



## **A model reconstruction of the Antarctic sea ice thickness and volume changes over the past decades using data assimilation**

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Sea ice variability in the Southern Ocean has a complex spatio-temporal structure. In a global warming context, the Antarctic sea ice cover has slightly expanded over the recent decades. This increase in sea ice extent results, however, from the sum of positive and negative regional trends and is influenced by a wide range of modes of climate variability. An additional view on sea ice thickness and volume changes would improve our understanding. Still, no large-scale multi-decadal well-sampled record of Antarctic sea ice thickness exists to date. To address this issue, we assimilate real sea ice concentration data into the ocean–sea ice model NEMO-LIM2 using an ensemble Kalman filter and demonstrate the positive impacts on the global sea ice cover. We find that the global Antarctic sea ice volume has risen at a significant pace over the period 1980-2008, with an increase in the Ross and Weddell Seas and a decrease in the Amundsen-Bellinghousen Seas. Sea ice volume anomalies co-vary well with extent anomalies, and exhibit yearly to decadal fluctuations. The results stress the need to analyze sea ice changes at the regional level first and then at the hemispheric level.