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Madden-Julian Oscillation in a climate model with a well-resolved stratosphere

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This work evaluates how well a coupled ocean/atmospheric climate model with a well-resolved stratosphere captures the observed MJO signal in the upper troposphere and lower stratosphere. The chosen model is the Centro Euro-Mediterraneo per i Cambiamenti Climatici (CMCC) CMCC-CMS coupled model with 95 levels. CMCC-CMS produces MJO composites of precipitation that are very similar to those of the ERA-40 reanalysis and previously published MJO precipitation and OLR. Furthermore, model precipitation is found to propagate eastward at the observed speed. There is further strong agreement in the tropics and subtropics between the temperature and flows at 100 and 200hPa between the composites based on the full 340 years of model output, those for the last 20 years of the model output, and the ERA-40 reanalysis. Agreement at high latitudes is relatively poor. At the 100 hPa level the temperature anomalies in the model output and reanalysis propagate eastward at about 7m/s across the globe at the equator and 25˚ and 65˚N. Longitude/height cross sections at 25˚N suggest vertically propagating wave one gravity waves to near the 10hPa level in both model and observations. Latitude/height cross sections indicate strong vertical propagation in the tropics in both model and reanalysis. Overall, the CMCC-CMS model shows MJO charactistics in the tropical and subtropical troposphere and lower stratosphere, which are in excellent agreement with observations.