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Mapping saturated hydraulic conductivity in the presence of deterministic trends

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The saturated hydraulic conductivity (Ks) is an important soil characteristic. Accounting for Ks spatial patterns in distributed hydrological models can improve the model performance considerably. However, obtaining realistic fields of Ks is notoriously difficult because of the pronounced small-scale variability of this variable. In an attempt to adequately characterize Ks spatial variation in a tropical forest catchment, which features a high density of surficial flowlines, we applied a combination of two sampling approaches. At first, we conducted a classical nested sampling survey to assess the scales over which Ks varied in the target area. Next, we applied a purposive sampling strategy which considered hydrologic information on the temporal frequency of overland flow occurrence in the flowlines. The nested sampling approach revealed the dominance of small-scale variability, which is in line with previous findings. Data from the purposive sampling, however, indicated the presence of a strong spatial gradient: surface Ks was extremely low in flowlines and approached values similar to the spatial mean of Ks at a distance of 10 m to flowlines. To build a geostatistical model of the spatial variation of Ks we combined the data from both nested and purposive sampling and used a linear mixed modelling framework where the data are modeled as the additive combination of fixed effects, random effects and independent random error. We ascribed the fixed effects to an external drift variable, the distance to flowline of each point in space. Random effects and independent random error are described by the variogram. In this contribution we will discuss the hydrological relevance of the modelled Ks pattern using probability maps of Ks exceedance for a range of rainfall intensities.