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Short term river flood forecast by artificial neural networks and numerical modelling

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Short term forecast (nowcasting) of a river flood is a very important topic for civil protection purposes. Suitable numerical tools are necessary, in order to cope with phenomena that often present strongly non-linear dynamics. For a section of the considered river, where the water height is continuously monitored, the aim of a nowcasting system is to forecast the heights at some future times $t + n\Delta t$, (n= 1,.., N, e.g.N= 4), using the hydrometric data at present time t and at past times $t - m\Delta t$, (m= 1,.., M, with M a suitable integer) at the same section and at possible upstream sections, as well as data provided by some pluviometric stations.

Artificial Neural Networks (ANN) are currently used in river flood nowcasting, thanks to their ability to simulate non-linear phenomena. Nevertheless, training, validation and test of an ANN are to this day based on hydrometric and pluviometric data generally related to a time interval of few years, so that events characterized by extreme values could be absent or quite rare. In order to guide the ANN in case of extreme events an approach based on physical modelling of some extreme events is proposed here. Some extreme events are artificially generated by means of geo-morphological models, on the basis of hydrometric and pluviometric data, as well as taking into account the river morphology, and validating the results using the historical data. These synthetic extreme events are then added to the data sets used for ANN training. Such an approach has been applied to the Agno-Guà, a small river of the Vento Region (North-East Italy), where 7 hydrometric stations and 13 pluviometric stations exist. The simulations show that helping the ANN with synthetic data change significantly the behaviour of the model at very large discharge values. This seems to be a sensible

tool in order to avoid large errors in ANN training and validation.