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Weather situation in observed ship-icing events

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This study highlights the risk of ice build-up for ships operating in a cold marine climate. Usually, predictions of ship icing are based on the modelling of the heat fluxes capable of freezing sea water originated from wave-ship interactions. In this study, on the other hand, a different and more general approach is followed by investigating the relationship between the weather situation and icing both using historical data from ships operating in the waters between Norway and Svalbard, and by applying upper-air parameters derived from NOrwegian ReAnalysis 10 km data (NORA10). A total of more than 1500 ship observations are applied in the study including both icing and no-icing events from 17 different ships. It is demonstrated that cold-air outbreak from the ice-covered ocean areas is the dominant weather situation during icing. However, around 10% of the events occur during cold-air outbreak mountain-wave situations. This is weather situations where a statically stable layer is present near the mountain top in a cross-barrier flow, resulting in gravity waves propagating both vertically and horizontally away from the barrier leading to downslope windstorm and foehn adiabatic warming on the lee-side of the barrier where the ships are present. Moreover, it is shown that snow showers and frontal snow, increase the risk of icing by using logistic regression regardless of the synoptic-scale weather situation. Finally, a simple model applying the temperature and temperature anomaly at 850 hPa is found to be more accurate than methods based on temperature and wind close to the surface. Thus, there is a potential for more accurate predictions of icing in the medium range by applying such upper-air parameters than by using the more traditional parameters near the surface.