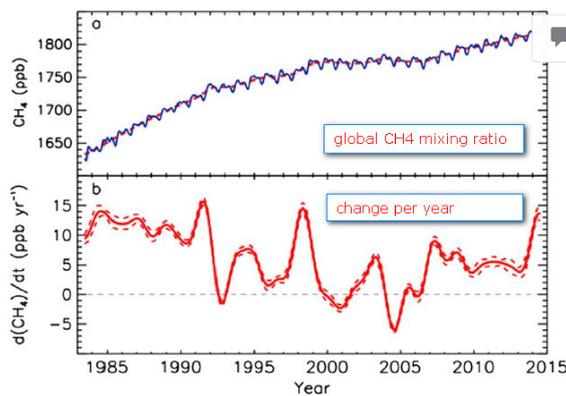


Recent methane rise mostly due to biogenic sources

There is an interesting new paper by Nisbet et al. in the AGU publication Global Biogeochemical Cycles titled "[Rising atmospheric methane: 2004-2014 growth and isotopic shift](#)". The fossil fuel industry (oil extraction, fracking....) is often blamed for rising methane emissions, and this argument went somehow into limbo as the atmospheric mixing ratio, after a period of clear rising, was stable for many years:



This picture documents the rise from 1984 to about 1999, the following plateau and finally a new lower rise from 2005 to 2015 (the lower plot shows the derivative = the change in mixing ratio per year).

One fingerprint in detecting the origin of the methane (from fossil fuels or from biogenic sources) is the isotopic composition: biogenic methane has a higher component of the ¹³C (carbon-13) isotope than the methane from fossil sources which are more depleted in ¹³C. Usually the isotopic fingerprint is given as delta_13C/12C in per mil (‰): the next figure (from Wikipedia) shows the exact definition.

The definition is, in per mil:

$$\delta^{13}\text{C} = \left(\frac{\left(\frac{^{13}\text{C}}{^{12}\text{C}} \right)_{\text{sample}}}{\left(\frac{^{13}\text{C}}{^{12}\text{C}} \right)_{\text{standard}}} - 1 \right) * 1000 \text{ ‰}$$

where the standard is an established reference material.

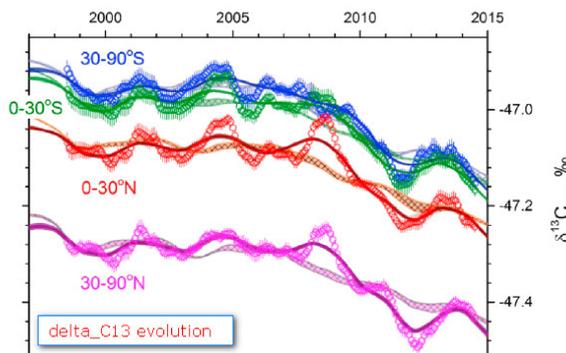
More negative values point to dominant biogenic sources, less negative values to fossil methane. For instance this [paper](#) gives a delta_13C/12C of about **-60** for methane from ruminants (cattle) and marsh gas (wetlands). The next [table](#) (right column) has an overview from different sources:

Table 1. A Global Methane Source Budget Modified From *Francey et al.* [1999] and *Lassey et al.* [2000] based on IPCC source strengths [*Prather et al.*, 1995; *Schimel et al.*, 1996]^a

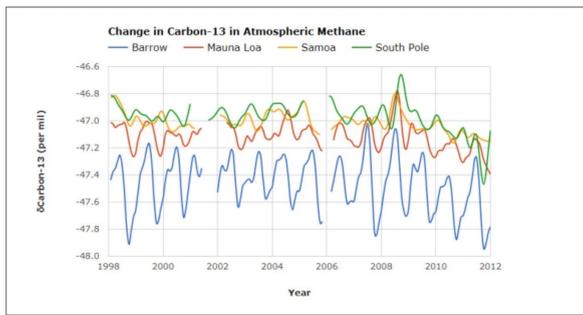
Source Type	Strength, Tg CH ₄ yr ⁻¹	δ ¹³ CH ₄ , ‰
Animals	125	-63
Wetlands ^b		
bogs/tundra	45	-64
swamps/alluvial	95	-59
Rice ^b	65	-62
Landfills	65	-51
Natural gas vents	20	-40
Natural gas leaks	65	-40
Coal mining	45	-38
Biomass burning ^b	45	-25
Termites	20	-62

Clearly methane from landfills or natural gas leaks and vents have a less negative delta_13C/12C.

The following picture from the Nisbet paper shows how this delta_13C/12C has evolved during the last 18 years:



CDIAC gives the series of 4 measurement stations (from North (Barrow) to South) which is consistent with the previous plots:



Clearly (in the 3 given regions) there was a general plateau until 2005, followed by a marked decrease. Nisbet et al. conclude that the dominant cause of this decrease was biogenic: greater rainfalls in the tropics increased wetlands, and helped increasing agricultural surfaces and livestock. But the contribution of the latter is estimated more gradual and lower, so that **the main cause seems to be a meteorological driven increase in the tropical wetlands.**

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