

## Review of “Symmetric Equations on the Surface of a Sphere as Used by Model GISS:IB”

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**Title:** Symmetric Equations on the Surface of a Sphere as Used by Model GISS:IB

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**Recommendation:** accept after minor revisions

### Summary:

This study propose a new methodology to represent two-dimensional flow on a sphere. Reinterpreting previous studies, the approach in this study use specific angular momentum on the unit sphere and avoid problems associated with singularities in effect. The authors provided applications for some vector calculus and the shallow water equations. They also performed standard test simulations for the shallow water equations and compared with other schemes.

The manuscript is generally well written and organized, though some typos and lacks of descriptions are found. The presented methodology gives the concise and elegant representation of the shallow water equations on a sphere, and it is valuable for the GMD readers. Although the practical advantage of the proposed representation are not evaluated, it seems suitable that this point be addressed in further studies.

Therefore, I recommend the acceptance after minor revisions.

### Comments:

1. Page 2, Line 11:  
Replace “Putman and Lin” with “Putman and Lin (2007).”
2. Page 3, Line 4–6:  
It is easier to read if what among/between the similarities and differences are discussed is specified.
3. Page 3, Line 17:  
Replace “[ ]” with “() .”
4. Page 5, Line 6–8:  
Can we derive Eq. (2.5) only from the forementioned relationships?
5. Page 6, Eq. (2.11)  
Place a period at the end of the line.
6. Page 6, Line 10:  
Something should be missed in the last sentence.

7. Page 6, Line 13–14:

The numbering of the faces are not shown in Fig. 1. Additionally, I am not sure that the way of description of order is common, whereas I can guess it.

8. Figure 2:

Please specify what the grid level 2.

9. Page 20, Line 7–8:

Please add descriptions about the reasons for the observed facts.

10. Page 20, Line 19:

Please insert the year number for the reference.