Geophysical Research Abstracts
Vol. 14, EGU2012-4288, 2012
EGU General Assembly 2012
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In situ measurements of TKE decay over sea-ice during evening transition using UAS.

P. Anderson
British Antarctic Survey, PSD, Cambridge, United Kingdom (philip.s.anderson@bas.ac.uk)

During the austral winter and spring of 2007, the British Antarctic Survey (BAS) and the Technical University of Braunschweig (TUB) collaborated to fly a suite of four Carolo T200 UAS over the Brunt Ice Shelf and Weddell Sea, Antarctica. The intended science goals were the investigation of fine-scale turbulence under stratified conditions (TUB) and the measurement of sensible heat fluxes over sea-ice (BAS). Both studies relied on a fast response turbulence sensors unit developed at TUB. The exacting demands of working during the polar wintertime highlighted the technical, logistics and human difficulties faced by such operations; however, viable data were gathered on turbulence characteristics during 20 flights, including four made off-station and over sea-ice.

This paper compares turbulence kinetic energy (TKE) profiles over sea-ice and shelf-ice for four flights, flown under two types of weather conditions. TKE_sea and TKE_shelf are similar for all occasions except during the "evening" transition: flights were made near equinox at 76 degrees South, and therefore experience solar diurnal variation. Time series of TKE measured at Halley, (TKE_Halley) some 20 km from the field site, shows expected reduction as sun angles reduced, and is in agreement with TKE_shelf. This is consistent with the existence of solar-driven weak, shallow convection over both shelf and sea.

TKE_ice shows a delay in reduction for one of the transition flights, that is, convective atmospheric turbulence over the sea-ice continues later than over the ice shelf. A number of possible mechanisms for this delay are discussed.