



Seasonal to interannual potential predictability of high northern latitude climate

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A 350-year control integration and ensemble predictability simulations have been performed with the global coupled atmosphere ocean model ECHAM5/MPI-OM. The potential prognostic predictability, which is defined as the variance of the ensemble members over the variance of the control run is analyzed for different climate variables. Arctic sea ice thickness shows a high predictability in the first two years in most areas of the central Arctic and Canadian Archipelago. A large part of this predictability is due to the persistence of sea ice thickness. However, in an area from the Laptev Sea across the North Pole to Fram Strait and along the coast of eastern Greenland and in the Labrador Sea the persistence only explains a small part of the predictability. Advection of sea ice anomalies in the Transpolar Drift Stream to Fram Strait, anomalous sea ice exports through Fram Strait and the subsequent advection of this sea ice/freshwater anomaly into the Labrador Sea are responsible for this. The freshwater anomaly in the Labrador Sea reduces Labrador Sea convection, which has an impact on sea ice, air temperature and surface salinity in the Labrador Sea. Thus, the potential predictabilities of these parameters in the ensemble simulations largely exceed the predictability gained by the autocorrelation. The predictability of 2m air temperature is generally larger over sea than over land where a significant potential predictability hardly exists longer than half a year. Largest predictability of 2m air temperature is found between 40 and 60 degrees north both in the North Pacific and North Atlantic. Here, predictability is significant for several years. This is due to a combination of relatively high persistence and advection of sea surface temperature anomalies into these areas. Sea level pressure (SLP) shows a potential predictability of several months over the northern North Pacific and over Canada. SLP in the area of the Azores has a small predictability for several years. However, the North Atlantic Oscillation shows no significant predictability at seasonal to interannual timescales.