Presentation Abstract

Integrating Landsat with Physics-based Models for Water Constituent Retrieval

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Remote sensing has been traditionally used to retrieve water constituents by establishing a relationship between in-situ measured quantities and image-derived products. Motivated by the dramatically improved potential of the Landsat Data Continuity Mission (LDCM), this paper describes a different approach for water constituent retrieval where both thermal and visible spectral bands of Enhanced Thematic Mapper Plus (ETM+) instrument on board Landsat 7 are utilized. In this effort, Landsat data is integrated with a 3D hydrodynamic model to obtain profiles of particles and dissolved matter in the near shore zone in the vicinity of a river discharge. The procedure is based upon performing many hydrodynamic simulations by adjusting input environmental/physical variables and generating Look-Up-Tables (LUTs). This is conducted in two phases, namely calibration and constituent retrieval. In the calibration phase, the best model output is determined by searching the LUT for the optimal surface temperature map against the Landsat-derived surface temperature map. The profiles of particles and dissolved matter are retrieved in the second step by comparing several modeled surface reflectance maps with atmospherically compensated Landsat 7 imagery. In this process, various case scenarios of simulated water constituent profiles drive a radiative transfer code, i.e. Hydrolight, which generates water-leaving remote sensing reflectance (Rrs). The best match, obtained via optimization, demonstrated an average Root-Mean-Squared-Error (RMSE) of 0.55% (percentage of reflectance), calculated over the plume. It is concluded that calibrating a physics-based model using Landsat 7 imagery can provide a better insight into the dynamics of spatially non-uniform waters. Ongoing efforts show that, due to its enhanced radiometric fidelity, the LDCM should significantly improve our ability to retrieve water constituents.