Demonstration of a Daily High-Resolution (375-m) ALEXI Evapotranspiration Product for the NENA Region

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Demonstration of a Daily High-Resolution (375-m) ALEXI Evapotranspiration Product for the NENA Region

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Atmosphere-Land-Exchange-Inversion Model (ALEXI)

ALEXI is a two-source energy balance model which was initially developed to address issues dealing with the monitoring of surface fluxes, including actual evapotranspiration (ET), from a satellite-based platform (Anderson et al., 1997; Fig. 1). Flux partitioning within ALEXI is driven by time changes in land surface temperature (LST); the amplitude of the diurnal surface temperature wave has been found to be a good indicator of surface flux partitioning, and using a time-differential measurement significantly reduces model sensitivity to errors in LST retrieval. Model evaluation through disaggregation over flux sites in the US and other regions indicate accuracy on the order of 1% of daily time steps (e.g., Commermole et al., 2013, 2014; Fig. 2).

Training a Regression Model to Estimate Mid-morning LST rise from Day/Night MODIS/VIIRS Observations

While the current constellation of geostationary sensors provides near-global coverage (15N to 85S), it requires merging data from 7 satellites (resolving time differences, e.g., single-sensor atmospheric correction). Polar orbiting sensors such as MODIS and VIIRS provide daily global coverage of ET at higher resolutions than GEO sensors but of only two times per day. A technique has been developed and evaluated using GOES data to train a regression model to use day-night LST differences from MODIS to predict the morning LST (ΔTRAD) rise needed by ALEXI (Fig. 3). The regression model can provide reasonable estimates of the mid-morning rise in LST (BASE – 5 to 8°C, Fig. 4) from the twice daily MODIS or VIIRS LST observations.

Prototype VIIRS ET Results – Spatial Resolution Improvements with VIIRS

Prototype VIIRS ET Results – 2015 Annual Evapotranspiration (mm)