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Reresentation of the interannual variability of equatorial Pacific air-sea CO_2 flux in the lasted earth system models

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We analyze the interannual variability of the air-sea CO_2 flux over the equatorial Pacific in the latest earth system models (ESMs; we choose 16 models with enough outputs of variables closely associated with the air-sea CO_2 flux variation for analyzing). Our results show that, about half of the models analyzed here have weaker interannual variability of the air-sea CO_2 flux over the equatorial Pacific compared with the previous observational results, although the 16 models are capable to illustrate the spatial distribution character of the air-sea CO_2 flux over the equatorial Pacific. For the possible reason for the weak interannual variation of the air-sea CO_2 flux over the equatorial Pacific in the models, we first examine the ENSO mode of the equatorial Pacific air-sea CO_2 flux, with the considering of that the equatorial Pacific air-sea CO_2 flux variation is dominated by El Niño events. Then we briefly analyze the variables which jointly influence the air-sea CO_2 flux interannual variability (such as, sea surface temperature (SST) , dissolved inorganic carbon (DIC) in the surface ocean, upward ocean mass transport (WMO), and net primary productivity of carbon by phytoplankton (NPP)). Nine of the 16 models are capable to represent the ENSO mode of the air-sea CO_2 flux over the equatorial Pacific, the other seven of them are incapable to represent this important character. Incapacity of representing the ENSO mode of the air-sea CO_2 flux in some models implies the limitation in depicting the response of air-sea CO_2 flux to the El Niño events over the equatorial Pacific, which contributes to weak interannual variability of air-sea CO_2 flux to some extent. The variations of DIC, NPP and WMO have large divergences in the 16 models over the central-eastern equatorial Pacific. Improvement of the depiction of physical and biological fields are important for accurate interannual variation of the equatorial air-sea CO_2 flux.