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How predictable is a summer-ice free Arctic?

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There is large interest from different stakeholders in when we will first see a summer ice-free Arctic Ocean. However, while the CMIP5 models agree that we will see a further decline of the Arctic sea ice cover over the 21st century, their projections of when an ice-free Arctic will occur has a range of over 100 years for even the strongest forcing scenario, the RCP8.5. A large part of this uncertainty stems from model biases in the simulation of Arctic sea ice in some models. But apart from this bias, how predictable is the Arctic sea ice extent and the timing of the first ice-free Arctic summer in general? Using the Community Earth System Model (CESM) large ensemble with 40+ members for RCP8.5 and the CESM medium ensemble with 15 members for RCP4.5, we will show that internal variability leads to a range of $\sim$20 years for predictions of threshold crossing of Arctic sea ice, limiting the long-term predictability of when an ice-free Arctic Ocean can first be expected. A detailed analysis of the trajectories of the individual ensemble members will reveal whether there are features of the climate system that allow an improvement of this predictability as we get closer to a summer ice-free Arctic.