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Interactive comment on "On the use of Schwarz–Christoffel conformal mappings to the grid generation for global ocean models" *by* S. Xu et al.

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The authors thank the referee for the thorough review of the manuscript, and agree to the comments regarding the necessary clarifications and changes needed to improve the manuscript. We list the corresponding revisions as below.

1) Regarding to the comment that multi-scale ocean modeling cannot be fully achieved by the grid (item 2 in general comments): the authors agree that the spatial resolution requirement of multi-scale modeling depends on specific goals (e.g., whether higher modes are needed rather than the 1st baroclinic mode), and multi-scaling modeling could not be achieved only with the grid generation. The authors also made emphasis

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on this issue on 1360:22, stating that the grid generation method proposed in Section 3 could exploit certain multi-scale behavior and serve as a basis for a comprehensive multi-scale modeling framework. Regarding the region of Okhotsk Sea, the large grid scales are also shown in Figure 9.a and Figure 9.b. As this region is near one end of the slit, the large grid edge sizes could be alleviated by modifying the polygon area on the Eurasia continent: to retract the slit end further into the continent. I.e., this is the result of the specific choice of the polygon regions used for SC mapping construction. The authors would also like to point out that the actual grid generation process with SC mappings could potentially involve an iterative procedure with refinement of choices for polygons in each iteration.

2) Regarding the comment that the sample grid in Section 3 can not fully meet certain design objectives in Section 1 (item 2 in general comments): the authors agree that the aforementioned items (no. 4 and 6) are not achieved by the sample grid in Section 3, but would like to point out that this is the result of the choice of the polygon areas chosen for the construction of the Schwarz-Christoffel mappings, but not due to the limitation of the methodology. E.g., item 6 could be achieved in a sample grid with another set of polygon choices, in which a polygon along the equator (with no area) could be used for SC mapping construction and mapped to a circular slit, in order to align it with a zonal grid line.

3) Regarding the requirement of the reason why certain regions (Australia, Antarctica, e.g.) are not used for land removal during grid construction in Section 3 (item 2 in general comments): the reason why Australia and Antarctica are not included is to demonstrate the grid generation methodology. It is worth noting that the sample grid in Section 3 is provided for the purpose of the demonstration of the methodology. The intention is to show that even if a continental area is not included for the SC mapping construction, they are still present in the grid index space and provide lateral boundary condition to the ocean model. They can be included if desired.

4) Regarding the question of whether very small spatial scale is introduced in the sam-

ple grid in Section 4 (item 3 in general comments): the authors would like to point out that in the sample grid, no grid edges with very small lengths are introduced by the grid generation method. This is indicated in Figure 9: (a) zonal step sizes near the poles are the smallest, (b) around the oceanic areas near the poles, the zonal step sizes are evenly distributed, which is also present in traditional dipolar grids. Hence in the sample grid, no small spatial scales are introduced by the proposed grid generation method.

5) Regarding the need for clarification of the grid generation method in Section 2 and Section 3 (item 4 in general comments): the authors would like to point out that the differences are stated in 1344:2∼20, but agree that further emphasis could be added to for clarification.

6) Regarding the need for introduction to dipolar and tripolar grids (item 1 in specific comments): the authors agree that a brief introduction is necessary in Section 1 to cover the following topics. (a) Bryan-Cox-Semtner type ocean general circulation models which support general orthogonal curvilinear coordinates. (b) Dipolar and tripolar grids widely used in current OGCMs, together with the state-of-the-art and shortcomings.

7) Regarding a more comprehensive introduction to Schwarz-Christoffel mappings (item 2 in specific comments): the authors would like to point out the fact that the construction theories of Schwarz-Christoffel mappings (both for single-connected regions and for multiple-connected regions) are out of the scope of this article, despite their relevance to the grid generation methods. The authors also suggest that necessary references are already provided in the original article draft: [DeLillo and Kropf 2011, DeLillo et al 2004, DeLillo et al 2013, Driscoll and Trefethen 2002].

8) Regarding the comment on re-writing parts in Section 2 (item 3 in specific comments): the authors acknowledge the fact that the term "scaling factors" are not well defined and several related issues. The authors intend to revise this part by adding

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definition to these terms (scaling factor) in Section 1, in the introductory part of dipolar and tripolar grids (as item 6 above).

9) Regarding grammar errors and typos (item 4 in specific comments), the authors revise according to the suggestions in the review:

a. On 1339:6∼7, replace "This is an established practice..." with "This is established practice ..."

b. On 1342:2, replace "Conformal mapping (Nehari, 1975) are ..." with "Conformal mappings (Nehari, 1975) are ..."

c. On 1342:6, replace "... configurations that are is easy to" with "configurations that are easy to ..."

d. On 1351:20, replace "...we cover several detailed design aspect." with "... we cover several detailed design aspects."

e. On 1352:15, replace "Since slits has zero area ..." with "Since slits have zero area..."

f. On 1356:5, replace "... the conformal mapping its harmonics ..." with "the conformal mapping and its harmonics ..."

g. Add references to POP and MOM (listed by the end of the reply), and also include references to NEMO on 1356:17.

The authors would like to thank the anonymous referee again for the thorough review of the manuscript.

Extra references:

Smith, R. D. and Gent, P: Reference manual for the Parallel Ocean Program (POP). Los Alamos Unclassified Report LA-UR-02-2484, 2002.

Geophysical Fluid Dynamics Laboratory – MOM ocean model, available at:

http://www.gfdl.noaa.gov/mom-ocean-model, last access: 12 April 2015.

NEMO Home Page, available at: http://www.nemo-ocean.eu/, last access: 11 April 2015.

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