Analysis of the performances of the Landsat8/OLI land surface reflectance product

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The spectral bidirectional surface reflectance, i.e., satellite derived top of atmosphere (TOA) reflectance corrected for the temporally, spatially and spectrally varying scattering and absorbing effects of atmospheric gases and aerosols, is needed to monitor the surface reliably. For this reason, the spectral bidirectional surface reflectance, and not TOA reflectance, is used to generate the greater majority of the global land products for example from the MODIS and VIIRS sensors. Even if atmospheric effects are minimized by sensor design, for example, the Landsat OLI has spectrally narrow bands and bands located at wavelengths that are less subject to atmospheric absorption, atmospheric effects are still challenging to correct. In particular, the impact of aerosols can be difficult to correct because they can be highly discrete in space and time (e.g., smoke plumes) and because of the complex scattering and absorbing properties of aerosols that vary spectrally and with aerosol size, shape, chemistry and density.

A number of atmospheric correction methodologies have been developed but those using radiative transfer algorithms and atmospheric characterization data provide the most potential for automated large area application. For example, the MODIS reflective wavelength bands are atmospherically corrected using the 6SV radiative transfer code to generate global daily and 8-day surface reflectance products, since 2000. The 6SV code has been implemented for correction of Landsat TM and ETM+ data. The approach relies on inverting the aerosol effect, using the bands centered at the shortest (blue) wavelengths where the surface reflectance is generally small and the aerosol signal strong.

We will present the Landsat 8 OLI atmospheric correction algorithm that has been developed using the 6SV approach refined to take advantage of the narrow OLI spectral bands, improved radiometric resolution and signal to noise, and the new OLI blue band (0.433–0.45mm), that is particularly helpful for retrieving aerosol properties as it has shorter wavelength than the conventional OLI, TM and ETM+ blue bands. A cloud and cloud shadow mask has also been developed using the “cirrus” band (1.360–1.390 μm) available on OLI, and the thermal infrared bands from the TIRS instrument. The performance of the surface reflectance product from OLI is analyzed both over the AERONET sites using accurate atmospheric correction (based on in situ measurements of the atmospheric properties) and by comparison with the MODIS surface reflectance product. Some preliminary evaluation of the cloud and cloud shadow mask will also be presented.