

Interactive comment on “Intercomparison of freshwater fluxes over ocean and investigations into water budget closure” by Marloes Gutenstein et al.

Anonymous Referee #1

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Review of: Intercomparison of freshwater fluxes over ocean and investigations into water budget closure By Gutenstein et al. This paper presents an inter-comparison of five recent satellite-based and one re-analysis E-P data sets. The different data-sets and the assumptions behind them are described. The different components of the hydrological cycle are presented separately. This is a well written paper, which presents a valuable contribution to the climate community. I have little to add to this paper, which in my opinion is almost ready for publication in its current form. The few and very minor comments I have are: “ In the introduction I missed a section motivating the study from a climate change perspective like you added to the “Final Comments” section. Monitoring trends in the hydrological cycle is of great importance under uncertain

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changing climate conditions. In that aspect I would like to point the authors to some recent papers on the topic 1-3 – The inter-comparison presented here is a very nice and useful framework also for comparing with climate models 4-6 such as CMIP6. I suggest to propose it in the “Final Comments” section (or elsewhere) for future work. It could enlarge the connection of this work to climate change research. – L96: Could you please elaborate on how wind speed is calculated based on temperature (BT) measurements? In addition, If E estimates are based on BT measurements, which are more accurate in clear sky conditions than in cloudy sky conditions, wouldn't that cause a bias? How is it calculated in cloudy (and rainy) conditions? If it is only calculated in clear sky conditions, wouldn't the E estimations be biased high (as in cloudy and rainy conditions the evaporation is lower)? – L368: is the largest deviation in E estimations in the tropics due to the large (and optically thick) cloud cover? – L437: I think that the correlation does not decrease when Delat Qocean is not considered because there is basically no correlation even when it is considered. So, it can't get any lower than that. Is that correct? Technical comments: – L208: us→use. – You alter between italic and non-italic in P, E and E-P. I think it should all be italic.

References 1 Allan, R. P. et al. Advances in understanding large-scale responses of the water cycle to climate change. *Annals of the New York Academy of Sciences* (2020). 2 Dagan, G., Stier, P. & Watson–Parris, D. Analysis of the atmospheric water budget for elucidating the spatial scale of precipitation changes under climate change. *Geophysical Research Letters* (2019). 3 Yin, J. & Porporato, A. Looking up or looking down? Hydrologic and atmospheric perspectives on precipitation and evaporation variability. *Geophysical Research Letters* 46, 11968-11971 (2019). 4 Liepert, B. G. & Previdi, M. Inter-model variability and biases of the global water cycle in CMIP3 coupled climate models. *Environmental Research Letters* 7, 014006 (2012). 5 Knutti, R. & Sedláček, J. Robustness and uncertainties in the new CMIP5 climate model projections. *Nature Climate Change* 3, 369 (2013). 6 Held, I. M. & Soden, B. J. Robust responses of the hydrological cycle to global warming. *Journal of Climate* 19, 5686-5699 (2006).

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