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Impact of snow initialization in coupled ocean-atmosphere seasonal forecasts

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The influence of the snowpack on wintertime atmospheric teleconnections has received renewed attention in recent years, partially for its potential impact on seasonal predictability. Many observational and model studies have indicated that the autumn Eurasian snow cover in particular, modulates circulation patterns over the North Pacific and North Atlantic, and may even condition the phase of the North Atlantic Oscillation (NAO) in the following winter. We have performed a suite of coupled ocean-atmosphere forecasts with the European Centre for Medium-Range Weather Forecasts (ECMWF) ensemble forecast system, to investigate the impact of accurate snow initialisation on the seasonal time scale. Pairs of two-month ensemble forecasts were started twice a month from October through December over the years 2004-2009, with either realistic initialization of snow variables based on re-analyses, or else with "scrambled" snow initial conditions from an alternate date or year. The impact of realistic snow initialization upon the forecast skill is estimated for various lead times. The influence of a thick snowpack on surface temperature turns from an initial cooling over the continental land masses of Eurasia and North America, to a dipolar pattern with warming over the Arctic and cooling over middle latitudes of Eurasia. This appears to be associated with an intensification and westward expansion of the Siberian High. A large and statistically significant surface temperature skill increment downstream of the snow-covered land masses, esp. over the Arctic and North Pacific at a 30-day lead time, is attributed to realistic snow initialization.