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## Making informed use of observations and climate models to advance understanding of past and future sea ice changes

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Polar Regions are viewed by many as "observational deserts", as in-situ measurements there are indeed scarce relative to other regions. The increasing availability of satellite observations does not entirely solve the problem, due to persistent uncertainties in the derived products. Climate models have been instrumental in completing the big picture, but they are themselves subject to errors, some of which are systematic. How to take advantage of the respective strengths of observations and models, while minimizing their respective weaknesses? To illustrate this point, I will discuss how recent advances in data assimilation, model evaluation, and numerical modeling have enabled progress on addressing important questions in polar research, such as: what are the causes of the recent Antarctic sea ice variability? What might the future of Arctic sea ice look like? How to improve the skill of seasonal sea ice predictions? How should the existing observational network be improved at high latitudes? What are the priorities in terms of modeling? By running through these cases, I will provide support for the emerging hypothesis that "the whole is greater than the sum of its parts": treating observations and climate models as two noisy instances of the same, unknown truth, gives access to answers that would not have been possible using each source separately.