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Using calibration constrained Monte Carlo analysis of alternative conceptual models in land use management of drained fens

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Quantification of groundwater model uncertainties is one of the key aspects when using models to direct land use or water management. An esker aquifer with a size of 90 km2 was studied to understand how the surrounding peatland forestry drainage, groundwater abstraction and climate variability can affect the aquifer groundwater level and the water levels of groundwater dependent lakes of the area. Aquifer was studied with steady state groundwater models using three alternative conceptual geological models of the esker and running calibration constrained Null Space Monte Carlo uncertainty analysis and linear analysis to each model. This kind of simulation approach has not been used in peatland management previously. Models and analyses were used to observe effects of different land use scenarios, e.g. peatland drainage restoration or water abstraction for a nearby city, and climate variability. Data from the models and analyses give the decision makers insight of how different management practices in peatlands can affect the groundwater system given the uncertainties arising from the geological understanding, hydrological measurements, and model conceptualization. Results from the models can be used, for example, to pinpoint restoration or conservation of specific peatland drainage areas in which the models suggest clearest connection to aquifer water level.