18 years of Energy Balance Observations on Antarctica using Automatic Weather Stations

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Since 1995, the Institute for Marine and Atmospheric research, Utrecht (IMAU) operates Automatic Weather Stations (AWS) on Antarctica. A total of 17 stations of which three located on the Larsen ice shelf, one on Berkner Island, and 13 in Dronning Maud Land (DML), are or have been operational. The obtained records are fairly complete and between 4 and 14 years long. The observed quantities include air temperature, relative humidity, wind speed, air pressure and incoming and outgoing short- and longwave radiation. These data are used to calculate the surface turbulent heat fluxes and study the temporal and spatial variability of meteorological quantities and the surface energy budget. The turbulent heat fluxes are calculated using the aerodynamic 'bulk' method between a single AWS sensor level and the surface, where the surface temperature is calculated using a surface energy balance closure assumption for a surface skin layer.

At all sites the annual mean net radiation is negative and the near-surface air is on average stably stratified. The negative net radiative flux is largely balanced by a positive sensible heat flux. The latent heat flux is on average small and negative indicating a small net mass loss through sublimation. The spatial variations reflect differences in elevation, cloud cover and wind speed. The temporal variability on annual time scales is fairly similar from site to site. The three sites with the longest records (>8 years) show an increase in annual average temperature. The largest temperature change occurs in DML on the Plateau. For this station the annual mean fluxes also show a trend towards less negative net radiation, smaller sensible heat flux and larger latent heat flux. However, these trends are not significant.