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Forecasting tropical high-impact rainfall events using a hybrid statistical dynamical technique based on equatorial waves

Samantha Ferrett^{1,2}, Gabriel Wolf, John Methven², **Tom Frame**², Christopher Holloway², Oscar Martinez-Alvarado^{1,2}, and Steve Woolnough^{1,2}

¹National Centre of Atmospheric Science, University of Reading, Reading, United Kingdom

²Department of Meteorology, University of Reading, Reading, United Kingdom

Recent work within the WCSSP FORSEA project and its successor FORWARDS has demonstrated that a hybrid statistical-dynamical forecasting technique combining model ensemble forecasts of equatorial waves with climatological rainfall statistics conditioned on wave phase and amplitude can provide additional skill in predicting high impact weather. The underlying rationale for the technique is twofold. Firstly that high impact rainfall events in the tropics are commonly associated with presence of equatorial waves; and secondly that while global models can adequately predict the evolution of dynamical structure of equatorial waves on time-scales of several days they do not predict the relationship between waves and rainfall well. In tests using the Met Office Global and Regional Forecasting System (MOGREPS) the hybrid forecast is found to outperform model rainfall forecasts from both the global and regional convection permitting versions of MOGREPS, however a weighted blend of the MOGREPS forecasts and the hybrid forecast was found to have the highest skill and further improvements in the method may be obtained by taking into consideration the effects of wave-superposition and interaction. To ascertain whether forecasts can be further improved by better predictions of wave amplitude and phase we compare to hypothetical best-case hybrid forecast computed using wave amplitudes and phases taken from reanalysis. This best-case scenario indicates that errors in forecasting all wave types diminish the hybrid forecast's skill, with the most significant reduction observed for Kelvin waves, suggesting that a significant improvement in the prediction of the propagation of equatorial waves would have a significant impact on rainfall prediction in the tropics.