Joint Passive-Active Surface Classification from GMI and DPR

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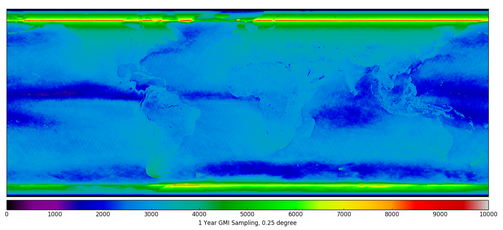
GMI/DPR Emissivity-sigma0 Databases

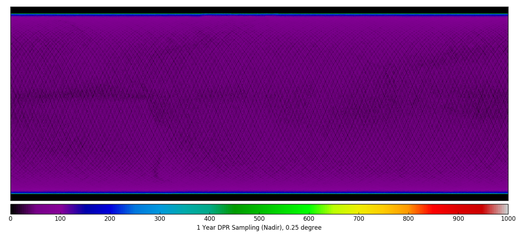
Full-Swath GMI

- Better sampling
- Land only
- Uses MERRA2 for T_{skin} and first-guess atmosphere profiles
- Cloud clearing from MERRA2



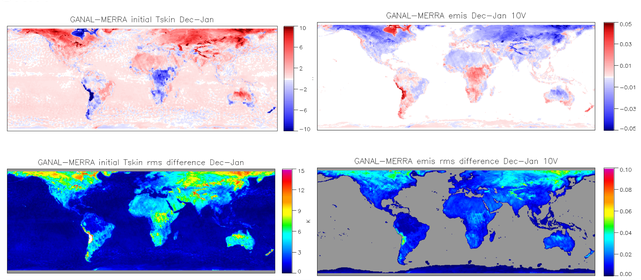
DPR Swath

- Limited sampling (especially at individual DPR angles)
- Land + ocean (for sigma0-wind model function development)
- Uses GANAL T_{skin} and first-guess atmosphere (for consistency with combined algorithm)
- Precip clearing from DPR and cloud clearing from MERRA2



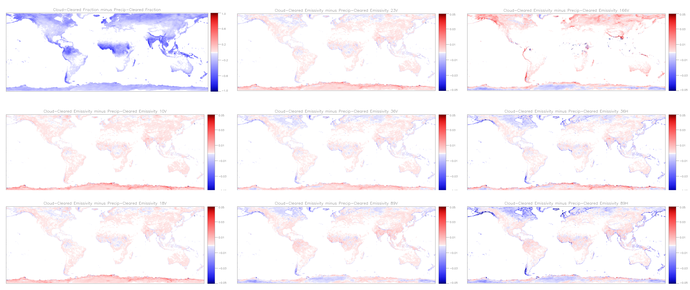
Effect of Differences in T_{skin} between MERRA2 and GANAL

The greatest source of uncertainty in the emissivity retrieval is the surface skin temperature, which must come from ancillary data since GPM does not have an IR instrument. MERRA2 and GANAL have systematic surface-dependent differences, particularly in the cold season. The GANAL surface model was also changed in March 2016, leading to a discontinuity affecting some GPM products.



Comparison of Cloud-Cleared and Precip-Cleared Emissivities

Another uncertainty in the emissivity database is the potential contamination from non-precipitating liquid clouds. These are difficult to detect directly over land from GMI data, so ancillary data (either geostationary satellite or reanlysis) must be used. MERRA2 indicates a signifant fraction of observations are effected by non-precipitating clouds in the tropics and high latitudes, and this has a significant impact on the retrieved emissivity at some frequencies.



Data availability: ftp://meso-a.gsfc.nasa.gov/pub/munchak/gpm/emis/

Phenomenological Classification

Snow-Free Surfaces

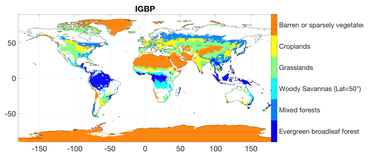
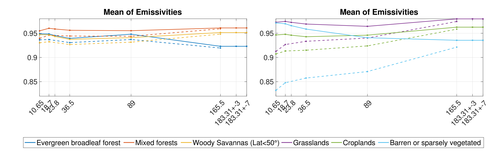
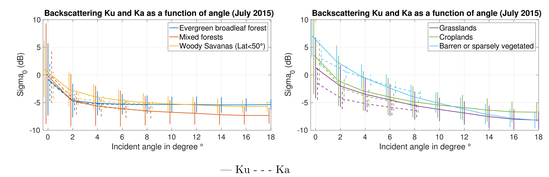


Figure 2.5 – The IGBP map





Snow-Covered Surfaces

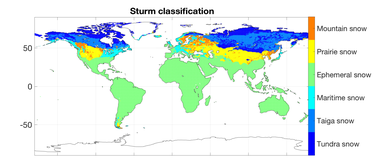
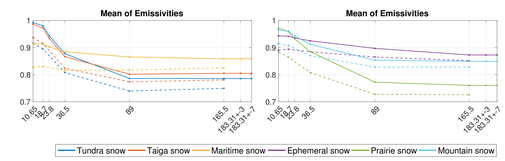
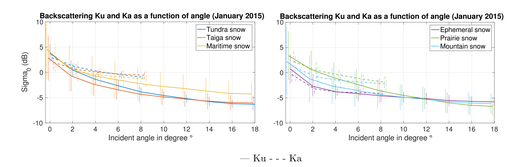


Figure 2.11 – Sturm snow classification.





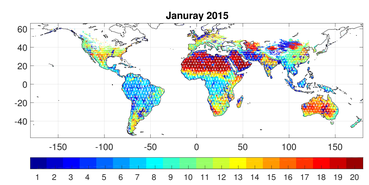


Figure 3.3 – Snow-free surface classification for January 2015

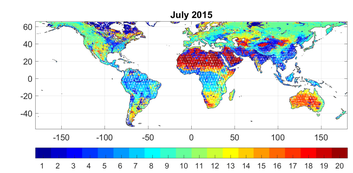
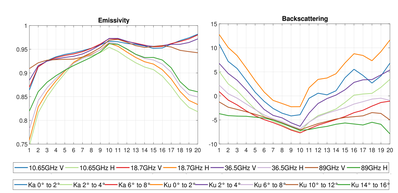


Figure 3.4 – Snow-free surface classification for July 2015



Kohonen Joint Classification

The gridded mean of emissivity and sigma0 was input to the unsuperivised Kohonen classification method to derive 20 snow-free and snow-covered classes. For snow free surfaces, these classes represent the gradual transition from low emissivity, high-polarization, strongly scattering surfaces representing wetlands and coasts to dense vegetation (low polarization, high emissivity, low backscatter), then to arid, low-vegetation regions. The snow-covered classes show the distinct nature of ice sheets (uniformly low emissivity) followed by dry snow (decreasing emissivity with frequency), wet snow with higher emissivities, and ephemeral snow with similar emissivity behavior to dry snow, but stronger backscatter.

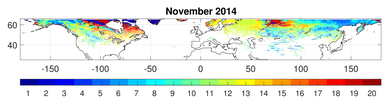


Figure 3.6 – Snow-covered surfaces classification for November 2014.

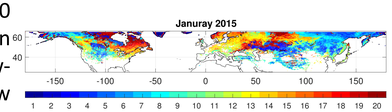


Figure 3.7 – Snow-covered surface classification for January 2015.

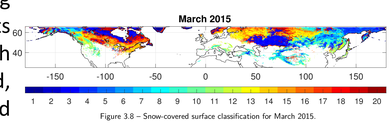
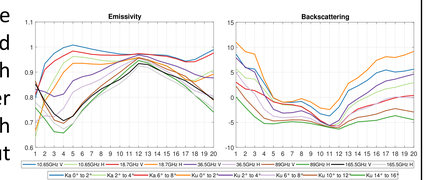



Figure 3.8 – Snow-covered surface classification for March 2015.