A novel approach in probabilistic quantification of risks within the context of maritime supply chain: The case of extreme weather events in the Arctic.

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Abstract: Extreme Weather Events (EWEs) are currently not well understood by the maritime community, even though the shipping industry is not immune to their potential disastrous consequences. This is critical for the Arctic supply chains, considering the serious lack of experience, data, communication facilities, and that rules and regulations governing the region are at the embryonic stage. Understanding such, the study develops an effective risk assessment model in the context of the maritime supply chain and quantifies the risks associated with EWEs in the Arctic. The model is developed based on a Bayesian Belief Network (BBN) that reflects a probabilistic risk priority index based on Failure Mode, Effects and Criticality Analysis (FMEA). Here, we introduce a new index, based on a weighted combination of the likelihood, visibility, and consequence of risk factors. The model is quantified by 51 respondents based on their sailing experience with cargo carriers along the Northwest Passage. Our findings suggest that dense fog and ice accretion are distinctly critical risk factors followed by thunderstorm, hail and/or waterspouts, extreme coldness, and blizzard. The study offers useful insight to all right- and stakeholders in the Arctic. Moreover, it presents an effective tool to develop high-resolution maps for maritime routes considering important shipping elements.

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