ROLE OF OCEAN IN THE TRANSIENT RESPONSE OF ATMOSPHERIC AND OCEANIC HEAT TRANSPORTS TO ANTHROPOGENIC WARMING

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In modern climate, both atmosphere (AHT) and ocean (OHT) are transporting heat from tropics to the poles, which is of significant importance to maintain energy balance on the earth. However, model projections of the near-future response to anthropogenic warming show an intensified AHT and reduced OHT (or compensation) that are largely symmetric about the equator, the causes of which remain unclear. Using both the CMIP5 archive and CCSM4 simulations forced with RCP8.5 to 2600, We for the first time explored the mechanisms behind the compensation of AHT and OHT from ocean perspective and showed that this transient compensation – specifically during the initial stage of warming – is caused by combined changes in both atmospheric and oceanic circulations: in particular, a southward OHT associated with a weakened Atlantic Meridional Overturning Circulation (AMOC), a northward apparent OHT associated with an ocean heat storage maximum around the Southern Ocean, and a symmetric coupled response of the coupled Hadley-Subtropical Cell in the Indo-Pacific Ocean. It is further shown that the true advective OHT differs from the flux inferred OHT in the initial warming due to the inhomogeneous responses of ocean heat storage. These results shed new insights into understanding future heat transport responses, and thereby global climatic processes such as the redistribution of ocean heat and the shift of Intertropical Convergence Zone.

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