Validation and Verification of Operational Land Analysis Activities at the Air Force Weather Agency

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Introduction

The NASA developed Land Information System (LIS) is the Air Force Weather Agency’s (AFWA) operational Land Data Assimilation System (LDAS) combining real time precipitation observations and analyses, global forecast model data, vegetation, terrain, and soil parameters with the community Noah land surface model, along with other hydrology module options, to generate profile analyses of global soil moisture, soil temperature, and other important land surface characteristics.

- A range of satellite data products and surface observations used to generate the land analysis products
  - Global, 3 deg spatial resolution
  - Model analysis generated at 3 hours

The operational land analysis users include:

- USDA Foreign Agriculture Service
- AFWA Dust Transport Algorithm
- AFWA Weather forecast model (WRF)
- ARL White Sand Missile Range
- AFWA CFSv3I world wide merged cloud analysis
- Naval Research Laboratory
- AF Technology Application Center
- Other modeling centers (NCER, NWS offices)

AFWA recognizes the importance of operational benchmarking and uncertainty characterization for land surface modeling and is developing standard methods, software, and metrics to verify and validate LIS operational Land Data Assimilation System (LDAS) combining real time precipitation observations and analyses, global forecast model data, vegetation, terrain, and soil parameters with the community Noah land surface model, along with other hydrology module options, to generate profile analyses of global soil moisture, soil temperature, and other important land surface characteristics.

Example 1: Precipitation

Verification Setup

Verification Products Analyzed:
1. AFWA GEOFRECIP: Geostationary IR technique from Vicente et al. (1998)
2. Bias corrected CMORPH based on Joyce et al. (2004)
3. GFS Forecasts: NCEP

Reference Data: NOAA Stage IV analysis

Time Period: May 2, 2011 to May 11, 2011

Location: CONUS

Analysis Tool: MET [http://www.dtcenter.org/met/users/]

Example 2: Shortwave radiation

Verification Setup

Verification Products Analyzed:
1. AFWA LIVET: Noah2.7 with AGRMET forcing,
2. Noah2.7 (Kumar et al. 2011)

Reference Data: SURFRAD

Time Period: Jan 1, 2006 to 1, Jan 2007

Location: CONUS

Analysis Tool: LIVET (Kumar et al. 2011)

Example 3: Soil Moisture

Verification Setup

Verification Products Analyzed:
1. AFWA LI4000 (Layer 1) output from LIS/Noah2.7 with AGRMET forcing,
2. Noah2.7 (Kumar et al. 2011)

Time Period: Jan 1, 2006 to 1, Jan 2007

Location: CONUS

Analysis Tool: LIVET (Kumar et al. 2011)

Results

Verification Summary:
- Evaluation tools have been adapted, and continue to be adapted, at AFWA for validation and verification of land surface characterization efforts.
- The use of formal benchmarking tools enable the systematic quantification and evaluation of enhancements made to the operational environment.
- The availability of performance benchmarks provide quantified measures of accuracy and uncertainty to the end-users of the products.

References

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