Evaluating the Antarctic Observational Network with the Antarctic Mesoscale Prediction System (AMPS)

Karin A. Bumbaco[1], Gregory J. Hakim[2], Guillaume S. Mauger[1], Natalia Hryniw[2], Eric J. Steig[3]

1: Joint Institute for the Study of Atmosphere and Ocean, University of Washington, Seattle, WA.
2: Department of Atmospheric Sciences, University of Washington, Seattle, WA.
3: Department of Earth and Space Sciences, University of Washington, Seattle, WA.

Environmental observing networks are established for a wide variety of purposes, ranging from short-term weather forecasting to monitoring ecosystem change. Station site selection is typically made subjectively, which suggests that the monitoring goals for the network are not met optimally or cost effectively. Especially in Antarctica, where harsh weather conditions make it difficult to maintain stations, practical considerations have largely guided the development of the manned and automated weather station network. An evaluation of the current network coverage in Antarctica is discussed here as a precursor for optimal network design.

We use archived surface pressure and temperature observations and the archived 15 km Antarctica Mesoscale Prediction System (AMPS) 00Z analyses from October 1, 2008 through October 31, 2012 for our network evaluation. For validation, we compare the spatial autocorrelations represented by AMPS to those in the observations, and find good agreement. We separate the analysis into three regions: the Peninsula, west Antarctica, and east Antarctica and examine the representativeness of the network as a function of time scale and season. The variance explained by the network is determined by using the AMPS grid cells that correspond to the observing locations. Preliminary results show that in general the temperature and surface pressure correlation length scales are larger in summer (October-March) when compared to winter (April-September), except near the coast for temperature, which we hypothesize is due to the persistent winter katabatic winds producing downslope warming at the coastal stations. We also find that temperature correlation length scales tend to be longer in east Antarctica, implying that station placement there may be highly valuable depending on the monitoring goal. We find that there are large gaps in spatial coverage at daily time scales, in particular for temperature observations. Although still incomplete, coverage improves substantially for weekly and monthly averages.