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Ocean wave induced mixing effects on SST by cloud-radiation feedback in tropical atmosphere

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The tropical temperature simulation biases in the coupled atmosphere-ocean model, named overly extended cold tongue in the equatorial Pacific, can be eliminated by including ocean wave-induced mixing in the climate model. In this study, the non-breaking wave ocean mixing parameterized as Bv is considered in CCSM3 model, we demonstrated that the warm temperature anomaly occurs in central Pacific can be amplified by cloud-radiation feedback. Sea surface temperature (SST) increasing due to the wave-induced mixing effect in the central and eastern equatorial Pacific is related to Bjernkes feedback (wind-evaporation-temperature interaction) and cloud-radiation feedback. Comparing the simulation results in the control run and the experiment coupled with the wave-induced mixing, the atmospheric humidity, air temperature and atmospheric stability change from low to high layer in the equatorial Pacific when the Bv is included in the coupled model. It leads to increased high cloud cover percentage in the central pacific and decreased low cloud cover percentage in the Eastern Pacific. By absorbing more shortwave radiation and blocking outward longwave radiation, the overly extended cold tongue is improved as the SST in the middle to east equatorial Pacific rising. When the wave model coupled with the ocean circulation model, it is shown that the temperature in upper Ocean is decreased. However, if the wave model coupled with the climate model, the change of SST is more complex because of the air-sea interaction.