Low and high frequency Madden-Julian oscillations in austral summer: interannual variations

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The Madden-Julian Oscillation (MJO) is the main component of intraseasonal variability of the tropical convection, with significant impacts on the Asian-Australian monsoon. Based on satellite observations, it is shown that there are two types of austral-summer MJO events (broadly defined as 30-120 days convective variability with eastward propagation of about 5 m/s). Equatorial MJO events have a period of 30-50 days and tend to be symmetric about the equator, whereas MJO events centered near 8°S tend to have a longer period of 55-100 days. The lower-frequency variability is associated with a strong upper-ocean response, having a clear signature in both sea surface temperature and its diurnal cycle. These two MJO types have different interannual variations, and are modulated by the Indian Ocean Dipole (IOD). Following a negative IOD event, the lower-frequency southern MJO variability increases, while the higher-frequency equatorial MJO strongly diminishes. We propose two possible explanations for this change in properties of the MJO. One possibility is that changes in the background atmospheric circulation after an IOD favour the development of the low-frequency MJO. The other possibility is that enhanced ocean-atmosphere coupling due to the shallower thermocline ridge and mixed layer depth, by enhancing SST intraseasonal variability and thus ocean–atmosphere coupling in the southwest Indian Ocean (the breeding ground of southern MJO onset), may enhance the low-frequency MJO variability.