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Turbulence and energy balance during summer in Dronning Maud Land, Antarctica

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Since 1997/1998 the Institute for Marine and Atmospheric sciences Utrecht (IMAU) has been operating Automatic Weather Stations (AWS) in western Dronning Maud Land, Antarctica. The data from the stations have a wide range of applications, from model validation, energy balance and mass balance calculations to supporting logistic operations. The instrumentation of an AWS consists of one level wind speed, temperature, humidity and radiation measurements. Accumulation is monitored by a sonic height ranger and sub-surface temperatures are measured at 5 levels. To aid the interpretation of the AWS data, a surf ce layer experiment was performed close to one of our AWS during the austral summer of 2006/2007. Detailed atmospheric surface layer measurements in the Antarctic region are very scarce and we present first results from our turbulence data and energy balances. An 11 m high profile mast with 6 wind speed and 5 temperature levels was installed together with a sonic anemometer. The snow surface surrounding our AWS is nearly flat, very smooth and uniform over at least 10 km. In the direction of the prevailing wind (North-East to East) the slope is about 0.8 degrees. The surface layer is in general neutral to moderately stable and the non-dimensional gradients for heat and momentum show surprisingly little scatter. Their non-linear behavior is conform well known functions adapted for very stable stratification. The turbulent energy flux ratios of the wind components and temperature are constant and behave well with relatively little scatter indicating the absence of low frequency contributions. The aerodynamic roughness length is very small and on average about 2x10-5 m. Using the above results, the surface energy balance is studied using the AWS data and a simple model.