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Ocean Science
Discussions

Interactive comment on "Study on the Tidal Dynamics of the Korea Strait Using the Extended Taylor Method" *by* Di Wu et al.

Di Wu et al.

fanggh@fio.org.cn

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Response (preliminary)to the Comments from Referee 2 by Guohong Fang and Di Wu

This paper contains an original contribution to the co-oscillating tide in Sea of Japan (East Sea) using an extended Taylor method. Writing is considered to be reasonably good with fine piece of references. However, there is an important point authors need to make correction to enhance the quality of the paper. Specifically, extension of the three sub-region model to four sub-region model is requested. Reviewer think the extension work is not difficult but considerable time around two months might be required to make correction of the content of manuscript. For that, a major revision is recommended.

Reply: We sincerely thank Reviewer for his carefully reading and constructive com-

ments. We plan to extend the model domain from three sub-regions to four sub-regions in the revised manuscript.

Detailed comments:

Pg.4, Lines 14-20: Authors constructed a model with three sub-regions as seen in Fig. 3. However, water depth of Fig.1 and tidal chart of Fig.2 indicate the necessity of including Tartar Strait region in the analytical model. Extension of the three sub-region model to the four sub-region model is requested. On the while, review think, though not much important, representing the Japan Sea (East Sea) as the Area 2 with width W1+W3 might be sufficient rather than width W2 unless the shallow water depth along the northern coastline of Japan is considered.

Reply: According to this comment,we plan to extend the model domain from three sub-regions to four sub-regions in the revised manuscript.Please note that we can only artificially place Area4 northeast of Area3 rather than north of Area3due to the limitation of the Taylor method. So that the Area4 cannot overlay the actual Tartar Strait.

Pg.7, Line 16: Authors used the Collocation approach. In fact there is another approach called Galerkin approach. Briefly comment why authors used Collocation approach. Is it mainly due to its simplicity?

Reply: Yes, it is mainly due to its simplicity. In Taylor's original work, he used the Fourier method, which involves the Fourier expansions at the connecting cross-sections, and thus making the solution more complicated. To our knowledge, nobody has employed the Galerkin method in the Taylor problem, though it has been widely used in the numerical computations.

Pg.8, Lines 11-12: Authors state that the influence of tide-generating force on the KS is negligible. Reviewer does not agree on this statement because the influence of direct tide generating force (DTGF) on the tide in JS can be significantly large, indirectly affecting on the tide in KS even though its direct influence on the KS is small. Reviewer

think co-oscillating tide may be dominant in Japan Sea (East Sea) but DTGF has some non-negligible effects.

Reply: This comment correctly points out a limitation of the Taylor method. The classical and the extended Taylor methods solve the homogeneous differential equations as shown in the governing equations in our manuscript (please see alsoTaylor, 1922;Hendershott and Speranza, 1971; among others). Once the DTGF is included, the governing equations will become non-homogeneous, and basic wave forms(namely the Kelvin wave and the Poincare wave) will no longer satisfy the governing equations. This is the reason why all existing studies (please see references listed in our manuscript) do not include DTGF.

To evaluatethe influence of the DTGF on the tides in the Korea Strait, we plan to numerically compute the tides in the Korea Strait and Japan/East Sea with and without DTGF, and make comparison between two results. We will report the results in the final responses.

Pg.9, Lines 10-12: In Table 1, it is noted that water depth of area 3 is 1783m, which is comparable with that of Area 2. With the model reproduction of tide in Tartar Strait shown in Fig.2 is hardly expected.

Reply: We plan to change Table 1 to include Area4, which represents the Tartar Strait. The depth of Area4 will be much shallower than Area3.

Pg.11, Lines 11-12: Authors' statement such that the model-produced tidal systems agree fairly well with the DTU10 result is reasonably acceptable. Reviewer however notices that there are some important points authors did not comment. Close examination of Fig.5 reveals that DTU10 produces amphidromic point further north than that calculated by the analytic model and that DTU10 and analytic model produces different contour patterns in Area 2 and Area 3. Reviewer thinks that these are due to neglecting the shallow Tartar Strait region in the analytic model. Again it is addressed that Area 3 is too deep and short to include the effects of presence of the Tartar Strait. According

to reviewer's modeling experience, the tides in JS (East Sea) and KS vary sensitively with change of bottom frictional coefficient in the Tartar Strait.

Reply: We accept this comment and plan to add the fourth sub-region (Area4) to represent the Tartar Strait in the revised manuscript. The water depth of Area4 will be chosen to be equal to the mean depth of main part of the Tartar Strait. As stated previously, we can only artificially place Area4 northeast of Area3 rather than north of Area3 due to the limitation of the Taylor method. So that the Area4 cannot overlay the actual Tartar Strait.

Pg.12, Lines 3-5: Authors state with regard to Fig. 6 that the greatest phase lag error occurred at the northernmost corner of JS due to the existence of degenerated amphidromic point near the area. This supports the necessity of developing an extended model which takes into account the shallow Tartar Strait region.

Reply: We expect that an amphidromic point or a degeneratedamphidromic point will present in Area4 of the revised model.

Pg.16, Line 1: Authors discussed tidal dynamics in KS-JS basin with emphasis on the amphidromic point. However, it is hard to find any discussions related to the influence of Area 2. Reviewer think this is because no meaningful contribution by Area 2. Again, it is strongly addressed that extension of the three sub-region model to the four subregion model is required.

Reply: In the text from page 17, line 6 onward in Section 4 our focus of discussion is on the role of Area2 which representing the JS. To emphasize the importance of the JS, we will insert "Eq. (36) indicates that the length, width and depth of Area2 are also important in determining the phase-lag increase of the reflected wave relative to the incident wave in Area1" in page 17 of the revised text; and add "(5) The length, width and depth of the JS is also important in determining the phase-lag increase of the reflected Kelvin wave in the KS" to the end of Section 5 (Summary) of the revised text.

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