Development of a Multi-Scale Remote-Sensing Based Framework for Mapping Drought and Evapotranspiration over North America

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Highlights:

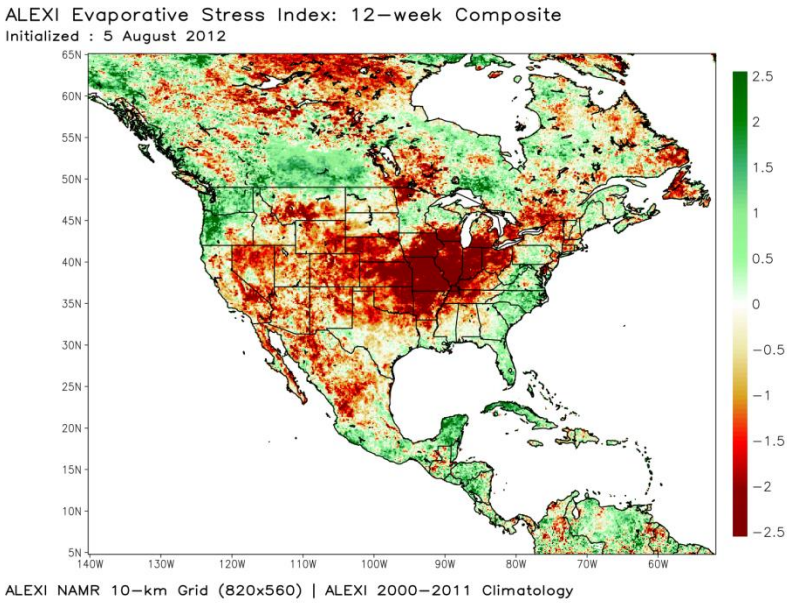
• The ALEXI Evaporative Stress Index (ESI) has been shown to be an effective, fast-response indicator for monitoring agricultural drought over CONUS.

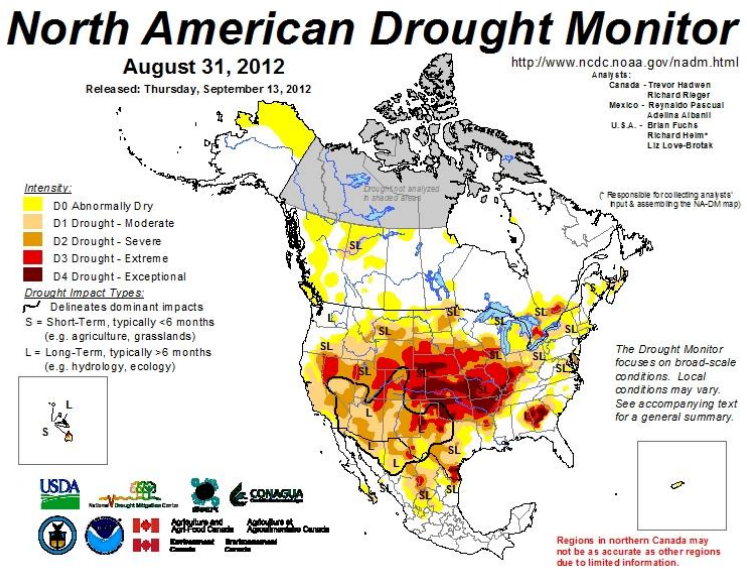
• The ESI uses GOES-derived land-surface temperature data to assess crop and soil moisture stress, and is an independent check on precipitation-based indices.

• To address the need for additional remote sensing-based drought monitoring tools covering North America, the current ESI domain has been expanded to include Canada, Mexico and Central America.

• ALEXI ESI provides the unique opportunity for a potential early warning system through detection of water stress on vegetation that is detectable through elevated canopy temperatures, which occurs well before drought-related plant damage observable through changes in NDVI. This was evidenced during the flash drought of 2012, where the ESI signal preceded that of precipitation-based indicators.

• The ALEXI system will be transitioned into operations at NESDIS OSPO in Summer of 2015.





Enhancing NCEP-NAM Weather Forecasts via Assimilating Real-time GOES-R Observations of Land Surface Temperature and Green Vegetation Fraction

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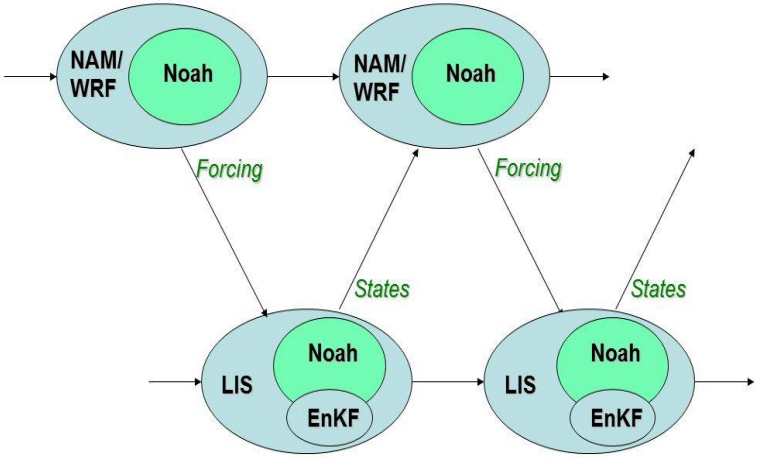
Highlights:

• Forecasts of temperature and precipitation from numerical weather prediction (NWP) models rely on the quality of the initialization of land surface state variables (e.g. soil moisture(SM)) and the representativeness of parameters that describe the current land surface (e.g. green vegetation fraction [GVF]).

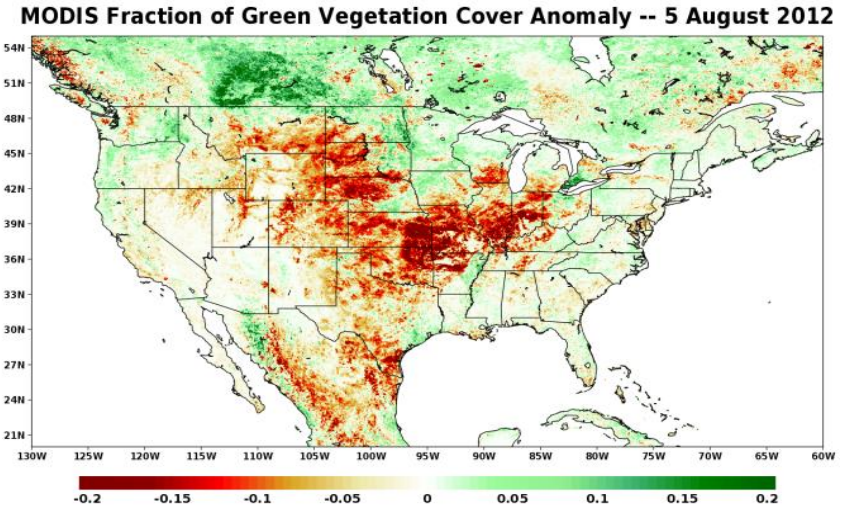
• With enhanced observations from the GOES-R, the goal of this project is to assimilate real-time GOES-R observations of land surface temperature (LST), a GOES-R based thermal infrared (TIR) soil moisture proxy retrieved using the Atmosphere-Land Exchange Inverse model (ALEXI), and GOES-R vegetation dynamics into the NAM.

• Based on our previous research results using GOES LST, we hypothesize that using the LST-driven ALEXI model as a "forward model" to assimilate LST information into NWP models, through the use of a thermal, ALEXI-based soil moisture proxy can be more effective and efficient than direct LST assimilation.

• Initial analysis will focus on the 2012 warm season (April – October) using a semi-coupled LIS/WRF system to assimilate LST (direct LST and ALEXI soil moisture proxy) and update climatological GVF fields.



The generic EnKF land data assimilation utility implemented in NASA Land Information System (LIS) coupled with the Weather Research and Forecasting (WRF) model will be tested for assimilating soil moisture or LST operationally.



Enhancing NCEP GFS Forecasts via Assimilating Satellite Soil Moisture an Snow Observations

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Highlights:

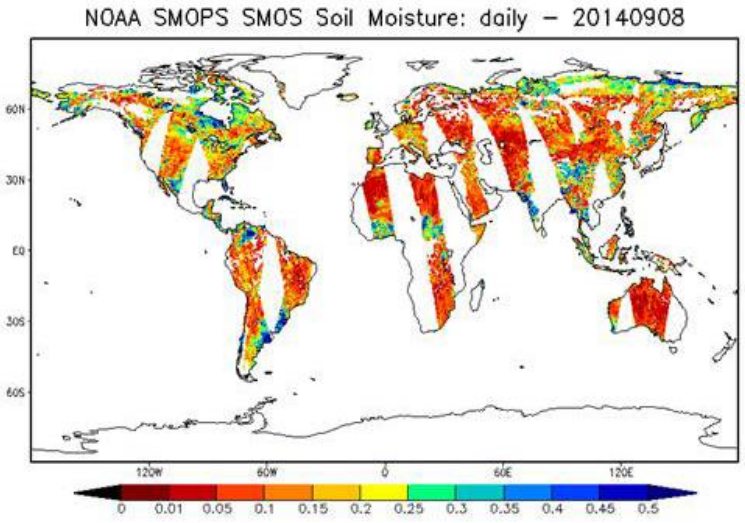
• Active and passive microwave remote sensing has been proved to be a reliable tool for remotely monitoring surface soil moisture which plays an important role in simulated surface fluxes. Remote sensing has also improved the monitoring of snow cover and depth which is one of the key factors that control the energy balance of the land surface.

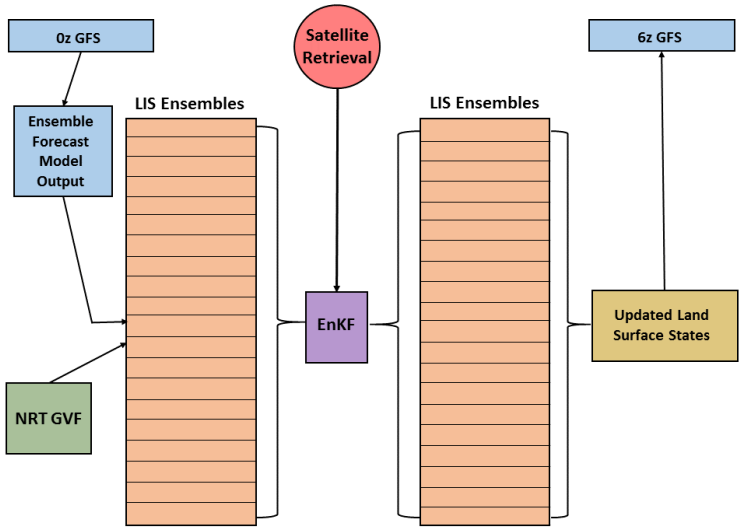
• The assimilated snow and soil moisture products will have reduced sensitivity to errors in current initializations of soil moisture and snow fields, thus leading to potential improvements in simulated surface and boundary-layer processes (e.g., 2-meter temperature/moisture fields, low-level cloud fields, precipitation) within the GFS.

• The LIS and GFS simulations will also use near-real-time green vegetation cover (GVF) product from MODIS or VIIRS (depending on availability) as the performance (e.g., retrieval error) for MW-based products have been shown to be correlated with density of green vegetation cover.

• Improvements in the initialization of SM have been shown by our research team to lead to improvements in precipitation forecasts in the 6-10 day period using a simplified EnKF within the GFS, developing a system which uses a full version of the EnKF could potentially lead to additional improvements due to a better specification of model and observation uncertainty.

• The proposed study makes use of multiple complementary remotely-sensed datasets (e.g. snow and soil moisture) and will be adaptable to future sensors (e.g. SMAP). All of which are not currently assimilated into any NCEP operational models.





Prototype Assimilation System for Ingesting Satelite Soil Moisture and Snow Observations