Comparison of MODTRAN to Heritage-based Results in Vicarious Calibration at University of Arizona

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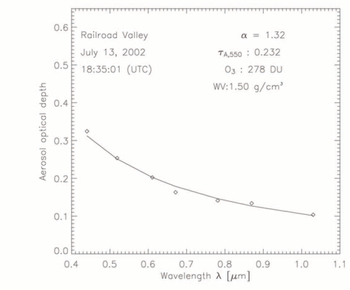
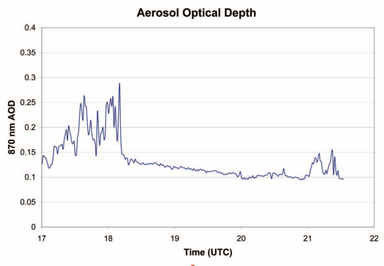
The Remote Sensing Group (RSG) has done vicarious reflectance-based satellite calibration since early work on the Landsat program in the mid 1980's. This work has been based on a radiative transfer code (UA-Flat) that incorporates a flat atmosphere profile assuming a plane parallel, horizontally homogenous atmosphere. Recently the RSG has switched to using MODTRAN-4 as a basis of a code to profile atmospheric and reflectance data and transfer the computed reflected radiance to the sensor. Calibration of the Quickbird-2 sensor using UA-Flat and MODTRAN-4 allows a comparison between the two codes.





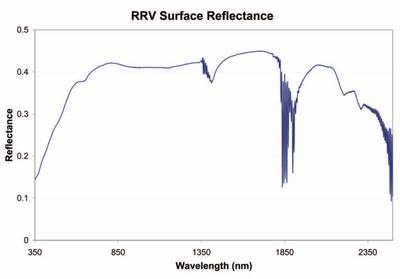
Reflectance-based Approach to Calibration

Surface reflectance based on ratio of surface to calibrated panel measurements collected over a 80-m by 300-m site during overpass.

Atmospheric data derived from a ten band solar radiometer
Aerosol size distribution assumed to follow a power law

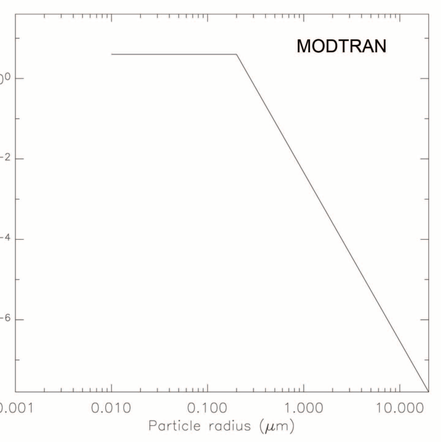
Radiative transfer code used to calculate band averaged radiance

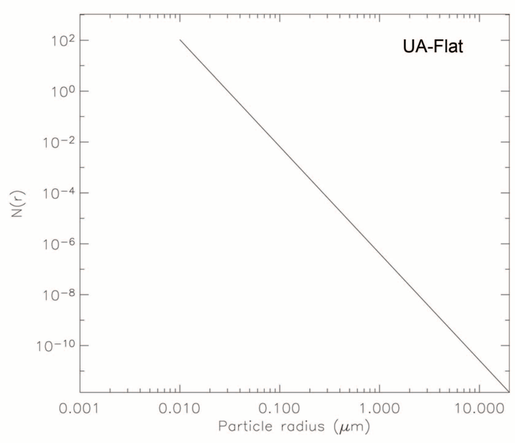
Band-averaged radiance is used with the digital output derived from satellite images to determine calibration coefficients.



Radiative Transfer Code

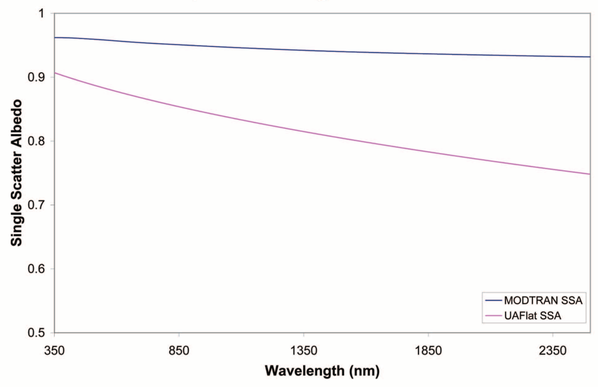
Calibration Coefficients (DN/Radiance)

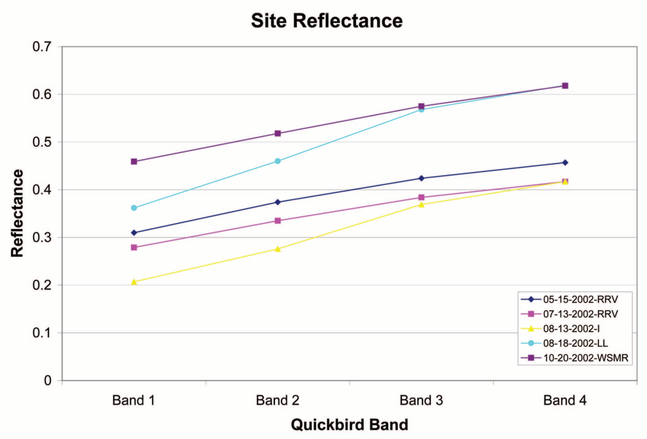




Changes in Processing

1.) Number of small aerosol particles limited (more realistic model for normal atmospheric conditions)
2.) Single Scatter Albedo (SSA) is usually higher due to fewer small aerosol particles
3.) Reflectance panel coefficients updated (not processing method)



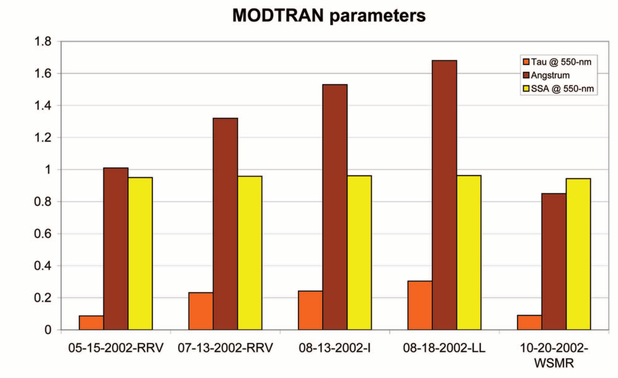


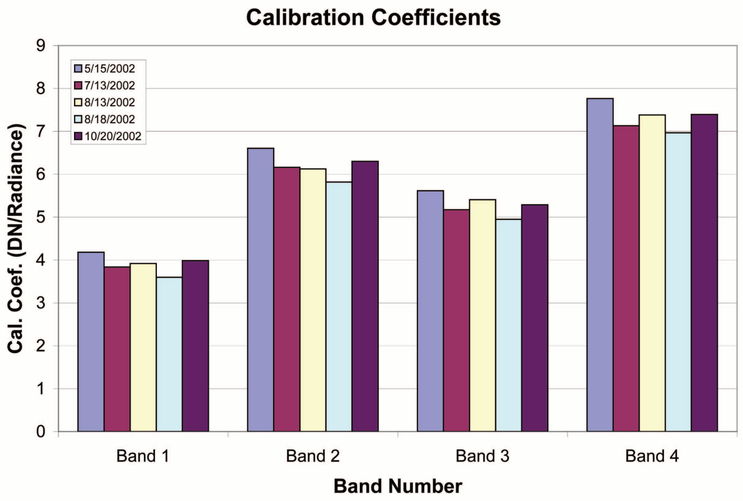
Calibration Work with Quickbird-2

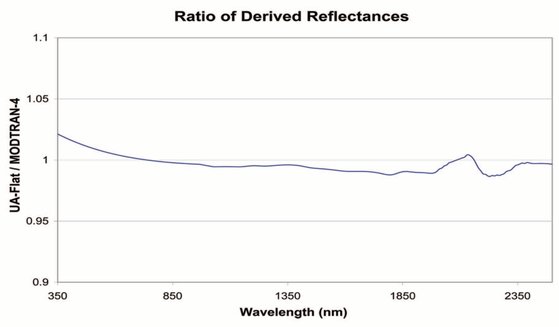
MODTRAN-4 used to calculate at-sensor radiance using vicarious data for Quickbird-2 and compared to previous work done using UA-Flat code for 5 overpasses

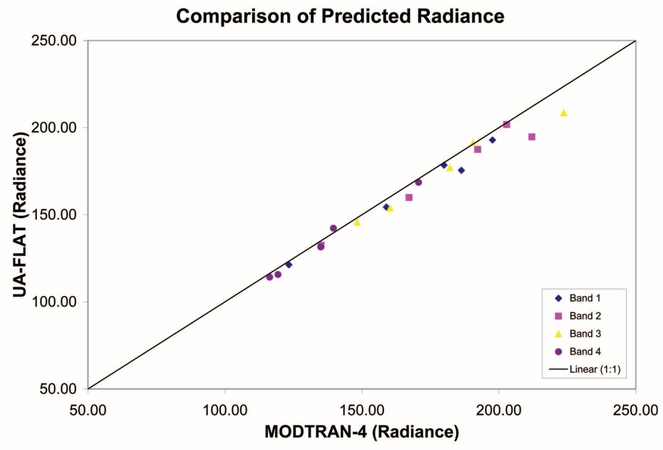
Trend towards higher at-sensor radiance values due to processing changes that we believe are correct

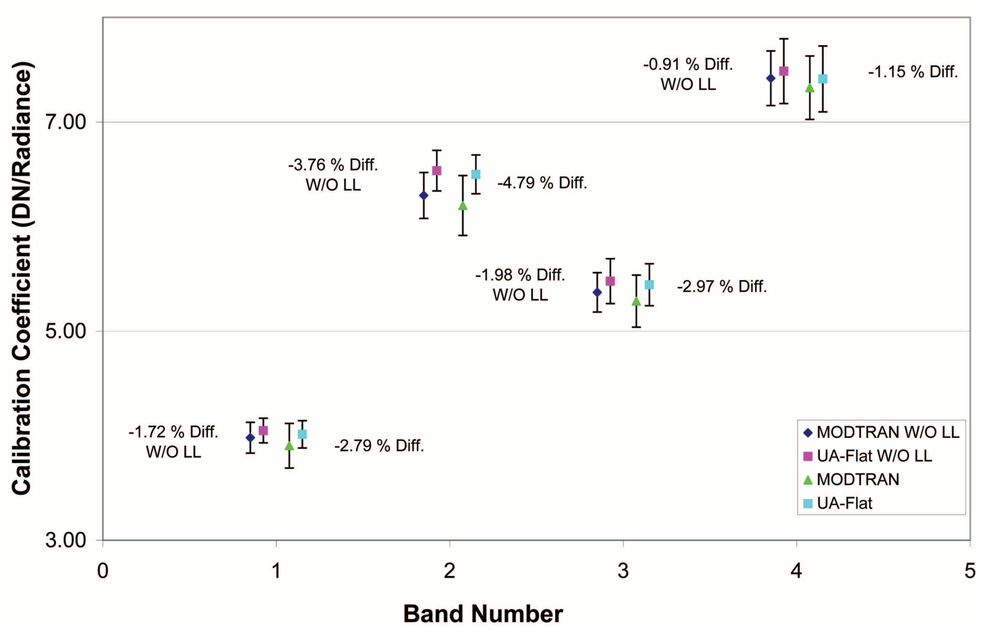
Results from 08-18-2002 at Lunar Lake different partially due to smoke particulate in the atmosphere











Conclusions and Observations

1.) Small sample size of 5 days of common results for Quickbird-2
2.) Ease of processing increases reliability of results
3.) Trend toward slightly higher at-sensor radiance due to:
   -Higher derived reflectance due to updated panel coefficients (not processing method)
   -Aerosol size distribution leading to different SSA
4.) Similar standard deviation in calibration coefficients to UA-Flat results with exception of Lunar Lake date