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Extratropical Forcing Triggered the 2015 Madden–Julian Oscillation–El Niño Event

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In this study, we report the triggering effect of extratropical perturbation on the onset of an atypical Madden–Julian Oscillation (MJO) and onset of the 2015–16 El Niño in March 2015. The MJO exhibited several unique characteristics: the effect of extratropical forcing, atypical genesis location and timing in the equatorial western Pacific, and the extremity of amplitudes in many aspects. The southward-penetrating northerly associated with the extratropical disturbances in the extratropical western North Pacific contributed to triggering the deep convection and westerly wind burst (WWB) and onset of the MJO over the anomalously warm tropical western Pacific in early March. The persisting strong WWB forced downwelling Kelvin wave-like oceanic perturbation that propagated eastward and led to the onset of the 2015–16 El Niño. The proposed novel extratropical forcing mechanism explaining the unique extratropics–MJO–El Niño association, based on both data diagnostics and numerical experiments, warrants further attention for a more detailed understanding of the onset of the MJO and its potential effect on El Niño.