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Earth System Science Data Discussions

Interactive comment on "Heat stored in the Earth system: Where does the energy go? The GCOS Earth heat inventory team" *by* Karina von Schuckmann et al.

Anonymous Referee #1

Received and published: 24 April 2020

Review of: Heat stored in the Earth system: Where does the energy go?

General Comments:

The paper provides a very nice update on the Earth's heat inventory for 1960-2018. It is a collaborative effort involving many authors who are experts in the various Earth subsystems in which heat storage occurs. One of the main findings from this analysis is a decrease in the contribution of ocean to the Earth heat inventory (89%) compared to prior assessments (93%), and a doubling of the land contribution (6% vs 3%). The latter is based upon recent analyses of data from FluxNet, geothermal data and model simulations. The paper also finds that the ocean heating rate has doubled since the

beginning of the altimeter era (1993-2018) compared to the "historical" period (1960-2018), and that the contribution of ocean heating in intermediate (700-2000 m) and deep (> 2000 m) ocean layers is notably greater for 2000-2018 compared to 1960-2018.

These new results are interesting and worthy of publication. However, it is unclear why the paper does not describe or discuss in any detail the geographical distribution of heat storage in the ocean. The global vertical distribution is discussed extensively but wouldn't the geographical distribution also be worth mentioning, particularly given the paper's title? Admittedly, this may only be feasible during the Argo period because of its better geographical sampling compared to earlier periods, but it seems appropriate to include a short discussion about this nonetheless.

Recommendation: Accept with some minor revisions.

Specific Comments:

Line 78: Hansen et al., 2005 is not in the reference list.

Line 151-153: Sentence beginning with "However". Please provide a reference or two supporting this statement.

Table 1 (second-to-last row): "0.7-0.9 +/- 0.1 Wm-2. The range is greater than the uncertainty. This implies the uncertainty is too small.

Figure 1: The figure would be clearer if colors were more distinct. Consider using more than just different shades of blue.

Lines 281-283: The trends given in the caption should appear in a separate table.

Figure 2: Are the trends for the ocean area only or are they averages over the entire surface area of the globe (as they presumably are in Table 1)? A common reference throughout the paper would be helpful in order to compare the magnitudes of heat storage in different parts of the Earth system.

Lines 392-393: cv is defined twice.

Lines 449-451: Is it necessary to mention everyone?

Lines 498-502: This is a very long sentence. Consider breaking it up into two or more sentences.

Lines 502-504 “These radiatively relevant processes include the stability and extent of the continental areas occupied by permafrost soils.”

Awkward sentence. Consider rewording. For example, “the stability and extent of the continental areas occupied by permafrost soils” are not “processes”.

Line 555: No “,” after “Such records”.

Line 556: What does “beyond the observational record” refer to? Perhaps you mean “prior to the observational record”? Lines 687-688: Do you mean 40 years instead of 40 decades?

Figure 7: The color for the atmosphere contribution is inconsistent between the pie chart (green) and label (blue).

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