Landsat 7 thermal band calibration and atmospheric correction: validation with ground-based measurements

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The thermal band calibration of the Enhanced Thematic Mapper + (ETM+) onboard Landsat 7 was assessed with ground-based radiometric measurements of land surface temperature (LST) performed in a homogeneous site of rice crops close to Valencia, Spain. Atmospheric radiosondes were launched at the test site around the satellite overpasses. Field emissivity measurements were performed for the near full-vegetated crops using the box method. Seven concurrences of Landsat 7 and ground data were obtained in July and August 2004-2007, with precipitable water larger than 2 cm. The ground-based measurements were used with the MODTRAN 4 model to simulate at-sensor radiances and brightness temperatures, which were compared against calibrated ETM+ observations over the test site. For the cases analyzed here, differences between simulated and ETM+ brightness temperatures showed average bias of 0.6 K and root mean square difference (rmsd) of ±0.8 K. We also used the ground-based measurements for the validation of LSTs derived for the test site from ETM+ at-sensor radiances with atmospheric correction based on: (1) the local radiosondes profiles and MODTRAN 4, and (2) the operational atmospheric correction parameter calculator available on-line at http//:atmcorr.gsfc.nasa.gov. For the first case, differences between the ground and satellite LSTs ranged from -0.6 to 1.4 K, with mean bias of 0.7 K and rmsd= ±1.0 K. For the second case, differences ranged between -1.8 and 1.3 K, with zero average bias and rmsd= ±1.1 K. Although the number of validation data is small, results are quite similar for both cases and reveal the good LST accuracy that can be achieved from the ETM+ thermal band.

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