Set up of ERA-Emulator from the ERA5 reanalysis dataset to Detect the Extreme Precipitation Events

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The ERA-Emulator is designed to approximate the downscaling function by utilizing low-resolution simulations to generate equivalent fields. This research introduces the ERA-Emulator concept and outlines a framework for its construction, training, and evaluation. the predictors that have been used are eastern and northern wind (u,v), geopotential height (z), specific humidity (q) and temperature (t) at four pressure levels, which are 1000hpa, 850hpa, 700hpa, and 500hpa. The frequency for the predictors is 3 hours, while the predictand is the precipitation accumulated over 3 hours. The data used in this study are the Re-Analysis -5th generation- (ERA5) produced by the European Center for Medium-Range Weather Forecast (ECMWF), with a resolution of 25 km at different pressure levels and for the surface (precipitation in our case). A key finding of this study is the credibility of the ERA-Emulator as a viable approach to address this challenge. The emulator demonstrates the capability to predict precipitation fields that align with ERA5 low-resolution simulations. In this study, we present a comparison of the various roles of loss functions, exploring their contributions to creating a highly accurate emulator.