5.031 Drivers of Increase in Atmospheric Methane since 2007.

Early Career Scientist

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Abstract:

Atmospheric methane (CH_4) is now the second most important anthropogenic greenhouse gas in terms of radiative forcing (IPCC, 2013). After continously increasing, methane levels plateaued from 1999 to 2006, but since then have continous to increase (Sussmann et al., 2012). At the same time, $\delta^{13}C$ have decreased globally (Nisbet et al., 2014). The contribution of increasing natural and anthropogenic emissions from agriculture and fossil fuel remain unknown.
Simulations forced with prescribed meteorological fields have been performed for the 2001-2010 period using the global chemistry-climate model (CCM) SOCOLv3 (Stenke et al., 2013). 48 methane tracers have been included in the model and used together with flux boundary conditions for CH_4 to allow the tracking of methane emissions from different source categories, (such as wetlands, rice paddies, ruminants, industy, etc.) as well as geographical regions. Isotopes of methane $^{13}CH_4$ have been implemented to simulate the trend in $\delta^{13}C$ for the studied 2001-2010 time period.
An analysis of the implemented tracers elucidates the impact of different emission source categories by comparing the change between 2008-2010 and 2001-2003. 8 locations have been chosen from the NOAA ESRL global network for comparison. For all locations, a study of the change in contribution of the tracers as well as the $\delta^{13}C$ trend indicates that a combination of increasing emissions over Africa, China, India, the Middle East, South America, and tropical Asia explain the observed rise in methane and can not be compensated by a negative contribution of decreasing emissions from Eurasia and Northern America and can explain the increase after 2007. Emissions over Africa, India and South America are mainly driven by agriculture, this, combined with decreasing fossil fuel emissions from Eurasia and North America, it explains the decrease in $\delta^{13}C$ both observed and simulated.