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Impact of snow initialization on sub-seasonal forecasts

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The influence of the snowpack on atmospheric teleconnections has received renewed attention in recent years, partially for its potential impact on sub-seasonal to seasonal predictability. Many observational and model studies have indicated that the autumn Eurasian snow cover in particular, influences circulation patterns over the North Pacific and North Atlantic.

We have performed a suite of coupled simulations with the ECMWF ensemble forecast system to investigate the impact of accurate snow initialisation on sub-seasonal forecasts, following the GLACE2 methodology but focusing on the impact of snow rather than soil moisture.

Pairs of two-month ensemble forecasts were run over the years 2004 to 2009, with either realistic initialization of snow variables, or else with "scrambled" snow initial conditions. Initially, the presence of a thicker snowpack cools surface temperature over the continental land masses of Eurasia and North America. At a longer lead of 30-day, it causes a warming over the Arctic and the high latitudes of Eurasia due to an intensification and westward expansion of the Siberian High. This "warm Arctic – cold continent" difference means that the forecasts of near-surface temperature with the more realistic snow initialization are in closer agreement with re-analyses over Eurasia, reducing a cold model bias over the Arctic and a warm model bias over mid-latitudes. We next focus on the cold winter of 2009/10 characterized by an exceptional negative NAO phase, and show that snow initialization reinforces the initial NAO anomaly.
The impact of the snowpack over the Himalaya-Tibet region in the springtime is also an area where better snow initialization could improve forecast, e.g. of the Indian summer monsoon. Some preliminary results are shown using the same approach as used for the autumn case.