Assessment of Atmospheric Correction Methods for Landsat-8 and Sentinel-2 Over Large Rivers

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The process of atmospheric correction removes effects of the atmosphere from satellite images to provide accurate estimates of reflectance at the Earth's surface. The resulting reflectance forms the basis for bio-optical models of water quality parameters such as chlorophyll-a and turbidity that are relevant to global biogeochemical cycles and water management. Atmospheric correction routines vary by sensor and application but remain widely untested over large river systems. Here we assess the consequence of atmospheric correction choice on derived water quality products over three large rivers: the Amazon, Columbia and Mississippi Rivers. We show the Landsat-8 Surface Reflectance Code (LaSRC) produces reflectance estimates similar to field measurements despite being a technique derived for terrestrial applications. We also found that specialized aquatic correction routines were in better agreement with each other than with the land-based LaSRC technique and that disagreements were more exaggerated for Sentinel-2 data compared to Landsat-8. The resulting maps of key water quality variables show mean absolute errors ranging from 15 -30% as a result of model choice. Our results demonstrate how choice of atmospheric correction method generates differences in surface reflectance that propagate through to estimates of water quality. This work lays the foundation for more intensive field-based measurements of optical properties relevant to the remote sensing of rivers and other inland water bodies.

Publication:
American Geophysical Union, Fall Meeting 2018, abstract #U12B-08

Pub Date:
December 2018

Bibcode:
2018AGUFM.U12B..08K

Keywords:
0810 Post-secondary education; EDUCATION