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Integrating greenhouse gas emission processes into a dynamic global vegetation model of TRIPLEX-GHG

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Methane (CH4) and nitrous oxide (N2O) are two potent greenhouse gases (GHG), which account for almost 20% of anticipated annual global warming. However, very few dynamic global vegetation models have integrated methane (CH4) and nitrous oxide (N2O) into the model simulations for climate change studies. In this study, we have developed new modules to simulate greenhouse gas (CO_2, CH4, N2O) emission processes over terrestrial ecosystems and integrated them into a dynamic global vegetation model of TRIPLEX-GHG. The model sensitivity analysis indicated that the release ratio of CH4 to CO_2 and the Q10 in methane production are two major factors controlling the methane emission. Meanwhile, the values of these two parameters are spatial heterogeneous. Model testing was conducted over twenty wetland sites across different geographic regions in the globe. Although the model simulation sometimes missed the daily details or the emission pulse, the model always capture the patterns of temporal variations of CH4 well. Our model simulations results suggest that the TRIPLEX-GHG can be used to simulate greenhouse gas emission under a changing environmental conditions for different global wetlands.