**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 Sands Missile Range
- AFWA CDF311 world wide merged cloud analysis
- Naval Research Laboratory
- AF Technology Application Center
- Other modeling centers (NCEP, NWS offices)

AFWA recognizes the importance of operational benchmarking and uncertainty characterization for land surface modeling and is developing standards, methods, software, and metrics to verify and/or validate LIS output products. To facilitate this and other needs for land analysis activities at AFWA, the Model Evaluation Toolkit (MET) - a joint product of the National Center for Atmospheric Research Developmental Testbed Center (NCAR DTC), AFWA, and the user community - and the Land surface Verification Toolkit (LVT) - developed at the Goddard Space Flight Center (GSFC) - have been adopted to operational benchmarking needs of AFWA’s land characterization activities.

**Example 1: Precipitation**

**Verification Setup**

**Verification Results**

**Example 2: Shortwave radiation**

**Verification Setup**

**Verification Results**

**Example 3: Soil Moisture**

**Verification Setup**

**Verification Results**

**Summary**

> Evaluation tools have been adopted, 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**


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

Michael Shaw,a,b,c, Sujay V. Kumar,b, Christa D. Peters-Lidard,a, Jeffrey Cetola,a

a – Science Applications International Corporation, McLean, VA
b – Hydrological Sciences Laboratory, NASA Goddard Space Flight Center, Greenbelt, MD
c – Air Force Weather Agency (AFWA), Offutt Air Force Base, NE

**Results**

**Verification Summary:**

- Wide range of metrics: value over different hydrologic regimes.
- High and areal grids are not expected to be representative, as other metrics in LIS such as the anomaly correlation statistic are more appropriate.