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Interactive comment on "On computation of Hough functions" *by* H. Wang et al.

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Dear Paul,

Our reply to the referee #2 is below. The revised manuscript and the marked-up version (difference from the revised manuscript in response to referee #1) are uploaded as supplement.
Thanks for your efforts with our article.

Best wishes,

Houjun Wang
John Boyd

1 Response to Referee #2

General comments *This paper presents implementation of two numerical methods for computing the eigenvalues and eigenvectors for the Laplace tidal equation, the normalized associated Legendre polynomial expansion and Chebyshev collocation method, which have some advantages over the commonly used unnormalized associated Legendre polynomial expansion method. The authors also show results (Fig 4) that demonstrate how the parity factor in the Chebyshev collocation method affect numerical convergence. A Matlab routine for the Chebyshev method is included in the paper. The implementation is rather straightforward, and the presentation of the paper is clear.*

Specific comments

1. *Parity factor: It will be helpful if the authors could briefly discuss why the parity factor is dependent on zonal wavenumber.*

Reply: We have added an appendix on the parity factor.

2. *Number of good eigenvalues (page 6 line 21 and Table 1): what are the percentages of good values for these modes using the unnormalized ALP method?*

Reply: It turns out that, when both the methods are implemented correctly (and the symmetric and anti-symmetric modes are computed separately, especially for the trickiest DW1 modes), the percentage of good values using the un-normalized ALP expansion method is the same as that of the normalized ALP expansion method. This is understandable as the recursive relationship for the normalized ALP expansion method can be derived directly from the recursive relationship for the un-normalized ALP expansion method.

However, the factorial factors (that convert the un-normalized ALPs to the normalized ALPs) grow rapidly with zonal wavenumber s and latitudinal degree, so we suspect that normalized versus unnormalized differences would appear for larger s and larger Legendre truncations. We can only say that differences are small in the parameter range for atmospherical tidal applications.

3. *Are the computational costs of the two methods comparable? How do they compare with the unnormalized ALP method?*

Reply: The computational costs are all very small, about a second or fractions of a second; so for most applications this question is of little concern now (also see our response to Major comment 1 of referee #1).

In addition, we have taken this opportunity to improve and clarify the manuscript in several places, as can be discerned from the marked-up version (difference from the revised manuscript in response to referee #1).

Please also note the supplement to this comment:
http://www.geosci-model-dev-discuss.net/gmd-2015-282/gmd-2015-282-AC2-supplement.pdf

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