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Evaluation of the ECMWF Operational Forecasting System for Probabilistic Flood Prediction in Mexico City

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Floods and puddles are incidents that occur every year in Mexico City. The surface runoff that occurs in areas of hills and mountains, such as torrential rains where precipitation is greater than the drainage capacity, are the main factors that give rise to floods in the city. The measures that have been implemented to control floods have focused more on reactive planning instead of implementing prevention measures; so the city is completely dependent on its drainage system to mitigate flooding. For these reasons, the forecast has become essential to respond to the demand for better risk management due to the exposure of infrastructure and people to flood events; and coupled with the uncertainty of future events in Mexico City.

Rainfall is the main source of uncertainty in flood prediction; That is why, in recent years, the Numerical Climate Prediction Models (NWP) have focused on the generation of Ensemble Prediction Systems (EPS); which constitute a feasible method to predict the probability distribution function of atmospheric evolution.

The objective of this work is to evaluate the Operational Ensemble Prediction System issued by the European Centre for Medium-Range Weather Forecasts (ECMWF) to open the doors to the development of a Flood Forecasting System in Mexico City. The EPS was evaluated against observed rainfall for two study zones: Mexico Valley Basin and Mexico City, where for the latter, the forecasts were compared against information of real time observed rainfall. To carry out an objective analysis of the quality of the forecast, metrics were applied for the scalar attributes: precision, reliability, resolution, discrimination and performance. The probabilities given by the ensembles were estimated using a predictive model.

The results show the EPS do represent the probability distribution of the observed events. The first 36 hours of forecasting are the most reliable, after which uncertainty increases. Finally, the predictive model shows good performance in estimating probabilities according to the area under the receiver operating characteristic curve.