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Australian monsoon variability linked to tropical Pacific SST anomalies

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The recently-termed El Niño Modoki events have become more frequent than traditional El Niños over the past four decades. This mode of variability is characterized by warm sea surface temperature (SST) in the central Pacific and colder SST anomalies on both sides of this oceanic basin. El Niño Modoki has important implications for regional climate variations around the globe. Over Australia, Modoki is linked to stronger rainfall impacts than El Niños in the northwestern region of the country, particularly during austral summer and early-autumn.

We investigate the influence of El Niño Modoki on rainfall variability over Australia and other Pacific Rim countries using observations and model output from a suite of numerical experiments forced with different configurations of SST anomalies along the equatorial Pacific. Australian rainfall appears to be sensitive to the position of the warming in the Pacific, with a stronger atmospheric response to positive SST anomalies located around the Dateline than to the eastern Pacific.

From January to February, an increase of precipitation is seen over Northern Australia during Modoki events, while in December and March a decrease occurs over the same region. The enhanced precipitation in January and February is associated with anomalous convergence of moisture flux induced by the SST gradient from the warming in the central-west Pacific and relatively cooler SST over the Indonesian region. In March, the situation is reversed, i.e. reduced rainfall is caused by anomalous divergence of moisture over Australia. The rainfall decrease in March is exacerbated by the subsidence of the western branch of the anomalous Walker circulation during Modoki events. These changes indicate a shift in the Australian monsoon regime during Modoki years. Implications for Australian rainfall trends are discussed.