

EGU23-8780, updated on 21 Apr 2024

<https://doi.org/10.5194/egusphere-egu23-8780>

EGU General Assembly 2023

© Author(s) 2024. This work is distributed under the Creative Commons Attribution 4.0 License.



Arctic and Antarctic sea ice thickness and volume changes during the last 29 years from satellites

Marion Bocquet¹, Sara Fleury¹, Frédérique Rémy¹, Florent Garnier¹, and Thomas Moreau²

¹LEGOS, Université de Toulouse, CNES, CNRS, IRD, UPS, Toulouse, France, Toulouse, France

²Collecte Localisation Satellites (CLS), Toulouse, France

Sea ice is both a key witness and driver of climate change. While sea ice extent and area is well described with observations during the last four decades, sea ice thickness and volumes changes remain poorly known. However, thickness is a mandatory variable to fully understand the past, present and future changes of sea ice. Despite improvements in sea ice thickness estimation from altimetry during the past few years thanks to SAR and laser altimetry, former radar altimetry missions such as Envisat and especially ERS-1 and ERS-2 have remained under exploited so far. ERS-2 arctic sea ice thickness has been recently retrieved thanks to a machine learning approach aiming at calibrating ERS-2 and Envisat against CryoSat-2. We are now able to extend the time series from ERS-1 for both polar oceans, allowing to propose a 29 years-long sea ice thickness and volume time series. Estimates are combined with uncertainties derived from a Monte Carlo methodology. Nearly 30 years of sea ice volume time series reveals that Arctic sea ice is melting by $120 \pm 45 \text{ km}^3/\text{year}$ up to 81.5°N ($-13.1 \pm 5.1 \text{ \%/decade}$). Antarctic sea ice evolution has no significant trends along the whole period, but a volume drop is observed since 2016. For both hemispheres, prominent regional changes have been identified with a strong heterogeneity of trends across regions. Finally, comparisons between observations and models show increasing negative bias while going back in time.