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On the role of tropical waves triggering extreme rainfall and flood in Sulawesi, Indonesia: a multi-scale interaction perspective

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On January 22, 2019 extreme rainfall in the South-Western Sulawesi, Indonesia, triggered a massive, deadly flood, the most devastating one ever reported. This happened during an interaction of a robust Convectively Coupled Kelvin Wave (CCKW) and Equatorial Rossby Wave (ER). Potential causes of a flood include Madden Julian-Oscillation active phase, rainy season with monsoonal flow in the Karimata Strait, positive sea surface temperature anomalies supportive of convection, and synoptic-scale weather systems. All these factors can contribute to extreme rainfall and a flood development. Nonetheless, here we show that in this particular case enhancement of low-level westerlies led to convergence and forced ascend of moist air over orographic features of the south-western Sulawesi. This chain of processes was a result of a propagation of a CCKW, with contribution from an ER. Satellite and radar data analysis, as well as in-situ observations reveal that convergence and strong westerlies in the Java Sea, forced by the CCKW, resulted in the rain events in Jeneberang River Basin and the devastating flood in the city of Makassar.

Additional analysis of 20 years of the flood database together with in situ observations and satellite data support our hypothesis, based on this case study, of a significance of an enhanced westerlies as a precursor of extreme rain events and floods in Makassar, the capital and most populous city in Sulawesi.