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The impact of Arctic sea ice cover on seasonal modulation of the M₂ tide

Inger Bij de Vaate^{1,3}, Amey Vasulkar^{3,2}, Cornelis Slobbe¹, and Martin Verlaan^{3,2}

¹Civil Engineering and Geosciences, Technical University of Delft, Netherlands

²Delft Institute of Applied Mathematics, Technical University of Delft, Netherlands

³Deltares, Delft, Netherlands

The impact of Arctic sea ice decline on future global tidal and storm surge extreme water levels is unknown. Regional studies show that the impact can be substantial; causing increased erosion and posing higher risks to fragile Arctic ecosystems in low-lying areas. Since Arctic tides and surges influence global water levels, consequences of Arctic sea ice decline will be noticed across the globe. In the ongoing FAST4NI project, an Arctic Total Water Level model will be used to quantify this impact. The model will be developed as an extension of the operational Global Tide and Surge Model (GTSM) and includes the effect of sea ice on tides.

Here we present the results of a study on the seasonal variability of the M₂ tide with respect to differences in sea ice cover. The effect of sea ice on the M₂ amplitude was modelled for minimal and maximal sea ice configurations. In addition, tidal harmonic analysis was performed on a global tide gauge data set, supplemented by SAR altimeter derived water levels from the Arctic region. The high along-track resolution of SAR altimeters (300 m) enables to derive water levels from leads in the sea ice. Here, the retrieved sea surface heights within a given region were stacked, in order to obtain a sufficiently large data set for analysis of the predominantly ice-covered areas. This allowed to gain insight in the seasonal modulation of both local and global tides and directly relate these processes to variations in sea ice.

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