Development and Analysis of a Long Term, Global, Terrestrial Land Surface Temperature Dataset Based on HIRS Satellite Retrievals

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Land surface temperature (LST) is a critical state variable for surface energy exchanges as it is one of the controls on emitted radiation at the Earth's surface. LST also exerts an important control on turbulent fluxes through the temperature gradient between LST and air temperature. Although observations of surface energy balance components are widely accessible from in-situ stations in most developed regions, these ground-based observations are not available in many underdeveloped regions. Satellite remote sensing measurements provide wider spatial coverage to derive LST over land, and are used in this study to form a high resolution, long term LST data product. Satellite measurements from the High Resolution Infrared Radiation Sounder (HIRS) sensor has been selected by the Global Energy and Water Exchanges Project (GEWEX) Data and Analysis Project (GDAP) as the primary satellite observations for the development of GDAP's internally consistent datasets due to HIRS' multi-decadal data record length. Using a post-processing Bayesian statistical procedure, a HIRS-consistent LST data set is developed at a hourly, global land, 0.5 degree resolution for clear and cloudy conditions from 1979 to 2009 through merging the National Centers for Environmental Protection (NCEP) Climate Forecast System Reanalysis (CFSR) LST estimates with the HIRS retrievals. The Baseline Surface Radiation Network (BSRN) observations are used to validate the HIRS retrievals, the CFSR LST estimates, as well as the final merged LST dataset. An intercomparison between the original retrievals and CFSR LST datasets, before and after merging, is also presented with an analysis of the datasets including an error assessment of the final LST dataset.