



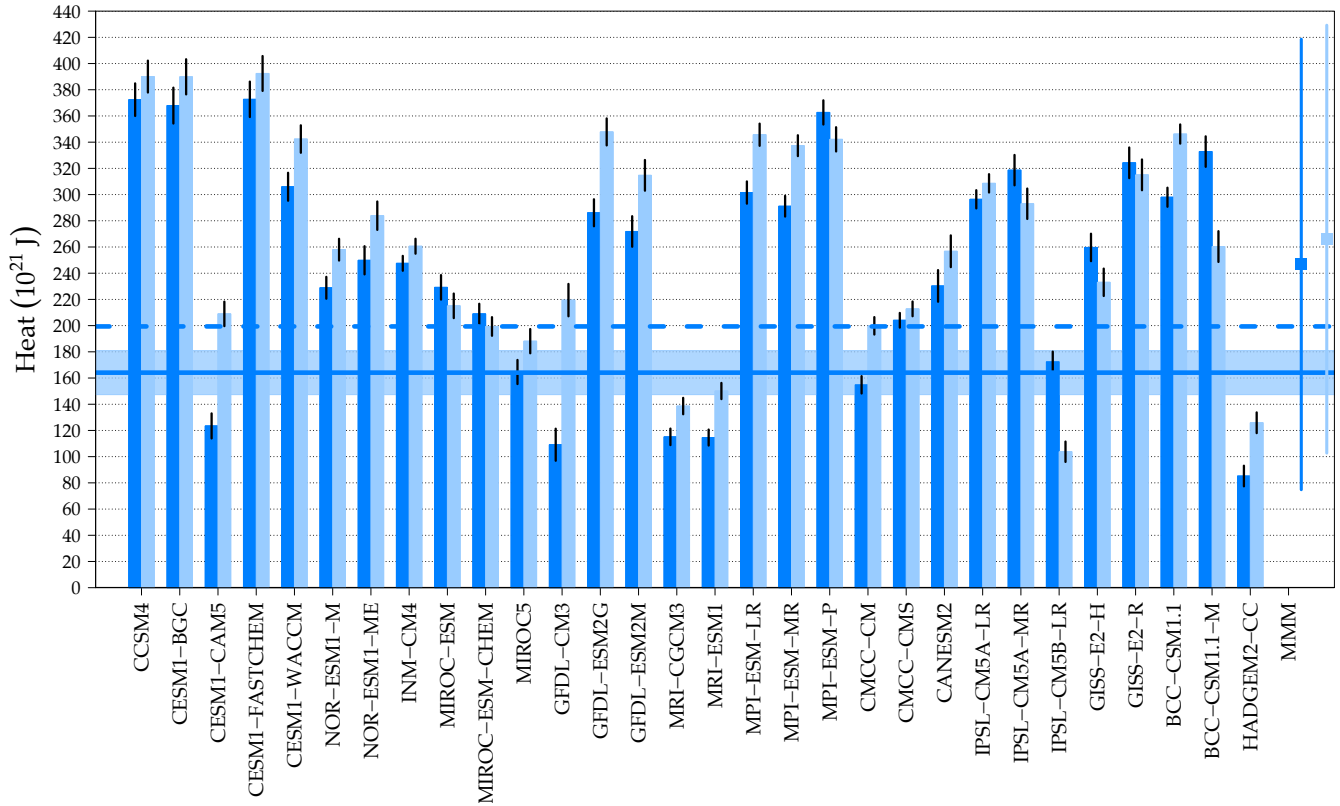
*Supplement of*

## **First assessment of the earth heat inventory within CMIP5 historical simulations**

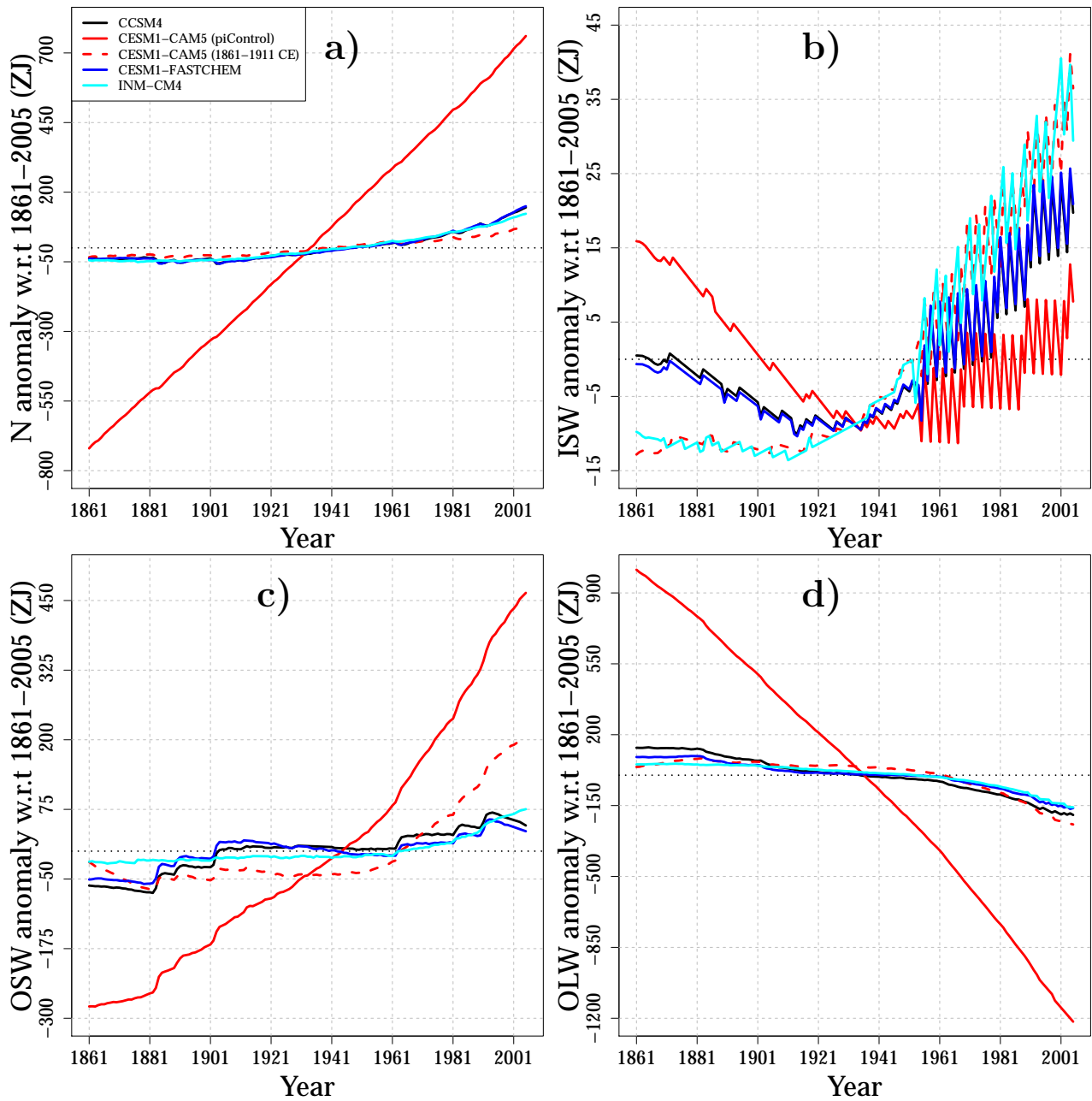
**Francisco José Cuesta-Valero et al.**

*Correspondence to:* Hugo Beltrami ([hugo@stfx.ca](mailto:hugo@stfx.ca))

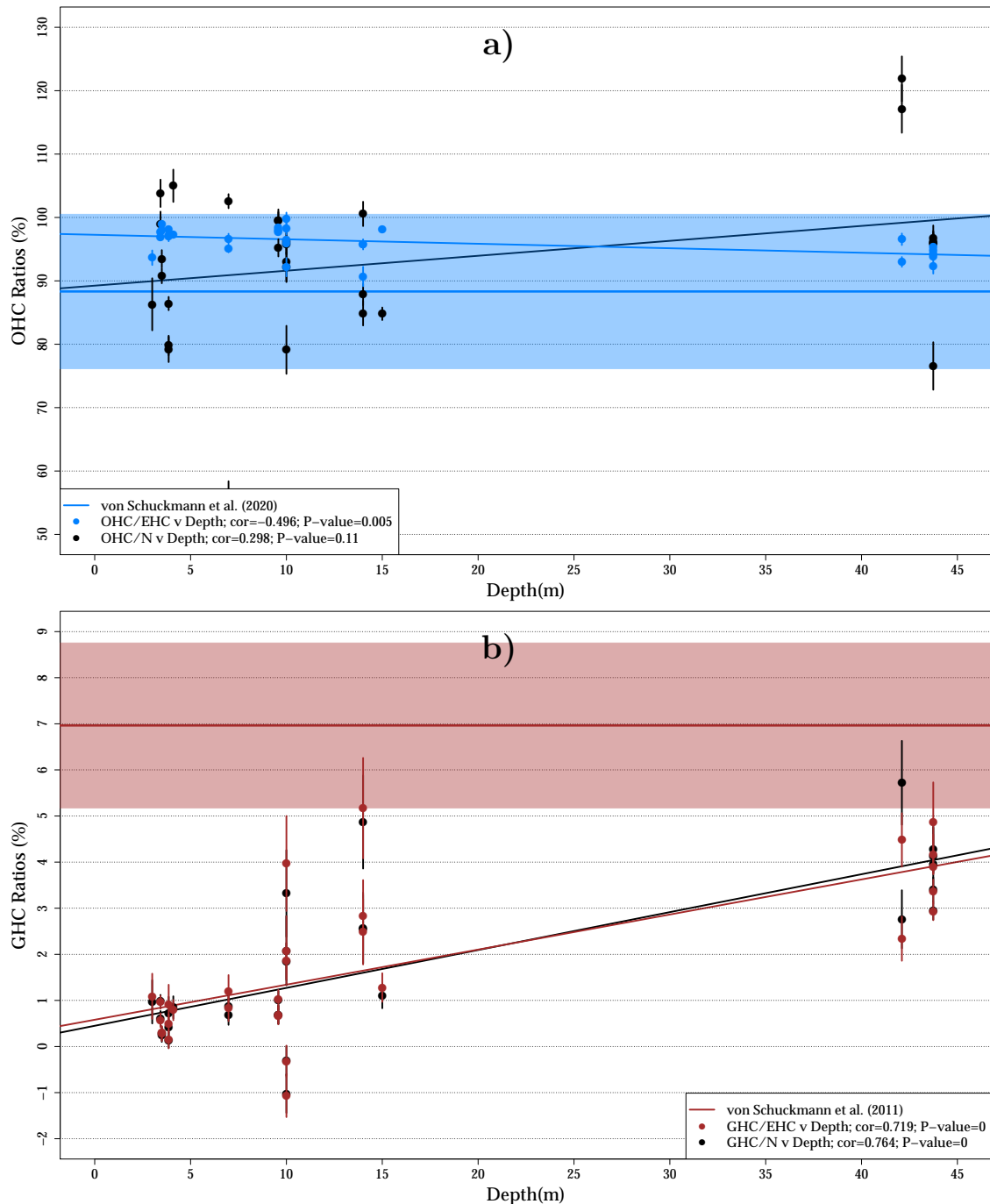
The copyright of individual parts of the supplement might differ from the article licence.



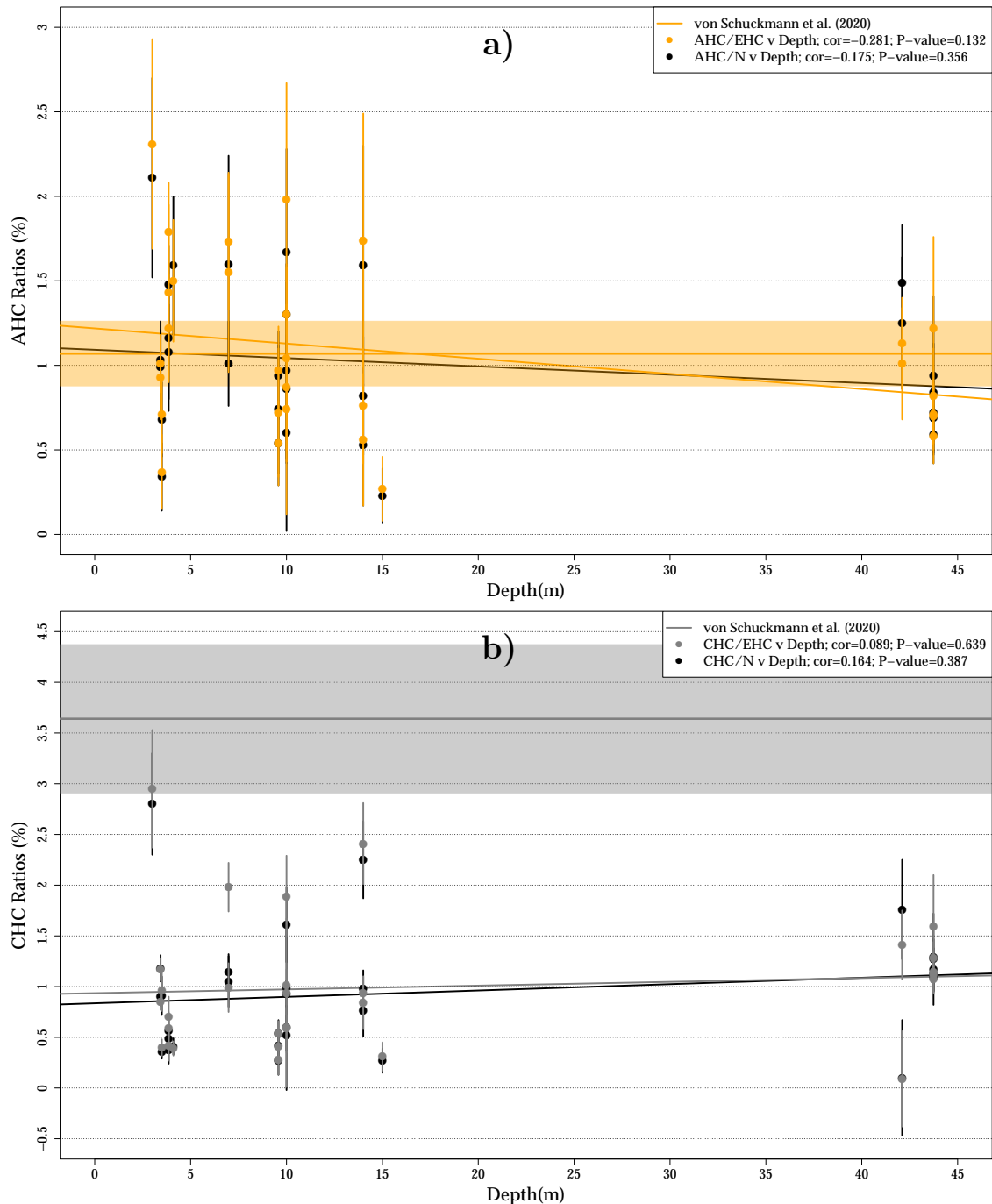
**Figure S1:** Simulated change in Ocean Heat Content (OHC) for the period 1972-2005 CE. Dark blue bars indicate the heat storage by the ocean integrating both temperature and salinity profiles. Light blue bars indicate results integrating only temperature profiles. Vertical black lines at the top of the bars indicate the 95% confidence interval for each model. The multimodel mean and 95% confidence interval for the ocean heat storage are indicated in the right side of the panel (MMM). Observations from von Schuckmann et al. (2020) are shown as solid horizontal lines and shadows (means and 95% confidence intervals), and observations from Church et al. (2011) are displayed as dashed horizontal lines.



**Figure S2:** (a) Integrated total radiative imbalance (N), (b) incoming shortwave radiation (ISW), (c) outgoing shortwave radiation (OSW) and (d) outgoing longwave radiation (OLW) at the top of the atmosphere for the CCSM4, CESM1-CAM5, CESM1-FASTCHEM and INM-CM4 Historical simulations. Data from the CESM1-CAM5 are dedrifted using the preindustrial control simulation (solid red lines) or the first five decades of the Historical simulation (dashed red lines). Data from the rest of models are dedrifted using the corresponding preindustrial control simulation.



**Figure S3:** (a) Relationship between the proportion of heat within the ocean and the depth of the used LSM component for the period 1972-2005 CE using EHC (blue dots) and N (black dots) as estimates for the total heat content in the climate system. (b) Relationship between the proportion of heat within the continental subsurface and the depth of the used LSM component for the period 1972-2005 CE using EHC (red dots) and N (black dots) as estimates for the total heat content in the climate system. Observations from von Schuckmann et al. (2020) are shown as solid horizontal lines and shadows (means and 95% confidence intervals). P-values retrieved considering a two-sided Student's t-distribution.



**Figure S4:** (a) Relationship between the proportion of heat within the atmosphere and the depth of the used LSM component for the period 1972-2005 CE using EHC (orange dots) and N (black dots) as estimates for the total heat content in the climate system. (b) Relationship between the proportion of heat within the cryosphere and the depth of the used LSM component for the period 1972-2005 CE using EHC (light blue dots) and N (black dots) as estimates for the total heat content in the climate system. Observations from von Schuckmann et al. (2020) are shown as solid horizontal lines and shadows (means and 95% confidence intervals). P-values retrieved considering a two-sided Student's t-distribution.

## References

- 5 Church, J. A., White, N. J., Konikow, L. F., Domingues, C. M., Cogley, J. G., Rignot, E., Gregory, J. M., van den Broeke, M. R., Monaghan, A. J., and Velicogna, I.: Revisiting the Earth's sea-level and energy budgets from 1961 to 2008, *Geophysical Research Letters*, 38, n/a–n/a, <https://doi.org/10.1029/2011GL048794>, <http://dx.doi.org/10.1029/2011GL048794>, 118601, 2011.
- von Schuckmann, K., Cheng, L., Palmer, M. D., Hansen, J., Tassone, C., Aich, V., Adusumilli, S., Beltrami, H., Boyer, T., Cuesta-Valero, F. J., Desbruyères, D., Domingues, C., García-García, A., Gentine, P., Gilson, J., Gorfer, M., Haimberger, L., Ishii, M., Johnson, G. C., Killick, R., King, B. A., Kirchengast, G., Kolodziejczyk, N., Lyman, J., Marzeion, B., Mayer, M., Monier, M., Monselesan, D. P., Purkey, S., Roemmich, D., Schweiger, A., Seneviratne, S. I., Shepherd, A., Slater, D. A., Steiner, A. K., Straneo, F., Timmermans, M.-L., and Wijffels, S. E.: Heat stored in the Earth system: where does the energy go?, *Earth System Science Data*, 12, 2013–2041, <https://doi.org/10.5194/essd-12-2013-2020>, <https://essd.copernicus.org/articles/12/2013/2020/>, 2020.
- 10