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IMPACT OF SNOW COVER AND SEA ICE ON SUB-SEASONAL TO SEASONAL PREDICTIONS IN THE ARCTIC

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Surface conditions at high northern latitudes, such as snow cover or sea ice, act as a boundary forcing which influences not only local meteorological conditions, but also atmospheric teleconnections. We highlight recent results on modeling the impact of such boundary conditions on Arctic predictability on the sub-seasonal to seasonal time-scale, using the high-resolution coupled atmosphere-ocean ensemble seasonal prediction system of the European Centre for Medium-Range Weather Forecasts (ECMWF).

Many observational and model studies have indicated that the autumn Eurasian snow cover influences circulation patterns over high northern latitudes. We have performed a suite of forecasts to investigate the impact of snow initialisation on sub-seasonal forecasts, with a focus on the recent cold Eurasian winters (e.g. 2009/10). Pairs of two-month ensemble forecasts with either realistic or else “scrambled” snow initial conditions are used to demonstrate how the influence of an anomalously thick snowpack turns from an initial cooling over the continental land masses of Eurasia, to a dipolar pattern with warming over the Arctic and cooling over middle latitudes of Eurasia in association with an intensification and westward expansion of the Siberian High. The maintenance of a negative North Atlantic Oscillation phase is also seen, with enhanced vertical wave propagation into the stratosphere and deceleration of the polar night jet. These results also highlight the role of the stratosphere in mediating the rapid influence of the Eurasian snow cover into the Arctic and North Atlantic regions.

We draw a parallel with the warm Arctic/cold continent paradigm associated to sea ice melt, which can also be seen in simulations with the ECWWMF ensemble prediction system.