

Coupling SKS and SWMM to solve the inverse problem based on artificial tracer tests data in karst aquifers

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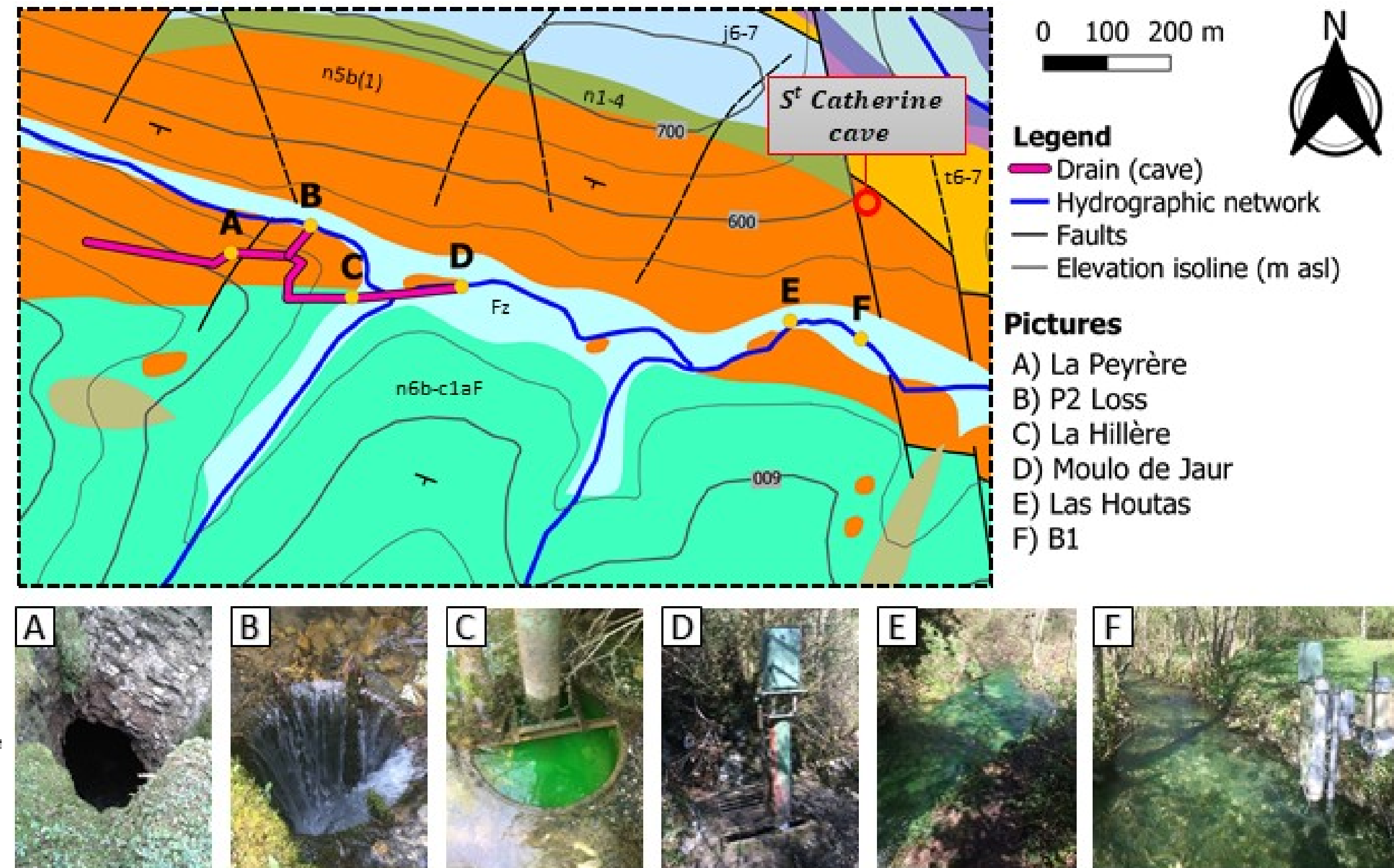
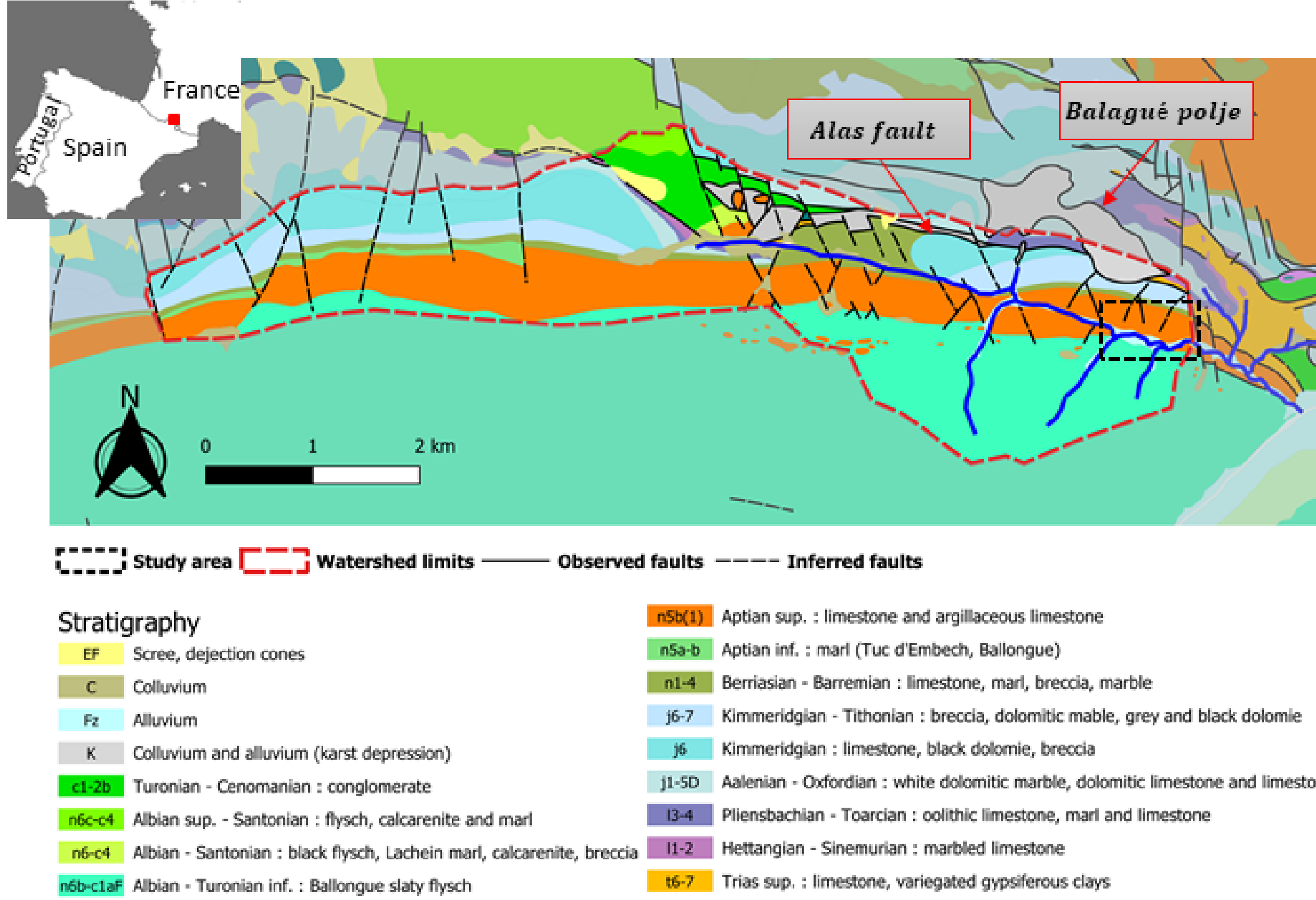
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Objectives

The main objective is to answer whether we can constrain a simulated conduit network geometry using artificial tracer tests data. To do so, we propose a systematic search procedure using a pseudo-genetic algorithm (SKS) and a flow and solute transport simulation routine (SWMM).

Study area : the Baget karstic system (Pyrenees Mountains, France)



Geological settings over the study area, modified from Sivelles et al. (2020)

The karstified part of the basin is characterized by metamorphic Jurassic to Cretaceous dolomites, limestones and calcareous marls.

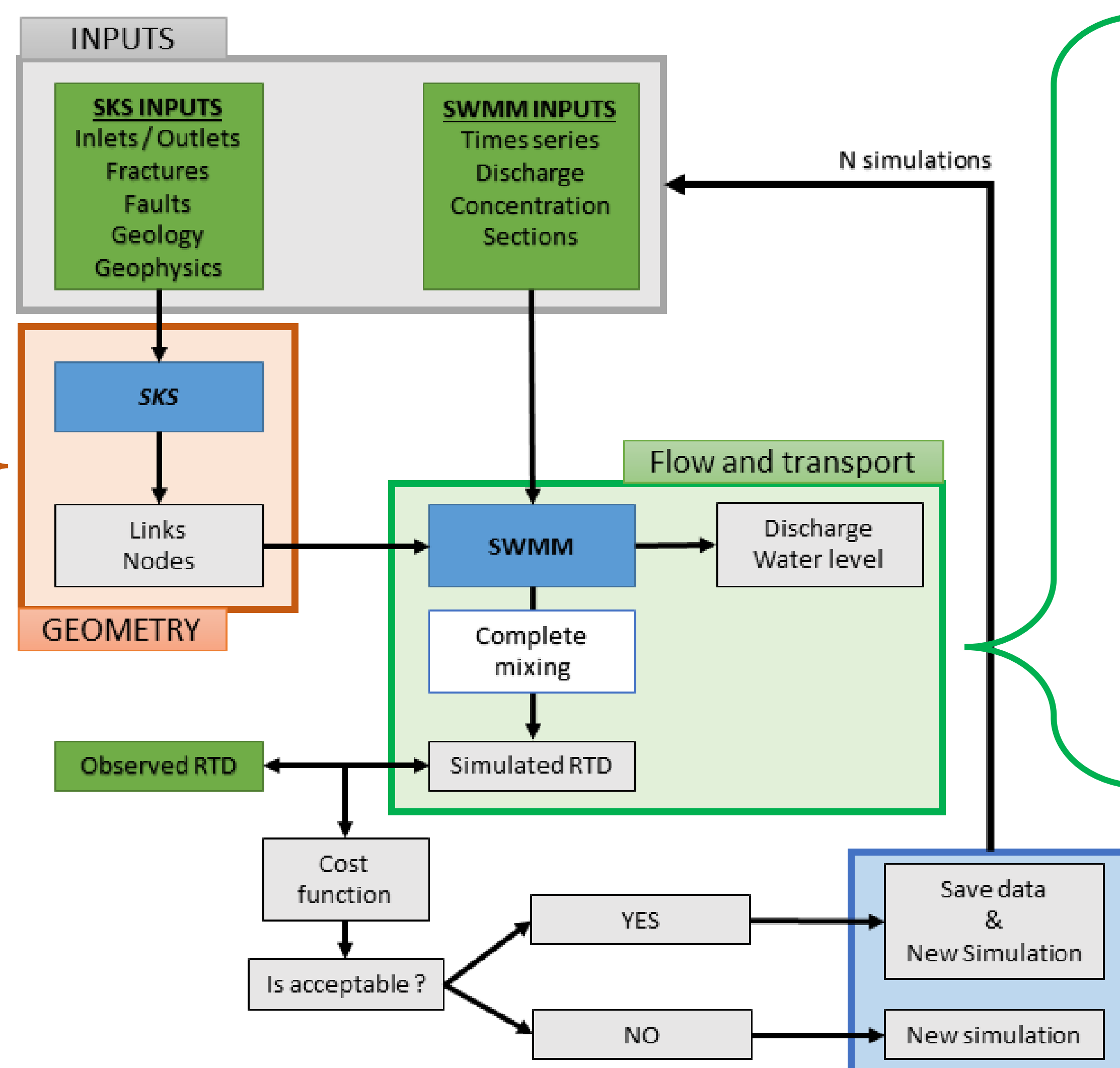
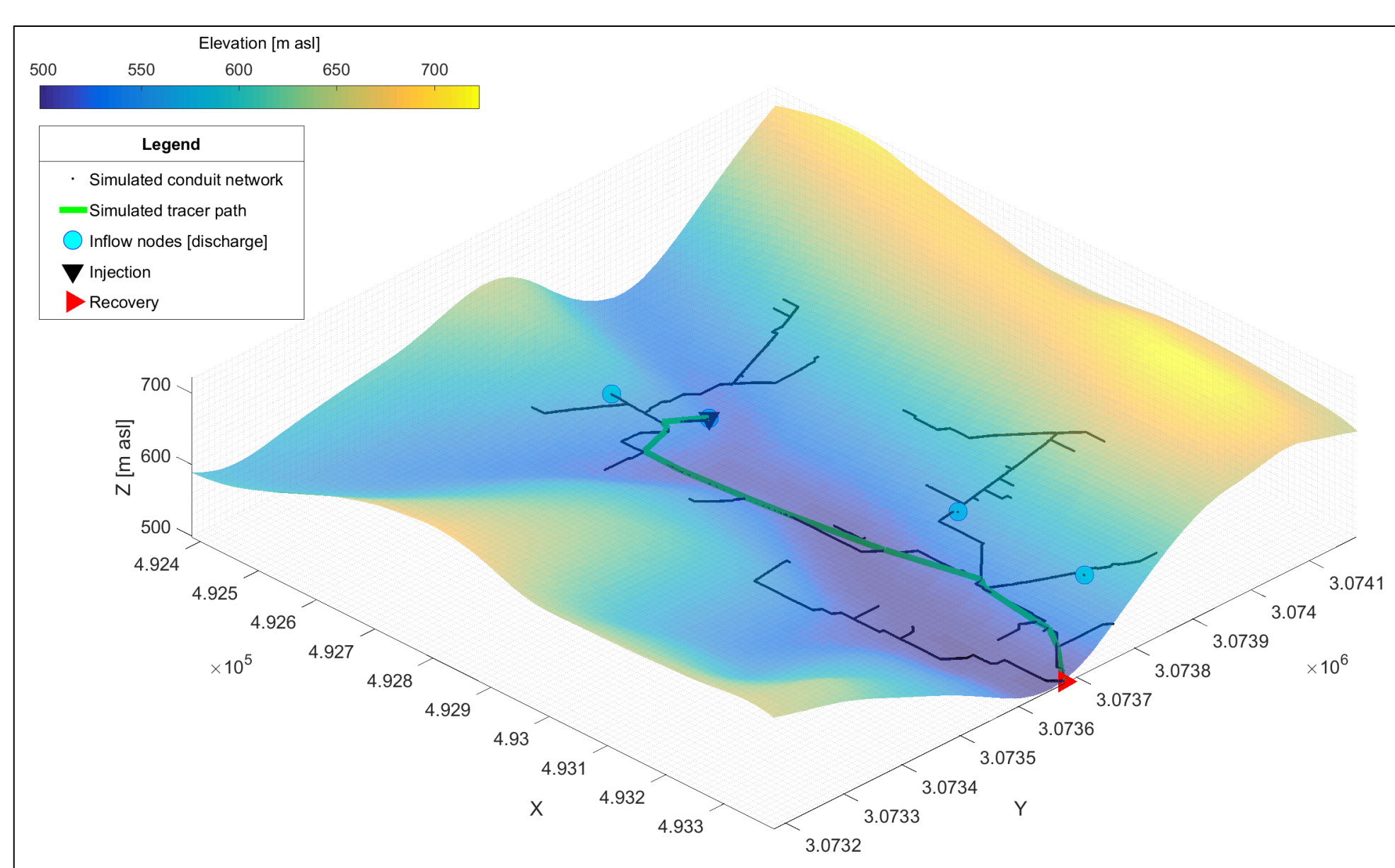
The study area is located in the downstream part of the watershed

Systematic search procedure

Systematic search procedure using SKS (conduit network simulation) and SWMM (flow and solute transport simulation), modified from Sivelles et al. (2020)

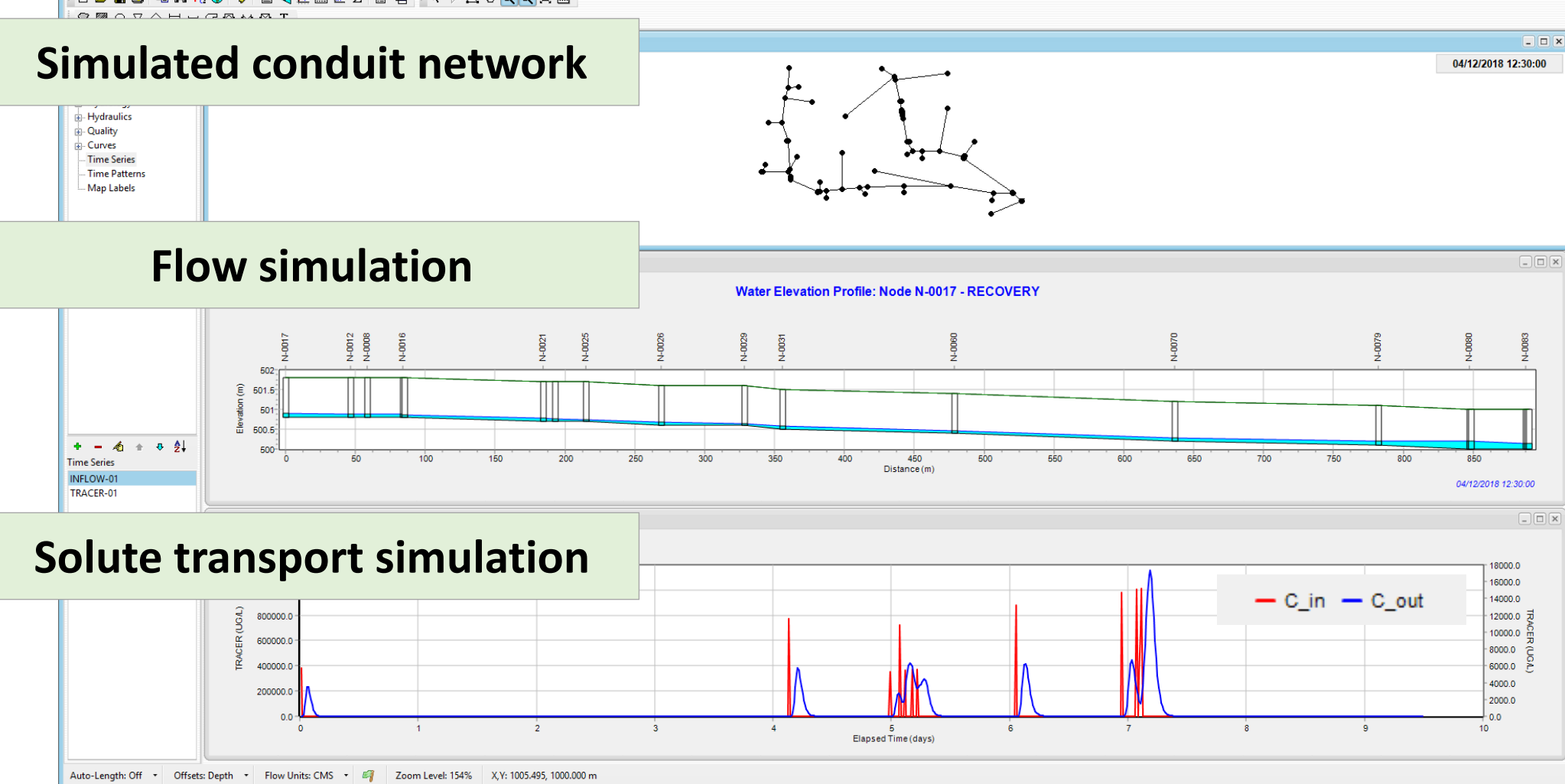
SKS – Stochastic Karst Simulator

Borghi et al. (2012, 2016)

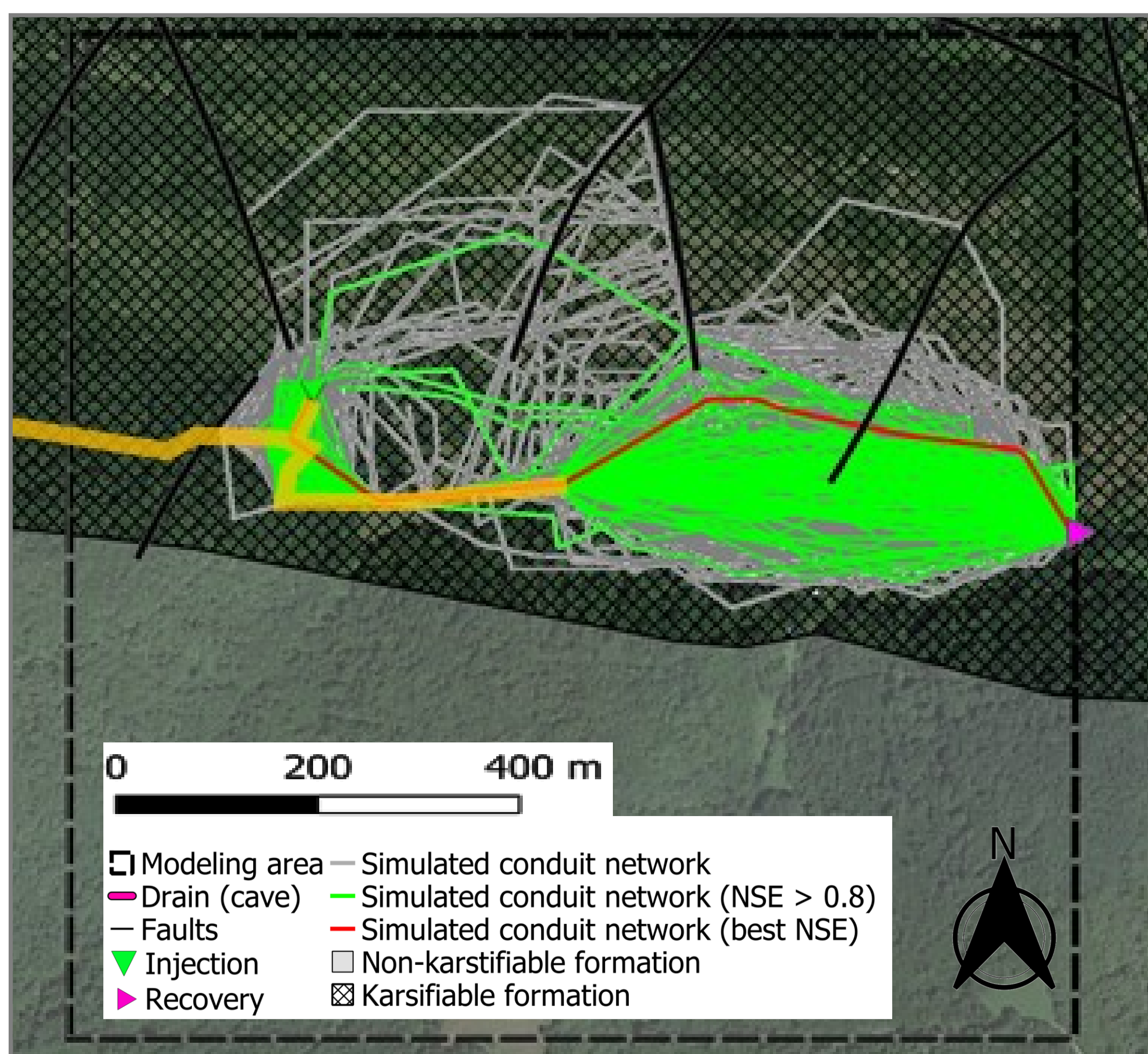


SWMM - Storm Water Management Model

Rossman (2004)



The simulated RTDs are compared to the observed RTD derived from artificial tracer tests performed in 2018, using the Nash-Sutcliffe Efficiency coefficient (NSE).

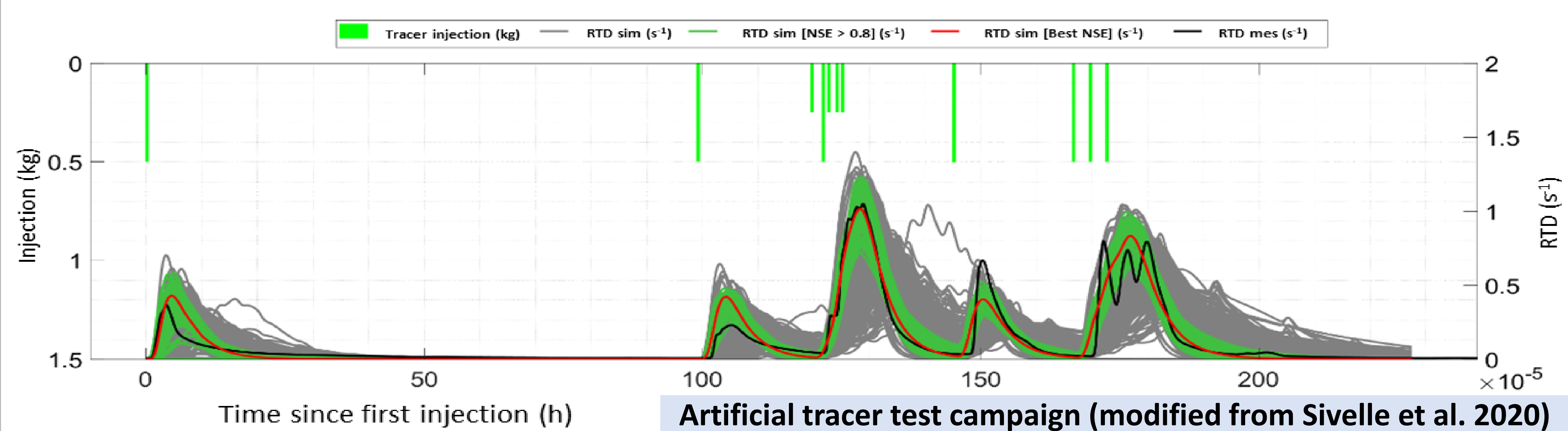


Simulated conduit networks, modified from Sivelles et al. (2020)

References:

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Applications



Results

The simulations that reproduce the observed RTD quite satisfactorily (here we chose NSE > 0.8 as criterion to accept a simulation) constitute a set of equiprobable conduit network geometries. These simulations honor both geological priors (lithology, faults, fractures) and artificial tracer tests data. The approach can be extended as a weighting factor for the Karst Network Development coefficient (K) implemented in karst vulnerability mapping method such as EPIK.