

The Dynamics of Monsoon Bursts in the Australian Region

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The wet season of the Australian monsoon is characterized by subseasonal periods of excessively wet or dry conditions, commonly known as monsoon bursts and breaks. This study is concerned with the synoptic evolution prior to monsoon bursts, which are defined here by abrupt transitions of the area-averaged rainfall over the tropical parts of the Australian continent. There is large variability in the number of monsoon bursts from year to year and in the time interval between consecutive monsoon bursts. Reanalysis data are used to construct a lag composite of the sequence of events prior to a monsoon burst. It is determined that a burst in the Australian monsoon is preceded by the development of a well-defined extratropical wave packet in the Indian Ocean, which propagates toward the Australian continent in the few days leading up to the onset of heavy rainfall in the tropics. As in previous studies on the monsoon onset, the extratropical disturbances propagate equatorward over the Australian continent. These extratropical systems are accompanied by lower-tropospheric airmass boundaries, which also propagate into low latitudes. Ahead of these boundaries, relatively warm moist air is advected from the surrounding oceans, locally increasing the convective available potential energy. Commonly employed climate indices show that monsoon bursts are more likely to occur when the active phase of the Madden–Julian oscillation is in the vicinity of Australia. Neither El Niño–Southern Oscillation nor the southern annular mode has a significant impact on the occurrence of monsoon bursts.