

Surface Morphology Variations over Dome A due to Ice Sheet Bed-Surface-Atmosphere Interaction

*Indrani Das¹, Robin Bell¹, Michael Wolovick¹, Theodore Scambos², Timothy Creyts¹,
Nicholas Frearson¹*

¹ Lamont Doherty Earth Observatory, Palisades, NY

*² NSIDC, University of Colorado at Boulder, Boulder, Colorado
e-mail: indrani@ldeo.columbia.edu*

This paper uses high resolution lidar data with ice-penetrating radar profiles and other regional data sets to study surface morphology variations over Dome A. The ice surface over Dome A is influenced by both basal processes and atmosphere-surface interactions associated with variations in accumulation and ablation. Previous studies of this region with airborne ground penetrating radar have revealed interesting basal processes such as freeze-on plumes at the base of the ice sheet. The same radar images also revealed the presence of an unconformity in internal layers of ice, likely owing to a sharp change in surface accumulation pattern at the time of deposition. Using a surface roughness map derived from airborne lidar, we determine (by inference) the accumulation and ablation sites over this region, and compare those with RADARSAT backscatter data. Horizontal velocities of the internal layers are modeled to study the deformation of the internal layers and the ice surface over the freeze-on and unconformity. Surface roughness and traced isochrones are then used to study how these processes influence the surface morphology of the ice sheet. The study suggests that an interesting chain of processes may link both surface and basal features in this region.