Post-audit of a hydrological model: Evolution of predictive uncertainty in a 9 year modelling exercise

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Most of the post audits reported in literature are split sample (SS) type of tests where no changes are assumed in climate, land use of groundwater abstraction and where long time series often are available for calibration (Konikow and Bredehoeft, 1974; Alley and Emery, 1986; Andersen and Lu, 2003; Brkic et al., 2013), while small changes (< 50 %) in groundwater pumping occurred in two other studies (Konikow, 1986; Stewart and Langevin, 1999) where the tests may be characterised as DSS-light (differential split sample). None of the reported post audits include situations where a model was used to predict major changes in for instance groundwater abstraction, or in other words no strong DSS tests have been subject to post audits.

The objectives of the present study are i) to provide an example of a post audit for prediction of situations representing large extrapolations from the calibration situation (strong DSS test); ii) to analyse how a post audit can improve the accuracy and reliability of model predictions; and iii) to discuss how post audit studies should be carried out.

The study evaluates a 9-year (2010-2019) hydrological modelling exercise following the planning, construction, and post-construction monitoring of a motorway through an urbanized and area in Western Denmark. During this period, a transient, 100 m discretised, 3D fully coupled groundwater-surface water model was developed and calibrated (2010-2013), updated and validated (2013-2016), and post-audited (2016-2019). Results describe the uncertainties of the early model predictions (groundwater conditions), to the uncertainties of the mature model based on a Monte Carlo methodology.

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