North American Land Surface Albedo and Nearshore Shallow-Bottom Properties from Landsat and MODIS/VIIRS

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• Produce Land Surface Albedo over North America by coupling Landsat with MODIS daily BRDF/Albedo retrievals

• Extend through the Landsat-8 era with both MODIS and VIIRS BRDF/Albedo retrievals

• Extend to Nearshore Substrates (albedo and bathymetry) through the use of the extra OLI ocean channel (427-459nm) and improved signal-to-noise.

• Establish a framework for producing spectral albedo from future Landsat and moderate resolution missions
Data processing flow chart for the Concurrent Landsat Land Albedo, Shuai et al., 2011
Landsat-8 May 2, 2013
White Sky Albedo for Landsat8 p12r31 on day 2013-122 (May 2\textsuperscript{nd})
Landsat Derived Albedo:
Landsat 5
2011
Day: 254  (Leaf On)

Land Surface Reflectance
K-means Unsupervised Classification
Shortwave Black Sky Albedo
Shortwave White Sky Albedo

SW, HW, MW
Landsat Derived Albedo:
Landsat 5
2011
Day: 270

Land Surface Reflectance
K-means Unsupervised Classification
Shortwave Black Sky Albedo
Shortwave White Sky Albedo

SW, HW, MW
Landsat Derived Albedo:
Landsat 5
2011
Day: 302  (Leaf-off)

Land Surface Reflectance
K-means Unsupervised Classification
Shortwave Black Sky Albedo
Shortwave White Sky Albedo

SW, HW, MW
Albedo Seasonal Progression

Black Sky Albedo

Albedo vs. 2011 Calendar Day

White Sky Albedo

Albedo vs. Calander Day 2011
Land Albedo Efforts Underway

• Group meeting last spring (Yanmin Shuai)
  – Transition concurrent algorithm to UMB team
• Group meeting Nov (delayed due to shutdown)
  – Work on operational processing strategies
• Utilize sample VIIRs BRDFs
  – BRDFs generated at LandPeate
  – Concurrent algorithm
Over-water Cross-validation of OLI with VIIRS/MODIS

• Motivation
  – Science-quality products over aquatic environments require accurate knowledge of sensor radiometric performance

• Objective
  – To obtain TOA gains. When applied, surface reflectances derived from OLI would be comparable to those produced from VIIRS/MODIS

• Procedure
  – Near-nadir/simultaneous L8 and SNPP scenes over high-latitude coastal (spatially uniform) waters
  – Comparison domain: normalized TOA radiance
  – RTM-based corrections for RSR and viewing geometry
  – VIIRS TOA observations are further adjusted using:
    • MODIS TOA
    • VIIRS surface products
• VNIR relative performances are within the specs.
• It is anticipated that the updated calibration would improve consistencies with VIIRS/MODIS.

Temporal average

+4.5 % (CA)
-1.1 % (Blue)
-1 % (green)
+0.5% (red)
+0.1% (NIR)
SWIR bands are ideal bands for atmospheric correction

VIIRS-MODIS responses are consistent within $< \pm 10\%$ in TOA

Note that OLI SWIR radiances (over water) are $> 40$ times lower than the typical radiances (for which SNR is defined)
Current Water Efforts Underway

- The OLI-VIIRS cross-validations will be further supported by insitu measurements made at AERONET-OC stations (vicarious calibration)
- Further scene-based over-water radiometric analysis (striping, uncertainties, etc.)
- Upcoming field campaign next month in Puerto Rico (nearshore)
North American Land and Nearshore Albedo

- Implementing concurrent algorithm for land
  - With MODIS
- Testing concurrent algorithm
  - With Landsat8 (both growing season and snow)
  - With VIIRS
- Continue over-water radiometric analysis Testing nearshore substrate scenes with Landsat8
- Participate in future Landsat planning
Landsat-8 May 2, 2013