Geophysical Research Abstracts
Vol. 18, EGU2016-8444, 2016
EGU General Assembly 2016

The global rise in methane 2007-present: isotopic constraints from Ascension and Alert. Is a significant change occurring?

Euan G. Nisbet (1), Martin R. Manning (2), David Lowry (1), Rebecca E. Fisher (1), James France (3), and Rebecca Brownlow ()

(1) Royal Holloway, Univ. of London, Earth Science, Egham, United Kingdom , (2) Climate Change Research Institute, School of Geography Environment and Earth Sciences, Victoria University of Wellington, New Zealand , (3) Centre for Oceanic and Atmospheric Sciences, School of Environmental Sciences, University of East Anglia, Norwich NR4 7TJ, United Kingdom

Since 2007, atmospheric methane has risen globally by about 6 ppb a year (NOAA data), though with strong year to year variations, after a prolonged approach to equilibrium in the 1980s and 1990s. Much of this growth has been driven from the tropics, especially in the Southern Hemisphere, though with brief episodes of strong growth also in the Arctic in 2007, and in the Northern Hemisphere's low temperate latitudes. Global growth was about 13$\pm$1 ppb in 2014 and continued strongly through 2015 (NOAA data).
The renewed growth in total methane burden has been accompanied by a significant shift in δ13CCH4 ratio to more 13C depleted values, which began simultaneously with the start of the rise, and has been broadly sustained, although there have also been large short term positive anomalies in δ13CCH4 occurring in both hemispheres. On Ascension island (8oS), δ13CCH4 values through into 2015 have stabilised around 0.2‰ more negative than in 2007-8. Measurements from Cape Point (34oS), and Alert (82oN) show similar patterns, as do NOAA-INSTAAR results from S. Pole. This isotopic trend is quite different from the trend of the 20th century, and implies current growth is driven by biogenic sources, not direct anthropogenic emissions.
A budget analysis of both methane mole fraction and δ13CCH4 ratio has been used to investigate patterns. It is unlikely that the growth was driven by reductions in the OH sink, as such scenarios are hard to reconcile with the isotopic record. Increased anthropogenic emissions, from coal and gas leaks or fires, would tend to shift isotopic values to less 13C depleted values, the opposite of observations. The most likely explanation for the change is thus sustained growth in low latitude and southern biogenic sources, probably mainly from tropical wetlands, forests and savannas, with a possible contribution also from ruminants.
In total, over the 9 year 2007- 2015 period, methane growth has been about 50-60 ppb, and continuing.
The broad observation that most growth from 2007-present has been led from the low latitudes and southern hemisphere shows that the tropics are capable of generating a 50 ppb methane rise in less than a decade. This total increase and time span is beginning to bear comparison with methane growth in smaller Dansgaard-Oeschger events in Ice Core records, and may thus provide an interesting analogy for interpreting D-O events, for example in the context of the 'hydrate vs wetland' debate. Although the post-2007 trend is exceptional in the instrumental record, it is however too early to assess whether the present rise is a very strong decadal-scale meteorological oscillation (including intense La Nina rainfall in the southern savannas in late 2010-11), or if the present trend marks the onset of a longer-sustained climate shift.