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Atmos. Chem. Phys., 10, 157-168, 2010

www.atmos-chem-phys.net/10/157/2010/

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The effect of misleading surface temperature estimations on the sensible heat fluxes at a high Arctic site – the Arctic Turbulence Experiment 2006 on Svalbard (ARCTEX-2006)

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Abstract. The observed rapid climate warming in the Arctic requires improvements in permafrost and carbon cycle monitoring, accomplished by setting up long-term observation sites with high-quality in-situ measurements of turbulent heat, water and carbon fluxes as well as soil physical parameters in Arctic landscapes. But accurate quantification and well adapted parameterizations of turbulent fluxes in polar environments presents fundamental problems in soil-snow-ice-vegetation-atmosphere interaction studies. One of these problems is the accurate estimation of the surface or aerodynamic temperature $T_{(0)}$ required to force most of the bulk aerodynamic formulae currently used. Results from the Arctic-Turbulence-Experiment (ARCTEX-2006) performed on Svalbard during the winter/spring transition 2006 helped to better understand the physical exchange and transport processes of energy. The existence of an atypical temperature profile close to the surface in the Arctic spring at Svalbard could be proven to be one of the major issues hindering estimation of the appropriate surface temperature. Thus, it is essential to adjust the set-up of measurement systems carefully when applying flux-gradient methods that are commonly used to force atmosphere-ocean/land-ice models. The results of a comparison of different sensible heat-flux parameterizations with direct measurements indicate that the use of a hydrodynamic three-layer temperature-profile model achieves the best fit and reproduces the temporal variability of the surface temperature better than other approaches.

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Citation: Lüers, J. and Bareiss, J.: The effect of misleading surface temperature estimations on the sensible heat fluxes at a high Arctic site – the Arctic Turbulence Experiment 2006 on Svalbard (ARCTEX-2006), Atmos. Chem. Phys., 10, 157-168, 2010. [Bibtex](#) [EndNote](#) [Reference Manager](#)



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