

## ***Interactive comment on “First Assessment of the Earth Heat Inventory Within CMIP5 Historical Simulations” by Francisco José Cuesta-Valero et al.***

### **Anonymous Referee #1**

Received and published: 3 February 2021

The article ‘First Assessment of the Earth Heat Inventory Within CMIP5 Historical Simulations’ provides an evaluation of the Earth heat inventory from climate model simulations, and assess the dissemination of heat storage distribution in the different Earth system components. The article is well written, timely and addresses a fundamental topic, and I recommend minor revision before publication following the different aspects provided below.

Comments :

L30-35 : The addition of more recent references would further support this part of the introduction, particularly while referring to outcomes of IPCC SROCC (and respective

C1

chapters).

L84: This is not correct, as also observation-based products have been accounted for in their estimate: Wegener Center (WEGC) multisatellite RO data record, WEGC OPSv5.6 (Angerer et al., 2017), as well as its radiosonde (RS) data record derived from the highquality Vaisala sondes RS80/RS92/VS41, WEGC Vaisala (Ladstädter et al., 2015). Also, microwave sounding unit (MSU) data records (Mears and Wentz, 2017) have been discussed, but have been finally excluded for the ensemble average used in the EHI. See Steiner et al. (2020) for references (<https://doi.org/10.1175/JCLI-D-19-0998.1>).

L97: This evaluation of ocean heat content is different from what is done by the observational community, where the integral of temperature anomalies is used instead of density integration. It would be interesting to understand why this approach is used here instead, and what the impact/difference between those different approaches are.

L.115-124: I recommend to consider the study of Steiner et al. (2020): <https://doi.org/10.1175/JCLI-D-19-0998.1>, 2020.

L.330-339: The conclusion could be extended a bit more, and draw a synthesis of all heat content components as discussed in the course of the article. More specific recommendations for future evolution, and knowledge gaps would further support the strength of the conclusion part. A specific element of discussion is also missing, i.e. on how the obtained results of this study further support the interpretation and future developments of climate models, and on how observation based and model based evaluations could seek strengthening of collaboration in the future to further advance on climate research topics, as well as on more robust and more robust potential for prediction validation – this is an essential element which should be addressed in this article. Finally, the consequences for climate models based on the outcomes, ie underestimates/overestimation of Earth system heat storage components should be commented as well (qualitatively in the conclusion, or as part of knowledge synthesis from

C2

previous publications in the introduction part).

Minor:

Supplement Fig. S3: error in ref in figure caption (last sentence).

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Interactive comment on Earth Syst. Dynam. Discuss., <https://doi.org/10.5194/esd-2020-88>, 2020.