AN ASSESSMENT OF AFRICAN TEST SITES IN THE CONTEXT OF A GLOBAL NETWORK OF QUALITY-ASSURED REFERENCE STANDARDS

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ABSTRACT

Earth surfaces with suitable characteristics have long served as benchmark for test sites to verify the post-launch radiometric calibration performance of satellite sensors. These test sites have been and will continue to be central to earth-observing sensors' data product quality assurance (QA) and quality control (QC) strategy and are explicitly embedded within the Quality Assurance Framework for Earth Observation (QA4EO). At present, test sites are primarily used to gain knowledge on biases among sensors and provide, at some level, a practical means of bridging anticipated data gaps in measurement continuity due to a lack of co-existent in-flight sensors. Test sites also provide a convenient means of obtaining information to verify sensor performance and the prospect of calibration information if the accuracy and its transfer to orbit can be properly assessed. The U.S. Geological Survey (USGS), as a supporting member of the Committee on Earth Observation Satellites (CEOS) and Global Earth Observation System of Systems (GEOSS), has established an online catalog of prime candidate test sites for the post-launch characterization and calibration of space-based optical imaging sensors. The online catalog provides easy public web site access to this vital information for the global community. The online catalog can be accessed at http://calval.cr.usgs.gov/sites_catalog_map.php.

The CEOS Infrared and Visible Optical Sensors (IVOS) sub-group members worked with partners around the world to establish a set of CEOS endorsed globally-distributed reference standard test sites for the post-launch calibration of space-based optical imaging sensors. This paper discusses the top five African pseudo-invariant sites (Libya 4, Mauritania 1/2, Algeria 3, Libya 1, and Algeria 5) that were identified by the IVOS sub-group. These stable desert sites have been characterized using multiple sensors (SPOT, ETM+, MODIS, MERIS, etc.) and have periodic satellite acquisitions over a number of years. The pseudo-invariant desert sites have high reflectance and are usually made up of sand dunes with low aerosol loading and, practically, no vegetation. Consequently, these pseudo-invariant reference standard test site can be used to evaluate the long-term stability of a sensor and to facilitate cross-comparison of multiple sensors. As an extension to previous effort made by members of the USGS/EROS and the NASA/GSFC MODIS Characterization Support Team (MCST), this paper focuses

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on monitoring the long-term on-orbit radiometric stability of the Terra Moderate Resolution Imaging Spectroradiometer (MODIS) and the Landsat 7 (L7) Enhanced Thematic Mapper Plus (ETM+) sensors. This analysis is conducted using near-simultaneous and cloud-free image pairs acquired from Jan 2000 to Dec 2008 over the five African desert sites mentioned above. From the geo-location information, homogeneous regions of interest (ROI) were selected in the image pairs and the mean target statistics were derived from sensor measurements in terms of top-of-atmosphere (TOA) reflectance. Residual errors and coefficients of determination were also generated to quantify the uncertainty in these relationships and to provide a high quality assessment on the calibration differences between the two sensors. Through greater access to and better understanding of these vital test sites and their use, the validity and utility of information gained from Earth remote sensing will continue to be improved.