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Ocean Science
Discussions

Interactive comment on "Interannual response of global ocean hindcasts to a satellite-based correction of precipitation fluxes" *by* A. Storto et al.

Anonymous Referee #2

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This manuscript presents a way to correct the daily precipitation field from the ERA-Interim reanalysis. The corrected precipitation is then used as forcing for an ocean model in order to assess the impact of the correction. While the manuscript is well written and raises interesting issues, the analysis of the results, though detailed enough, should have a much stronger link with the features of the correction factor. For instance, a sizeable improvement in oceanic features around the Antarctic Circumpolar Current is noted in a few instances in the manuscript, as well as in the abstract, but the correction factor appears to be very small south of 30S. No explanation is provided for a possible tele-connection mechanism, if one exists.

Despite this correction factor being at the heart of this work, the discussion about its computation and its features is too scanty to properly assess its effectiveness. In particular, it is unclear why an unconstrained approach is adopted but later a fix needs to be introduced to force the [E-(P+R)] budget to balance globally at each time step. Such forced global balance appears to be too strong and not physically justifiable. Further, with a (zonal average of the) correction factor added to a number four-five order of magnitudes larger (the correction factor of around 0.1-0.01 is to be added to 1,000, see equation 2), it is actually surprising there is such a sizeable effect on the oceanic circulation.

My recommendation is therefore for major revisions, which would need to focus primarily on an improved and more robust way to compute the correction factor for the precipitation field. The ensuing discussion would also need to be much better tied in with the updated precipitation correction. The specific comments below might assist in revising the manuscript.

Specific comments:

Page 613, line 1: "Usually, oceanographers delegate . . .". This is awkwardly presented.

Page 613, line 18: Sv is a measure of volume transport, as such its units are m3/s not m3.

Page 613, line 19: What would be the river runoff derived from ERA-Interim? Would this be in a better balance with the E-P from ERA-Interim?

Page 614, line 28: What does "assimilation-blind" mean?

Page 616, line 6: ". . . allows us to apply the correction to any period . . . ". This statement has not been tested. Indeed, it is likely that, because of the inhomogeneity in the atmospheric observational system, different periods would require different coefficients (see e.g. Troccoli A and KaÌŁllberg P (2004) Precipitation correction in the ERA-40 reanalysis, ERA-40 Project Report Series, 13).

Page 616, lines 8-9: Not obvious why the correction would by construction not alter inter-annual variability. The authors would need to prove this, by also stating what is meant by inter-annual variability.

Page 616, line 10: There is no explanation of how such a relationship was derived. This relationship is at the heart of this work and needs a much more detailed discussion and justification. Also, it is unclear why an unconstrained approach is adopted. Later though a fix needs to be introduced to force E-(P+R) to be zero globally. It would be better to devise a correction that considers such a constraint in a more congruous way.

Page 616, second paragraph: Why not show lat-lon maps of the correction coefficient? The zonally-averaged figure, though useful, is not as informative. For instance, are the very small values south of 30S due to averaging or are they small all around at those latitudes?

Page 617, line 14: Forcing the E-(P+R) to zero at every time step seems much too strong? What's the physical rational for this? Also, how is the fix introduced in the model? And what is the size of these fixes?

Page 619, line 8: It is hardly surprising that the difference in precipitation is about 0.3 percent when the correction factor is of the order of 0.1-0.01 (albeit on zonal averages, Fig 2) and this is added to 1,000 (see 1,000+c in equation 2). It is unclear why the correction factors could not be larger, especially since the computation of the factor is not constrained (eq. 1).

Page 619, line 20: The reason for the 15x increase in the amplitude of the annual cycle (0.032 Sv to 0.484 Sv) needs to be better explained.

Page 619, line 27: What is meant by "remote effect"?

Page 619, line 29: It is unclear why such an improvement could not be achieved with this work.

Page 620, line 4: When assessing the impact of the correction using independent

datasets, it should be noted that the other variables (e.g. SSS) may not be in balance with the observed (or corrected) precipitation.

Page 621, line 11: "... may induce many secondary effects ...". What are these effects?

Page 622, line 6: I do not think "clearly" is justified here.

Page 622, line 6: "... improves ... interannual sea level variability ...". Figure 5 shows the sea level linear trend, which is not the same as interannual variability (related to the year-to-year variance).

Page 626, line 9: The statement of a "4% error decrease" (and later 9%) is ambiguous. It should be clarified that a reduction in RMSE is a reflection of change in variability not in mean bias. Note also that the global mean actually increases (Fig 9a).

Page 629, line 26: "The correction also yields a 16% reduction ...". This was achieved by construction of equation 1.

Page 630, line 1: "the remote effect of the superimposed ...". Unclear.

Page 630, line 4: "One of the most appreciable ...". This is in spite of having what appears to be a negligible correction factor south of 30S. Please explain.

Page 630, line 9: As mentioned above a more advanced precipitation correction approach should be the focus of this work.

Page 630, line 11: "since the main motivation ...". Unclear.

Figure 1: "difference" instead of "bias". It would be useful to compute and overplot global statistics such as mean and standard deviation.

Figure 3: Specify averaging period.

Figure 4: "difference (cm) due" instead of "decrease (cm) due". It would be useful to compute and overplot the mean difference in Fig 4a. Specify averaging period.

Figure 5: Mid and bottom panels look the same.

Figure 6: Difference between corrected and non-corrected sea level over the Antarctic region is noticeable only for the first three years (bottom left): discuss.

Figure 8: Panel (f) is the same as (f).

Interactive comment on Ocean Sci. Discuss., 9, 611, 2012.