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*Supplement of*

# Importance of El Niño reproducibility for reconstructing historical $CO_2$ flux variations in the equatorial Pacific

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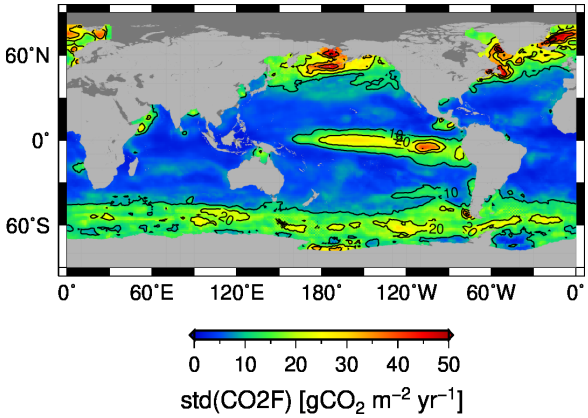


**Figure S1.** Map for standard deviations of CO2F anomalies derived from observation-based dataset SOM-FFN (Landschützer et al., 2016, 2017). Monthly CO2F anomalies were calculated with respect to the 1982–2005 monthly mean climatology, with one-year running mean filter applied.

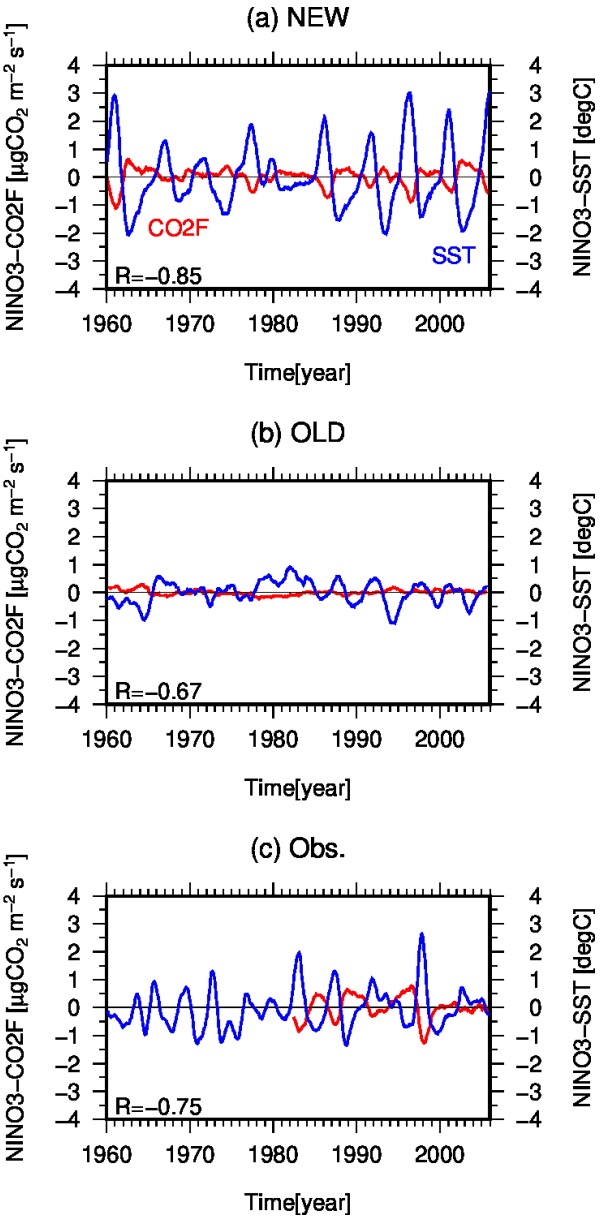


**Figure S2.** Timeseries of the detrended NINO3-SST (blue line) and NINO3-CO2F (red line; positive upward) anomalies simulated by one member of each ensemble in (a) NEW and (b) OLD. Values plotted are the one-year running mean. R denotes the ensemble mean correlation coefficients between detrended NINO3-SST and NINO3-CO2F anomalies, with one-year running mean filter applied. (c) As in (a), but for the observational dataset, COBE-SST2 (Ishii et al., 2005; Hirahara et al., 2014) and SOM-FFN (Landschützer et al., 2016, 2017).

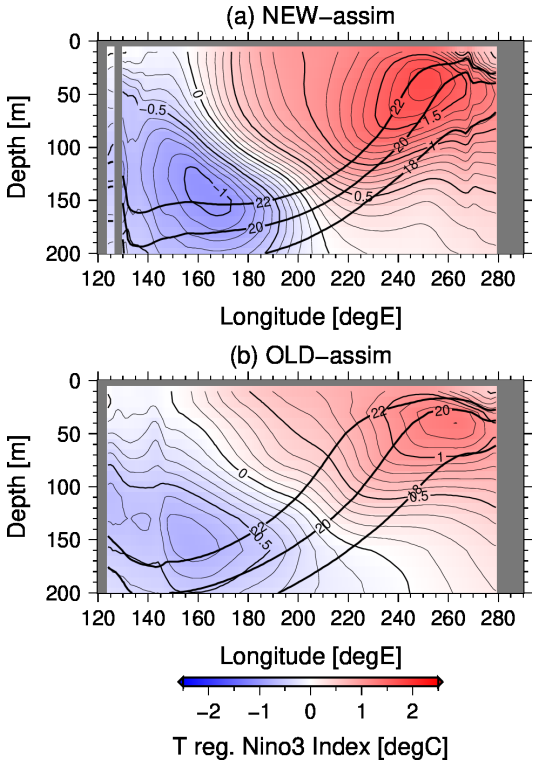


**Figure S3.** Anomalies of the equatorial ocean temperature regressed onto standardized NINO3-SST anomalies for NEW-assim (top), and OLD-assim (bottom). Contour interval is 0.1 °C. Thick solid lines indicates the climatological-mean isotherms of the 18, 20, and 22 °C.

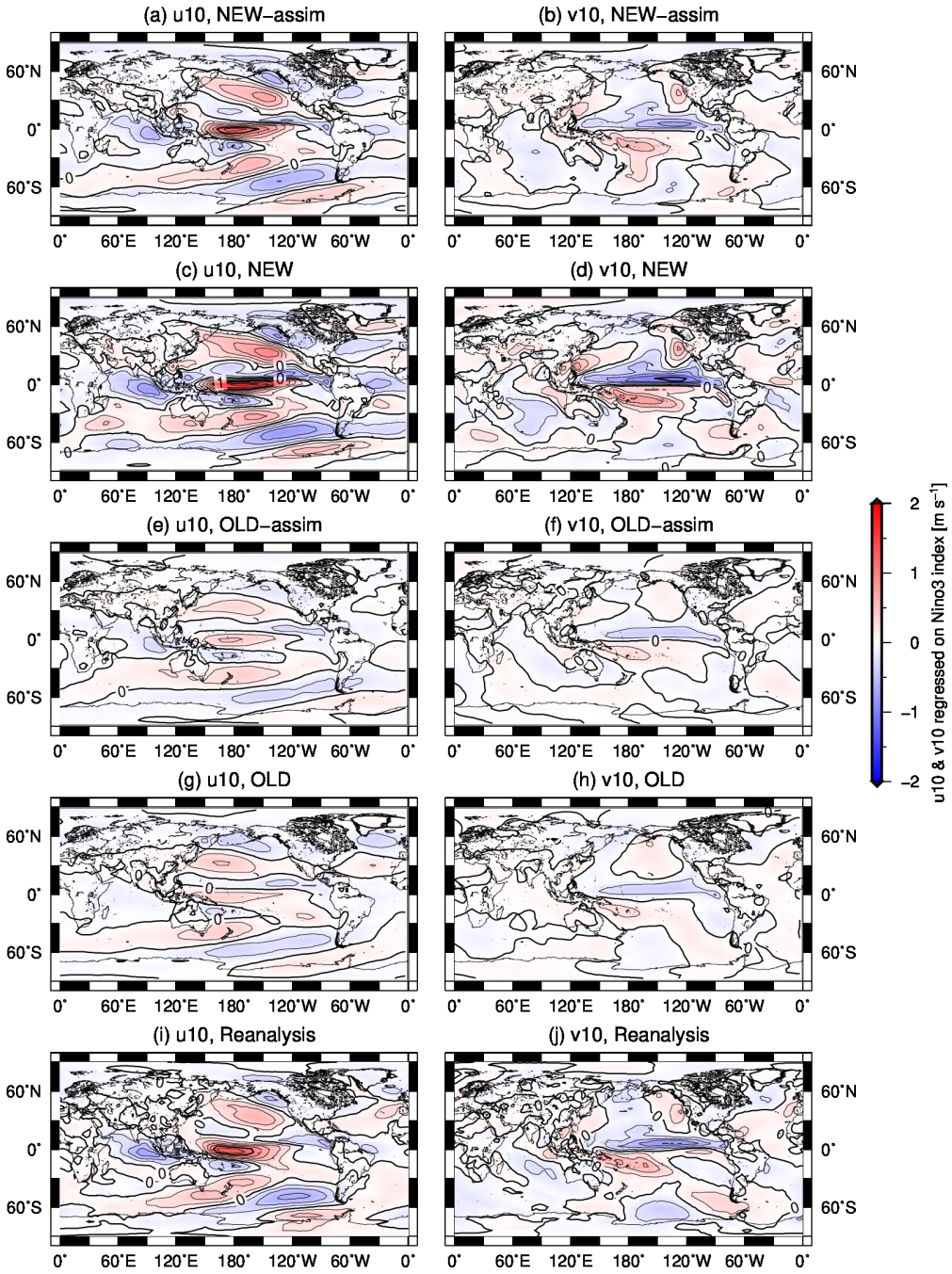


**Figure S4.** Map for 10 m (left) zonal and (right) meridional wind anomalies regressed onto standardized NINO3-SST anomalies simulated (a,b) in NEW-assim, (c,d) in NEW, (e,f) in OLD-assim, (g,h) in OLD, and (i,j) that derived from JRA-55 reanalysis (Kobayashi et al., 2015) and observational COBE-SST2 (Ishii et al., 2005; Hirahara et al., 2014). Contour interval is 0.2 m $s^{-1}$.

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