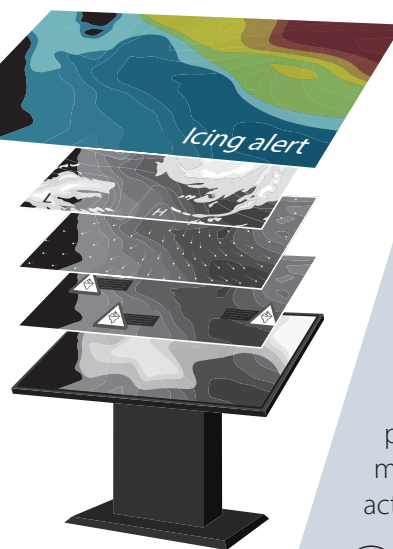
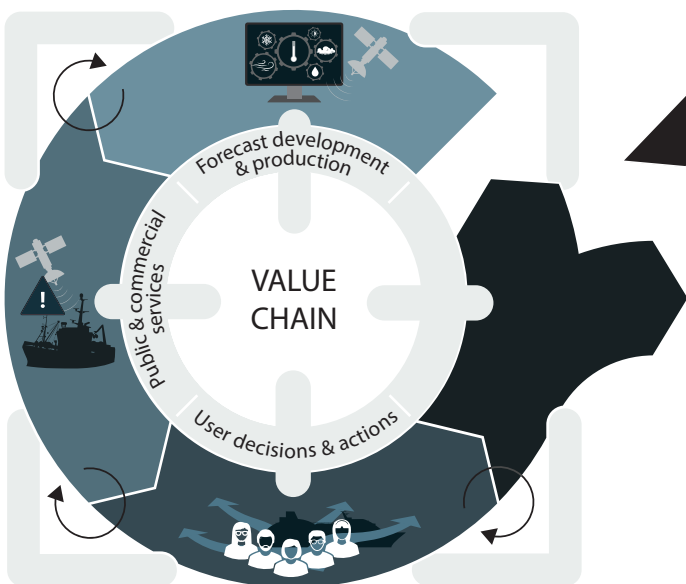



This policy brief outlines the findings of the FOCUS project involving meteorologists, oceanographers, social scientists, and industry experts to explore the challenges and prospects of utilizing uncertainty information in Arctic maritime operations. This co-production approach resulted in an advanced understanding of the provision of uncertainty information and in the actual integration of novel forecasting products in existing maritime sector information platforms of the Norwegian Meteorological Institute and e-navigation company NAVTOR.



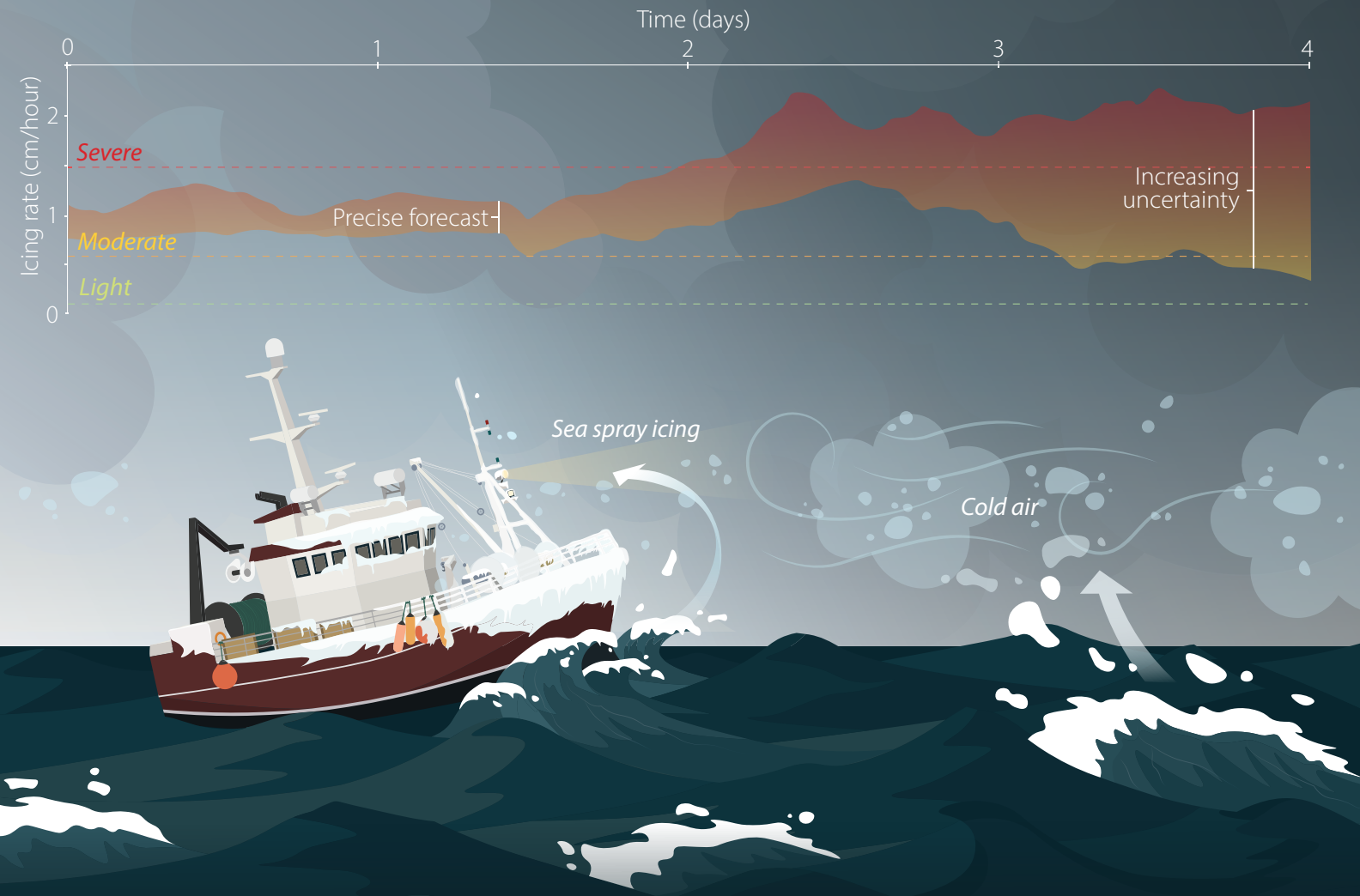
The provision of actionable forecasts requires genuine and long-term collaboration between different scientific disciplines, as well as providers and users of these forecasts. Through our joint experience in the FOCUS project, we are convinced that transdisciplinary collaboration facilitates learning across the value chain, and is an essential prerequisite for making forecasts more accurate, useful, and actionable.

 *Feedback, meetings, workshops, stakeholder engagement*

The potential of uncertainty-based forecast products is not realized currently

The Arctic environment is characterized by the interplay of atmospheric conditions, ocean and wave dynamics and sea-ice movements. Developing coupled forecasting models that account for these interactions is essential to accurately predict, for example, sea-spray icing (see below) and its related uncertainties. The presentation of the uncertainties is not only a forecasting challenge, but also a behavioral, cognitive and institutional challenge.

High quality forecast information is not yet translated and transferred into actionable services for the maritime sector operating in challenging Arctic conditions. Uncertainties are often presented in complex messages that can easily lead to misinterpretation by maritime users. In such case, negative user experiences will lead to mistrust in forecast information, or even in decision support tools in general. There does not exist a one-size-fits-all solution, and there is a need to develop information interfaces that are tailored for use in specific contexts.



Sea-spray icing occurs with cold winds across open water. It leads to tiny water droplets in the air freezing to cold surfaces on ships or other structures and forming a layer of ice. This accumulation can affect the performance of equipment and, in the worst-case scenario, the capsizing of the vessel.

KEY RECOMMENDATIONS

- **Forecast providers** should provide uncertainty information in consistent and intuitive colour schemes, and actively engage with user groups and social science in co-production;
- **Maritime sectors** should integrate forecast uncertainties in e-navigation tools as an essential part of strategies towards safety and environmental sustainability in shipping;
- **Policy makers** should ensure that probability-based forecast information becomes more explicitly part of Arctic maritime regulations, such as the Polar Code;
- **Funding agencies** should ensure a more enabling institutional environment with regard to funding, to allow for interdisciplinary and transdisciplinary co-production processes, experimentation, education and training.

