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Comparison of MODIS land surface emissivity at 8.6 micrometers with ground measures of soil moisture in the Sahel

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The land surface emissivity is often overlooked when considering surface properties that effect the energy balance. However, knowledge of the emissivity in the window region is important for determining the longwave radiation balance at the surface and thus the radiation emitted to space. This radiation balance is strongly affected by the difference between the temperature of the emitting surface and the sky brightness temperature, which will be the greatest in the window region. The emissivity variability is typically greatest in arid regions where the exposed soil and rock surfaces display the widest range of emissivity. For example the dune regions of the Sahara have emissivities of 0.7 or less in the 8 to 9 micrometer wavelength region due to the quartz sands of the region.

The multispectral thermal infrared data obtained from the MODerate resolution Imaging Spectrometer (MODIS) sensor on NASA's Terra satellite have been shown to be of good quality and provides a unique new tool for studying the emissivity of the land surface at the global scale. Two years of monthly composites of thermal infrared (TIR) surface emissivity data from the MODerate resolution Imaging Spectrometer (MODIS) sensor on NASA's Terra satellite were analyzed for temporal variations over North Africa and the Arabian peninsula. It was found that the emissivity of the 8.6 micrometer band (MODIS band 29) increased by about 0.1 each July/August in southwestern Sahara (17 N, 1.5W). To understand this increase, the emissivity variation was compared with the normalized difference vegetation index (ndvi) also de-

rived from MODIS and with soil moisture estimates from the Advanced Microwave Scanning Radiometer (AMSR-E) microwave sensor on NASA's Aqua satellite. No correspondence was found with ndvi, however the TIR emissivity increase was found to be qualitatively correlated with an increase in AMSR derived soil moisture in some regions. This increase in TIR emissivity with soil moisture is in agreement with the lab measurements. To study this temporal variation in more detail 8-day composites of the emissivity were studied and compared with ground data from the African Monsoon Multidisciplinary Analysis (AMMA) site in Mali (15 - 18 N and 1 - 2 W). This site will be ground validation site for the Soil Moisture and Ocean Salinity (SMOS) satellite to be launched in 2007. These data were for the 0-5cm layer and it was found that this is too deep a layer for the infrared emissivity and that the soil moisture for a thinner layer at the surface would be more appropriate for describing the TIR emissivity.