

## ***Interactive comment on* “Investigation of how observed methane concentrations in Ny-Ålesund are influenced by atmospheric flow patterns” by I. T. Pedersen and K. J. Holmén**

### **Anonymous Referee #2**

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This study analyses the methane concentration record at Ny-Alesund focusing on the extent to which the observed variation is explained by (changing) meteorological conditions at Ny-Alesund. As expected, enhanced methane concentrations are observed for airmasses originating from source regions in Europa en Russia. In addition, information on the vertical elevation of the trajectory is taken into account, but it is not entirely clear how this is done and the results seem somewhat difficult to interpret. A comparison is made with previous work addressing a different period. The results of this comparison suggest that flow patterns have changed over time, but, as I will explain below, the significance of this finding is not clear. Even if there was a significant change in meteorology, the time span of the methane measurements does not allow address-

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ing its relevance for methane. In my opinion, this manuscript will only be suitable for publication in ACP after significant revisions addressing the points raised below.

## MAJOR COMMENTS

### Trend analysis

A cluster analysis has been applied to the 2001 - 2003 period and the relative abundance of trajectories of several clusters has been compared to a previous study, which followed essentially the same procedure for a different period. The question, however, is whether or not the clusters can be compared one to one. As mentioned in the current manuscript a limitation of this study is that the cluster analysis has not been applied to the whole period. In my opinion this is indeed crucial. Interestingly, the two analyses share the years 2000 and 2001. Looking into Eneroth et al. 2003 I found that cluster 1 had a relative frequency of 15.2 and 17% for resp. 2000 and 2001. This study, however, reports 8.5 and 7.8% for the same years. This clearly suggests that the 'trend' is just explained by the fact that cluster 1 represents slightly different clusters in both studies. Furthermore, cluster 3 in Eneroth et al. 2003 has a large variation, which probably doesn't allow a significant statement on a 2% change (also in this case the year 2000 differs by more than 2% already between the studies). Because of this I can only conclude that the trend analysis is inadequate.

### Methane concentration time series

It is not clear why the methane measurements cover only the period 2001-2003. As mentioned in the text, the instrument started operating in 1997. It is not clear why the data before 2000 have not been taken into account. In fact, the methane data at Svalbard go back to 1994 - albeit at a lesser temporal resolution - still a significant number of data is available to address differences between the periods 1992-2001 and 2001-2003.

### Vertical motion

Trajectories are classified differently dependent on whether or not they have been in contact with the boundary layer (here loosely defined as the 950 hPa - there is some confusion in the wording because 'below 950 hPa' means at a pressure higher than 950 hPa). Firstly, the selection criterion is not hard (each cluster has contributions of trajectories below and above 950 hPa), which complicates the interpretation. Secondly, it seems that contact with the marine boundary layer is not very relevant in case of methane. The results indicate either enhancement or depletion of methane when the trajectory has been in contact with the boundary layer. In the case of depletion - notably depletion over the ocean - it is difficult to understand how that might happen. The text doesn't provide an explanation nor a footnote that such a result is unexpected.

#### DETAILED COMMENTS

The manuscript is full of grammar and spelling errors. To give some examples:

page 11026, line 18: 'The identified seasonal and indications of decadal shifts in transport pathways ...'

page 11029, line 15: 'To few clusters would make it difficult ...'

page 11030, line 15: 'To see how the transport to Mt. Zeppelin station through the year the clusters are divided into months ...'

page 11033, line 9: ' ... that has been below 950 hPa ones or several times ...'

page 11033, line 13: ' ... there are no trajectories in cluster 1 that has been ...'

page 11033, line 15: 'The time the trajectories have been below 950 hPa vary between ...'

page 11033, line 19: ' ... hourly mean methane data for July 2002 is plotted ...'

page 11033, line 24: 'These two clusters are transport from areas ...'

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From page 11038 line 10 until the bottom of the page the discussion becomes rather vague, for example:

line 10: 'Caution must be taken when interpreting concentration records and attempting to derive source and sink distributions.'

This case seems to address source/sink quantification without an atmospheric transport model. If, however, inverse modelling methods are addressed here then it should be realized that these methods take atmospheric transport variations into account (the question remains whether or not the models are capable of resolving the relevant meteorological variability, but this question is not addressed by this study).

line 20: 'remote sensing data to enable continuous evaluation of the representativity' It is unclear what remote sensing methods are meant here and how they could be used to 'evaluate seasonally varying representativity'.

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Interactive comment on Atmos. Chem. Phys. Discuss., 6, 11025, 2006.

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