Characterizing Precipitation and Accumulation Variability at Hercules Dome, Antarctica

David B. Reusch, University of Washington
Eric Steig, University of Washington
The Hercules Dome Team

Hercules Dome is an ice divide at the edge of the East Antarctic ice sheet, south of the Transantarctic Mountains at 86 °S, 105 °W, with optimal glaciological conditions for the recovery of a long, well-dated ice core. Understanding local variability of snow accumulation is an important step in interpreting ice core records, for regional context, to identify local patterns and to know where ice at depth originated. We explore the strengths/weaknesses of ice cores, ice-penetrating radar and meteorological forecast models for estimating precipitation and accumulation on varying time and space scales at this site.

Annual layering in the 2002 72-m US-ITASE ice core 02-4 indicates an accumulation rate of 0.12 m/yr ice equivalent over the last 300 years while nearby radio-echo sounding traverse data suggest 0.09-0.11 m/yr over the past 18,000 years (Jacobel et al, 2005 with revisions). Recent (2019/20) site selection radar data yield a 420-year average rate of ~0.11-0.14 m/yr (Fudge et al, 2022).

The Polar WRF-based Antarctic Mesoscale Prediction System (AMPS) archive provides 5+ years of operational meteorological forecasts at a spatial resolution (2.7 km) close to the feature scale of this region. ERA-5 provides a longer (40+ years), more consistent reanalysis dataset at a reduced scale (30 km). Neither of these models fully resolves site topography. Preliminary results indicate general agreement of model averages with prior glaciological/radar estimates. Additional analyses will investigate spatial and temporal variability in the model datasets.

Comprehensive understanding will require further meteorological modeling, processing of recent field-based datasets and synthesis of results.