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Trans-basin water vapor transport and ocean salinity changes between the Atlantic and Pacific under global warming

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Using the latest Coupled Model Intercomparison Projects phase 6 (CMIP6) abrupt-4xCO2 scenario, this study investigates the sea surface salinity (SSS) and hydrological cycle changes in response to global warming in the tropical Atlantic and tropical eastern Pacific. The analysis results reveal the enhancement of the global water cycle and the effect of El Niño-like sea surface temperature (SST) warming. Under global warming, the SSS decreases in the tropical Pacific and increases in the tropical Atlantic, following the “wet-get-wetter” mechanism. The increase of specific humidity leads to the enhancement of inter-basin moisture transport. More water vapor transports from the Atlantic to the Pacific in response to the rise of the freshwater flux gradient between the two basins, resulting in an SSS decrease in the Pacific and an increase in the Atlantic. At the same time, the increase of trans-basin SST gradient leads to the enhancement and westward shift of the Walker circulation, further resulting in the precipitation increase and the salinity decrease in the tropical Pacific. Furthermore, the El Niño-like warming induces a Wind-Evaporation-SST (WES) feedback in the tropical eastern Pacific. The reduced SST meridional gradient weakens the atmospheric circulation. Correspondingly, precipitation (salinity) decreases (increases) in the northeastern Pacific and increases (decreases) in the southeastern Pacific.