

Freshwater transport in the coupled ocean-atmosphere system: a passive ocean

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Conservation of water demands that ocean and atmosphere freshwater transports (FWT) are of equal magnitude but opposite in direction. This suggests that the atmospheric FWT and its associated latent heat (LH) transport could be thought of as a 'coupled ocean/atmosphere mode'. But what is the true nature of this coupling? Is the ocean passive or active?

Here we analyze a series of simulations with a coupled ocean-atmosphere sea ice model employing highly idealized geometries but with markedly different coupled climates and patterns of ocean circulation. Exploiting streamfunctions in specific humidity coordinates for the atmosphere and salt coordinates for the ocean to represent FWT in their respective medium, we find that atmospheric FWT/LH transport is essentially independent of the ocean state. Ocean circulation and its salinity distribution adjust to achieve a return freshwater pathway demanded of it by the atmosphere