

Antarctic sea-ice lead frequencies and regional distribution from MODIS satellite imagery

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Sea-ice leads are elongated cracks within the pack ice more than 50 m in width and up to several hundreds of kilometers in length. Since sea-ice leads interact with the atmospheric boundary layer and the ocean, it is crucial to specify their temporal and spatial distribution. Leads influence e.g. the fluxes of moisture and sensible heat from the ocean to the atmosphere and contribute to the ice production. They are primarily caused by mechanical forcing by ocean currents and wind stress. Consequently, they are short-lived and non-stationary objects.

The characteristics of leads require a temporally and spatially accurate monitoring. The new version 6 of the satellite thermal imagery from the Moderate Resolution Imaging Spectroradiometer (MODIS) sensor is used to produce daily potential lead maps for the entire Southern Ocean at a spatial resolution of 1.5 km. Data are analyzed for the winter periods April to October for the period 2002 to 2018. Hence, the lead retrieval algorithm introduced by Willmes and Heinemann (2015) is adapted to the southern hemisphere.

The new data of daily leads suggest a high influence of near-surface ocean currents, namely the Antarctic currents at the shelf breaks. Possible links to bathymetrically induced upwelling are also addressed since the location of the shelf breaks agrees with an increased overall lead frequency. Therefore, our newly retrieved lead data set is brought into context with recent results from oceanography.

Moreover, the daily maps of leads can be used for further analysis e.g. the investigation of the structure of wintertime sea-ice leads. Furthermore, our data can be included in sea-ice/ocean and climate models to better describe the sea-ice dynamics.