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Sea ice change in the 21st century: are we getting more certain?

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Complex and still insufficiently understood climate processes and feedbacks involving sea ice contribute significantly to the challenge that the polar regions pose from the viewpoint of physically-based climate prediction. This challenge makes itself particularly evident in the range of sea ice projections by state-of-the-art global climate models, even for the same scenarios of anthropogenic radiative forcing. Sea ice prediction (as well as detection and attribution of the observed sea ice change in the polar regions) is further complicated by the vigorous unforced natural variability inherent to the climate system in high latitudes that may amplify or mask the anthropogenic signal. Being a product of air-sea interaction, sea ice simulated by climate models carries the burden of systematic errors in simulation of both the atmospheric and the oceanic general circulations in high latitudes. Hopes for decreasing sea ice prediction uncertainties, as well as for better quantifying regional and global impacts of sea ice changes, are pinned on enhancing and synthesizing remote and in situ observational networks and high performance computing. Meaningful prediction/projection of the sea ice conditions in the both hemispheres for the coming decades and beyond requires determining priorities for observations and model development, evaluation of the ability of climate models to reproduce the observed sea ice behavior as a part of the broader climate system, improved quantification of the interplay of the forced and unforced aspects of the sea ice change, and improved understanding of the predictability of sea ice conditions on seasonal through centennial time scales in the wider context of the polar climate predictability.