Estimating Methane Emissions from Natural Wetlands: Model Development and Application

Professor Qiuan Zhu
（朱求安教授）

Center for Ecological Forecasting,
College of Forestry, Northwest A&F University

A new process-based model TRIPLEX-GHG was developed based on the Integrated Biosphere Simulator, coupled with a new methane (CH_4) biogeochemistry module (incorporating CH_4 production, oxidation, and transportation processes) and a water table module to investigate CH_4 emission processes and dynamics that occur in natural wetlands. The simulated results showed that the interannual variability of global wetland CH_4 emissions primary controlled by tropical wetlands. As a result of a balance of emissions from tropical and extratropical wetlands, the stable to decreasing trend in wetland CH_4 emissions was a particular factor in slowing the atmospheric CH_4 growth rate during the 1990s. The rapid decrease in tropical wetland CH_4 emissions that began in 2000 was supposed to offset the increase in anthropogenic emissions and resulted in a relatively stable level of atmospheric CH_4 from 2000 to 2006. The results also showed that CH_4 emissions from tropical wetlands respond strongly to repeated ENSO events, with negative anomalies occurring during El Nino periods and with positive anomalies occurring during La Nina periods. The ENSO events can explain 49% of interannual variations for tropical wetland CH_4 emissions.

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Enquires: 3943 9624 essc@cuhk.edu.hk