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A hydrographic risk assessment methodology integrating the user's preferences: application to a use-case in the English Channel

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Abstract

The Shom (French hydrographic and oceanographic service) is in charge of describing the physical marine environment in its relationship with the atmosphere, the seafloor and coastal areas, and to predict its evolution. The main objective of its mission is the dissemination of all nautical information that guarantees safe navigation, mainly in the form of nautical charts. Given the extent of the area to be covered, a global assessment methodology for navigational risk appears to be essential to evaluate cartographic needs in an exhaustive and rational way, and to prioritize the hydrographic surveys to be carried out.

A risk is usually evaluated according to three main factors: a hazard, its probability of occurrence, and its severity of consequences. In the context of marine traffic, the hazard is represented by ship accidents. The probability of an accident depends on many criteria (seabed morphology, reliability of the hydrographic data, presence of dangerous zones, traffic, ...). An accident can have several consequences (marine pollution, economic losses, ...) which are again rated according to several criteria (proximity of a protected site, ...).

To evaluate this navigational risk, the "Land Information New Zealand" (LINZ) has proposed the "New Zealand Hydrographic Risk Assessment" methodology, based on multiple aggregations through weighted sums, to estimate the probability of an accident and a score of the consequences of an accident. This risk score is then used to plan hydrographic survey campaigns, which should focus on high risk zones first. One of the drawbacks of this method is the somewhat arbitrary setting of the weights of these criteria, as well as the little information that is provided by the synthesized risk score.

We therefore propose in this work, to integrate a Multi-Criteria Decision Aiding technique (MR-Sort) into the "New Zealand Hydrographic Risk Assessment" methodology, in order to model the priorities of the end user more accurately, and to ensure greater explainability of the risk level. This should increase the user's confidence in the final recommendation, and allow the planning of hydrographic survey campaigns in a way that is more faithful to his / her priorities.

We demonstrate the interest of our approach on a use-case in the English Channel, implemented in the deSEAsion geographical decision support tool, and compare the outputs of the original methodology and of our modified version.

Keywords

risk assessment, hydrographic survey, MR-Sort, deSEAsion decision support tool