Natural Hazards
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Discussions

Interactive comment on "Safe-economical route model of a ship to avoid tropical cyclones using dynamic forecast environment" *by* L. Wu et al.

Anonymous Referee #1

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General Comments —————-

The manuscript "Safe-economic route model of a ship to avoid tropical cyclones using dynamic forecast environment" describes a novel method to design ship routes that are optimized to avoid tropical cyclones at an acceptable level of risk for capsizing while minimizing the added cost. The main new element of the suggested method when compared with standard methods is the inclusion of specific ship and cargo characteristics, hence the optimal route will not necessarily be identical for different ships. While it is reasonable to assume that route design could be improved by taking into account these elements, it becomes more difficult to evaluate the result in a general setting. The authors include an example where the method is used under realistic conditions, which can be viewed as a "proof-of-concept", but only to a limited extent achieves to

demonstrate the advantages and shortcomings of the method. This is the main weakness of the paper, and should be addressed more carefully in order to improve the scientific quality of the paper.

There also seems to be a substantial overlap between the content in this paper and Wu et al. (2013), including several of the figures. Some differences are mentioned at the end of the introduction, but the authors need to make clear exactly what is new and what is based on previous results in the present paper. I also find it strange that the authors do not comment on how the results obtained in this paper compares with results from Wu et al. (2013).

In my opinion the results presented in this paper needs to be substantially expanded in order to warrant publication, and I would therefore recommend the paper to be rejected.

Comments to specific sections ——————————

The title and abstract adequately reflects the contents of the paper, and is easy to understand for a wide audience.

The introduction summarizes the available methods and present day practices used for weather routing and in particular avoidance of tropical cyclones. The number of references seems to be adequate, although several of them are only available in Chinese and therefore not easily accessible for an international audience. The authors should, if possible, replace these references with articles published in international journals.

Three different TC avoidance methods are mentioned in the introduction without much additional description. It is necessary to at least describe the concept behind the "sector diagram typhoon avoidance method", as this is used as a reference solution in the final result section.

The description of the mathematical model is rather brief, and I think some of the concepts require further description.

1) Starting at the end of this section, presumably the authors mean "min{Ra}", not

"min{C_cost}" as is stated in the paper. Otherwise eq. (6) would not be needed.

2) What is the purpose of introducing the "control vector U" and restraint vector M"? Also, I don't see the practical need for introducing eq. (1).

3) What is C_t? It seems strange that the profitability (presuming it is a positive number) should add to the total cost. It would be more natural if this was the sum of operation costs. Is it assumed to be constant?

4) Is M_{all} needed in the calculation, or is it only a constant value that makes Ra non-dimensional?

5) It would help if the authors would sketch what they mean with "l", "d" and "v" which are introduced on page 6. Perhaps some of these variables could be included in Figure 3?

The description of the RATC algorithm is brief and not entirely easy to follow. This is partly caused by using the same symbol for multiple purposes, which the authors should avoid.

1) Probably eq. (13) is not what the authors intended to put in this place, since it is nearly identical to eq. (9) and does not include wave height or wave length as variables.

2) "S" is used to denote both excitation intensity of white noise and wave spectrum.

3) "mu" (Greek letter) is used to denote both the ship's speed and the mean value of a distribution

4) "x" is introduced as a non-dimensional angle, but has already been used to denote the ship's position.

5) I don't see any explanation as to what "omega_en" should represent in eq. (9).

6) What is "Delta C_1"?

7) Eq. (19) contains the parameter "L", which is described as "the length of two make-

fasts". A "makefast" in nautical terms is to my understanding a support (buoy, post) to which the ship is secured, but I fail to see how this can be relevant in this context.

The results are based on 6 simulation experiments, one of which is the "sector diagram typhoon avoidance method" reference case. Whereas the results obtained are explained well enough, they do not provide much insight into the advantages and possible shortcomings of the proposed method. Based on results presented in Table 3 it is not obvious that the proposed new method performs better than the reference method. Given that this study is presented as a continuation of Wu et al. (2013), I would expect to see a much more thorough analysis of the impact of different parameter choices on the final result, as well as a discussion on how this compares with previous findings. The paper in its present form seems to me to offer too little new results to warrant a publication.

Technical issues ——————-

- The introduction of the abbreviation (TC) for tropical cyclones in the abstract is not necessary and should therefore be removed.

- The abbreviation for "tropical cyclone" (TC) is introduced on page 2, line 5, and it is therefore not necessary to introduce it again on page 3, line 24.

- In eqs. (2) and (22) the variable of integration (dt) is missing.

- p.5 line 4: Presumably, C_{oil} is the COST OF fuel consumption per unit time

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