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Comment

## ***Interactive comment on “Evaluation of wet troposphere path delays from atmospheric reanalyses and radiometers and their impact on the altimeter sea level” by J.-F. Legeais et al.***

**J.-F. Legeais et al.**

jlegeais@cls.fr

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Please find below the point by point answer to the Referee Comment:

Section 3, page 1620: “This result is not expected”. Indeed, one would expect ERA-Interim to produce wet corrections of comparatively lower quality than the one provided by the operational ECMWF system over the recent years. An explanation could be related with the fact that the operational corrections are processed differently than the ones from ERA-Interim. The operational ECMWF wet troposphere correction has been received from a third-party whereas the correction from ERA-Interim has been computed by us from gridded fields. As we have access to the ECMWF operational 3D

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fields over 2013, we have been able to check that our procedure used to compute the correction from the gridded fields gives the same result as the procedure employed by the third-party and this difference of procedure has no impact on our results. Thus the counter-intuitive result obtained after 2006 and discussed in the paper cannot be explained by the different processing of the corrections and it remains an open issue. The fact that there is no difference between our procedure of computation and the one from the third-party will be added in the paper when describing the method of comparison in section 2.3.

Figure 9: Indeed, this could be instructive to pursue the work into the space of measured radiometer brightness temperatures to improve the quality control of the instruments. This has not been performed for this paper but this is currently on-going work by one of the co-authors.

Figure 4 and 3 (top right compared to top left): We agree that there is a stronger annual signal in the differences with ESA missions than with TOPEX and Jason (1, 2). This will be mentioned in an updated version of the paper. Note that the annual cycle of each time series have not been removed before computing the differences. We have checked that removing the biases between the radiometer measurements of the altimeter mission (as it is mentioned in the caption of Fig. 3) does not affect these annual signals. The fact that no selection of the data has been performed over latitude mainly explains the difference of observed annual signal. Some other elements may have to be taken into account: (i) contrary to TOPEX/Jason, ESA missions are sun-synchronous and the time difference between each measurement and the date of the model output are always the same. (ii) All radiometers don't work with the same number of frequencies (bi or tri frequencies), (iii) For the Envisat mission, a potential seasonal signal may be introduced by the side lobes correction which takes into account the land contamination and the associated impact on the annual signal is currently analyzed by comparison with a wet tropo correction free of this side lobes correction. We don't know whether these elements affect the observed annual signal of the differences.

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Figure 4 and Figure 3 (top row): the potential relationship between the bowing shape in both time series and the rain assimilation problem in ERA-Interim is discussed in section 6.

Figure 7 (Hudson bay and Antarctic Weddell Sea): indeed, this is probably indication of radiometer correction suffering from sea-ice contamination rather than a problem in the models.

Minor points:

Page 1617, line 5 "should not be affected by jumps": This will be replaced in an updated version of the paper by: "have been more uniformly processed than the operational models, thereby eliminating jumps due to changes to the processing strategy."

The last sentence of the last paragraph of section 3.2 (page 1620, line 11) will be replaced by this: "The quality assessment of the WTC at longer time scales will benefit from improved precision at shorter ones. Indeed, reduced high frequencies errors will decrease the formal error estimation of larger temporal signals such as annual cycle or trend."

Page 1629, the sentence "the number of precipitate water content (PWC) retrievals from SSM/I satellites is not taken into account properly and the ERA Interim atmosphere becomes too dry" will be replaced by "the greater the number of total column water vapor retrievals from SSM/I satellites, the greater the drying induced by the analysis increments. This results in the atmosphere being represented in ERA-Interim as more dry"

The online reference to Cazenave et al. 2009 will be added in the updated version: <http://www.oceanobs09.net/proceedings/pp/2A3-Cazenave-OceanObs09.pp.11.pdf> (last access 3 July 2014)

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