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Saturated hydraulic conductivity spatialization strategy to model recharge and hydrogeological transfers on an industrial site in France

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Pollutant transfers in the critical zone is an issue for decades both because of complex physico-chemical interactions in the porous media and because of the emergence of new materials/molecules rejected in the environment for which rules are not ready. The study presented here is part of a research project which aimed to predict transfers and residence time of pollutants in the critical zone including the Unsaturated Zone (UZ), and in aquifers on the CEA Cadarache site (France). This site benefits from a large instrumentation for decades to survey both the water dynamic and quality in the aquifers below the industrial facilities. One of the remaining challenges is to study the distributed recharge in the UZ. In situ measurements of saturated hydraulic conductivity K_s are often time-consuming, but also costly to implement at a catchment scale. To overcome this difficulty, an approach using Pedotransfer Functions (PTFs) is possible in order to spatialize this parameter of the UZ (Nasta *et al.*, 2021; Weihermüller *et al.*, 2021). The main objective of the study is to evaluate a spatialization strategy of K_s values using PTFs calibrated from an intensive in situ measurement campaign.

A total of 48 measurement points were selected on the study site, covering an area of around 900 hectares. The points were chosen to represent the different types of geological formations at the outcrop as well as the different types of land cover on the site. For all those locations, in situ hydraulic conductivity measurements were carried out with a disc infiltrometer, using the multi-potential method (Vandervaere, 1995), together with physico-chemical analyses of the surface soils. The results obtained show that for most of the measurement points, a fairly clear break in the slope of the exponential function $K(h)$ appears for potentials h around -30 / -20 mm. The estimate of the value of K_s is chosen as being the value of $K(h)$ obtained for the last value of potential $h = -5$ mm, considering that saturation has been reached. On site, K_s varies from 20 to 410 mm/h.

Several PTFs for estimating K_s were selected (Rawls & Brakensiek, 1985, Wösten *et al.*, 1999, Weynants *et al.*, 2009, Szabó *et al.*, 2021, Rosetta (Schaap *et al.*, 2001; Zhang & Schaap, 2017)). The study will help us to identify some geological or land cover drivers for K_s ranges and to select which PTFs are able to represent such a variability.

