



## **The effects of the Indo-Pacific Warm Pool on the water vapor transport to the stratosphere and the East Asian monsoon region**

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Time-slice experiments with the Whole Atmosphere Community Climate Model version 4 (WACCM4) and composite analysis with satellite observations are used to demonstrate that the Indo-Pacific Warm Pool (IPWP) can significantly affect lower stratospheric water vapor. It is found that a warmer IPWP significantly dries the stratospheric water vapor by causing a broad cooling of the tropopause, and vice versa for a colder IPWP. Such imprints in tropopause temperature are driven by a combination of variations in the Brewer–Dobson circulation in the stratosphere and deep convection in the troposphere. Changes in deep convection associated with the El Niño–Southern Oscillation (ENSO) reportedly have a small zonal mean effect on lower stratospheric water vapor for strong zonally asymmetric effects on tropopause temperature. In contrast, IPWP events have zonally uniform imprints on tropopause temperature. This is because equatorial planetary waves forced by latent heat release from deep convection project strongly onto ENSO but weakly onto IPWP events. In addition, atmospheric convection over the IPWP can influence the distribution of heat and water vapor by generating planetary waves that significantly affect the East Asian summer monsoon. It has been found that a warming IPWP induces a strengthened Hadley circulation from boreal spring to summer, leading to substantial increased transport of water vapor to the East Asia and thus enhanced rainfall during summer.