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Interannual Variability of Arctic Climate: Seasonal and Regional Disparities

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The future of year-to-year variability of Arctic climate change indicators such as sea ice and precipitation is still fairly uncertain. Alongside climatic changes in means, a thorough understanding of interannual variability (IAV) is needed to accurately distinguish between signal and underlying noise, as well as to describe the likelihood of extreme events.

In this study we quantify the IAV of Arctic surface air temperature, precipitation, evaporation, and sea ice area from 1851-2100 as a function of time in order to assess the effect of climate change on future variability. By influencing the likelihood of extreme events, changes in the magnitude of IAV can not only influence the surface mass balance of the Greenland Ice Sheet, but also affect regions in lower latitudes. Investigations of global climate model output strongly suggest that intermodel differences in CMIP6 projections of IAV are largely explained by natural variability versus model physics. Our results further highlight the need to distinguish between seasons as well as regions when investigating past, present and future states of IAV of Arctic climate. For example, increases in precipitation variability will become much more significant and intense in winter (after 2040) and most pronounced in coastal regions near the Bering Strait, the GrIS and the Norwegian Sea. Depending on the season, the retreat of sea ice can alter precipitation patterns through the process of enhanced evaporation over open ocean areas. Sea ice variability can therefore explain regional and seasonal changes of the Arctic water cycle, as it shifts from being snow- to rain-dominated.