Verification of Probabilistic Precipitation Forecasts in Metropolitan Area of Valley of Mexico Using the ECMWF Ensemble Prediction System

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Security against extreme rainfall events is a basic need for social and economic development. The climate projections suggest a changing world in the rainfall patterns, forecasting increasingly extreme rainfall and droughts events; nevertheless, there is a lot of uncertainty in the future hydrologic cycle of the basins, where rainfall is the more complicated weather phenomena to predict. To deal with this difficulty, process such as assimilation, a better description of weather phenomena and the use of ensembles have been developed. Such technologic advances have resulted in the use of Numerical Weather Prediction Models (NWP) and its chain with Ensemble Prediction Systems (EPS), which have been recognized as valuable tools for a good Warning System.

Currently, Mexico City is one of the largest metropolis of the world with more than 22 million of inhabitants and serious difficulties on hydraulic infrastructure. The city depends completely on the sewage system to prevent and mitigate floods. For these reasons, this work proposes to evaluate the deterministic and meteorological ensemble precipitation forecasts issued by the European Centre for Medium Range Weather Forecasting (ECMWF) for two study cases: 1) Mexico Valley Basin and 2) Mexico City. For study case 1, the precipitation forecasts were compared against 24 hours accumulated observed rainfall, issued by CLICOM System (clicom-mex.cicese.mx) and for 2007 to 2014 period time. For study case 2, the forecast were compared against observed real-time precipitation data issued by the Hydrological Observatory of Engineering Institute (OHIIUNAM), using a lead-time and time step of 90 hours and 6 hours respectively; and carried out for the rainy season of years 2017 and 2018. For this, deterministic and probabilistic verification metrics were applied (Relative Operating Characteristic, Reliability Diagram and the Brier Score) in order to measure the quality and performance of the forecasts products and its potential use for floods prediction in Mexico City.

The evaluation of the results shows that the observed events are within the range of the probability distribution, which means that the EPS constitutes a good representation of the possible atmospheric scenarios along the time horizon. Metrics establish a greater reliability for forecast in the range of 2 to 10 mm of accumulated rainfall in 24 hours; in the other hand, there is a good discrimination and accuracy of observed and unobserved events of accumulated
precipitation of 1 mm in 6 hours.