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A reproducible flood forecasting case study using different machine learning techniques

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Lukas Kugler(1), **Sebastian Lehner**(1,2)
(1)University of Vienna, Department of Meteorology and Geophysics, Vienna
(2)Zentralanstalt für Meteorologie und Geodynamik, Vienna

Extreme weather events can cause massive economic and human damage due to their inherent rarity and the usually large amplitudes associated with them. For this reason, forecast with a focus on extreme events is essential.

The core of this study is the prediction of extreme flooding events using various machine learning methods (Linear Regression, Support Vector Regression, Gradient Boosting Regression, Time-Delay Neural Net). These will be compared with each other, with a persistence forecast and with forecast reruns from the GloFAS (Global Flood Awareness System). The whole work was carried out with Jupyter Notebooks using a small sample data set, which is all available on Github [1] and hence, open source and fully reproducible.

The data bases are the ERA5 reanalysis, of which various meteorological variables are used as predictors and the GloFAS 2.0 reanalysis from which river discharge is used as predictand. The area of interest is the upper Danube catchment. All of the data is available from 1981 to 2016 and was divided into 25 years for model training, 6 years for validation and hyper parameter optimization, as well as 5 years for an independent testing period.

Since the focus is on extreme flooding events, times within the test period containing steep increases in river discharge are evaluated with 14-day forecasts, with varying initialisation times. Additionaly, a comparison with GloFAS 'forecast reruns' is carried out for the 2013 flooding event in Central Europe.

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[1] https://github.com/esowc/ml_flood

Primary authors: KUGLER, Lukas (University of Vienna); LEHNER, Sebastian (Zentralanstalt für Meteorologie und Geodynamik)

Presenter: LEHNER, Sebastian (Zentralanstalt für Meteorologie und Geodynamik)

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