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Using multi-model averaging to improve the reliability of catchment scale nitrogen predictions

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Abstract. Hydro-biogeochemical models are used to foresee the impact of mitigation measures on water quality. Usually, scenario-based studies rely on single model applications. This is done in spite of the widely acknowledged advantage of ensemble approaches to cope with structural model uncertainty issues. As an attempt to demonstrate the reliability of such multi-model efforts in the hydro-biogeochemical context, this methodological contribution proposes an adaptation of the reliability ensemble averaging (REA) philosophy to nitrogen losses predictions. A total of 4 models are used to predict the total nitrogen (TN) losses from the well-monitored Ellen Brook catchment in Western Australia. Simulations include re-predictions of current conditions and a set of straightforward management changes targeting fertilisation scenarios. Results show that, in spite of good calibration metrics, one of the models provides a very different response to management changes. This behaviour leads the simple average of the ensemble members to also predict reductions in TN export that are not in agreement with the other models. However, considering the convergence of model predictions in the more sophisticated REA approach assigns more weight to previously less well-calibrated models that are more in agreement with each other. This method also avoids having to disqualify any of the ensemble members.

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