EGU21-10607
https://doi.org/10.5194/egusphere-egu21-10607
EGU General Assembly 2021

Sea ice deformation and thickness in the Western Ross Sea

Wolfgang Rack et al.

Sea ice cover is arguably the longest and best observed climate variable from space, with over four decades of highly reliable daily records of extent in both hemispheres. In Antarctica, a slight positive decadal trend in sea ice cover is driven by changes in the western Ross Sea, where a variation in weather patterns over the wider region forced a change in meridional winds. The distinguishing wind driven sea ice process in the western Ross Sea is the regular occurrence of the Ross Sea, McMurdo Sound, and Terra Nova Bay polynyas. Trends in sea ice volume and mass in this area unknown, because ice thickness and dynamics are particularly hard to measure.

Here we present the first comprehensive and direct assessment of large-scale sea-ice thickness distribution in the western Ross Sea. Using an airborne electromagnetic induction (AEM) ice thickness sensor towed by a fixed wing aircraft (Basler BT-67), we observed in November 2017 over a distance of 800 km significantly thicker ice than expected from thermodynamic growth alone. By means of time series of satellite images and wind data we relate the observed thickness distribution to satellite derived ice dynamics and wind data. Strong southerly winds with speeds of up to 25 ms^{-1} in early October deformed the pack ice, which was surveyed more than a month later.

We found strongly deformed ice with a mean and maximum thickness of 2.0 and 15.6 m, respectively. Sea-ice thickness gradients are highest within 100-200 km of polynyas, where the mean thickness of the thickest 10% of ice is 7.6 m. From comparison with aerial photographs and satellite images we conclude that ice preferentially grows in deformational ridges; about 43% of the sea ice volume in the area between McMurdo Sound and Terra Nova Bay is concentrated in more than 3 m thick ridges which cover about 15% of the surveyed area. Overall, 80% of the ice was found to be heavily deformed and concentrated in ridges up to 11.8 m thick.

Our observations hold a link between wind driven ice dynamics and the ice mass exported from the western Ross Sea. The sea ice statistics highlighted in this contribution forms a basis for improved satellite derived mass balance assessments and the evaluation of sea ice simulations.

How to cite: Rack, W., Price, D., Haas, C., Langhorne, P. J., and Leonard, G. H.: Sea ice deformation and thickness in the Western Ross Sea, EGU General Assembly 2021, online, 19–30 Apr 2021, EGU21-10607, https://doi.org/10.5194/egusphere-egu21-10607, 2021.

Displays

Display file