EGU21-13946
https://doi.org/10.5194/egusphere-egu21-13946
EGU General Assembly 2021

Eastern equatorial Pacific warming delayed by aerosols and thermostat response to CO_2

Ulla K. Heede[1] and Alexey V. Fedorov[1,2]
[1]Earth and Planetary Sciences, Yale University, New Haven, CT, USA (ulla.heede@yale.edu)
[2]LOCEAN/IPSL, Sorbonne University, Paris, France

Understanding the tropical Pacific response to global warming remains a challenging problem due to discrepancies between models and observations, as well as a large intermodel spread in future projections. Here, we assess the recent and future evolution of the equatorial Pacific east-west temperature gradient, and the Walker circulation within the CMIP6 dataset. Using 40 models, we compare simulated tropical climate change across a wide range of experiments with varying CO_2 and aerosol forcing. In abrupt CO_2-increase scenarios, many models generate an initial strengthening of the east-west gradient resembling an ocean thermostat (OT), characterized by lack of warming in the central Pacific, followed by a small weakening; other models generate an immediate weakening that becomes progressively larger establishing a pronounced eastern equatorial Pacific (EP) warming pattern. The initial response in these CO_2-only experiments is a very good predictor for the future EP pattern simulated in future warming scenarios, but not in historical simulations showing no multi-model trend. The likely explanation is that recent CO_2-driven changes in the tropical Pacific, which are relatively small compared to future projections, are masked by aerosol effects. In future warming scenarios, however, the EP warming pattern emerges within 20-40 years as greenhouse gases overcome aerosol forcing. These findings highlight the need to understand the largely overlooked, but possibly significant role of aerosols in delaying sea surface warming in the tropical Pacific, and the implications for predicting future climate change across the tropics.