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Interactive comment on "VISIR-I: small vessels, least-time nautical routes using wave forecasts" *by* G. Mannarini et al.

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General comments

The authors present a clear description and informative evaluation of a new ship routing model, with an emphasis on the use of wave forecast data for optimal and safer routing in the Mediterranean. The review of literature (Sect. 1.1) is thorough and wide ranging. Justification for the new development (VISIR-I) is clearly articulated in Sect. 1.2. The method section (Sect. 2) is very well organized, from first principles to all necessary practical details, including computational peformance and validation alongside an analytical example. The three Mediterranean case studies (Sect. 3) are clearly presented and provide a diverse range of model testing. Overall, the manuscript is well-written,

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with clear tables and figures throughout. It should be suitable for publication in GMD, subject to minor and technical revisions in response to comments below.

–Authors' response:
We thank the Referee for his/her general comments: we feel gratified for the efforts put into the design and implementation of VISIR and the preparation of this manuscript. (In the following "GMDD" stands for Mannarini et al. (2015). When not specified, all other references to equations, figures, and tables are relative to the present supplement.)

Specific comments

A -*The Abstract is well written, providing general information. It could be developed to provide specific, quantitative information on route lengthening, time saved, computational performance, etc.*

–Authors' response:
Agreed.

–Authors' changes to manuscript:
A1, A2.

A1) The abstract to be edited, starting from (P7912, row 17), as follows:

"Examples of VISIR-I routes in the Mediterranean Sea are provided. The optimal route may be longer in terms of miles sailed and yet it is faster and safer than the geodetic route between the same departure and arrival locations. Time savings up to 2.7%

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and route lengthening up to 3.2% are found for the case studies analyzed. However, there is no upper bound for the magnitude of the changes of such route metrics, which especially in case of extreme sea states can be much greater. Route diversions result from the safety constraints and the fact that the algorithm takes into account the full temporal evolution and spatial variability of the environmental fields."

A2) Table 11 to be augmented with 3 columns, as in Table 1 below[1].

B - *While operational focus is on the Mediterranean, VISIR-I could presumably be used worldwide. The prospects for this wider uptake could be discussed in Sect. 4.*

–Authors' response:
Agreed.

–Authors' changes to manuscript:
B1) In the Conclusions, at (P7947, row 25), to add:

"Extension of VISIR-I to any other marine domain is possible. To this end, the corresponding databases for shoreline and bathymetry, along with the forecast or analysis fields are required. Depending on the extension and topological features of the domain, the graph grid and its edges could deserve a redesign. Furthermore, other environmental fields (such as sea currents, winds, tropical cyclones, sea ice) may also be relevant, depending on geographical domain and/or vessel class addressed, requiring a revision of the analysis done in Sect.2.4.2 of this manuscript and, correspondingly, an update of the vessel model."

[1] The values of case study #2 were updated, since what was published in the GMDD suffers from a versioning issue.

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Table 1. Summary metrics for the case study routes displayed in Figs.10-15 of GMDD. Values in bold between brackets for case study #3 refer to the optimal route without voluntary speed reduction (engine throttle forced to be always 100 %). Variations are computed as $\Delta = 100 \cdot (\text{opt}/\text{gdt} - 1)$. N is the number of sea nodes found in the bounding box selected for the computations; T_O is time spent in the computation of the optimal route; while T_J is the total job computing time (excluding pictures rendering). T_J is shorter in case voluntary speed reduction is not applied, since edge weights have to be evaluated just at a single engine throttle. T_O and T_J refer to the performance achieved on a 3.5 GHz Intel Core i7 processor with 32 GB RAM memory, 1600 MHz DDR3.

case #	Quantity	units	Geodetic route	Optimal route	Δ [%]	N	T_O [s]	T_J [s]
	Length	NM	127.5	131.6	+3.2			
1	J	h	14 : 02	13 : 39	-2.7	15834	2.6	14.0
	Mean speed	kt	9.1	9.6	+5.5			
	Length	NM	138.2	139.7	+1.1			
2	J	h	15 : 21	15 : 23	+.2	15419	2.5	19.8
	Mean speed	kt	9.	9.1	+1.1			
	Length	NM	270.4	277.4	+2.6			
				(**285.1**)	+5.4			
3	J	h	27 : 00	27 : 47	+2.9	27700	6.7	42.5
				(**28:07**)	+4.1		(**6.7**)	(**37.6**)
	Mean speed	kt	10.0	10.0	+0.			
				(**10.1**)	+1.			

C - *Technical Corrections*

–Authors' response:
We thank the Referee for his/her careful inspection of the manuscript.

–Authors' changes to manuscript:

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C1) The pointed out items to be all addressed and corrected in the revised version.

References

Mannarini, G., Pinardi, N., Coppini, G., Oddo, P., and Iafrati, A.: VISIR-I: small vessels, least-time nautical routes using wave forecasts, Geosci. Model Dev. Discuss., 8, 7911–7981, 2015.

Interactive comment on Geosci. Model Dev. Discuss., 8, 7911, 2015.

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