

Supporting information for

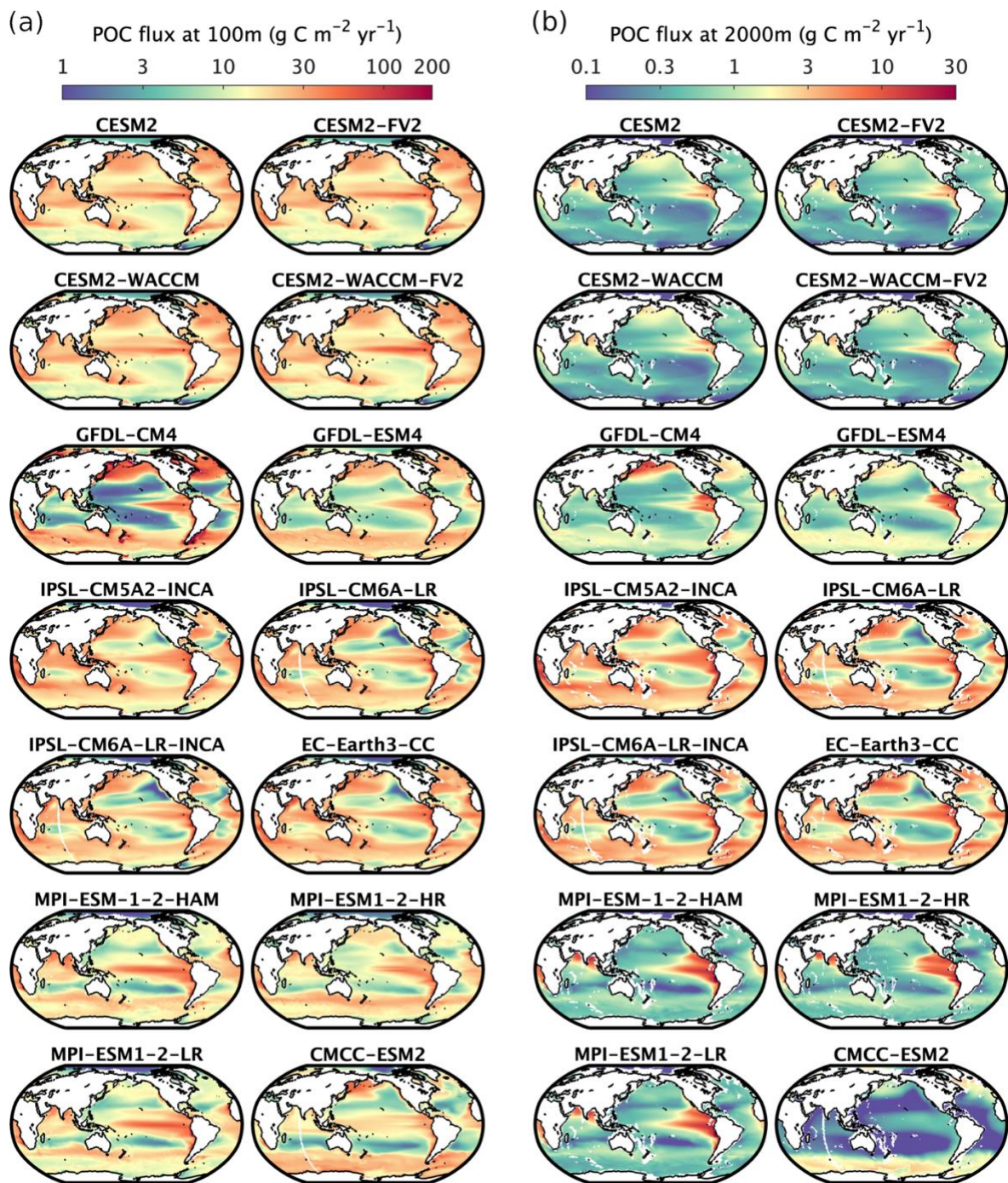
**Distinct sources of uncertainty in simulations of the ocean biological carbon pump at different depths**

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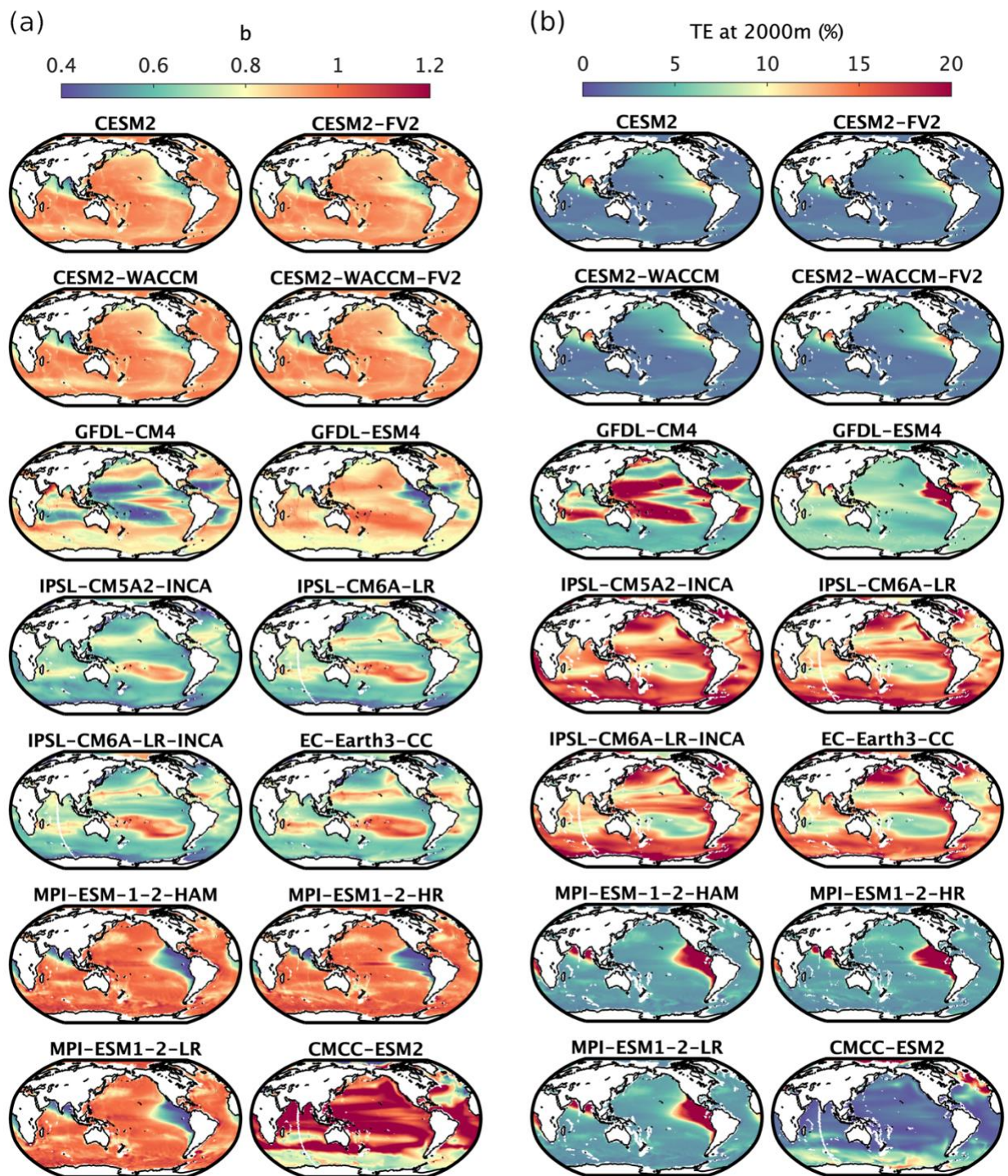
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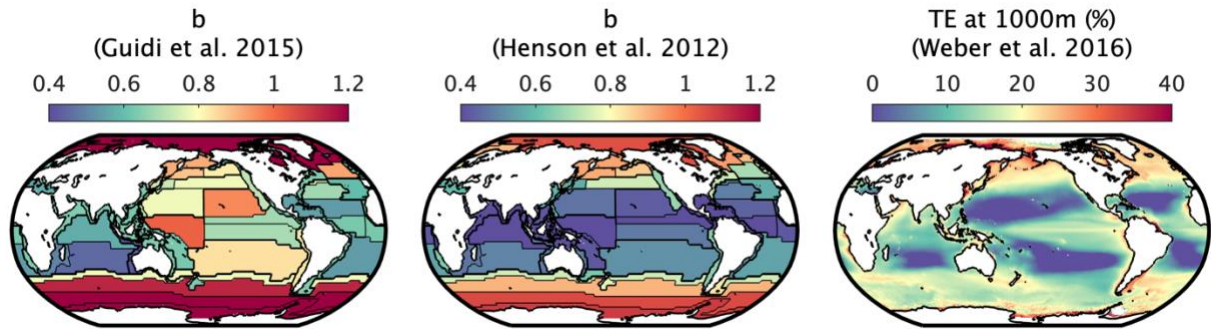
## Supplementary Figures



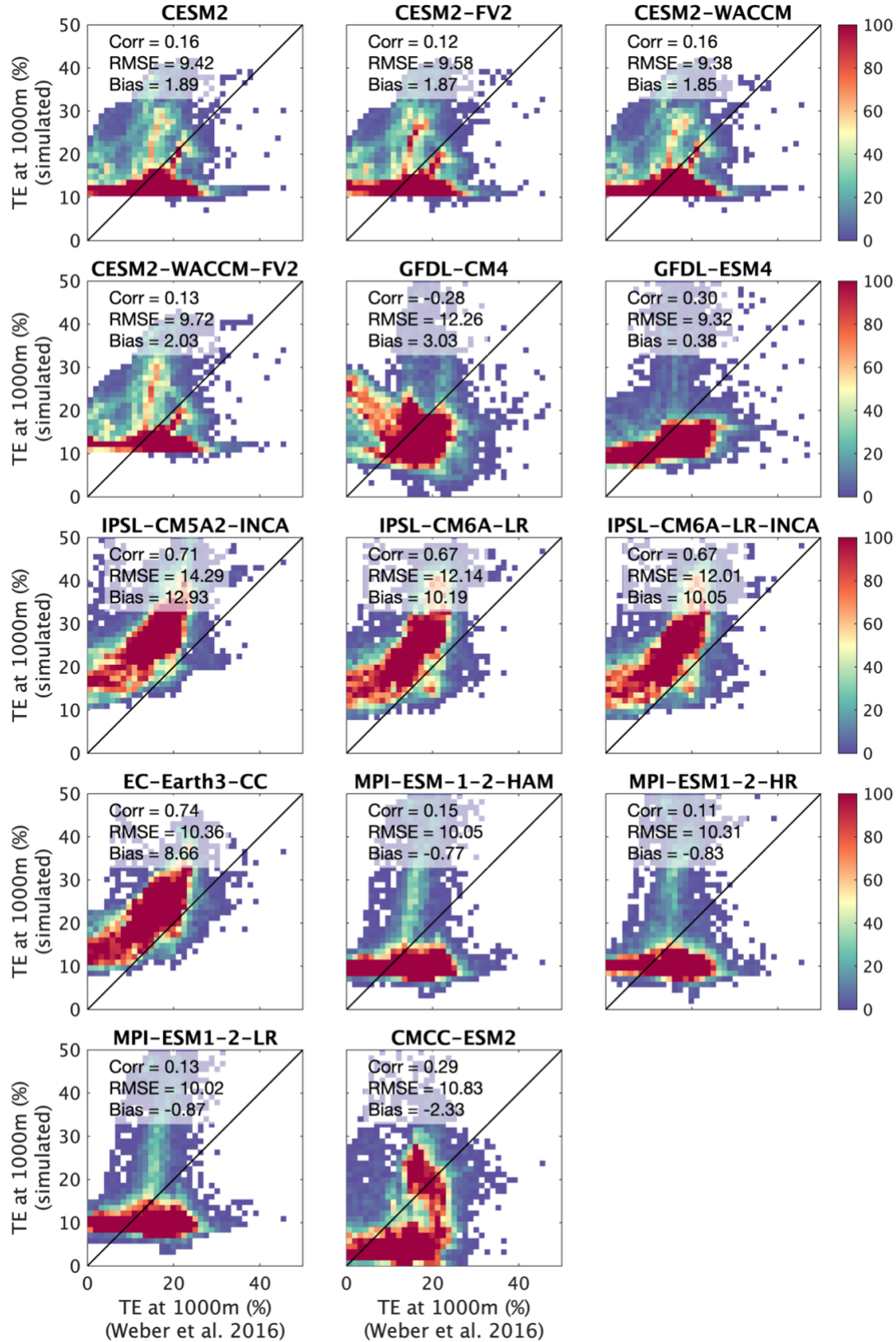
Supplementary Figure 1. Spatial distributions of the vertical carbon flux at 100 m and 2000 m from 14 CMIP6 models.



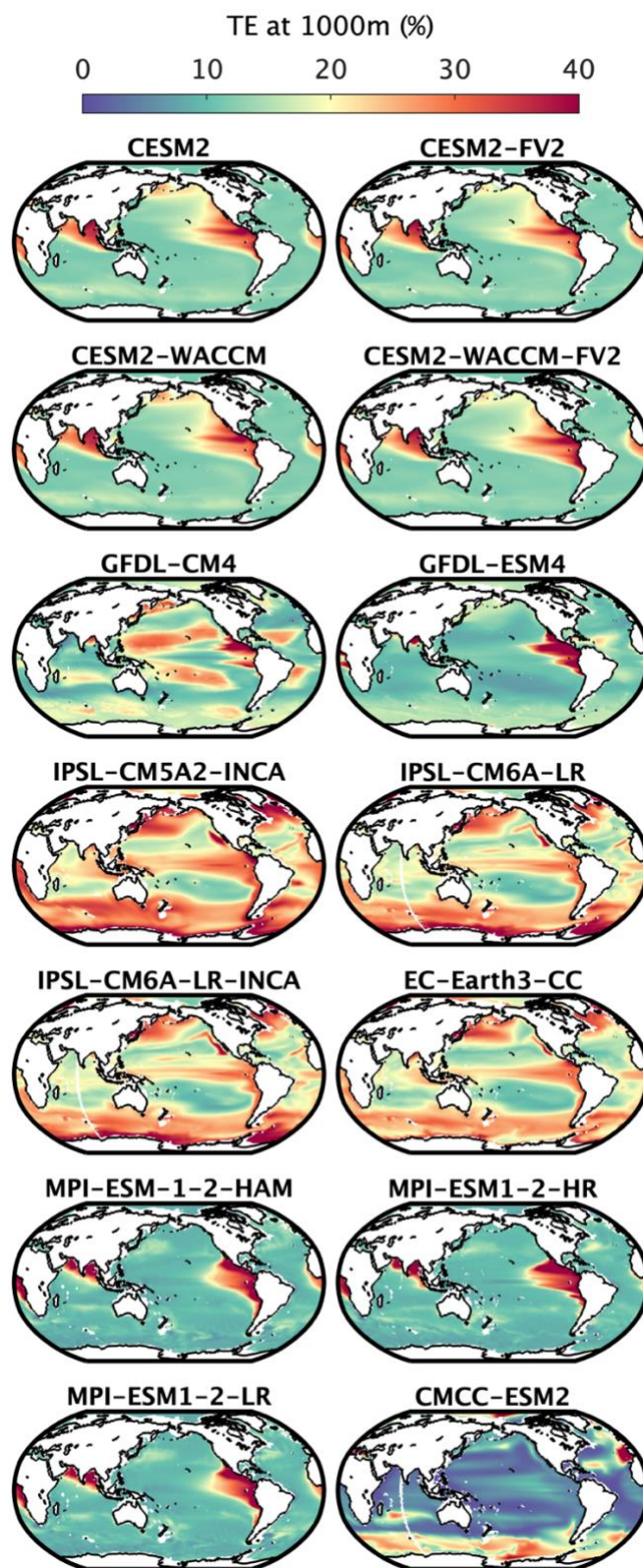
Supplementary Figure 2. Spatial distributions of the Martin curve exponent  $b$  and the transfer efficiency at 2000 m simulated by the CMIP6 models.



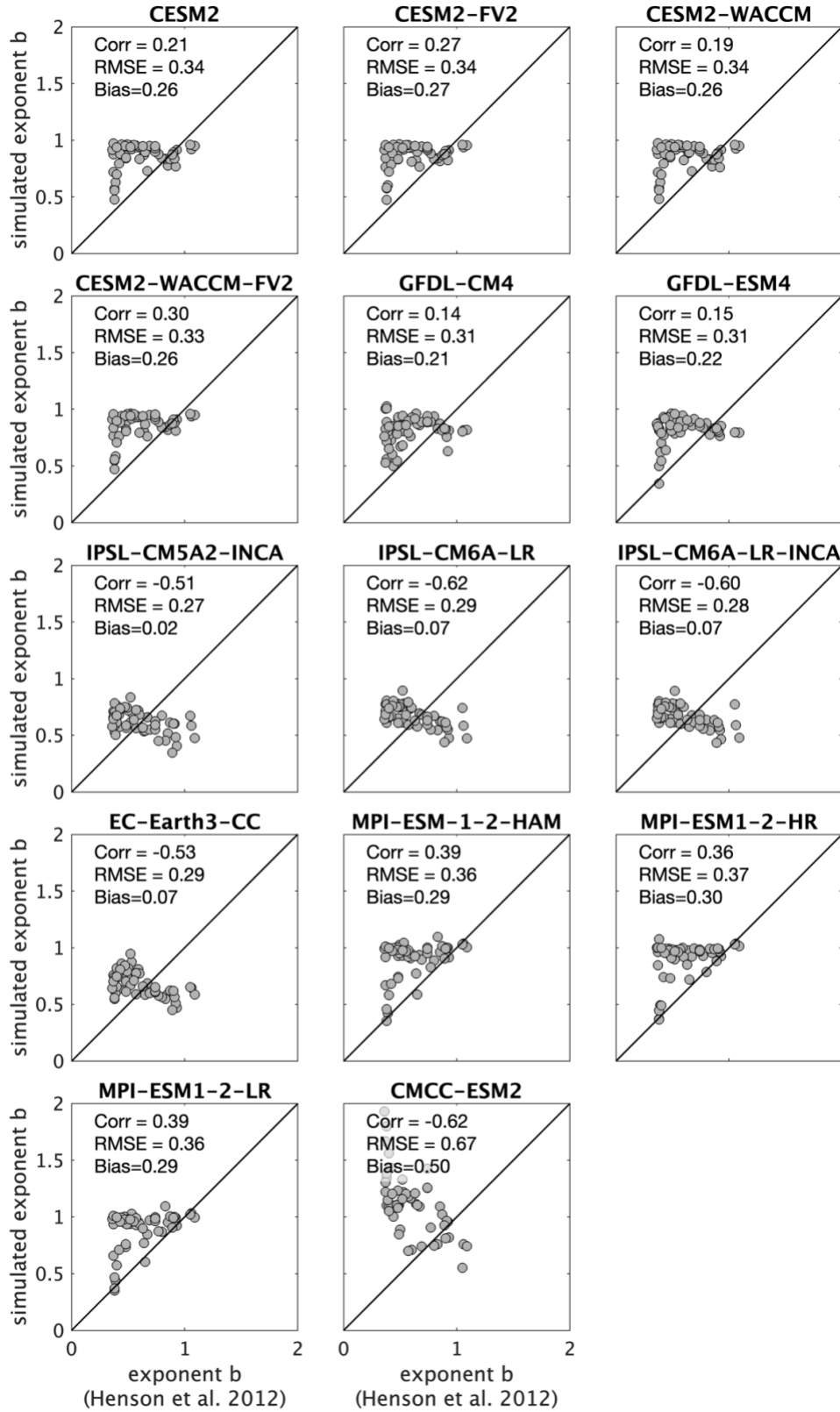
Supplementary Figure 3. The regionalized exponent  $b$  within Longhurst provinces<sup>1</sup> and transfer efficiency at 1000 m which are estimated by supplementary refs.<sup>2-4</sup>.



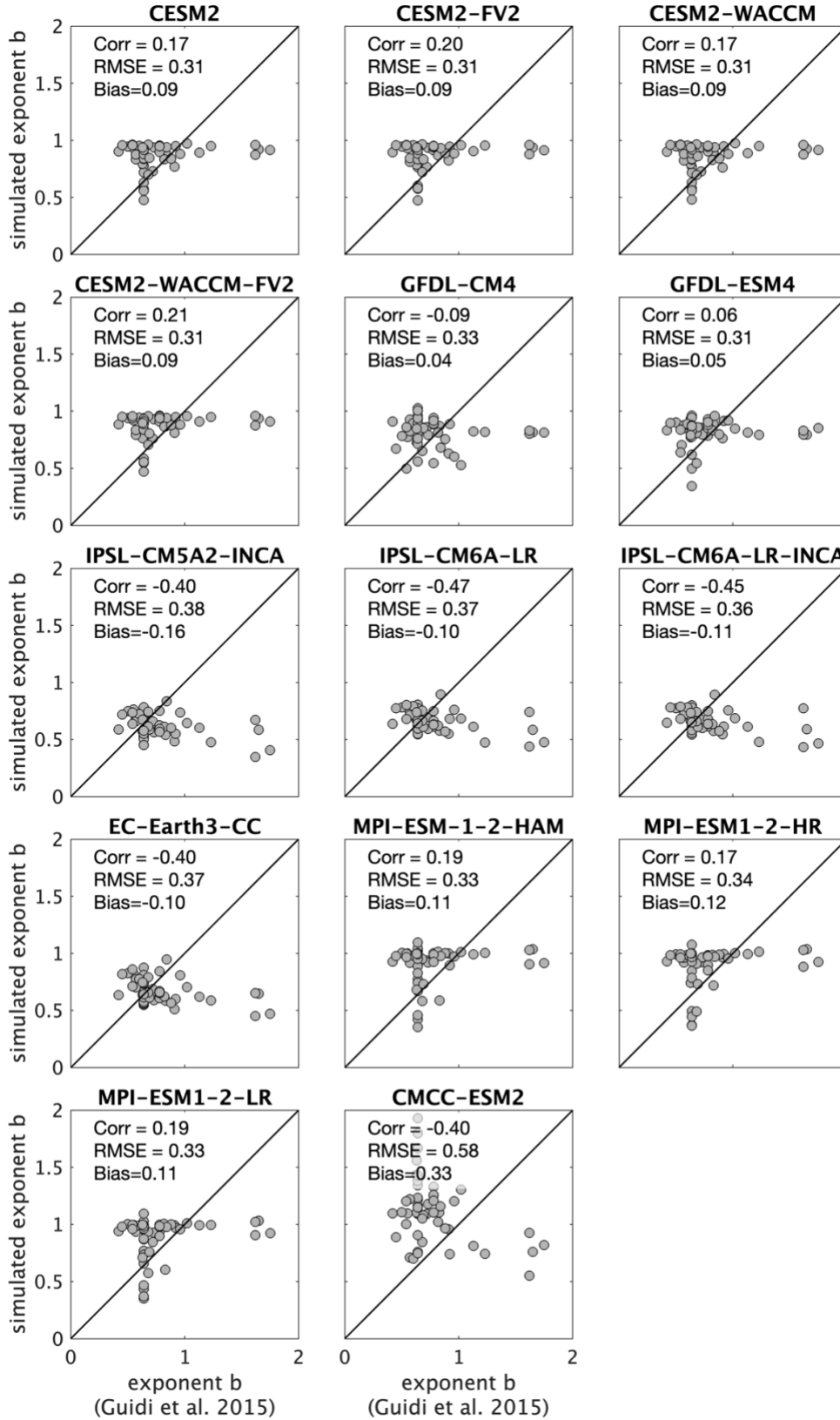
Supplementary Figure 4. Comparisons of simulated transfer efficiency at 1000 m by CMIP6 models with estimates from supplementary ref.<sup>4</sup>



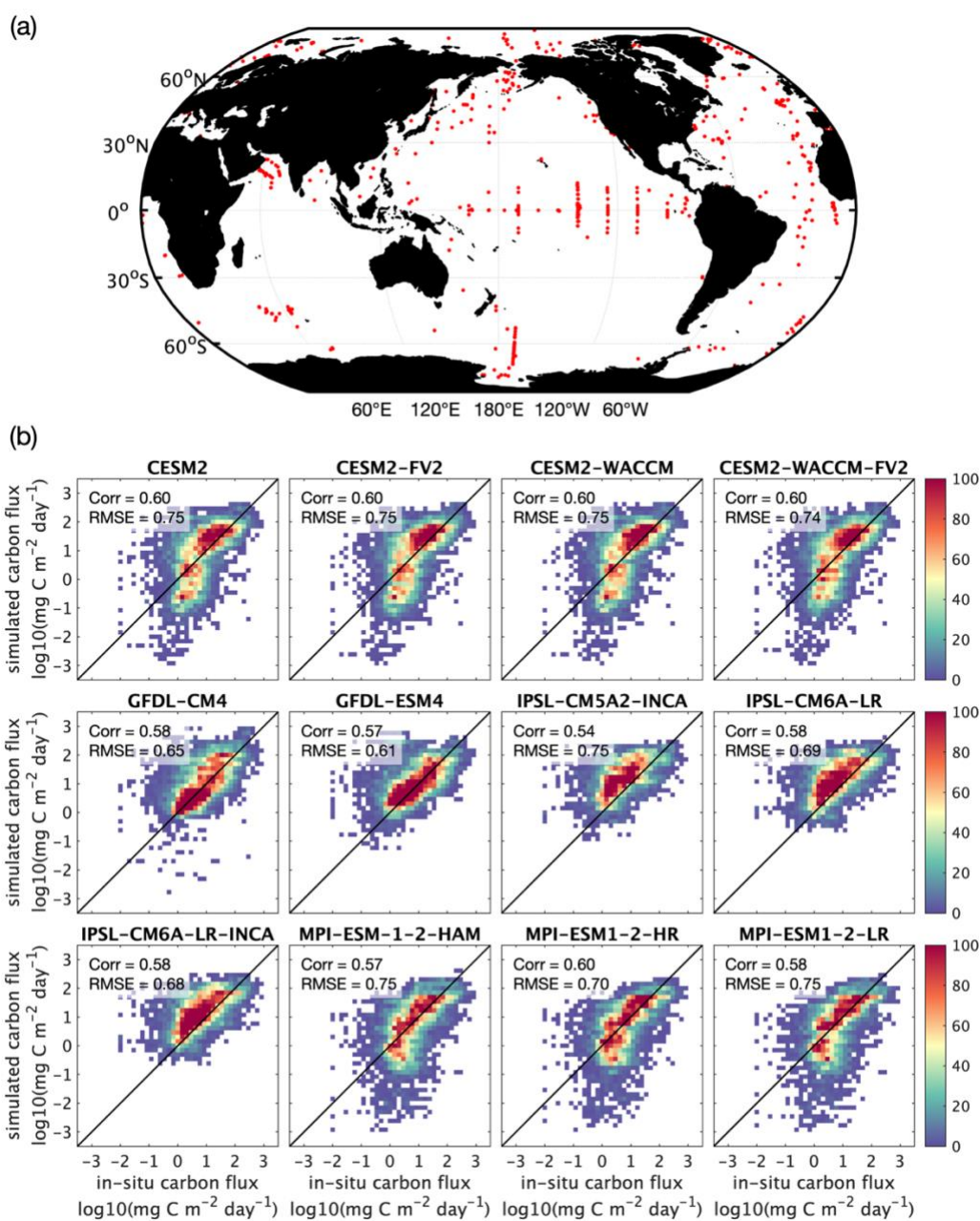
Supplementary Figure 5. Spatial distributions of the transfer efficiency at 1000 m simulated by the CMIP6 models.



Supplementary Figure 6. Comparisons of the regionalized exponent  $b$  which is simulated by CMIP6 models with estimates from supplementary ref.<sup>3</sup>



Supplementary Figure 7. Comparisons of the regionalized exponent  $b$  which is simulated by CMIP6 models with estimates from supplementary ref.<sup>2</sup>



Supplementary Figure 8. The location of in-situ observations of vertical carbon flux compiled by supplementary ref. <sup>5</sup>(a) and regression analysis of the monthly climatology of vertical carbon flux simulated by CMIP6 models and from in-situ observations (b). The in-situ observations were matched-up with the monthly climatology of simulated POC fluxes in the nearest model grid cell

of each ESMs. The EC-Earth3-CC and CMCC-ESM2 models are missing because they don't provide monthly output of the vertical carbon flux.

### **Supplementary References**

1. Longhurst, A. R. *Ecological geography of the sea*. (Elsevier, 2010).
2. Guidi, L. *et al.* A new look at ocean carbon remineralization for estimating deepwater sequestration. *Global Biogeochem. Cycles* **29**, 1044–1059 (2015).
3. Henson, S. A., Sanders, R. & Madsen, E. Global patterns in efficiency of particulate organic carbon export and transfer to the deep ocean. *Global Biogeochem. Cycles* **26**, 1–14 (2012).
4. Weber, T., Cram, J. A., Leung, S. W., DeVries, T. & Deutsch, C. Deep ocean nutrients imply large latitudinal variation in particle transfer efficiency. *Proc. Natl. Acad. Sci.* **113**, 8606–8611 (2016).
5. Mouw, C. B., Barnett, A., McKinley, G. A., Gloege, L. & Pilcher, D. Global ocean particulate organic carbon flux merged with satellite parameters. *Earth Syst. Sci. Data* **8**, 531–541 (2016).