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Highlights of advances in the field of hydrometeorological research brought about by the DRIHM project

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The FP7 DRIHM (Distributed Research Infrastructure for Hydro-Meteorology, http://www.drihm.eu, 2011-2015) project intends to develop a prototype e-Science environment to facilitate the collaboration between meteorologists, hydrologists, and Earth science experts for accelerated scientific advances in Hydro-Meteorology Research (HMR). As the project comes to its end, this presentation will summarize the HMR results that have been obtained in the framework of DRIHM.

The vision shaped and implemented in the framework of the DRIHM project enables the production and interpretation of numerous, complex compositions of hydrometeorological simulations of flood events from rainfall, either simulated or modelled, down to discharge. Each element of a composition is drawn from a set of various state-of-the-art models. Atmospheric simulations providing high-resolution rainfall forecasts involve different global and limited-area convection-resolving models, the former being used as boundary conditions for the latter. Some of these models can be run as ensembles, i.e.$\, with perturbed boundary conditions, initial conditions and/or physics, thus sampling the probability density function of rainfall forecasts. In addition, a stochastic downscaling algorithm can be used to create high-resolution rainfall ensemble forecasts from deterministic lower-resolution forecasts. All these rainfall forecasts may be used as input to various rainfall-discharge hydrological models that compute the resulting stream flows for catchments of interest. In some hydrological simulations, physical parameters are perturbed to take into account model errors. As a result, six different kinds of rainfall data (either deterministic or probabilistic) can currently be compared with each other and combined with three different hydrological model engines running either in deterministic or probabilistic mode.

HMR topics which are allowed or facilitated by such unprecedented sets of hydrometerological forecasts include: physical process studies, intercomparison of models and ensembles, sensitivity studies to a particular component of the forecasting chain, and design of flash-flood early-warning systems. These benefits will be illustrated with the different key cases that have been under investigation in the course of the project. These are four catastrophic cases of flooding, namely the case of 4 November 2011 in Genoa, Italy, 6 November 2011 in Catalonia, Spain, 13-16 May 2014 in eastern Europe, and 9 October 2014, again in Genoa, Italy.