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Coupling hydrologic and hydraulic models to determine the response of rural-urban environments in an endorheic area

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In the past Los Llanos and the city of Albacete (Spain) were located in an area composed of lakes and springs of great extent. Due to economic and agricultural development in the area was built an extensive network of canals that allowed drainage and exploitation of the resource, but the emergence of new populations has increased the vulnerability of the territory, and because of its endorheic, arise significant drainage problems in the area of Los Llanos and the city of Albacete. The origin of the problem serves two different time scales, associated to continuous events from Atlantic fronts and convective precipitation typical of Mediterranean. On Los Llanos drain many watersheds which evolve with two-dimensional flows through the territory forming broad fronts of progress. In the city of Albacete, levels in Maria Cristina Channel determine the drainage of the urban drainage system when there are local storms, being the strongest of convective origin. For these reasons Júcar River Basin Authority has tendered the services to carry out the work necessary to model the case of Los Llanos-Albacete.

To model these processes has been necessary to couple in series of 3 types of hydrological and hydraulic models, so that the outputs of the first feed the inputs of the following. The first model in the series has been TETIS, a distributed and conceptual hydrological model, which modelled rainfall-runoff processes, hourly and daily, at river basins that drain to Los Llanos. Hydrographs and net precipitation obtained from the hydrological model are used as input for the model of Los Llanos. For choosing the ideal model has prioritized the ability to reproduce the flow on the surface (2D) and their connection to the network of channels (1D) consists of many different types of structures. For these reasons we have employed the hydraulic model SOBEK Rural 1D/2D, where the one-dimensional part consists of 76.6 km of the network of canals, which include structures such as bridges, weirs, orifices, ..., while for the two-dimensional is employed a grid with an area of 700 km2 and resolution of 50x50 meters, on which 2 grids of 10x10 meters have been nested to give more detail in areas of higher vulnerability. Finally, the city of Albacete requires a comprehensive urban model that reproduces hydrologic-hydraulic and is able to integrate 1D/2D topologies. In this case, we have introduced as boundary conditions outflows of Los Llanos, precipitation events over the urban area and flows in Maria Cristina Channel. The model used is INFOWORKS CS, which combines 1D/2D topologies to represent the flow in pipes and their connection to the surface. One-dimensional topology consists of 4894 pipes connected to the surface through 4911 manholes. The modelled surface (34.2 km2) is represented by an irregular triangular mesh with 497021 elements and maximum size of 100 m2.

The results allow us to reach interesting conclusions. About the hydrological model there are two types of basins in terms of rainfall-runoff formation: the basins Lezuza and Jardín with an important component of base flow, and Escartana basin with an explosive and ephemeral character. In the case of the hydraulic model of Los Llanos puts in evidence the large rolling capacity due their endorheics, remaining large volumes stored on the surface. Finally, the hydraulic performance of the drainage network of the city of Albacete is limited because of levels in the Maria Cristina Channel, which could cause a reverse operation when network is dry.