Atmos. Chem. Phys. Discuss., 6, S1281–S1283, 2006
www.atmos-chem-phys-discuss.net/6/S1281/2006/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effects of methane outgassing on the Black Sea atmosphere" *by* K. Kourtidis et al.

Anonymous Referee #1

Received and published: 21 June 2006

Methane is supplied to the ocean from a variety of sources located in depths ranging from a few meters to a few thousand meters. There is a great deal of interest in how much of this gas reaches the atmosphere, particularly in the case that the supply is perturbed by sudden releases. The Black Sea with its anoxic interior generally contains much higher concentrations of methane than found elsewhere in the ocean, and in addition there appear to be large sources of methane associated with the mud volcanoes and seeps on the margin. The surface water and atmospheric methane measurements in this article are thus of interest to the question of methane emission to the atmosphere.

This article describes a survey of surface water methane using an equilibrator system as well as simultaneous atmospheric measurements. From the partial pressure differ-

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ence, sea to air methane fluxes were estimated according to various correlations of the transfer coefficient with wind local speeds. The wind speed measurements, however, are not presented. Therefore, it is not possible for the reader to make his own estimate of the air-sea flux nor to view what effect the variation of wind speeds may have had on the flux calculations.

The methods and results of the equilibrator measurements are well described and clearly presented. Presently, in order to figure out whether the high methane concentrations that were encountered were associated with the Danube River, an active seep, a harbor, etc. one must read the narrative carefully. It would be good if Figures 1 and 2 were annoted in such a way as to identify the associations.

Wind speeds are not only employed in the flux estimates but also in a box-model calculation of how much the methane fluxes would perturb the atmospheric concentration. Again, wind speed measurements used in this calcuation ought to be supplied. The results are shown in Figure 4, where the unit of the atmospheric mixing ratio is given as ppt. It is not clear what this unit means - normally the reader might think this is 1000 ppm. Perhaps the authors mean the fractional increase of the mixing ratio in parts per thousand over the existing concentration or the absolute increase in the mixing ratio in parts per trillion. This should be explained in the figure caption. Whatever this unit is, the authors conclude that the presently observed fluxes are not sufficient to significantly perturb the atmospheric concentrations over the Black Sea.

The authors have also employed a three dimensional model of dispersion in the atmosphere to calculate the regional methane increase expected an outburst from a mud volcano. As input, a flux of 6.25 mmol/m2/s from the mud volcano is assumed, but it is not explained how this flux was arrived at, and this ought to be done. In contrast to the measured fluxes, they conclude that such events could cause significant increases in atmospheric methane at distances up to several kilometers from the source. The model itself, however, is not described nor are any literature references concerning the model provided. Therefore, it is not possible to repeat this computation, and the con-

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clusion is difficult to verify. The figure caption containing these results emphasizes that unignited methane is being simulated. Since this presumably is the usual situation, it would appear that something here has been left unsaid. For example, has methane ignition above the sea surface been observed?

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 3611, 2006.