

Wind Effect on Snow Over Arctic Sea-ice: Evaluation of a Sea-ice / Snow / Blowing Snow Model System

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Blowing snow frequently occurs in the Arctic Ocean and Antarctica, transporting snow by saltation and suspension and yielding sublimation of snow particles. In this study, it is found that erosion due to blowing snow may account for snow depth overestimation in a multi-layer snow/sea ice coupled system. Atmospheric forcing measurements made during the Surface Heat Budget of the Arctic Ocean Experiment (SHEBA) were used to examine the effect of wind erosion on snow and ice evolution over the Arctic pack ice from October 1997 to October 1998. Total erosion due to blowing snow was found to be as large as 56 mm of snow water equivalent and was showed to strongly influence snowpack redistribution for the particular case under study. A sensitivity analysis of ice thickness has been also performed and revealed that ice depth depends on surface albedo, new snow density and thermal conductive fluxes at the ice/snow interface; results that are similar to those from a sensitivity analysis of snow depth. The snow/sea-ice coupled system was modified in order to account for wind erosion for low-level wind speed greater than 9 m/s. Results show that including blowing snow significantly improves the simulation of snow depth and of temperature at the snow/ice interface, but slightly degraded the simulated sea ice thickness. It also leads to other changes such as a decrease of snow temperature by an average of 0.87K and a decrease of snow depth by 4.93 cm on average. An overall effect is to shorten the duration of the snowpack and increase the underlying ice thickness.