Geophysical Research Abstracts
Vol. 17, EGU2015-1439, 2015
EGU General Assembly 2015

Taking into account hydrological modelling uncertainty in Mediterranean flash-floods forecasting

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Title : Taking into account hydrological modelling uncertainty in Mediterranean flash-floods forecasting
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Mediterranean intense weather events often lead to devastating flash-floods (FF). Increasing the lead time of FF forecasts would permit to better anticipate their catastrophic consequences. These events are one part of Mediterranean hydrological cycle. HyMeX (HYdrological cycle in the Mediterranean EXperiment) aims at a better understanding and quantification of the hydrological cycle and related processes in the Mediterranean. In order to get a lot of data, measurement campaigns were conducted. The first special observing period (SOP1) of these campaigns, served as a test-bed for a real-time hydrological ensemble prediction system (HEPS) dedicated to FF forecasting. It produced an ensemble of quantitative discharge forecasts (QDF) using the ISBA-TOP system. ISBATOP is a coupling between the surface scheme ISBA and a version of TOPMODEL dedicated to Mediterranean fast responding rivers. ISBA-TOP was driven with several quantitative precipitation forecasts (QPF) ensembles based on AROME atmospheric convection-permitting model. This permitted to take into account the uncertainty that affects QPF and that propagates up to the QDF. This uncertainty is major for discharge forecasting especially in the case of Mediterranean flash-floods. But other sources of uncertainty need to be sampled in HEPS systems. One of them is inherent to the hydrological modelling.
The ISBA-TOP coupled system has been improved since the initial version, that was used for instance during Hymex SOP1. The initial ISBA-TOP consisted into coupling a TOPMODEL approach with ISBA-3L, which represented the soil stratification with 3 layers. The new version consists into coupling the same TOPMODEL approach with a version of ISBA where more than ten layers describe the soil vertical stratification, that is ISBA-DF. The use of ISBA-DF into ISBA-TOP coupling permits to get rid of the calibration issues but also to change the pedometer functions used to compute the main hydrological parameters (saturated water content, saturated hydraulic conductivity,...).
The first step of this work is thus to assess the impact of these new options on discharge simulations. This was carried out through an academic case to reduce the degrees of freedom of the system. Each parameter is then tested one after another to determine which has the greatest impact on discharge simulations. Finally, the conclusions of the sensitivity analyses are cheeked in realistic configurations.
The following step is to vary initial conditions which is another part of modelling uncertainty. The most important parameter tested is soil moisture.
The last step will be to slightly vary the ISBA-TOP sensitive parameters so as to produce an QDF ensemble from a given single rainfall forcing field. Later on, this will be applied to ISBA-TOP driven by QPF ensembles. This should improve the HEPS performances.