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Observed and simulated surface energy budget at Ny-Ålesund, Svalbard

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Located in the Arctic region, the Svalbard archipelago is projected to experience a significant warming over the 21st century with potentially large implications for the terrestrial cryosphere. With its large horizontal inhomogeneity, there is a need for high resolution modeling and process studies to quantify the role of the different processes governing the surface energy budget (SEB).

Observations and high resolution modeling with a numerical weather prediction model are combined to study the annual cycle of the SEB at a permafrost site near Ny-Ålesund, Svalbard. The observations (Westermann et al., 2009) include independent measurements of all components of the SEB (radiation, sensible and latent heat fluxes and ground heat flux) since March 2008, at a temporal resolution of one hour. By closing the SEB, and covering all seasons for several years, this data set is to our knowledge unique in the Arctic, where observations of SEB are in general sparse. For our model simulations we use the Weather Research and Forecast model (WRF), nested down to a 1 km horizontal resolution, and using high resolution data for topography, land use and sea surface temperature (SST), which could be of significance due to the high horizontal inhomogeneity in this region. Together, these observations and simulations enable detailed studies of the different processes important for the SEB. Especially, we investigate the effect of (i) clouds, which are important for the radiation budget, (ii) SST and sea ice, (iii) turbulent fluxes, and (iv) snow, especially how changes in snow cover during the polar day alters the SEB. In addition to the Ny-Ålesund data set, observations of radiation (four components), temperature, relative humidity and wind are available from an automatic weather station at Austfonna glacier, Nordaustlandet, which will be used for further model validation.

The presentation will cover on a one year period, emphasizing the different seasons and their different characteristic processes governing the SEB.