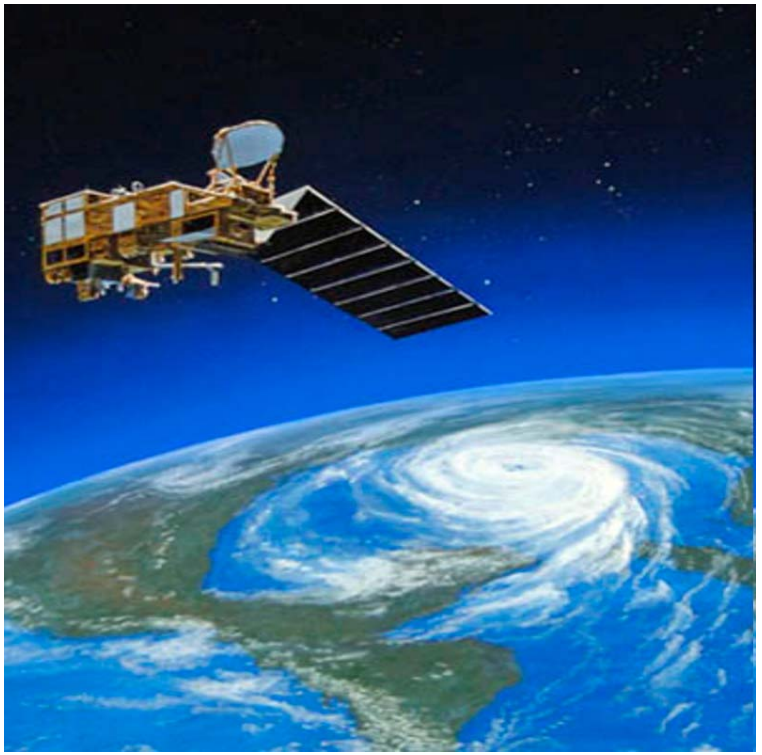


Figure: NPOESS Illustration, 2006.

Source: http://www.wired.com/images_blogs/photos/uncategorized/2008/05/05/npoess_illustration_2006.jpg

GOES-R

- What?
  - Increase lead time and accuracy for weather and water warnings and forecasts.
  - Improve predictability of the onset, duration, and impact of hazardous and severe weather/water events
- How?
  - Provides, via ABI, 3x temporal, 4x spatial, and 5x spectral performance improvements to produce more timely, accurate, new, and enhanced suite of products
  - GLM detects all lightning (in-cloud, cloud-to-round) and provides information to increase severe storm warning lead time and accuracy
  - Improved accuracy of tropical cyclone formation and intensity

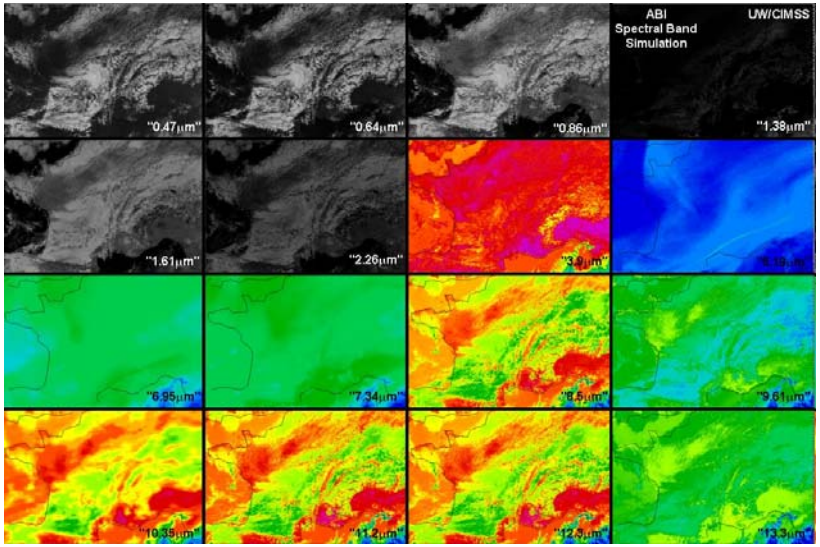


Figure: Simulated cloud features for GOES-R ABI spectral bands

GPM

- What?
  - Improve quantitative precipitation estimation
  - Improve flash flood lead time
- How?
  - Provides precipitation type and phase, 3-D assimilation of precipitation (DPR)
  - Identifies cold season precipitation; precipitation CDRs
  - Assists with calibration for GOES-R/ABI retrievals
  - Provides global, 3-hourly precipitation rates (GMI)

Oceansat-2

- What? (launched Sept 2009)
  - Improves marine weather forecasting and warning
  - Improves the marine transportation system, recreational boating and fishing activities

- How?
  - Mitigates impact of data flow reductions, through availability of alternative sources, from US sources on operational and research users of ocean color data and products
  - Improves our knowledge of how the ocean and atmosphere interact which is important for understanding the longer-term (climate) and shorter-term (weather) changes of the global ecosystem

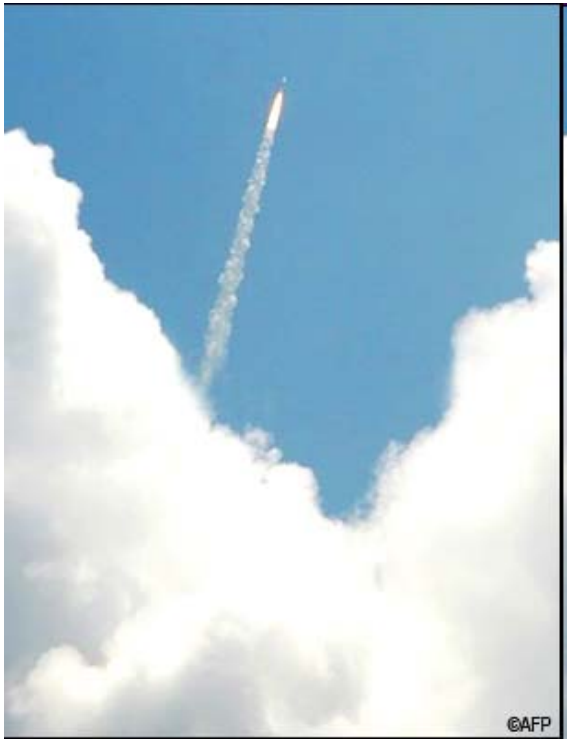


Figure: *The Ocean Monitoring Satellite Oceansat-2 is seen 18 minutes after blast off in Chennai on September 23, 2009.*

Source: *http://stbjp.msn.com/i/C6/FB236A3BF78725217F019E4D7E810.jpg*

GCOM C and GCOM W

- What?
  - Improve the accuracy of climate change predictions
  - Increase lead time and accuracy for weather and water warnings/forecasts

- How?
  - Provides soil moisture products and applications
  - Makes available merged SST products; CDRs for all variables
  - Allows for assimilation in cloudy atmospheres
  - Contributes to GPM Constellation

Aquarius

- What?
  - Improves marine weather forecasting and warning
  - Reduce uncertainty in climate projections through timely information on the forcing and feedbacks contributing to changes in the Earth's climate

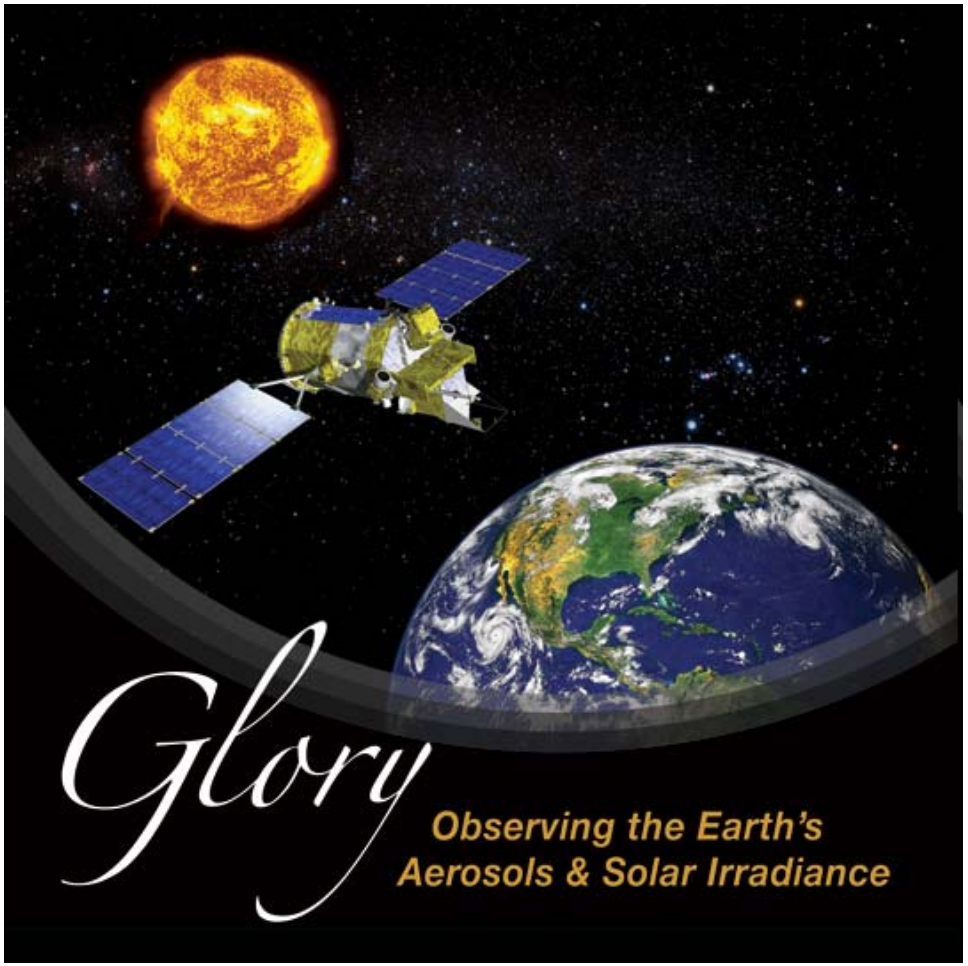
- How?
  - Provides global assessment of the horizontal sea-surface salinity distribution, a crucial parameter for assessing and modeling the ocean-atmosphere moisture fluxes critical for weather and climate prediction and the density fluxes for ocean circulation
  - Provides a significant component for assessing marine ecosystems and the evolution of habitats

Figure: Illustration of Aquarious/SAC-D above earth

Source: http://aquarius.nasa.gov/gallery-spacecraft.html

Glory

- What?
  - Reduce uncertainty in climate projections through timely information on the forcing and feedbacks contributing to changes in the Earth's climate
  - Understand and predict the consequences of climate variability and change on marine ecosystems
- How?
  - Provides a global distribution of natural and anthropogenic aerosols (black carbons, sulfates, etc.) with accuracy and coverage sufficient for reliable quantification of the aerosol effect on climate, the anthropogenic component of the aerosol effect, and the potential secular trends in the aerosol effect caused by natural and anthropogenic factors
  - Provides an assessment of the direct impact of aerosols on the radiation budget and its natural and anthropogenic components, and the effect of aerosols on clouds (lifetime, microphysics, and precipitation) and its natural and anthropogenic components;
  - Allows for an investigation into the feasibility of improved techniques for the measurement of black carbon and dust absorption to provide more accurate estimates of their contribution to the climate forcing function



Decadal Survey Missions

- SMAP
  - Improves knowledge of soil moisture which controls the water, energy and carbon exchanges between land surface and the atmosphere
  - Provides more accurate soil moisture initialization and data assimilation for numerical weather, seasonal climate and hydrological prediction models will improve their forecast skills

- GPS/RO
  - Significantly improves vertical, horizontal resolution in lower troposphere and stratosphere
  - Provides improved vertical profiles of ionospheric electron densities
  - Alerts customers of degradation of activities , such as loss of GPS, HF and VHF radio communication, false targets in radar observations, and communications with satellites; detailed information of these observations allows respond, work around to find alternatives

- XOVWM
  - Makes available OSVW data much closer to the coast (1.5–3 miles) than is currently available (12–18miles); important for meteorological and oceanographic applications for numerous reasons: nearly 50% of the U.S. population lives within 50 miles of the coast; coastal fisheries depend on wind-driven nutrient upwelling; shipping and fishing industries need to know wind conditions near the coast
  - Provides for more reliable estimates of tropical and extratropical cyclones' intensity through all stages of development (currently capped at Category 1 out of 5).
  - Allows more accurate tracking of tropical cyclone (TC) centers and earlier identification of developing systems, ensuring more accurate initial motion estimates as input into numerical weather prediction model for identification of global trends in extreme wind events
  - Improves analysis of the TC wind field structure (34, 50, and 64 kt wind radii) which will yield more refined watch/warning areas for the coast and marine areas

Final Notes

- CREST has been involved in most if not all of STAR's high-priority activities
- Significant opportunities are coming up with new satellites, the next 10 years should be at least as exciting as the last 10 years
- New and strengthened partnerships will be needed for success

think **Big**