

# Supporting Information for “Observation-based variability in the global ocean carbon sink from 1959-2020”

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## Contents of this file

1. Text S1-S2
2. Figures S1-S2

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## S1. Reconstructed Air-Sea CO<sub>2</sub> Fluxes

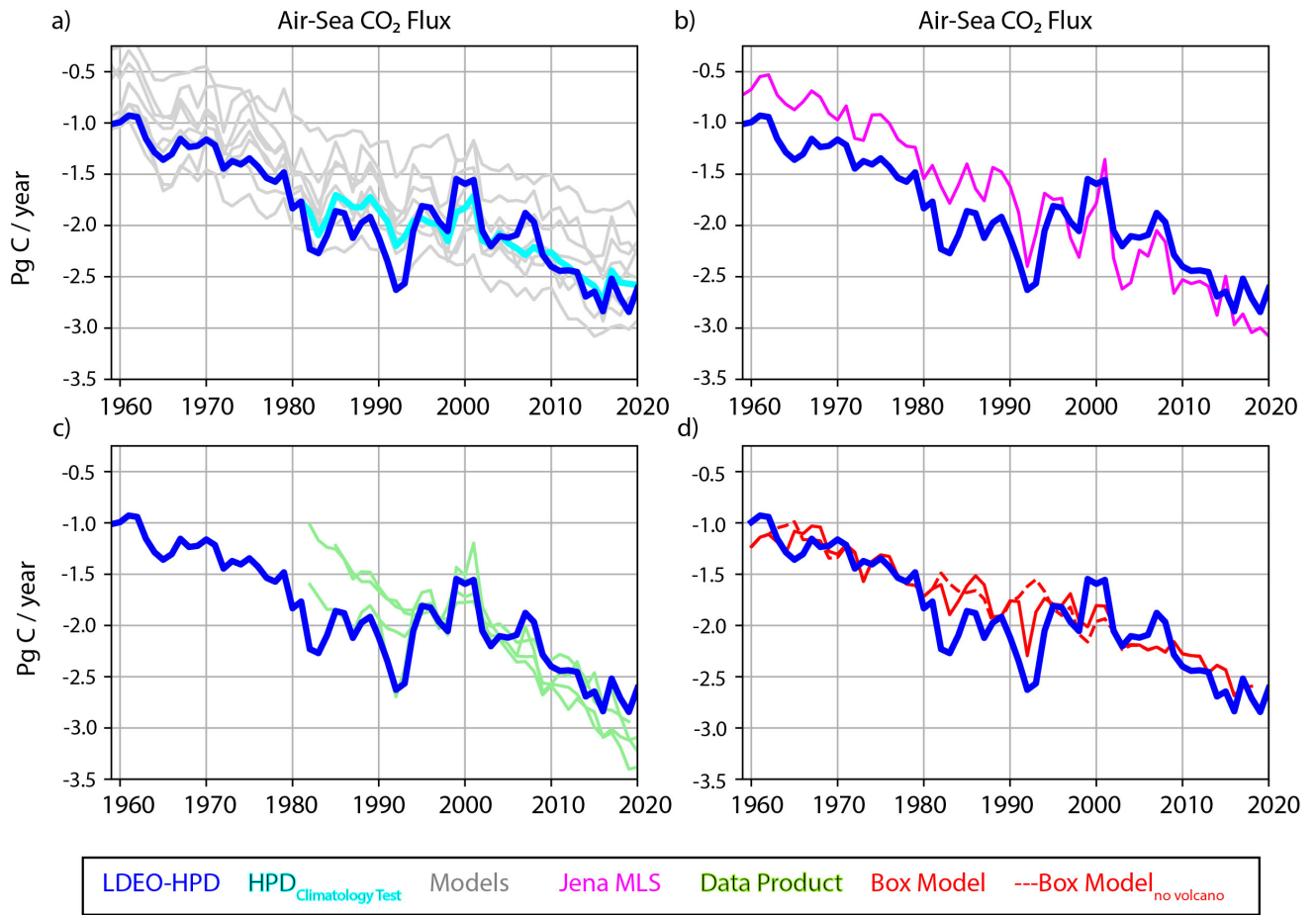
Figure S1 shows the air-sea CO<sub>2</sub> fluxes reconstructed by LDEO-HPD as compared to the eight GOBMs and HPD Climatology Test (Figure S1 a), Jena MLS (Figure S1 b), other observation-based products (Figure S1 c) and the box model simulations with and without volcanoes (McKinley et al., 2020) (Figure S1 d).

## S2. Anomalies of Detrended Reconstructed Air-Sea CO<sub>2</sub> Fluxes

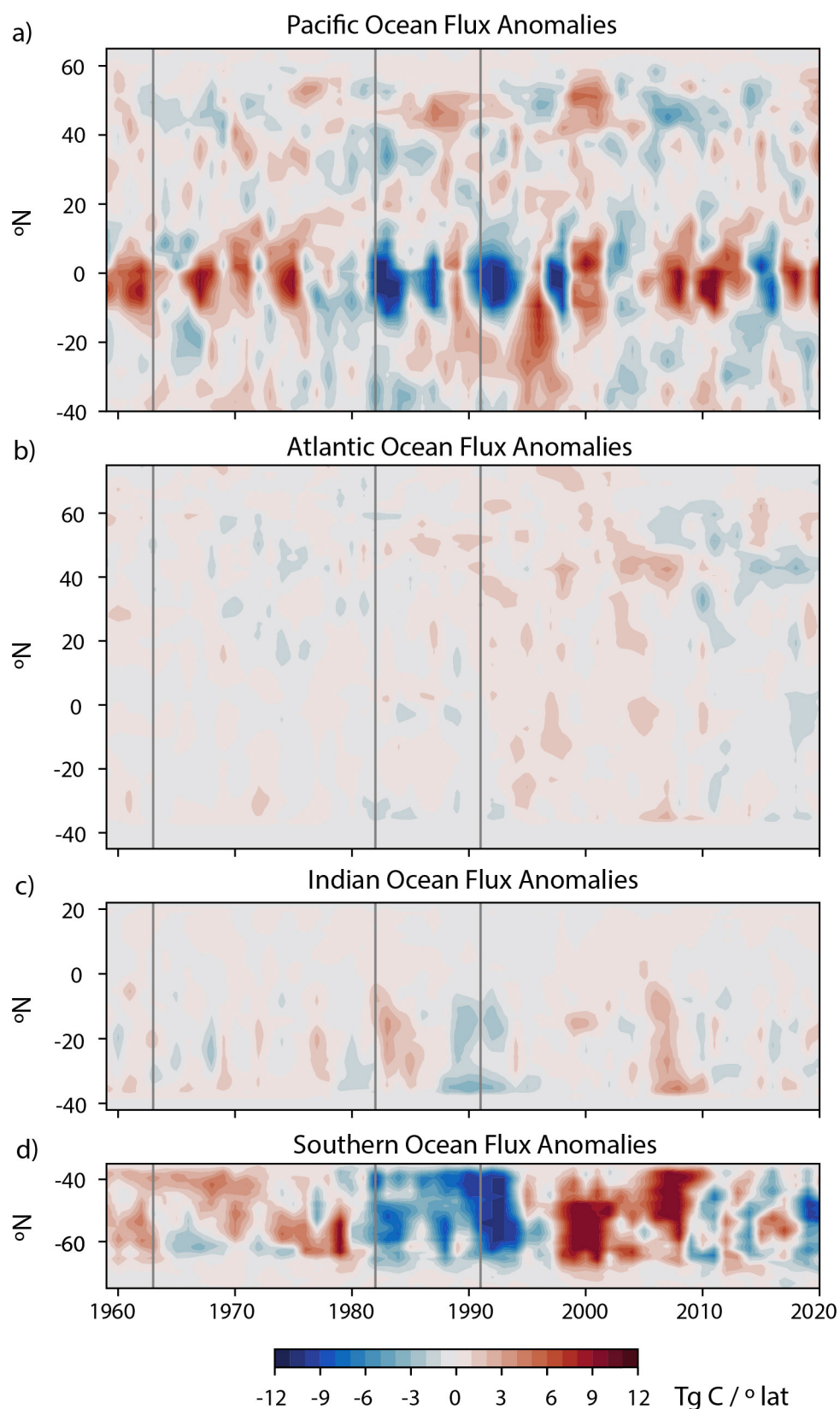
Figure S2 shows the anomalies of detrended air-sea CO<sub>2</sub> fluxes in the four ocean basins. The years of major volcanic eruptions are depicted with vertical grey lines Agung (1963), El Chichon (1982) and Mt. Pinatubo (1991). The Pacific and Southern Oceans show clear increases in their ocean sink immediately following the volcanic eruptions.

## References

- McKinley, G. A., Fay, A. R., Eddebbar, Y. A., Gloege, L., & Lovenduski, N. S. (2020). External forcing explains recent decadal variability of the ocean carbon sink. *AGU Advances*, 1(2), e2019AV000149. doi: <https://doi.org/10.1029/2019AV000149>
- Rödenbeck, C., DeVries, T., Hauck, J., Le Quéré, C., & Keeling, R. (2021). Data-based estimates of interannual sea–air CO<sub>2</sub> flux variations 1957–2020 and their relation to environmental drivers. *Biogeosciences Discussions*, 2021, 1–43. doi: 10.5194/bg-2021-304



**Figure S1.** (a) Air-sea CO<sub>2</sub> fluxes for 1959-2020 according to LDEO-HPD (blue), HPD Climatology Test (cyan), and the nine unadjusted GOBMs (grey). (b) Air-sea CO<sub>2</sub> fluxes for 1959-2020 according to LDEO-HPD (blue) and Jena MLS (magenta) (Rödenbeck et al., 2021). (c) Air-sea CO<sub>2</sub> fluxes for 1959-2020 according to LDEO-HPD (blue) and the other data products (green). (d) Air-sea CO<sub>2</sub> fluxes for 1960-2018 according to LDEO-HPD (blue) and the box model of McKinley et al. (2020) with volcanoes (red) and without volcanoes (dashed red).



**Figure S2.** Detrended air-sea CO<sub>2</sub> flux anomalies in four ocean basins (TgC/yr/°lat). Major volcanic eruptions denoted with vertical grey lines (Agung, March 1963; Chichon, April 1982; Pinatubo, June 1991).

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