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Tropical variability and stratospheric equatorial waves in the IPSLCM5 model

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The atmospheric variability in the equatorial regions is analyzed in the Earth System Model pre-industrial simulation done at IPSL in the framework of CMIP5.
We find that the model has an interannual variability of about the right amplitude and temporal scale, when compared to the El-Nin˜o Southern Oscillation (ENSO), but that is too confined to the western Pacific. At the intra-seasonal periods, the model variability lacks of large-scale organization, and only produces one characteristic Madden-Julian Oscillation every 10 winters typically. At shorter timescales and in the troposphere, the model has Rossby and Kelvin Convectively Coupled Equatorial Waves (CCEWs), but underestimates the Kelvin CCEWs signal on OLR. In the model stratosphere, a composite analysis shows that the Temperature and velocities fluctuations due to the Kelvin waves are quite realistic. In the model nevertheless, the stratospheric waves are less related to the convection than in the observations, suggesting that their forcing by the midlatitudes plays a larger role. Still in the model, the Kelvin waves are not predominantly occurring during the life cycle of the tropospheric Kelvin CCEWs, a behaviour that we find to be dominant in the observations. The composite analysis is also used to illustrate how the waves modify the zonal mean-flow, and to show that the model Kelvin waves are too weak in this respect. This illustrates how a model can have a reasonable Kelvin waves signal on the velocities and temperature, but can at the same time underestimate their amplitude to modify the mean flow. We also use this very long simulation to establish that in the model, the stratospheric equatorial waves are significantly affected by ENSO, hence supporting the idea that the ENSO can have an influence on the Quasi-Biennial Oscillation.