Land-atmosphere interactions associated with snow in a climate model

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Cold processes associated with snow cover strongly impact the quality of weather and climate prediction mainly due to the albedo and thermal insulation effects of the snowpack. The role of cold processes, associated with snow cover in controlling land-atmosphere interactions is assessed by performing climate simulations with the EC-EARTH model. A revised snow scheme was developed and tested in EC-EARTH. This improved the representation of the snowpack dynamics in the model and also near surface temperature simulations. The snow scheme was further developed to a multi-layer version that shows its potential in modeling thick snowpacks. A key process is the snow thermal insulation that leads to significant improvements of the surface water and energy balance components. A set of experiments with and without free snow evolution was carried out with EC-EARTH to assess the impact of interannual variability of snow cover on near surface and soil temperatures. It was found that snow cover interannual variability explains up to 60% of the total interannual variability of near surface temperature over snow covered regions. Although these findings are model dependent, the results show consistency with other works in the literature. Furthermore, the detailed validation of the snow dynamics simulations of EC-EARTH (snow cover and surface albedo) guarantees consistency of the results.