Ocean Sci. Discuss.,
doi:10.5194/os-2016-50-RC2, 2016

Ocean Science Discussions

Interactive comment on "Sub-basin scale sea level budgets from satellite altimetry, Argo floats and satellite gravimetry in the North Atlantic" *by* Marcel Kleinherenbrink et al.

Anonymous Referee #2

Received and published: 3 October 2016

General comments

This paper evaluates the sea level budget in regions of the North Atlantic basin using altimetry, GRACE, and steric Argo. Because of the treatment of each dataset is novel and the analysis of budget closure is on sub-basin scales, the subject matter is worthy of publication. However, there are several errors in the description of data processing and in citing previous work that will need to be corrected. More important, the treatment of GIA for both the altimetry and GRACE data is too vague for me to evaluate the claims of sea level budget closure. Another reviewer has already identified several spelling and grammar errors, which I will attempt not to repeat.

The paper needs a better justification for the selection of the North Atlantic as

an area of study. The North Atlantic has been well surveyed before Argo, and other hydrographic profiles or gridded products could have been evaluated. For example, the NOAA Ocean Climate Laboratory's Global total steric sea level anomaly fields include both Argo, XBT, CTD, and other hydrographic data: https://www.nodc.noaa.gov/OC5/3M_HEAT_CONTENT/fsl_global.html

Page 12: I am confused by this statement: "Ultimately, the mean GIA OBP over a polygon (degree 2 and higher, as measured by GRACE) are subtracted from the results, to make them compatible with altimetry." To be compatible with the treatment of the altimetry, a correction based on the same GIA model should have been used. It's not clear from the paper what GIA model was removed from the GRACE data, which is crucial to understanding how the sea level budget was closed for trends. The paper is also unclear about the meaning of the "GIA correction of 10-20%" referred to on page 26. 10 to 20% of what? Since the choice of GIA model used is critical for closure, this issue needs to be more clearly explained.

Minor comments: Introduction, 2nd paragraph. The time periods for a couple of the cited papers is not correct Willis et al., 2008 looked the budget over 2003.5 and 2007.5, not 2003 to 2007. The budget was closed within error by Leuliette and Miller (2009) for 2004-2008, but in Leuliette and Willis (2011) over the period was 2005-2010.5. Page 2, line 4: I'd recommend that throughout the paper the term "GRACE ocean bottom pressure" not be used. Strictly speaking, OBP is the sum of atmospheric and oceanic mass variations, which is what would be recorded by a pressure gauge in the ocean. Here, of course, in equation 1, the authors intend for H_OBP to reflect the sea level component of ocean mass changes. The IPCC and other authors have opted to call this component "barystatic sea level". I would recommend using this term or "ocean mass component" instead of OBP to avoid confusion. Also, I'd recommend describing how the inverted barometer correction applied to the altimetry data and the GRACE data.

Page 2, line 20: Line 20: Purkey (2014) should be Purkey et al. (2014)

Page 7, line 1: The “inclination weighting” scheme that is a function of the latitude of the measurement and the orbit inclination angle of the satellite and used to generate the University of Colorado time series of GMSL was first suggested by Wang and Rapp [1994] (see the report “Estimation of sea surface dynamic topography, ocean tides, and secular changes from Topex altimeter data” at http://sealevel.colorado.edu/files/pubs/wang_rapp_report_430.pdf). Tai and Wagner (2011) simplified the approach using a spherical Earth approximation. I would recommend citing one or both of these papers. Rather than calling this weighing the “Nerem method,” it would more properly be termed the “inclination/latitude weighting” or the Wang and Rapp weighting.

Table 2: EWL is not defined.

Interactive comment on Ocean Sci. Discuss., doi:10.5194/os-2016-50, 2016.