# SPECTRAL CALIBRATIONS OF HICO DATA USING ATMOSPHERIC BANDS AND RADIANCE ADJUSTMENT BASED ON HICO AND MODIS DATA COMPARISONS

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## ABSTRACT

The Hyperspectral Imager for the Coastal Ocean (HICO) [1] instrument is now operating from a location on the Japanese Experiment Module-Exposed Facility (JEM-EF) on the International Space Station (ISS). HICO was successfully launched into space in September of 2009. Before shipping the HICO instrument to Japan to be launched with a Japanese HII-B rocket, spatial, spectral, and radiometric calibrations of HICO were made in a calibration lab at the Naval Research Laboratory in Washington, DC. Based on the analysis of HICO data acquired from ISS, we have observed that the wavelengths of the HICO instrument are slightly changed in comparison with those from laboratory calibrations. We have used a spectrum-matching technique [2] for adjusting wavelengths. Several atmospheric water vapor and oxygen absorption bands in the HICO data measured under the normal operation mode with a spectral resolution of approximately 5.7 nm are used for spectrum-matching. Three extra-terrestrial solar lines in the HICO data with a spectral spacing of 1.7 nm acquired under the special high spectral resolution mode are also used for spectrum-matching. The spectrum-matching technique and results will be presented.

The radiances of ISS HICO data obtained using the laboratory-based calibration coefficients are lower than expected. HICO does not carry any internal radiometric and spectral calibration devices, unlike the NASA Terra and Aqua MODIS instruments that have several onboard calibration devices. In view of this situation, we have decided that one way to radiometrically calibrate the HICO data is to transfer the MODIS radiometric calibrations to the HICO radiometric calibrations through inter-satellite data comparisons. The MOBY site off the coast of Lanai, Hawaii is the site used by the NASA ocean color

community for the calibration of SeaWiFS and Terra and Aqua MODIS instruments. This site is also placed on the HICO target list for repeated HICO data collections. Through analysis of a number of HICO data sets measured over the MOBY site, we have concluded that this site is not really quite suited for inter-satellite data comparisons. One fact is that this site is often covered by thin cirrus clouds. Another fact is that the radiances for the two most important narrow atmospheric correction channels centered near 0.75 and 0.865 micron over clear waters are very low. Although HICO is an ocean color instrument, it does not saturate over high reflecting desert areas. We have decided to use desert calibration sites used by the Landsat Science Team and the NASA EO-1 Science Team for inter-satellite comparisons. Pairs of HICO data and MODIS data have been acquired over several desert calibration sites under approximately the same solar and viewing angles. The HICO radiances are consistently lower than the corresponding MODIS radiances by approximately 25%. The inter-satellite calibration technique and gain adjustment factors will also be presented.

## REFERENCES

[1] R. L. Locke, M. Corson, N. R. McGlothlin, et al., The Hyperspectral Imager for the Coastal Ocean (HICO): Instrument Description and Early Results (in preparation).

[2] B.-C. Gao, M. J. Montes, and C. O. Davis, Refinement of wavelength calibrations of hyperspectral imaging data using a spectrum-matching technique, Remote Sensing of Environment, 90, 424-433, 2004.

## BRIEF BIOGRAPHY

**Bo-Cai Gao** received the B.S. degree in Physics from Nankai University in the People's Republic of China in 1982, and the M.S. and Ph.D. degrees in Physics from the Ohio State University in 1984, and 1988, respectively. He is presently a research physicist with the Remote Sensing Division, Naval Research Laboratory in Washington, D.C. He is conducting research in remote sensing of atmospheric water vapor, cirrus clouds, and coastal waters using both the hyperspectral and multi-spectral imaging data.