Session: C5 Poster: M192B

Simulated future changes in Arctic air temperature of relevance for frozen ground conditions

Annette Rinke[†]; Heidrun Matthes; Jens Christensen; Peter Kuhry; Vladimir Romanovsky; Klaus Dethloff
[†] Alfred Wegener Institute for Polar and Marine Research, Germany
Leading author: Annette.Rinke@awi.de

The regional climate model HIRHAM with high horizontal resolution (25 km) is used to downscale 20-year-long time slices of present-day and future pan-Arctic climate, as simulated by the ECHAM5/MPI-OM general circulation model under the A1B emission scenario. The large magnitudes of the changes in simulated air temperature and derived indices at the end of the century indicate that a significant impact on the ground temperature can be expected. The projected warming of annual mean air temperature over land is up to 8 K. A decrease in freezing and increase in thawing degree days are interpreted as potential decrease in seasonal freeze depth and increase in active layer thickness (ALT). In relation to ALT changes specifically, future summer air temperature changes are quantified in more detail. Positive/negative maximum summer temperature changes are associated with increase/decrease of interannual temperature variability in summer. The occurrence of warm/cold summers and spells changes significantly in the future time slices using the present-day criteria for classification. The simulations emphasize the spatially non-uniform responses in these future changes. In addition to these aspects of the general warming trend that would promote an increase in ALT and a northward shift of the southern permafrost boundary, additional analyses of the occurrence of warm summers and spells using the mean conditions of the warmer climate in the future time slices highlight some particularly vulnerable regions for permafrost degradation (West Siberian Plain, Laptev Sea coast, Canadian Archipelago). Other regions show no such cumulative effects.