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DATA FUSION APPROACHES FOR CHARACTERIZING POLAR LANDSCAPES FROM REMOTELY SENSED DATA – CASE STUDIES FROM THE MCMURDO SOUND REGION

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Geomorphologic mapping and landscape interpretation provide key information toward understanding the climate, tectonic and volcanic evolution of the McMurdo Sound region. The main goals of the research presented here are combining pattern recognition and landscape analysis techniques for delineation of soil landscape units and other geomorphic features, inferring the physical properties and composition of the surface, and generating numerical measurements of geomorphic features from remotely sensed data. The sheer amount of data and the disparate data sets (e.g., LIDAR, stereo imagery, multi- and hyperspectral and SAR imagery) make the joint interpretation (fusion) a daunting task. However, new, interdisciplinary approaches benefiting from recent advances in photogrammetry, remote sensing and image understanding enable the reconstruction of past and present polar environments with unprecedented details and accuracy. Development of rigorous camera models, calibration methods and novel methods for sensor invariant registration of images, LIDAR data and topographic maps provide a uniform reference frame for change detection. The use of advanced pattern-recognition techniques greatly facilitates the delineation of different landscape units and the recognition and analysis of geomorphological features from the multisensor data sets. The McMurdo Sound region has been the focus of topographic, geologic, glaciological and soil mapping for many decades, making it an ideal site for validation of new approaches. In our study we combine the analysis of spectral and textural information from satellite and airborne imagery with spatial operations, such as morphological filtering and active contour modelling applied on high resolution DEMs, to delineate and characterize patterned ground. Other examples include the mapping of soil distribution and landscape units by using object-based contextual image classification of satellite imagery and high resolution DEMs, and the characterization of volcanic terrains by delineating lava flows and extracting morphometric information describing the shapes of volcanic cones.