

A Reanalysis Synthesis of EOS Observations at Regional Scales to support the National Climate Assessment

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- Assimilated data sets that synthesize and integrate the existing satellite (and conventional) data streams for the EOS/Aura period – an enabling tool
- Specialized products to support the NCA
- Builds upon the ~50 km reanalysis for the satellite era generated as the Modern-Era Retrospective analysis for Research and Applications (MERRA).

➤ Use of MERRA for NCA applications:

- Extract regional and sector-specific products for use in the NCA
- Use MERRA with the ERA-Interim Reanalysis from ECMWF and NOAA's CFSR, where appropriate, to estimate uncertainties in derived products

➤ Perform a new GEOS-5 analysis that improves upon MERRA for NCA applications:

- Include new data streams (MLS, OMI, IASI, GPSRO) for the atmosphere
- Include aerosol and land-surface analyses, to enhance the value of the product for radiation budget studies
- Increase resolution to ~25km, to improve the regional utility of the products
- Provide the period 2005-2009 to the climate analysis community by Dec. 31, 2012
- Continue beyond 2009 during CY2013

NCA-specific derived products from MERRA: can support the needs of both sector and regional assessments and of climate model evaluations. MERRA includes complete coverage of regions where station observations are quite sparse (e.g., Great Plains and western states). Many of the product collections have hourly temporal resolution - essential for many climate statistics.

Expression of Interest submitted to NCA:

- Statistical analysis of temperature and precipitation anomalies for all of the NCA regions
 - Long term monthly time series
 - Variations including extreme event analysis
- Metrics or diagnostics identified by sector representatives - water resources, agriculture, human health, energy supply, and possibly ecosystems and society
- WWW interface into results of extreme analysis for each NCA region
- Subset data, as a capacity for other efforts
- Technical report; NCA workshops,.....

MERRA-Land Reanalysis: a supplemental and improved set of land-surface hydrological fields, including soil moisture, snow, and run off - corrects some limitations of MERRA in a land-only post-processing system.

A 25-km EOS synthesis as an Integrated Earth System Analysis update to MERRA

Meteorology

- Correct some deficiencies in MERRA – remove surface-peaking channels
- Assimilate MLS temperature retrievals, IASI, GPSRO

Ozone

- Assimilate MLS and OMI ozone retrievals

Stratospheric Water Vapor

- Assimilate middle atmospheric moisture from MLS

Aerosols

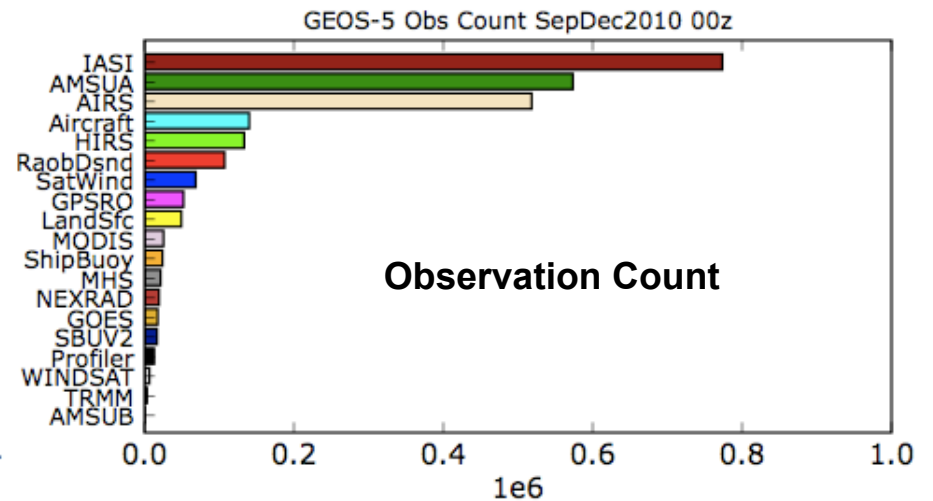
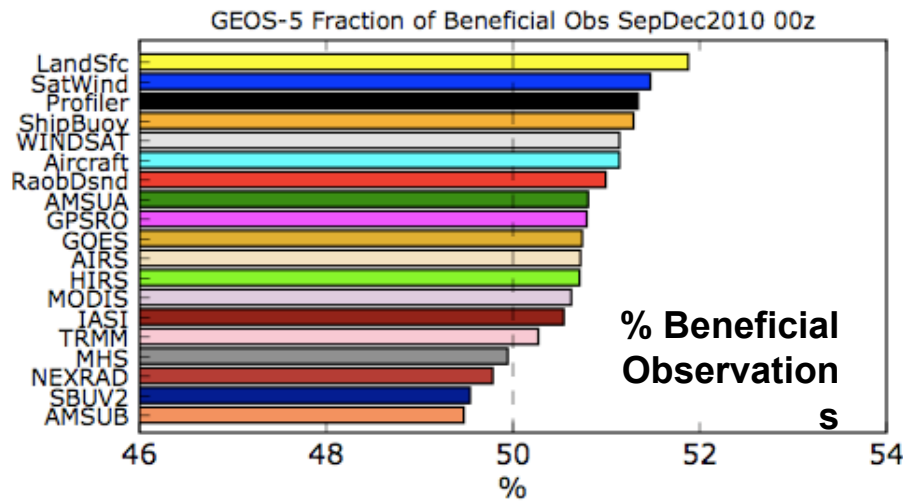
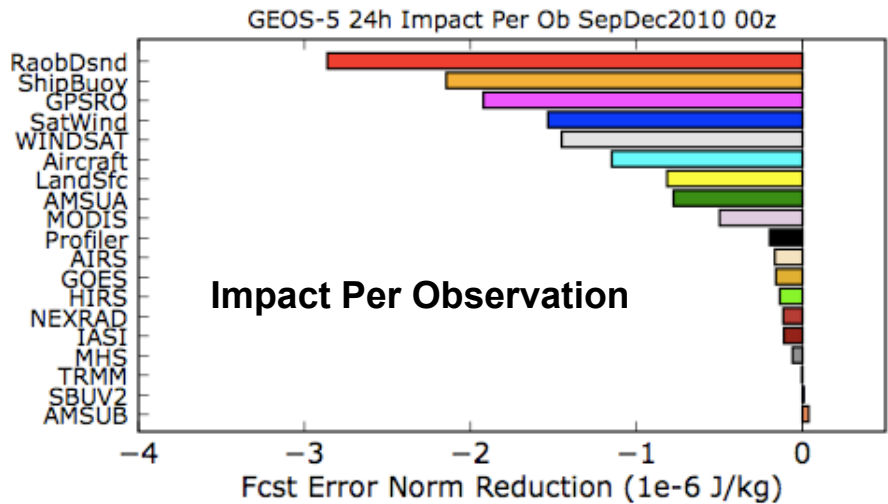
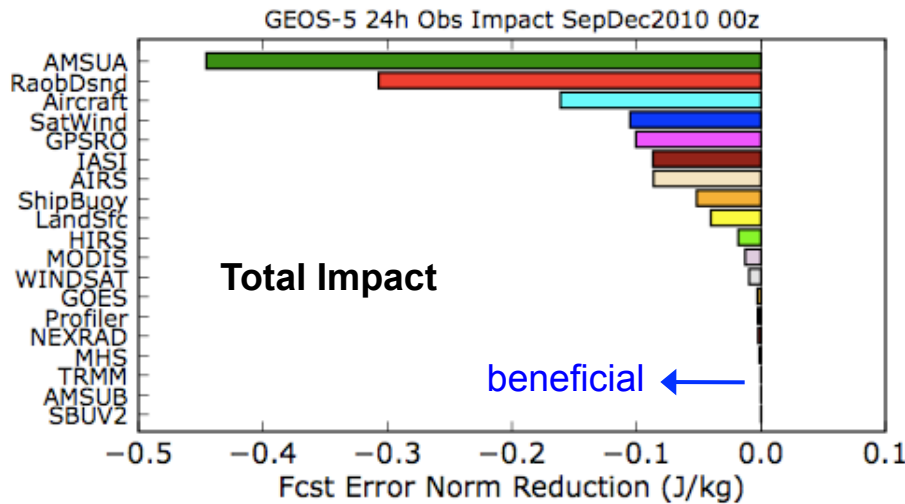
- Assimilate AOD from MODIS (land, ocean, deep blue) and MISR
- Assimilate absorption AOD from OMI (if beneficial)

Land Surface

- Assimilate T_{skin} from geostationary satellites (LaRC product)
- Assimilate surface soil moisture from AMSR-E

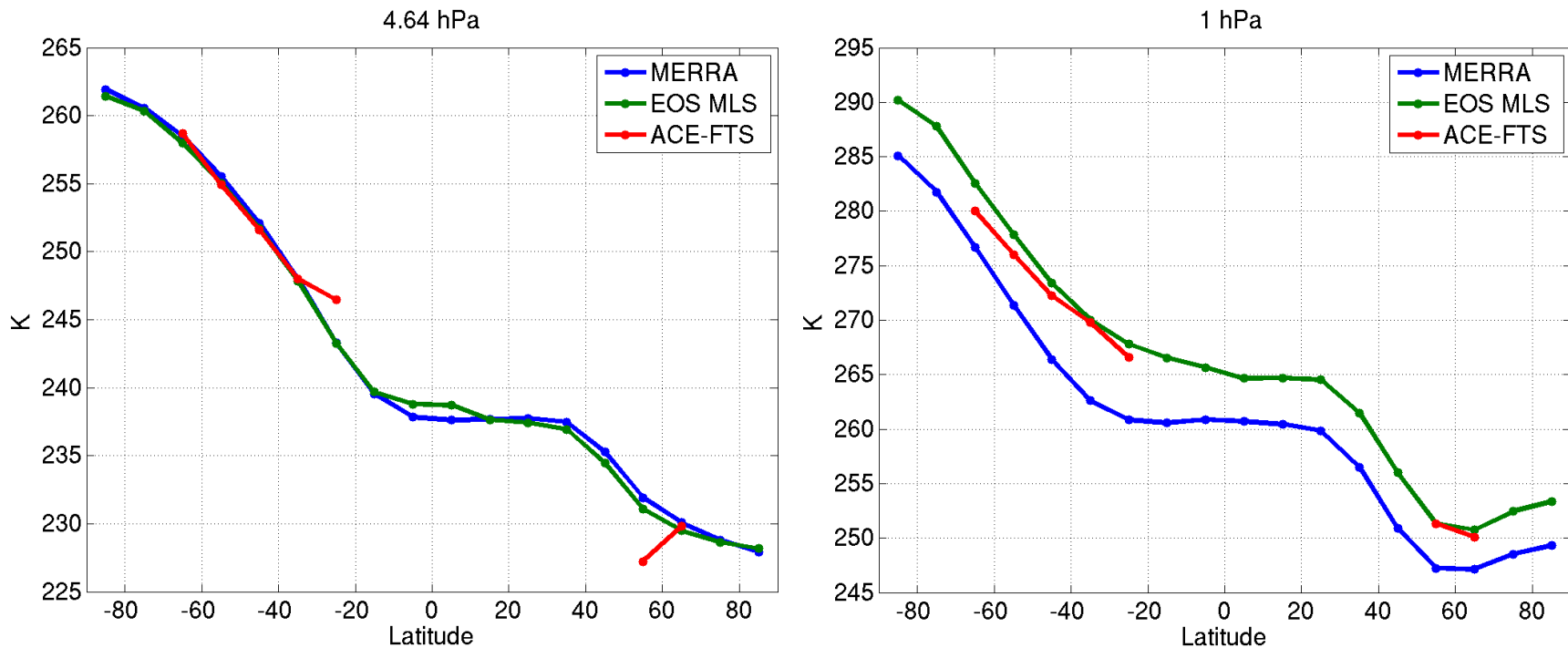


Daily Average Impacts of Various Observing Systems in GEOS-5 01 Sep – 31 Dec 2010 00z



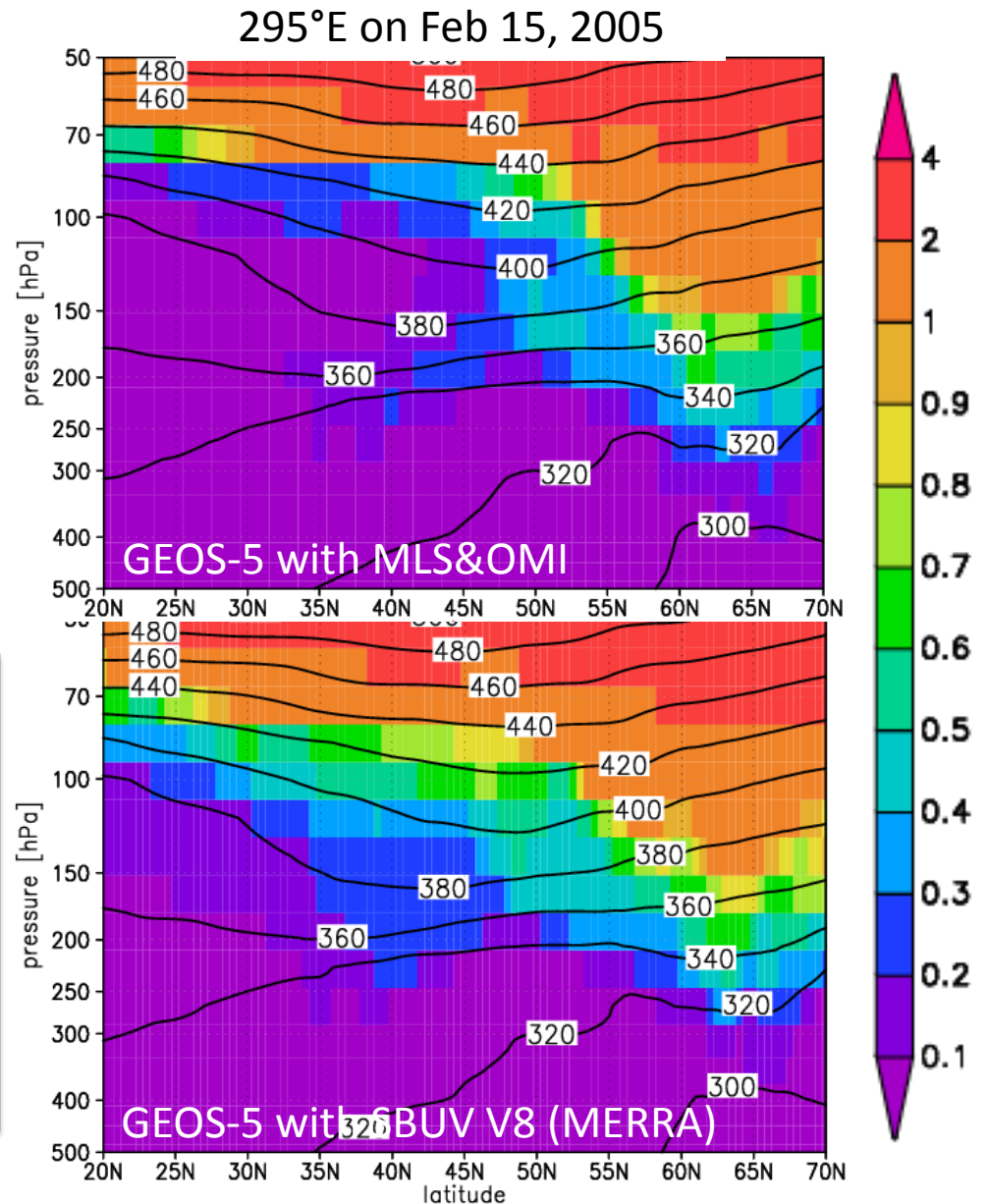
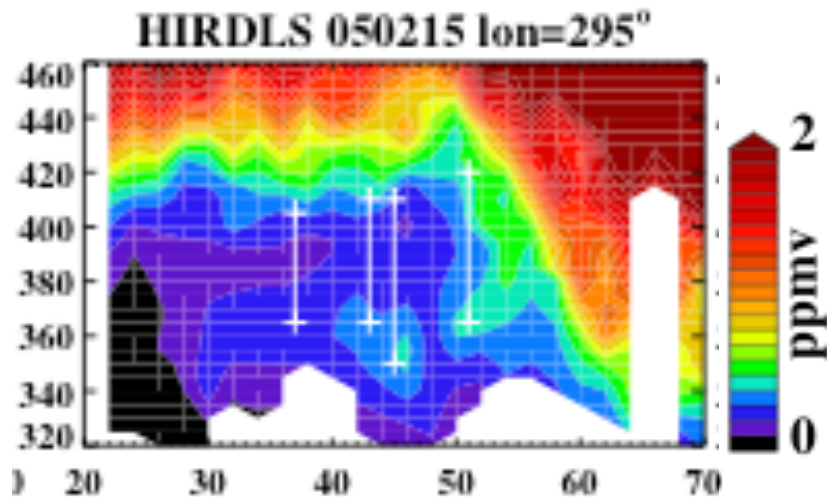
Assimilating MLS Temperature will improve upper atmosphere temperatures

MERRA Temperature (2005-2009) with independent data
5 hPa and 1 hPa



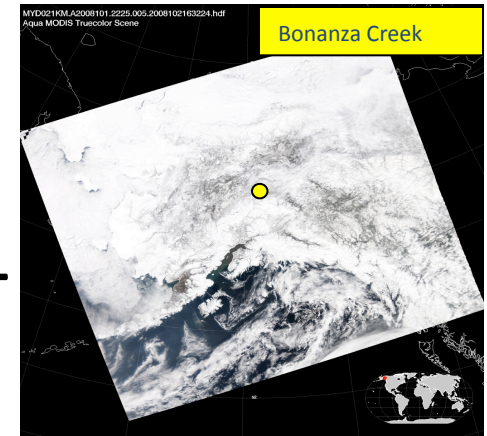
MLS provides detailed temperature information from ~316 hPa to ~0.001 hPa, with 3-14 km vertical resolution, substantially improves the analyses in the upper atmosphere, where other observations have little information on vertical structure.

GEOS-5 ozone in the upper troposphere/lower stratosphere, where ozone is important for the radiation balance



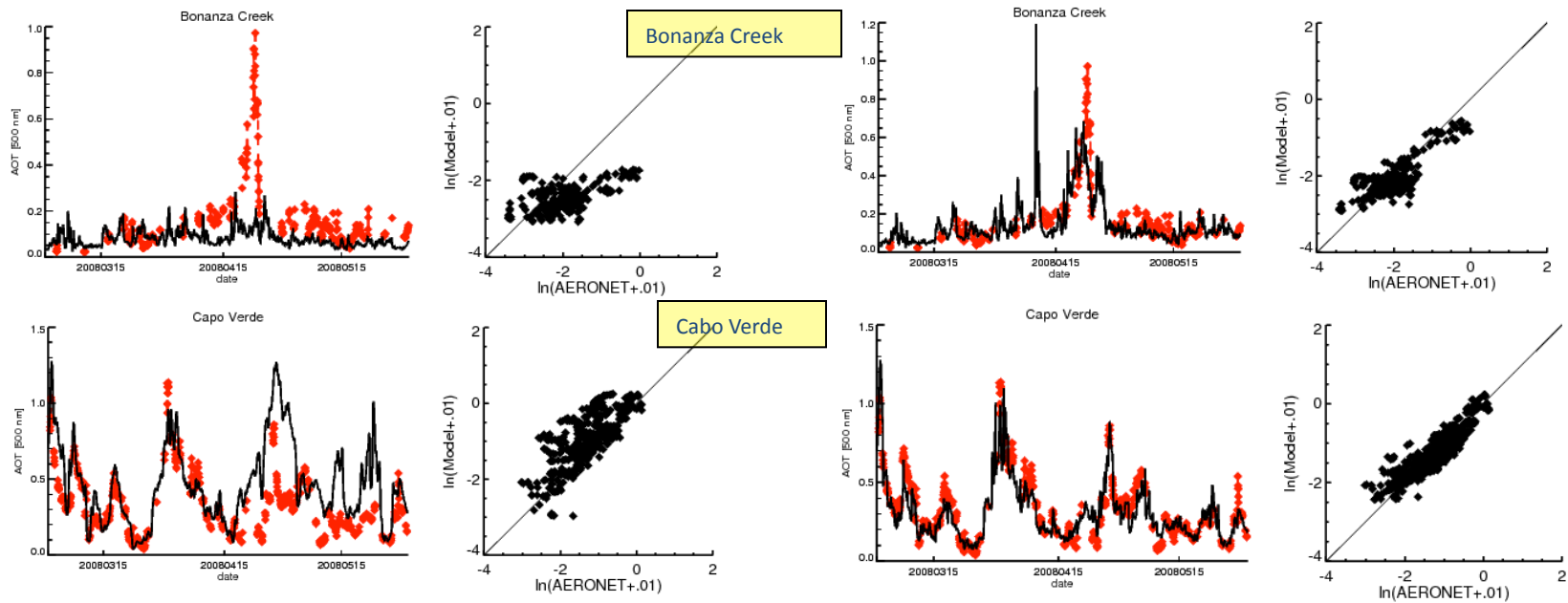
With MLS retrievals, GEOS-5 ozone analyses can capture very realistic spatial ozone structure in the UTL. This is not the case when SBUV V8 retrievals are assimilated.

MERRA/Aerosol Mini-Reanalysis: 2003-11



**GEOS-5 AOD
Without MODIS Assimilation**

**GEOS-5 AOD
With MODIS Assimilation**



Comparison against independent AERONET ground stations