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The hydrological cycle of the Walker Cell

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The hydrological cycle of the tropical Pacific Ocean is traced with Lagrangian water mass trajectories in the coupled ocean-atmosphere system.

The cycle consists of one half in the atmosphere and one half in the ocean, where the two halves are connected by the evaporation and precipitation regions at the sea surface.

The atmospheric part of the water cycle is traced backward from the precipitation at the sea surface of the Warm Pool to the evaporation regions in the eastern tropical Pacific.

Reversely, the ocean part of the cycle is also traced from the precipitation to the evaporation regions with water mass trajectories, with emphasis on the part that recirculates within the Tropical Pacific.

The air circulation of the Walker Cell is superimposed on the ocean-atmosphere water cell both in the zonal-vertical space as well as in the hydrothermohaline space. This reveals how the ocean and atmosphere are connected, which are, to some extent, governed by the Clausius-Clapeyron relationship in the evaporation regions.

The Lagrangian trajectories are computed with the trajectory code TRACMASS, where the atmospheric water parcels are advected with the 3D water mass fluxes based on a new water mass conservation method, which includes precipitation.