Geophysical Research Abstracts
Vol. 17, EGU2015-9402-1, 2015
EGU General Assembly 2015

Role of OH variability in the stalling of the global atmospheric CH4 growth rate from 2000 to 2006

Joe McNorton (1), Martyn Chipperfield (1), Chris Wilson (1), Emanuel Gloor (2), Garry Hayman (3), Steve Montzka (4), and Matt Rigby (5)

(1) Institute for Climate and Atmospheric Science, University Of Leeds, Leeds, United Kingdom (eejrm@leeds.ac.uk), (2) School of Geography, University Of Leeds, Leeds, United Kingdom, (3) The Centre for Ecology and Hydrology, Wallingford, UK, (4) National Oceanic and Atmosperic Administration, Boulder, USA, (5) School of Chemistry, University of Bristol, Bristol, UK

Methane (CH4) is the second largest contributor to anthropogenic greenhouse warming. Atmospheric sources and sinks of CH4 are generally thought to be well understood globally; however recent variations in the growth rate have raised several questions that need to be addressed. Surface air samples show that between 1993 and 1998 the growth rate of CH4 was steady at 3.6 ppb/yr. In 1999 a period of near-zero growth began which continued until 2007 (0.5 ppb/yr), after which growth resumed (6.0 ppb/yr). A full understanding of this stalling is important for accurate predictions of future CH4 levels. Most previous studies focus on the potential change in emissions that may have influenced the change in growth.

This study combines recent atmospheric observations of CH4 and methyl chloroform from the NOAA and AGAGE networks with detailed models to assess the contribution of changes in the atmospheric sink to the stalling. CH4 emissions taken from industry emission estimates, a wetland land surface model (JULES) and various other studies have been used to drive a global off-line chemical transport model (TOMCAT). The variability of the OH loss field in the model is based on recent methyl chloroform measurements and a prescribed methyl chloroform emission. TOMCAT simulations were performed at a horizontal resolution of 2.8° x 2.8° with 60 levels extending from the surface to ∼60km and were forced by ECMWF ERA-interim reanalyses. Additionally, a one-box-model has been used to simulate atmospheric CH4. This provides estimated emissions based on CH4 measurements and, changes in OH and temperature.

Results show that variability (on a timescale of a few years) in atmospheric OH, temperature and transport all contributed to the stalling of growth in atmospheric CH4, highlighting the importance of the variability in the CH4 sink term. These results imply a smaller role for changes in CH4 emissions during the stagnation period. Observationally derived estimates of OH become more uncertain after 2007; however they do suggest that changes in OH can partly account for the renewed growth with the remaining contribution coming from increased emissions.