

Interactive comment on “Stable isotopes provide revised global limits of aerobic methane emissions from plants” by D. F. Ferretti et al.

F. Keppler (Referee)

Frank.Kepler@mpi-hd.mpg.de

Received and published: 22 August 2006

The short article deals with the global source strength of methane emissions from plants recently reported by Keppler et al. The authors have looked at carbon isotope signatures of methane that they measured in air bubbles of a 2000 year old ice core from Antarctica (Ferretti et al, 2005). By using a stable isotope top-down approach and based on their assumptions they now provide revised global limits of methane emissions from vegetation. In the first reported attempt Keppler et al. suggested the global emissions of methane from vegetation to be in the range of 62-236 Tg/yr whereas Ferretti et al. now suggest that the range is more likely to lie in the range 0-46 Tg/yr. From the information provided in this manuscript, in some instances I found it impossible to determine exactly how the authors arrived at some of the figures for their budgets. Thus

for the purposes of clarity it is important that the authors detail and logically discuss the assumptions they used in their calculations. However, even though I have some reservations about the merit of this present study before much more data are available about emission rates and stable isotope signatures of methane from a much broader range of plants, I consider the manuscript suitable for publication in ACP following considerable revision and after addressing the issues listed below.

Specific comments:

Abstract, line 4 "This is ~10-50%..."

I think it should read ~10-40%, if 10% is ~60 Tg/yr

Abstract, lines 10,11 "are likely to lie in the range of 0-46 Tg/yr"

Must change sentence to read "are likely to lie in the range of 0-137 Tg/yr" The rationale for this is that in their conclusions the authors state "Our "Best Estimate" of the methane budget suggests that pre-industrial and modern plant emissions are likely to be in the ranges 0-46 Tg/yr and 0-137 Tg/yr,...". It is important that both information are mentioned in the abstract, otherwise it would appear the authors have a hidden agenda for trying to keep the plant emissions range in modern times low and not basing it upon their own calculations (see Table 1).

Introduction

In the light of the ongoing controversial discussion about the global source strength of methane emissions from vegetation and for additional information, I would point the authors to the special report on the "methane mystery" published by Quirin Schiermeier in Nature (see reference below).

Results and discussion line 13,14 "However, there is no evidence for temperature dependency of plant emissions over ambient ranges (10-30°C)..."

In the paper of Keppler et al. it is clearly shown that emissions of methane from plant lit-

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

ter are highly sensitive to temperature changes: ‘concentrations approximately doubled with every 10°C increase’. It is right that in the same study temperature dependency for living plants could not be explicitly shown due to the limited number of experiments. However, it can be assumed that temperature plays also an important role in controlling methane emissions from living plants since for most volatile organic compounds (VOCs) emitted from vegetation it is known that temperature plays an important role in controlling emissions (e.g. isoprene). It is also well known that the biosphere responds very quickly to changes in environmental parameters. That’s why I am a bit surprised that the authors try to ignore this fact when reconciling the pre-industrial methane budget.

Results and discussion

In this section the authors must highlight and discuss the fact that small changes (range of a few Tg/yr) in the source strength of biomass burning will significantly alter the isotope composition of the methane budget and thus modify the conclusions of their study. Furthermore, I feel that it is important that the manuscript discusses the large uncertainties associated with both strength and stable carbon isotope values of each source, in particular the isotope number used for the plant source is still uncertain. Unfortunately as this discussion is missing it tends to suggest that our knowledge of the global budget methane is considerably better than it actually is and may mislead many readers.

For completeness, in this study the work published recently by Houweling et al. (2006) addressing upper limits of the methane vegetation source should be referenced and discussed.

Table 1

For clarity purposes stable carbon isotope source signatures and uncertainty ranges should be included in the table by addition of a new column.

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

Additional references:

S. Houweling, T. Röckmann, I. Aben, F. Keppler, M. Krol, J.-F. Meirink, E. J. Dlugokencky, C. Frankenberg (2006). Atmospheric constraints on global emissions of methane from plants. *Geophysical Research Letters*, 33, L15821, doi:10.1029/2006GL026162.

Q. Schiermeier. The methane mystery. *Nature* 442, 730-731 (2006).

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 6, 5867, 2006.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper