

# **MJO propagation and dependence on mean state in the Met Office Unified Model**

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Madden-Julian Oscillation (MJO) in the Met Office Unified Model (MetUM) is assessed using a simple method that determines whether the convection generated in the Indian Ocean (IO) moves across to the Maritime Continent (MC) and then to the West Pacific (WP). Events that do not propagate out of IO are classified as stationary (or IO) events. Statistics of these MJO events in the observations suggest 53% of the MJO events are stationary, 22% of them propagate over to MC and weakens (MC events) and the remaining 25% maintains their amplitude throughout their propagation from IO to WP (WP events). Assessment of various versions of MetUM is done using this simple metric. In AMIP simulations, the IO events dominate (over 80% of all events) and consequently the propagating events are much fewer and are less organised than those in the observations. Increased horizontal resolution improves some of the MC mean rainfall biases and it helps with the MJO propagation.

MetUM when coupled with NEMO Ocean model improves the propagation features significantly especially when the atmospheric model is at a higher resolution. In order to understand the role of mean state in improving the MJO, an AMIP simulation with SST from the coupled model is performed. This simulation also produces improved MJO statistics compared to a standard AMIP simulation with observed SST highlighting the role of mean state in determining MJO properties. A further set of AMIP simulations are done to understand whether the warmer SST bias in the coupled model is forcing the model to a new mean state that favours more MJO propagation through improved convection-moisture relationship. In these simulations, artificial SST anomalies of various amplitude and spatial extent are added on top of observed SST in the IO, MC and the whole tropical warm pool. Detailed process diagnostics to explain the differences in sensitivity of convection to moisture profiles due to mean state changes will be presented.