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The heat and gas exchange in the polar tundra
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Recent climate warming in the Arctic requires improvements in permafrost and carbon cycle monitoring, accomplished here by setting up long-term observation sites with high-quality in situ measurements of turbulent atmospheric energy fluxes applying the eddy covariance method. Eddy covariance measurements of energy and gas fluxes have been performed in Arctic (Tiksi) and Antarctic (King George island), a commonly occurring tundra ecosystem type in circumpolar middle and high Arctic areas, allowing for detailed investigations of relationships between energy fluxes and meteorological and soil physical characteristics.

Accurate quantification and well-adapted parameterizations of turbulent energy fluxes, e.g., during neutral to stable stratified conditions, are a fundamental problem in soil?snow?ice?vegetation?atmosphere interaction studies. We present results from our experiments performed during the summer in polar tundra regions that focus on data correction and quality assessment, on synoptic weather conditions, as well as site-specific micrometeorological features. A quality assessment and data correction adapted to the environmental conditions of polar regions demonstrates that specific measurement errors common at a high Arctic landscape could be minimized. Recommendations and improvements regarding the interpretation of eddy flux data as well as the arrangement of the instrumentation under polar distinct exchange conditions and (extreme) weather situations are presented.

Essential interannual variations of average energy exchange characteristics above different underlying surfaces due to variability of large-scale hydrometeorological conditions in the Arctic and Antarctic tundra regions are founded. Aerodynamic Drag coefficient and roughness parameter of the surface, influencing on energy exchange characteristics, are changed substantially in time and in space, and largely depend on the state of snow cover, the atmospheric stability, wind velocity and directions, variability of which is connected with the climatic situation. The data set are used to understand how the land surface and the atmosphere interact in terms of regional climate change. In addition, its are used to monitor how polar terrestrial ecosystem responds to the possible climate change.

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