Evapotranspiration and Drought Monitoring Using GOES-R Proxy Data

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Monitoring evapotranspiration (ET) and the extent and severity of agricultural drought is an important component of food and water security and world crop market assessment. Because agricultural systems are climate-sensitive, and conventional surface instrument networks are sparse and report with delays, satellite remote sensing and modeling play a vital role in monitoring regional water use and providing early warning of impending moisture deficits, and can be used to supplement coarser resolution data from weather and precipitation networks to assess drought conditions. Because land-surface temperature (LST) is strongly modulated by evaporation, thermal infrared (TIR) remote sensing data carry valuable information regarding surface moisture availability and therefore have been widely used to map ET, drought, and vegetation stress. Signatures of vegetation stress are manifested in the LST signal before any deterioration of vegetation cover occurs, for example as indicated in the Normalized Difference Vegetation Index (NDVI), so TIR-based drought indices can provide an effective early warning of impending agricultural drought. Evapotranspiration deficits in comparison with potential ET (PET) rates provide proxy information regarding soil moisture availability. In regions of dense vegetation, ET probes moisture conditions in the plant root zone, down to meter depths. Our group has spearheaded use of anomalies in the remotely sensed ET/PET fraction (*fPET*) generated with ALEXI as a drought monitoring tool that samples variability in water use, and demonstrating complementary value in combination with standard drought indices that reflect water supply.

The current generation GOES-based Evaporative Stress Index (ESI) is in transition to operational production in support of the NOAA-NCEP Drought Briefing, the U.S. Drought Monitor, and will be disseminated through the National Integrated Drought Information System (NIDIS) Drought Portal. Fully automated ALEXI ET and drought monitoring systems have been implemented at 10-km resolution over the continental U.S. using TIR and shortwave information from current GOES instruments. With the launch of GOES-R, our capabilities for ET and drought monitoring will be significantly enhanced due to substantial improvements in spatiotemporal resolution, radiometric accuracy, and cloud-clearing capabilities. With GOES-R, the resolution of ALEXI ESI and ET products can be improved to 2-km. This will significantly improve utility to the drought community and action agencies served by NIDIS, who are demanding drought

information at increasingly higher spatial resolution to support decision making at the sub-county scale. Additional spectral resolution and higher radiometric accuracy available in the ABI will improve cloud-cleared LST retrievals, and should substantially reduce noise in ALEXI-derived fluxes. Finally, significantly decreased scan times (5 to 15 minutes [GOES-R] vs. 1 hour [current GOES Sounder]) will lead to more precise computation of the time integrated LST signal used as the primary driver to ALEXI. Through the GOES-R Risk Reduction program, we will demonstrate the improved performance of ALEXI drought and ET products using GOES-R proxy data, and develop an operational system ready to ingest real-time baseline and option 2 GOES-R products post-launch. Resulting enhanced drought products will be demonstrated over NIDIS pilot study areas and distributed through the NIDIS drought portal.