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Assessing the physical controls of simulated drain flow dynamics

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Almost 50% of the agricultural land in Denmark is tile drained, and it includes a wide range of hydrogeological and topographical settings. These drains in the shallow groundwater system influence the hydrology and nutrient transport in subsurface and surface waters significantly. Therefore, it is critical to understand the share of drainage with respect to the recharge in shallow groundwater systems to get a holistic picture of drain flow dynamics in varied topographical and hydrogeological settings. To address these issues, multiple tile-drain catchments (28 sites, with measured drain flow timeseries) across Denmark are used to test the response of tile drains in varied topographical and hydrogeological settings on field scale. Using the national hydrological model of Denmark (DK-model) in MIKE-SHE as a basis, 10m resolution groundwater flow models for all the drain catchments are established. Combined calibration for all drain catchments is conducted by evaluating percent bias (PBIAS) and Kling-Gupta Efficiency (KGE) of simulated and observed discharge data using the Pareto Archived Dynamically Dimensioned Search (PADDS) of the OSTRICH optimization tool. Principal component analysis (PCA) on independent physical explanatory variables (and indexes) representing topography and hydrogeology is used to reduce all collected variables to significant variables only. Linear polynomial ridge regression is used to study whether independent explanatory variables are sufficient to represent drain flow distribution or whether additional information derived from the groundwater flow models is needed. In this presentation, we will show if the independent topographical and geological variables can predict drain flow fraction and among all explanatory variables, which variables play the most significant role. Moreover, the resulting groundwater flow model of Denmark will serve to produce a training dataset of drain flow fraction that can be used further with machine learning approaches to predict drain flow dynamics for all of Denmark. The results of the study will contribute to improved drain flow predictions across all of Denmark by improving the understanding of controls on drain flow behaviour.