Supplementary Information

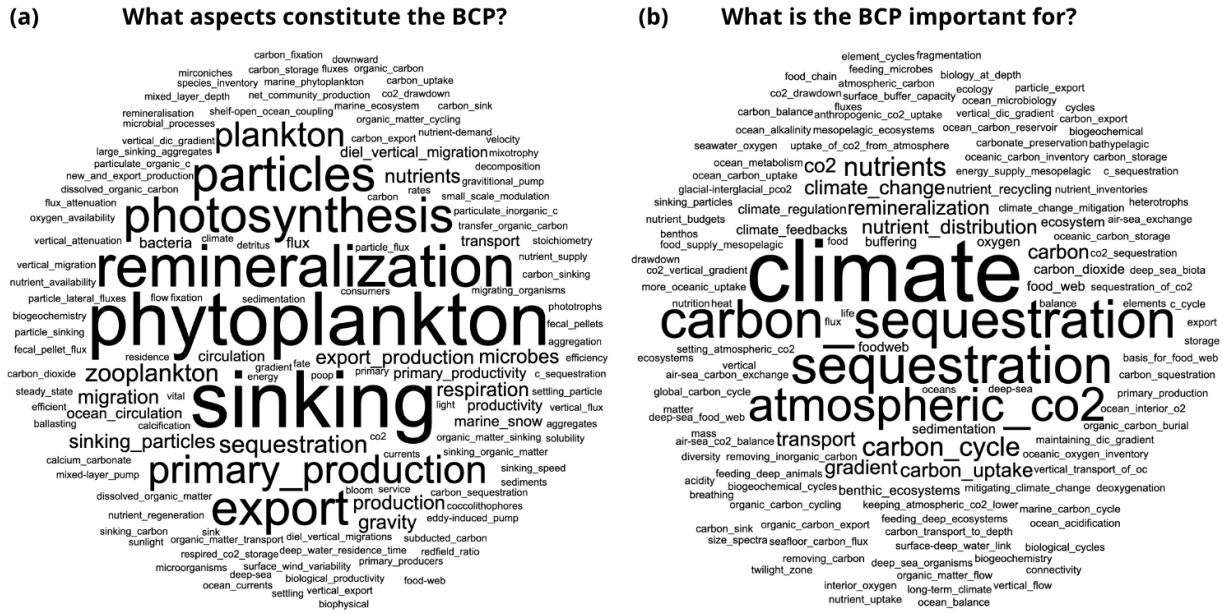

Figure S1: Perception within our research community to equate the biological carbon pump (BCP) with export flux, and that the BCP is important for climate. Qualitative results ("word clouds") of a brief survey with close to 100 participants that show that the BCP commonly **(a)** is associated with processes of the "gain side" of storage of biogenic carbon in the ocean interior (see also Fig. 1 in the main manuscript), including "export", "phytoplankton", "sinking", remineralization", and also **(b)** is thought to be important for climate. The survey was advertised among colleagues through personal emails, mailing lists, and via X (formerly Twitter). Responses stem from 2021 and included responses from colleagues mostly from the fields of biogeochemistry and oceanography. In a second small seminar survey with 20 participants, 60% of participants expected higher export flux to correlate with lower atmospheric CO_2 (10% "Other", 15% "negative correlation", 15% "I do not know"), and (68%) of participants were surprised that such a correlation did not hold. Such small-scale surveys, taken together with one-on-one discussions with colleagues, statements in published literature on the biological carbon pump and/or export flux, and keyword searches across the literature (see Web of Science search results in the main manuscript) suggest to us that a misconception is prevailing.

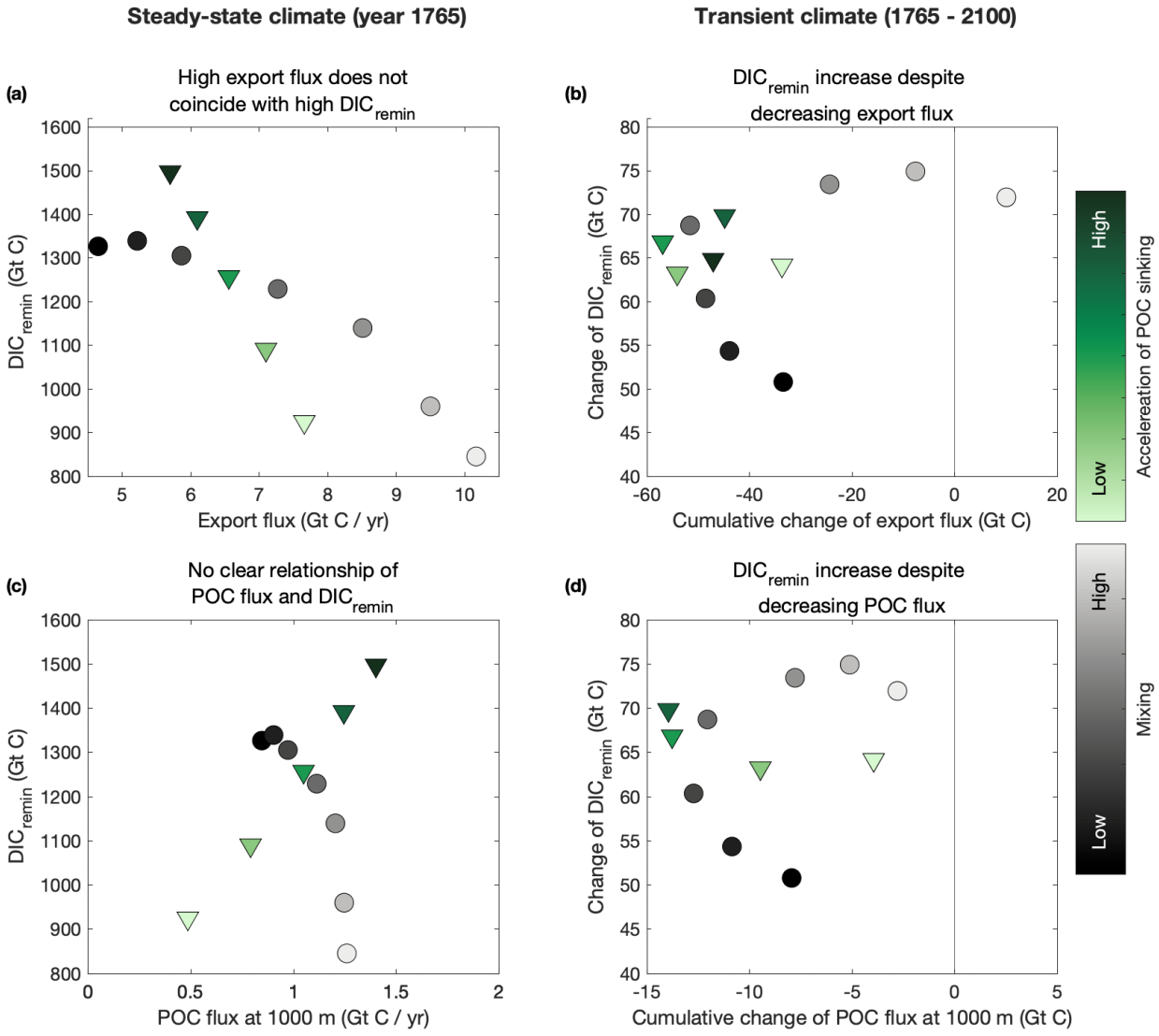

Figure S2: Same as Figure 3 in the main manuscript but illustrating the lack of a universal relationship of flux of particulate organic carbon and storage of biogenic carbon in the ocean interior; (a,b) export flux and **(c,d)** flux of particulate organic carbon (POC) at 1000 m depth. **(c,d)** illustrate that also the deep (across a 1000 m depth horizon (Wilson et al., 2022) which is commonly understood as the flux that passes down to below upper ocean well ventilated waters) flux of organic carbon (similarly to export flux) cannot be used to robustly estimate DIC_{remin}, and thus atmospheric CO_2. Generally, there is no "intuitive" relationship between the deep flux and change of DIC_{remin}, with a higher flux correlating with higher DIC_{remin}. Only for a subsample of models in a steady-state, with idealistically modified sinking speed profile of organic matter (triangles in panel c), we achieve a qualitative correlation of deep flux with DIC_{remin}, and thus atmospheric CO_2.