

EGU22-1083

<https://doi.org/10.5194/egusphere-egu22-1083>

EGU General Assembly 2022

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Projected Future Changes in Equatorial Wave Spectrum in CMIP6

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The simulation of the Madden-Julian Oscillation (MJO) and convectively coupled equatorial waves (CCEWs) is considered in 13 state-of-the-art models from phase 6 of the Coupled Model Intercomparison Project (CMIP6). We use frequency-wavenumber power spectra of the models and observations for Outgoing Longwave Radiation (OLR) and zonal velocity at 250 hPa (U250), and consider the historical and end-of-century projections for the SSP245 and SSP585 scenarios. The models simulate a spectrum quantitatively resembling that observed, though systematic biases exist. MJO and Kelvin waves (KW) are mostly underestimated, while equatorial Rossby waves (ER) are overestimated. The models project a moderate future increase in power for the MJO, a robust increase for Kelvin waves (KW) and weaker power values for most other wavenumber-frequency combinations, including higher wavenumber ER. In addition to strengthening, KW also shift toward higher phase speeds (or equivalent depths). Models with a more realistic MJO in their control climate tend to simulate a stronger intensification, and models with a more realistic KW in their control climate tend to simulate a weaker intensification.