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ENSO heavy rain prediction based on tropospheric water vapor as a continuous phase transition in the Central Pacific

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Rain, and especially intense rain, is one of the most difficult natural phenomena to predict. One of the main limitations are the fluid dynamics equations used by climate models to describe extreme events satisfactorily. Recent literature proposes new relations, from complex systems and continuous phase transitions physics, which suggest the occurrence of intense precipitation when the rain system gets a critical value of tropospheric water vapor. In consequence, it is proposed a continuous phase transition from a state of light stratiform rain into a state of intense convective rain, which can be described by a power law behavior, with correlations of hundreds of kilometers. Nevertheless, this model has not been proven in extreme rain conditions, as the presented during some warm ENSO events. The main objective of this study is to assess the effectiveness of this theory into opposite ENSO events. For this purpose, the central zone of the Pacific Ocean was studied: Niño 2-3 (4.8 millons km2), during warm (2010) and cool (2009-2010 / 2011-2012) ENSO occurrence, using TRMM satellite data of superficial rain and tropospheric water vapor; with a resolution of 5 km and every 1.6 seconds. Even if the coefficients of the model depend on the climatic characteristics of the precipitations events, a unique exponent of the power law was found. This shows the ability of this theory to describe the extreme rain events, during opposite ENSO conditions; and agrees with the consequences of increasing precipitation extreme events due climate change water vapor accumulation.