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Predictability of Arctic Temperatures from Observational Data and Model Simulations
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Low-frequency variations and secular trends offer the potential for predictability of Arctic temperatures over timescales from months to decades. Here we consider the effects of natural variability and trends together by asking the question ”What is the probability that the next N-year period will be warmer than the preceding N-year period?”. We compute the probabilities as a function of N based on observational data from particular Arctic stations and corresponding climate model grid cells, as well as from areal averages derived from observational data and model output. The model output is from the Community Climate System Model, Version 4 (CCSM4). The probability generally increases from about 50% for N=1 to 60-90% for N˜20-30 in both the observational data and the model results, implying a greater predictability of longer-term averages. The North Atlantic subarctic shows less predictability of this kind than do other sectors of the Arctic. However, the increase with N is smaller in observational data than in the corresponding model output, and smaller for local temperatures than for areal averages. The implication is that the natural variability is smaller relative to the trend in the model output. All ensemble members of the 20th-Century simulations by CCSM4 show this behavior. Similar results based on sea level pressures indicate that the atmospheric circulation, through its advective driving of temperature variations, is the reason for the discrepancy in temperature predictability. Not surprisingly, sea ice variations show similar increases of predictability with N as the effect of the trend eventually outweighs the effect of natural variability. However, even over decadal timescales, there are substantial probabilities that sea ice extent will increase, as shown by similar examinations of sea ice output from CCSM4 in other studies.

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