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Present state of global wetland extent and wetland methane modelling: methodology of a model inter-comparison project (WETCHIMP)

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Abstract. The Wetland and Wetland CH₄ Intercomparison of Models Project (WETCHIMP) was created to evaluate our present ability to simulate large-scale wetland characteristics and corresponding methane (CH₄) emissions. A multi-model comparison is essential to evaluate the key uncertainties in the mechanisms and parameters leading to methane emissions. Ten modelling groups joined WETCHIMP to run eight global and two regional models with a common experimental protocol using the same climate and atmospheric carbon dioxide (CO₂) forcing datasets. We reported the main conclusions from the intercomparison effort in a companion paper (Melton et al., 2013). Here we provide technical details for the six experiments, which included an equilibrium, a transient, and an optimized run plus three sensitivity experiments (temperature, precipitation, and atmospheric CO₂ concentration). The diversity of approaches used by the models is summarized through a series of conceptual figures, and is used to evaluate the wide range of wetland extent and CH₄ fluxes predicted by the models in the equilibrium run. We discuss relationships among the various approaches and patterns in consistencies of these model predictions. Within this group of models, there are three broad classes of methods used to estimate wetland extent: prescribed based on wetland distribution maps, prognostic relationships between hydrological states based on satellite observations, and explicit hydrological mass balances. A larger variety of approaches was used to estimate the net CH₄ fluxes from wetland systems. Even though modelling of wetland extent and CH₄ emissions has progressed significantly over recent decades, large uncertainties still exist when estimating CH₄ emissions: there is little consensus on model structure or complexity due to knowledge gaps, different aims of the models, and the range of temporal and spatial resolutions of the models.

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