(1) CH4MOD – a process-based model for simulation of CH₄ emissions from natural/managed wetlands

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(3) Available modes for the model runs: Operational

(4) Components & processes: Atmosphere, Biosphere & Physical, Chemical, Biological
-> linking to impact assessment

(5) Brief model description
CH4MOD was developed to predict methane fluxes from rice paddy soils. The model associated this process with rice growth, organic C depletion and environmental factors (Huang et al., 1998; 2004). The model’s input parameters included the rice grain yield, the soil sand percentage, the amount of organic amendment, the water management pattern, and the daily air temperature. The outputs are the daily and annual rates of CH₄ production and emissions. The model was validated against a total of 94 field observations that covered the main rice cultivation regions from northern (Beijing, 40°30'N, 116°25'E) to southern (Guangzhou, 23°08'N, 113°20'E) China and from eastern (Hangzhou, 30°19'N, 120°12'E) to southwestern (Tuzu, 29°40'N, 103°50'E) China. This model can reasonably simulate CH₄ flux from irrigated rice fields (Huang et al., 2004). The CH4MODwetland (Li et al., 2010) describes the processes of CH₄ production, oxidation and transportation. It was modified from CH4MOD, which was used to simulate CH₄ emissions from rice paddies (Huang et al., 1998), after attentively considering the differences between rice paddies and natural wetlands. The wetland plants will not be harvested as in rice paddies. So, the decomposition of plant litter is part of the methanogenic substrates for methanogens. In addition, there is thick sod layer which contains great amounts of organic matter that can supply the substrates to methanogens. Moreover, in natural wetlands, the variation of soil redox potential is controlled by the natural variation in water table depth. And finally, the effect of salinity on CH₄ emissions is also considered in the coastal wetlands. We adopted the linear relationship between salinity and log-transformed CH₄ (Poffenbarger et al. 2011) to describe the influence of salinity on CH₄ emissions (Li et al., 2016a). In this model, the CH₄ production was determined by the methanogenic substrates as well as the environmental factors. The methanogenic substrates come from three sources: the root exudate, plant litter and organic soil matter. The environmental factors include the soil temperature, soil redox potential and soil texture. The model includes a sub module for simulating plant growth. The plant phenology data (date of germination, date of achieving maximum biomass and date of death) were determined by the accumulated temperature. CH₄ is emitted from the soil to the atmosphere via plant transportation, ebullition and diffusion. CH₄ oxidation occurs during the plant transportation and diffusion processes. The model inputs include the environmental data (daily air or soil temperature, the daily water depth and the daily soil salinity for the coastal wetlands), soil data (soil sand fraction, soil organic matter and soil bulk density) and data related with the plant (e.g., NPP). The model outputs estimated daily CH₄ emissions. Additional details on the CH4MODwetland model have been described in previous studies (Li et al., 2010., 2012). This model has been used to simulate CH₄ emissions from Chinese wetlands (Li et al., 2015; 2017) as well as Finland peatlands (Li et al., 2016b).
Key references:


