Supporting Information for Ocean Surface Flux Algorithm Effects on Tropical Indo-Pacific Intraseasonal Precipitation

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Contents of this file

1. Text S1

2. Figures S1

Introduction The supplementary information includes the text explaining the derivation of the surface variables based on the 1000 hPa field in E3SMv1 coupled simulation and the figure showing the relationship between latent heat flux and intra-seasonal precipitation in the E3SM_climo and CESM2_amip simulations.

Text S1 Surface variables for E3SMv1 CMIP6 simulation: The simulation provides $|\mathbf{V}|$ and q at 1000 hPa. Following de Szoeke et al., (2012), we use the Monin-Obukhov Similarity Theory to estimate T_{sfc} and q_{2m} for the simulation. Following their approach,

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November 16, 2021, 9:22pm

we use the wind velocity and specific humidity at 1000hPa to derive the surface values

based on

$$u_{10m} = \frac{u^*}{k}(\ln(\frac{10}{z_0}) - \Psi(\frac{10}{L})) \tag{1}$$

$$q_{2m} = q(1000\text{hPa}) + \frac{q^*}{k}(\ln(\frac{z(1000\text{hPa})}{2}) + \Psi(\frac{2}{L}) - \Psi(\frac{z(1000\text{hPa})}{L})) \tag{2}$$

, where k is the von Kármán constant, L the Monin–Obukhov length, stability parameters

q^* and u^* which parameterized the vertical turbulence flux are iteratively derived, and Ψ

is determined by the stability condition based on L. We also adjust the background mean

field of the derived daily q_{2m} and u_{10m} to their mean values obtained from the monthly

output from the E3SMv1 historical simulation in the CMIP6 repository.
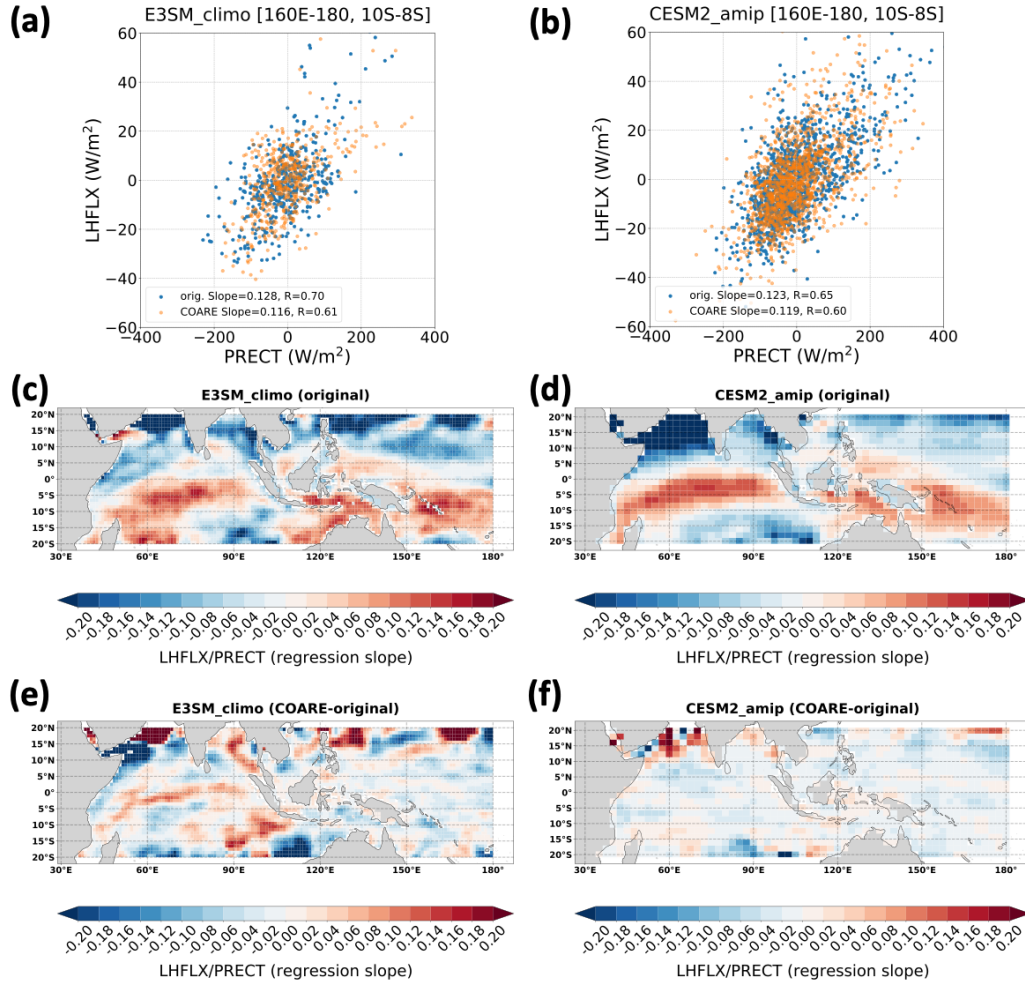
Figure S1. The scatter plot of mean precipitation and mean latent heat flux over the 160°E-180° and 10°S-8°S region in the unit of W/m^2 during Nov-Apr of each year in (a) E3SM_climo and (b) CESM2_amip simulations. The blue dot represents the latent heat flux determined using the original bulk flux algorithm while the orange dot represents the COARE bulk flux algorithm. The linear regression for both original and COARE result are shown in the legend. The map of regression slope value at each grid point during Nov-Apr of each year in (c) E3SM_climo and (d) CESM2_amip simulations based on the original bulk flux algorithm in the models. The map of regression slope changes after the latent heat flux is determined based on the COARE bulk flux algorithm in (e) E3SM_climo and (f) CESM2_amip simulations.

November 16, 2021, 9:22pm