



Assessing simulation uncertainty of hydrological models using stochastic geological models generated with air borne geophysical data

Xin He (1), Jens Christian Refsgaard (1), Flemming Joergensen (2), and Cyril Schamper (3)

(1) Department of Hydrology, Geological Survey of Denmark and Greenland, Copenhagen, Denmark (xhe@geus.dk; jcr@geus.dk), (2) Groundwater Mapping Division, Geological Survey of Denmark and Greenland, Aarhus, Denmark (fj@geus.dk), (3) Department of Geoscience, University of Aarhus, Aarhus, Denmark (cyril.schamper@geo.au.dk)

Uncertainty in hydrological simulations can be originated from various sources such as observational uncertainty of input data, model structural uncertainty, model parameter uncertainty, and/or local scale heterogeneity. The model structural uncertainty is essential since it accounts for the majority of the uncertainty during model conceptualization, and it becomes the dominating factor in the overall simulation uncertainty when the subject being simulated is an indirect extrapolation from the model calibration. In the present study, we assess the simulation uncertainty of coupled surface water – groundwater models by using multiple geological models that are generated stochastically. The study area is the Norsminde catchment located in eastern Jutland, Denmark, where the complex terrain and heterogeneous geological structure makes it an ideal example to showcase the scientific challenge described above. To establish the geological model, it is first delineated with dominant geological elements by an experienced geologist using all available field data. Subsequently the internal heterogeneity within the large scale geological elements is introduced by using TProGS realizations, which are generated based on information from both borehole data and airborne geophysical data (SkyTEM). Due to the high spatial resolution and exhaustiveness, the SkyTEM data is used in two ways. First it is used to estimate the horizontal transition probability, and afterwards used as information for soft conditioning in stochastic simulations with TProGS. 10 hydrological models are developed using MIKE SHE code, to which the individual geological models are associated. The hydrological models are inversely calibrated against groundwater head and stream discharge data using PEST optimization tool. Finally the simulated flows from the 10 models are collected and presented as an ensemble in order to assess the hydrological simulation uncertainty.