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ATMOSPHERE-GROUND MODELLING OF FREEZE AND THAW PROCESSES IN PERMAFROST REGIONS

C. Hauck (1), C. Kneisel (2) and C. Kottmeier (1)

(1) Institute for Meteorology and Climate Research, University of Karlsruhe/Karlsruhe Research Center, Germany, (2) Department of Physical Geography, University of Würzburg, Germany, (hauck@imk.fzk.de)

The aim of this proposed project is to realistically simulate the water and energy exchange processes between atmosphere and ground in permafrost regions by using a coupled soil-atmosphere model system. The project will be focused on freezing and thawing processes of the ground, in particular permafrost degradation processes such as changes in the active layer thickness. The coupled model system consists of the non-hydrostatic mesoscale model KAMM (Karlsruhe Atmospheric Mesoscale Model) and the soil vegetation atmosphere transport (SVAT) model VEG3D, recently extended to incorporate explicit treatment of the snow cover evolution. In order to simulate the evolution of frozen ground and to address permafrost specific processes, the SVAT model has to be extended to incorporate the occurrence of frozen water. Parameterisations for processes associated with freezing and thawing, such as freezing point depression and changes in unfrozen water circulation will be included. Model validation will be performed using data sets from different permafrost sites, including monitoring data of ground temperature, soil water content and standard meteorological parameters. Model simulations will be conducted on different temporal and spatial scales, especially for comparative analyses of similar atmospheric episodes in different Arctic and Alpine regions.