

# Mapping Surface Roughness and Snow Grain Size across Antarctica with MISR images ... a Work in Progress

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MISR is the Multi-angle Imaging SpectroRadiometer. This instrument was built at NASA Jet Propulsion Laboratory and is one of five scientific instruments aboard the EOS Terra satellite. It images Earth simultaneously from nine angles, collecting an image series of data along-track that can be used to distinguish different clouds, atmospheric particles, and land surface covers. For ice sheets, this angular information can be exploited to quantify surface roughness. The sensor has outstanding radiometric resolution (14-bits) in all bands, and the nadir camera provides this level of measurement for blue, green, red, and infrared channels. Thus a second application we are pursuing is a more accurate snow grain size mapping, building on previous work (Nolin et al., 2002; Nolin and Payne, 2007; Scambos and Bohlander, 2011). Both surface roughness and optical snow grain size have been shown to be related to climate condition and accumulation rate, particularly for East Antarctica.

We compute a normalized difference angular index from the 60° fore and 60° aft camera data. A previously completed pilot study (Scambos and Bohlander, 2011; see also Scambos et al., 2012) created a preliminary roughness mosaic of East Antarctica from this quantity. It revealed that seasonal variations in solar illumination geometry and the viewing geometry produce effects in addition to those of the actual roughness and grain size changes. The current project aims to examine seasonal variability of surface roughness and snow grain size distributions and adjust for varying illumination and viewing geometries. This starts with construction of several shorter-term (early summer, for example) regional MISR mosaics spaced throughout a summer season, each providing more of a “snapshot” of the ice sheet surface. Additionally we will use the MODIS Mosaic of Antarctica (MOA) grain size band to validate our grain size derivation from the MISR nadir camera data.

Ultimately our goal is to create separate mosaics for grain size and for surface roughness that will support investigations into the relationships between surface slope, wind direction and accumulation rate for East and West Antarctica. A. Nolin, F. Fetterer, and T. Scambos, 2002, “Surface Roughness Characterizations of Sea Ice and Ice Sheets: Case Studies With MISR Data”, IEEE Transactions on Geoscience and Remote Sensing, Vol. 40, No. 7, pp 1605-1615.

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