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Cross-Calibration Of The Current Landsat Sensors With Foreign Landsat-Class Sensors For Long-Term Monitoring Of Land Surface Processes

The goal of this proposal is to extend our theoretical and applied understanding of radiometric cross-calibration of multiple sensors in support of continued long-term studies of the Earth's land surfaces. Particular emphasis will be placed on the cross-calibration of the Landsat 5 (L5) Thematic Mapper (TM) and Landsat 7 (L7) Enhanced Thematic Mapper (ETM+) sensors with the Indian Remote Sensing Satellite Payload (IRS-P6) Advanced Wide Field Sensor (AWiFS) and Linear Imaging Self-Scanner (LISS-III) sensors, both potential sources of data to help fill the pending Landsat data gap. This proposal builds on the well-established abilities in radiometric calibration of key research groups at the U.S. Geological Survey (USGS) Center for Earth Resources Observation and Science (EROS), National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) Landsat Project Science Office (LPSO) and South Dakota State University (SDSU). Three activities are proposed. First, the major focus is to rigorously perform the cross-calibration between the L5/7 and the IRS-P6 sensors. To facilitate this cross-calibration, a tool set will be developed, including coincident imaging and spectral simulation tools. Second, the uncertainties inherent in the cross-calibration process will be quantified. These include error sources such as differing spectral profiles, spatial and radiometric resolution differences, geometric registration, Bidirectional Reflectance Distribution Function (BRDF) effects from differing view and illumination angles, and atmospheric effects. The results from this sensitivity study will provide a theoretical lower error bound for sensor cross-calibration and provide a basis for the sensitivity of cross-calibration to these various factors. Last, to validate the cross-calibration approach, the suitability of IRS sensors for land cover applications (e.g., land-cover mapping, quantifying fractional landscape components, and land change analysis) will be evaluated. The comparability of results from primary data gap candidates with legacy Landsat-based land cover datasets will be analyzed. In an era when the number of Earth-observing satellites is rapidly growing and measurements from these sensors are used to answer increasingly urgent global issues, it is imperative that scientists and decision-makers can rely on the accuracy of Earth-observing data products. The proposed work supports NASAs long-term commitment to Land Remote Sensing by specifically creating a bridge between the calibration record of current Landsat sensors and the upcoming LDCM sensor, as well as providing tools and techniques applicable to other current and future sensors. This project will develop a reliable, low-cost method for continual monitoring of data quality from multiple satellites, and provide assessments of the impact of this improved knowledge in real, ongoing scientific applications.