Geophysical Research Abstracts,
Vol. 10, EGU2008-A-03211, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-03211
EGU General Assembly 2008

Study of the aerodynamic roughness length and the roughness length for temperature in the Antarctic sea ice zone

A. Weiss, J. King, T. Lachlan-Cope, R. Ladkin
British Antarctic Survey, High Cross, Madingley Road, Cambridge, England.

In the Antarctic sea ice zone the most important links between air, sea and ice are radiation and turbulent fluxes. Turbulent fluxes are commonly determined in numerical models by using a bulk parameterization. For an accurate determination of turbulent fluxes from bulk parameterization schemes the aerodynamic and scalar roughness length, respectively, have to be known. Due to the fact that the sea ice zone in the Antarctic is characterized by a strong heterogeneity, the roughness lengths are also strongly variable. In order to increase our knowledge of the aerodynamic roughness length and the roughness length for temperature of Antarctic sea ice a field study was conducted by the British Antarctic Survey. Atmospheric boundary layer parameters were collected over different sea ice conditions during two summer seasons by aircraft. First, on the basis of this data set, we determine typical values of both roughness lengths for various Antarctic sea ice types and atmospheric conditions. The values for the roughness length of sea ice show a large variation. In the Weddell sea, for example, we observed for pack ice a median effective aerodynamic roughness length of $z_0\_eff = 4.3 \times 10^{-4}$ m and a median effective temperature roughness length of $z_T\_eff = 5.3 \times 10^{-3}$ m; for newly formed Weddell Sea ice we observed a median value of $z_0\_eff = 2.3 \times 10^{-3}$ m and for the effective temperature roughness length a median value of $z_T\_eff = 7.2 \times 10^{-3}$ m. Our measurements shows that over newly formed ice, the values of $z_0_eff$and z_T_eff are often of same order of magnitude, like it is assumed in most models. However, this was not observed for the roughness lengths of multi-year pack ice. Secondly, we investigate in this study, which parameters and atmospheric conditions most influences the aerodynamic roughness length

and the temperature roughness length of sea ice. It was seen that in particular the friction velocity and atmospheric stability has a large impact on both roughness lengths of sea ice. Although, for newly formed ice and large friction velocities the roughness length for temperature shows a linear dependent on the temperature defect. Finally, we validated with our data existing roughness lengths models, which use the roughness Reynolds number for roughness length parameterizations. This validation shows which model reflects best our roughness lengths observations of Antarctic sea ice.