**Ocean Science
Discussions**

Interactive comment on "An oceanographer's guide to GOCE and the geoid" *by* C. W. Hughes and R. J. Bingham

Anonymous Referee #1

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The submitted paper is intended for oceanographers with few o no experience in geodesy and who will be interested in using the future GOCE data for their own research. Although nothing new is described in the paper, as stated by other reviewers, the novelty of the approach lies in the link that is intended to be done between two communities (the oceanographic and the geodetic communities) that hardly had the opportunity to communicate before the launch of the new gravity missions (GRACE, GOCE). In that sense I find this paper very opportune, valuable and helpful and I recommend its publication.

However, corrections should be made in order to further improve the quality and the clarity of the paper. First of all, if a strong link is to be done between oceanography and geodesy, the authors should not limit themselves to a description of the numerous

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subtleties of the geoid computation but rather put the whole discussion more in the context of combining such data with altimetric measurements. I agree this is partly done but this should be done more explicitly all through the paper. In particular, in order to summarize/clarify all the discussions and warnings about the different reference ellipsoids and tidal systems, as well as the geodetic/geocentric coordinate issue, an exhaustive check list should be given of the different computational steps (with the corresponding equations) the user will have to go through before combining properly a geoid model and altimetric data. I think this should be the main objective of section 6, and it should not be limited only to the geoid height computation.

Another key issue when using a geoid model for oceanographic applications is the handling of errors. The distinction between omission and commission errors is done but a discussion on the error variance/covariance matrix of the spherical harmonics coefficients is definitively needed. This is one of the main GOCE Level-2 products that will be distributed to the users. What does it contain? How can/should an oceanographer use it?

In order to clarify the whole paper, a better organization of sections 2 and 3 is needed. Adjacent paragraphs don't always have a clear connection one to another and subsections definitively have to be created. I would rather put the sub-section going from line 20, page 1546 until line 20, page 1547 at the end of section 2. I also would suppress section 5 whose utility is unclear to me.

Other comments:

-Page 1546, lines 20-22. Please clarify. If what is needed by oceanographers is "the sea surface height above the geoid" (page 1545, line 18) why is the sea surface height relative to one particular geopotential (and so is the geoid) not the required quantity?

-Page 1549, line 25. The sentence is unclear. ("The effect of the masses of the sun and moon, averaged over a long time, would result in an imaginary mass band hoveringĚ" may be better?)

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- Page 1550: Similarly to the zero-tide system case (for which the GGM02 model is given as example), an example of tide-free model should be given.

- Page 1552: it is unclear how the geodetic/geocentric issue is handled when combining a geoid with altimetry. Altimeter products use the geodetic latitude. The geoid height at a given point computed through equations 13, 14, 22 is expressed using the geocentric latitude. Where do we reconcile both latitudes? Should we do it when computing both surfaces relative to consistent reference ellipsoids? It is a bit confusing.

- Page 1556, lines 18-20. I would rather write :"Taking this rough guide, the ocean model resolution needed in order to be consistent with a degree L is approximately 20000/3L km, giving a needed model resolution of 33 km for degree L=200."

- Page 1557: The Gibbs'fringes issue. My own understanding is that the Gibbs fringes are not an issue when a geoid model is developed using the entire information contain in the spherical harmonics coefficients (i.e. to its maximum resolution). However, Gibbs fringes issue arises when coefficients are available up to a given degree Lmax and only part of them are used to reconstruct the geoid model (i.e, when using the spherical harmonics as a filtering tool).

Interactive comment on Ocean Sci. Discuss., 3, 1543, 2006.

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