**Ocean Science
Discussions**

Interactive comment on "Sea level variability in the Arctic Ocean observed by satellite altimetry" *by* P. Prandi et al.

Anonymous Referee #1

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R E V I E W of the manuscript (OS-2012-66) entitled "Sea level variability in the Arctic Ocean observed by satellite altimetry" by P. Prandi et al.

The topic of the manuscript is very interesting and of high importance. The data sets used by the authors for the analysis look very promising that the goals of the study will be accomplished. However, I found this manuscript not suitable for publication in its present form. The major problem, as I see it, is that the current version of the manuscript lacks 1) careful description of data (including their quality, spatial and temporal coverage), 2) methods used to process data and 3) careful statistical evaluation of the estimates (like trends, standard deviations etc) derived for various parameters. My detailed comments are provided below.

Specific comments: 1. Page 4, line 3: SLA is used before it is defined.

2. Section 2.2. Please provide detailed description of all corrections used to process the data. For example: a) Statement "This effect has to be..." (page 5, lines 11-13) needs further description. b) Statement "... is performed best ..." (page 5, line 16) needs further evaluation for the high-latitude region.

3. Section 2.3 needs further work: a) Please provide detailed description of EN3 data set (its spatial resolution and data quality), b) addition of ASBO data needs further description (like, how ASBO snapshot temperature and salinity profiles have been merged with the gridded EN3 data). c) Please quantify the effect related to "continental leakage" for the Arctic region. d) Please define "mean depth". e) Please show spatiotemporal data coverage, not only temporal. It is of key importance to understand suitability of the dataset for the analysis. f) Please explain why the data coverage is minimal in the 2007-08 when actually there were lots of observations. g) Please provide details of how steric sea-level height was obtained.

4. Section 2.4, page 6, lines 20-25: Please provide further details for this correction quantifying it for the Arctic region.

5. General comments to Sections 3.1-3.2: a) In the presence of uncertainties in the data due to gaps, processing procedures etc. estimates of trends should be viewed with caution. b) Available time series are extremely short and all statistical estimates should be viewed critically. For example, strong variability of trends presented in Figure 3 is a good example of the effect of short time series when one anomalous value may lead to significant changes in trends. c) All estimates should be complemented by their statistical significance. Since time series are extremely short, in addition to traditional tests for statistical significance, I suggest to perform Monte-Carlo like statistical simulations in order to provide further support for estimates of trends.

6. Page 7, line 4: What does "mean SLA standard deviation" mean?

7. Page 7, lines 10-11: Internal correlation has also impact on other statistical estimates, not only trends. Why is this part ignored in this analysis?

8. Page 7, last paragraph: Please show contribution of steric height and GRACE estimates separately. Particularly, how did the authors deal with the problem of different spatial data coverage for these data sets?

9. Figures 3 and 4: Please provide error bars for these time series.

10. Page 8, lines 12-13: Please provide details on how these estimates were obtained. What is their statistical significance?

11. Page 8, Seasonal signal: How many points were used to define this signal? What is the level of uncertainty in this estimate? How was different spatial data coverage for these data sets taken into account?

12. Page 8, lines 22-27: This statement is not clear.

13. Page 9, line 8: Please define RMS.

14. Page 9, line 10: Why is this variability called "most important"?

15. Page 9, line 11: How did the authors derive conclusion that the errors are due to tidal prediction?

16. Page 9: For correlation, please provide its statistical significance and number of points used for comparison. Comparing the two data sets, please provide more complete evaluation not just limited by correlation. A good illustration would be a figure showing data points with horizontal axis for one data set and vertical axis for another.

17. Page 9, line 17: Why was 200km radius selected?

18. Page 10, line 9: "is good" requires further quantification.

19. Page 10, line 10: What does "collocated altimetry trend" mean?

20. Page 10, line 12 and further: What does "mean drift" mean?

21. Page 10, lines 15-20: Please provide further details for this analysis (i.e. how many points were used etc).

22. Page 10, comparison with other papers. Please provide more careful evaluation of your data vs. Giles et al 2012 and Proshutinsky et al. 2009b analyses. For example, I see big differences between the time series shown in Figure 2 from Giles et al. and the authors' Figure 3.

23. Page 11, EOF analysis of September SLA. How many fields were used for this analysis? How well are the EOF modes separated? I.e., further description for the analysis is required.

24. Page 11, line 20: I am not sure that the statement ". . . indicating that. . ." is well proved. It may be just the property of the EOF analysis which main mode captures the most variability which is maximum over shelves.

25. Page 11, EOF analysis. This use of the EOFs looks displaced since its (limited) description is provided on the next page.

26. Page 12: The discussion of these corrections should be probably placed in data description sections; this description should be much more detailed providing quantitative estimates of its impacts. Further justification is necessary for the choice of the model: Why is this particular model is chosen? Why is it better than others? Why can we trust the model?

27. Page 12: I thought that Proshutinsky et al. argued that the most important mode of Arctic Ocean variability is dipole-like.

28. Figure 1: Besides percentage, I would like to see absolute number of data points available for the analysis and temporal coverage which would illustrate potential gaps in the data.

29. Figure 2 does not provide any clue on the spatial data coverage.

30. Figure 8: Please provide statistical significance for these estimates.

31. Figure 9: Why do the authors show estimates for the limited area only? How can

they judge that this structure represents dipole-like one?

32. Figure 10: If these SLA estimates (left) depend on model results (right), why should we expect to see a different pattern?

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