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Attenuation of surface waves in the Antarctic marginal ice zone from in-situ measurements

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Antarctic sea ice has an important impact on the global climate, affecting albedo, global circulation and heat- and gas exchange between the ocean and the atmosphere. Wave energy propagating into the sea ice can affect the quality and extent of the sea ice, and wave attenuation in sea ice is therefore an important factor for understanding changes in the ice cover. Yet in-situ observations of wave activity in the Antarctic marginal ice zone are scarce, due to the extreme conditions of the region.

We estimate attenuation of significant wave height in the Antarctic marginal ice zone using in-situ data from two drifting Surface Wave Instrument Float with Tracking (SWIFT) buoys deployed in the Southern Ocean for two days in the Antarctic winter and two weeks in the Antarctic spring. The buoy location ranges from open water to more than 200 km into the sea ice. The extent of the sea ice coverage is determined using satellite sea ice concentration from AMSR-E and SAR imagery from Sentinel-1. Waves were observed more than 150 km into the sea ice, and in higher than 85 % sea ice concentration. Significant wave height and wave direction measured by the buoys in open water agreed well with ERA5 reanalysis data. We find that the significant wave height decayed exponentially in sea ice, which is consistent with physical experiments and other field observations in the Arctic and Antarctic marginal ice zones.