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Effect of overpressure on the catchment outflow of a tile drainage system: an integrated modeling strategy

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The effect of agricultural artificial drainage on catchment outflow has been a debate for quite some time. Predicting the drainage impacts on downstream peak flow is complex because it involves different flow media: soil, drainage pipes' network and open channels.
This work follows up field experiments carried out in a small subsurface drained catchment. Flow rates and pressure heads were monitored in buried pipe collectors, within the drainage network, at the junction between field collector and main collector, and at the whole catchment outlet. A watertable profile in the drained field was recorded simultaneously to investigating underground flow during pipe pressurization.
Several years of data collection showed that pipe pressurization, during intense rainfall events, induced limited or reversed collector discharge and temporary storage of infiltrated water within the field soil while the water table rose.
In order to better understand and predict the influence of the temporary pipe pressurization on field drainage discharge during intense rainfall events, this work proposes an integrated modeling strategy.
The modeling approach consists in adapting and coupling a 1D Saint-Venant network model, with a 2D Boussinesq shallow watertable model. Two main issues are addressed here. The first one is the ability of both models to cope with pressurized conditions for both buried pipes and watertable above drain. The second issue deals with assessing the effects of topography and network organization on drainage pipe pressurization.