LARISSA Glaciology – The Bruce Plateau Ice Cap: Ice Dynamics across the Antarctic Peninsula

Erin Pettit[1], Ted Scambos[2], Martin Truffer[3], Robert Bauer[2], Ellen Mosley-Thompson[4], Victor Zagorodnov[4], Terry Haran[2], Ronald Ross[5], Bryan Blair[6], and Ian Joughin[7]

[1]Department of Geology and Geophysics, University of Alaska Fairbanks, Fairbanks, AK, USA,
[2]CIRES, University of Colorado, Boulder, CO, USA,
[3]Geophysical Institute, University of Alaska Fairbanks, Fairbanks, AK, USA,
[4]BPRC, The Ohio State University, Columbus, OH, USA,
[5]Avega Systems, Sydney, NSW, Australia,
[6]NASA/GSFC, Greenbelt, MD, USA,
[7]University of Washington, Applied Physics Laboratory, Seattle, WA, USA

The Bruce Plateau is a broad, gently undulating ice plateau at 2000m elevation spanning the divide of the Antarctic Peninsula near 66^{o} S. The western side is the catchment area for the glaciers of inlet fjords such as Beascochea and Barilari Bays. The eastern side is the catchment area for the glaciers of the southern Larsen B Embayment and the northern Larsen C Ice Shelf. The LARISSA Project, an NSF-funded multi-disciplinary investigation of the region, has a series of observation sites located from the ice divide to the ice shelf: an ice core was drilled to bedrock in 2010 (447m of ice), instruments were installed on the Leppard and Flask Glaciers, and the Scar Inlet Ice Shelf of the southern Larsen B Embayment. We present the preliminary results of an observational and modeling analysis of the dynamics of the Bruce Plateau with respect to its role as the source region for the glaciers and ice shelves of the Larsen B Embayment and the western outlet fjords.

We use a suite of data from site installations and remote sensing efforts. Surface topography data are from NASA (including IceBridge Data) augmented with surface-based GPS profiles. We mapped bedrock and internal structure with a RES survey. We installed geophysical weather stations (AMIGOS) on Flask Glacier and the Scar Inlet Ice Shelf. On upper Leppard and Flask Glaciers we installed continuous GPS stations. We combined these surface velocity observations with InSAR-derived surface velocities.

Bedrock topography of the central Bruce Plateau near the ice core site consists of several hills with relief of several hundred meters. Ice thickness ranges from 200m above the hills to more than 700m deep in the troughs. The ice divide is up to 2 km to the west of the local bedrock divide. Accumulation at the ice core site ~1km east of the divide averaged ~2 m/yr between 1963 and 2010 (from beta radioactivity). Accumulation rates decrease by at least an order of magnitude towards the Larsen B Embayment. At the ice core site, mean annual temperature is -15.1^{o} C and the basal ice temperature is -11.2^{o} C.

Due to high accumulation rates, the Bruce Plateau ice slopes steeply from the divide and initiates channelized valley glacier flow within less than 5 km of the ice divide. The strong orographic precipitation pattern leads to steep, short glaciers ending in fjords on the warmer, wetter, western side of the Peninsula and more gently sloping, longer glaciers which end in ice shelves on the colder, drier, eastern side of the Peninsula. Recent warming and western-side sea ice loss has

likely led to increased accumulation rates on the western side of the Antarctic Peninsula. Our radar data suggest a recent (within the top 150 m of internal layering) westward migration of the crest of the ridge. We confirmed this with finite element modeling of divide migration in response to change in accumulation. The timescale for the response of the divide to changes in accumulation rate is 25 years.