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Quantifying the potential to predict Arctic climate on seasonal to interannual time scales

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We characterise seasonal to interannual predictions of present-day Arctic climate, performed with several state-of-the-art global climate models (GCMs) under the perfect-model assumption.

Start dates are chosen to systematically sample different initial states of the Arctic, i.e. high versus low sea-ice coverage, and high versus low Atlantic heat transport.

We find predictive skill for key Arctic climate variables, such as sea-ice extent and volume, upper-ocean heat content, and surface air temperature, for lead times of up to three years.

The predictive skill achievable varies considerably both across initial states, and across different GCMs. While the former illustrates that predictability is state-dependent, the latter points towards deficiencies in the GCMs to consistently simulate the physical processes that determine Arctic predictability.

Since these results are obtained by assuming both an unbiased model and perfect knowledge of the initial conditions, they represent an absolute upper limit of predictive skill for the Arctic climate that we can achieve with the current generation of GCMs.