EGU23-14171, updated on 29 Mar 2024
https://doi.org/10.5194/egusphere-egu23-14171
EGU General Assembly 2023

Numerical simulation of the atmospheric CH_4 increase and the corresponding decrease of $\delta^{13}C(CH_4)$ after 2007

Anna-Leah Nickl, Franziska Winterstein, and Patrick Jöckel
Institute of Atmopsheric Physics, German Aerospace Center (DLR), Germany (anna-leah.nickl@dlr.de)

The global atmospheric CH_4 growth rate stagnated between 2000 and 2007, and has continued to grow since 2007. This renewed CH_4 rise has been analysed with respect to a 2007 onward decline in $\delta^{13}C(CH_4)$, indicating changes in the relative contribution of CH_4 sources. However, this is still subject to debate and a variety of hypotheses have been put forward. In our work, we present numerical sensitivity simulations that investigate the impact of different inventories of methane emission fluxes on the globally averaged $\delta^{13}C(CH_4)$ signature. We apply the state-of-the-art global chemistry-climate model EMAC and use a simplified approach to simulate methane loss. We include methane isotopologues and take the kinetic isotope effects in physical and chemical processes into account. We further consider regional differences in the isotopic signatures of individual emission source categories, such as, for example, the differences between signatures of tropical and boreal wetlands emissions. Based on recent emission inventories and isotopic source signatures from the literature, our chemistry climate model reproduces the actual atmospheric methane and $\delta^{13}C(CH_4)$ distribution adequately. We show that our setup is suitable to constrain the individual influence of different CH_4 sources on the global average $\delta^{13}C(CH_4)$. We further present an approach to optimize the global methane level with respect to station measurements probing for a strategy to include the isotopic information into such an optimization process.