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Heavy rainfall in the northern coast of Ecuador in the aftermath of El Niño 2015/2016 and its predictability

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In January 2016, a high precipitation event (HPE) affected the northern coast of Ecuador leading to devastating flooding in the Esmeraldas' river basin. The HPE appeared in the aftermath of the 2015/2016 El Niño as an early onset of heavy rainfalls otherwise expected in the core rainy season (Mar-Apr). Using gauge data, satellite imagery and reanalysis we investigate the daily and 'weather-within-climate' characteristics of the HPE and its accompanying atmospheric conditions. The convective storms developed into a mesoscale convective complex (MCC) during nighttime on 24th January. The scale size of the heavy rainfall system was about 250 km with a lifecycle lasting 16 hours for the complete storm with 6 hours of convective showers contributing to the HPE. The genesis of the MCC was related to above-normal moisture and orographic lifting driving convective updrafts; the north-south mountain barrier acted as both a channel boosting upslope flow when it moves over hillslopes; and, as a heavy-rain divide for inner valleys. The above normal moisture conditions were favored by cross-time-scale interactions involving the very strong El Niño 2015/2016 event, an unusually persistent Madden–Julian oscillation (MJO) in phases 3 and 6, remotely forced by tropical synoptic scale disturbances. In the dissipation stage, a moderate low-level easterly shear with wind velocity of about 10 m/s moved away the unstable air and the convective pattern disappear on the shore of the Esmeraldas basin.

We use ECMWF re-forecast from the Sub-seasonal to Seasonal (S2S) prediction project dataset and satellite observations to investigate the predictability of the HPE. Weekly ensemble-mean rainfall anomaly forecasts computed from raw (uncorrected) S2S reforecast initialized on 31st Dec 2015, 7th, 14th and 21st Jan 2016 are used to assess the occurrence of rainfall anomalies over the region. The reforecast represents consistently, over all lead times, the spatial pattern of the HPE. Also, the ensemble-mean forecast shows positive rainfall anomalies at times scales of 1-3 weeks (0-21 days) at nearly all initialization dates and lead times, predicting this way successfully the timing and amplitude of the highest HPE leading the 25th January flood.