On the Use of AIS and Meteorological Data to Identify Adrift Ships and Extrapolate their Drift Characteristics

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Thomas Ackermann*[1], Sami Kaidi[1], Philippe Sergent[1] and Emmanuel Lefrançois[2]
[1] CEREMA, Direction Technique Risques, Eau et Mer
134 Rue de Beauvais, 60280 Margny-lès-Compiègne, France
Email : thomas.ackermann@cerema.fr ; sami.kaidi@cerema.fr ; philippe.sergent@cerema.fr
[2] Université de Technologie de Compiègne (UTC), Laboratoire Roberval
Centre de Recherches de Royallieu, 60200 Compiègne, France
Email : emmanuel.lefrancois@utc.fr

ABSTRACT

Apart from 2009 and 2020, the international maritime trade has been constantly growing for the last 50 years and is now accounting for 80% of the volume of international trade [1]. This leads to ever more ships at sea, increasing the need for efficient tools to monitor traffic and detect anomalies. One such tool is the Automatic Identification System (AIS) [2]. The wealth of information that constitutes AIS database has been used extensively to produce approaches for anomaly detection [3]. A specific type of anomaly that can be of interest is a ship going adrift. Spotting a ship adrift is important if it does not signal itself rapidly. It can then be useful to be able to predict its trajectory, especially in regions with intense maritime traffic. The method commonly used to predict the trajectory of a drifting object is based on the use of object-specific drift coefficients in addition to wind and current field [4]. However, such coefficients are obtained through field study and are not readily available for large size ships.

We thus propose a method to identify a ship going adrift based on its AIS data and to then use these AIS data together with meteorological data to determine the ship drift characteristics.

Of the many studies regarding AIS based anomaly detection, none considered ships adrift as a specific category of anomaly. Depending on the case it would fall under a broader category such as route deviation or zone entry. To determine a specific AIS signature corresponding to a drifting ship we used AIS data from the SPATIONAV database and intervention report from the various French rescue centres to generate a reference base. Two approaches were then tested. The first was based on simple pre-processing using threshold rules on certain parameters such as speed and drift angle completed by manual validation. The second was based on a neural network trained using the reference base previously generated. Both methods gave pertinent results, with the neural network achieving over 90% correct identification on a carefully constructed database. Application on a less refined database was less successful in part due to false positive and the need to manually check the results.

The AIS data corresponding to periods of time where a ship was adrift were then used alongside current data from the HYCOM3D model and wind data from the AROME model to determine drift characteristics. This was done in a similar fashion to what Breivik et al. [4] did, with model and AIS data instead of direct measurement. The results obtained were not satisfactory. Although they were of the magnitude expected, the dispersion was too important. We believe it was due to issues in the way the current was accounted for.

Overall, we believe that this method is worth exploring further as it might provide valuable data regarding the drift of large ships.

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