

## ***Interactive comment on “Past terrestrial water storage (1980–2008) in the Amazon Basin reconstructed from GRACE and in situ river gauging data” by M. Becker et al.***

**Anonymous Referee #1**

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This paper propose a "new" method for reconstructing the past amazon water distribution. The idea, as I understand it, is to learn from the period where GRACE and some local measurements coexist the relation between the GRACE data, which integrate the whole water layer, and the local sensors, which go way back in time. When the relation is known, they use it to infer the total water to the whole time series. The relation between the GRACE data and the gauges is obtained by a EOF decomposition of the GRACE data, which is then projected on the gauge data, to allow reconstructing the past time series.

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I think the work is interesting, but the hypotheses are strong, so I would recommend to make them even more clear than they already are.

(1) The main hypothesis is that the gauge data are a good proxy for the GRACE total water content. The main justification given to sustain this hypothesis is that it has been demonstrated by previous studies that TWS are correlated with river water level fluctuations and the correlation between gauges and GRACE data. BTW, I hope that this correlation is done after the annual cycle has been removed. If it is not, it does not mean anything, as the annual cycle has only 1 degrees of freedom (the phase). So, if it is done with the annual cycle in, I think you should redo the table with the annual cycle out. The problem is the correlation between the gauge data and the value of GRACE away from the gauge data. I think that it should be checked by estimating the correlation between the EOF time series obtained from the GRACE data and from the gauge data only, or the variance explained by the reconstructed gauge data from GRACE.

(2) The second major hypothesis is the stationarity in time of the EOF modes. The test done by the authors is useful (though the last "holds" sounds a little bit optimistic to me). Still, I think it would also be interesting to show some of the major relevant variables in the area, to see if the climate regime has not changed (I mean the precipitation rate, the temperature, the precipitable water in the atmosphere, for instance). If those fields are not stationary, I am not sure that the EOF modes should be.

(3) I do not think your method hold for annual timescale, as correlation there does not mean that they see a common cause. I would be interested by a comment on that point in the paper.

(4) Is there a reason for which river altimetry data have not been used? I mean something like hydroweb...

(5) I am not sure that fitting a sinusoid on the data is the best way to remove the annual cycle, as the system is most probably behaving like a capacitor. I think a composite

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annual cycle would be more appropriate.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 8125, 2010.

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