Atmos. Chem. Phys. Discuss., 11, C8066–C8069, 2011
www.atmos-chem-phys-discuss.net/11/C8066/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Interpreting elevated space-borne HCHO columns over the Mediterranean Sea using the OMI and SCIAMACHY sensors" *by* A. Sabolis et al.

Anonymous Referee #2

Received and published: 22 August 2011

General comments In this paper, Sabolis et al. report on the study of the seasonal variation and the spatial distribution of formaldehyde over the Mediterranean Sea between 2005 and 2007. The results are principally based on OMI formaldehyde observations and on the GEOS-Chem model. The main objective is to explain the elevated concentrations of formaldehyde columns over the Mediterranean Sea during summer months. The scientific topic is relevant for ACP and the paper is well written. However, two major concerns need to be addressed before publishing: 1/ Even if the findings about the effects of aerosols on OMI AMFs and of the marine biogenic source are valuable and innovative, the main objective of the paper is not attained. Other possible reasons for the enhanced formaldehyde columns over the Mediterranean Sea (like transport

from continental sources) should be more discussed (on the base of GEOS-Chem). 2/ The comparison between OMI and SCIAMACHY observations is not convincing. The use of SCIAMACHY data do not bring anything more to the discussion and we advice either to improve this section (taking into account differences between OMI and SCIAMACHY products such as the treatment of aerosols in the AMF calculations or differences in the sampling frequency of the two sensors), either to skip this part of the paper. Specific comments Intro, p17915, line 26: Reference to Stavrakou et al., 2009b would be more appropriate than 2009a. Intro, p17917, line 1: Remove the word "polluted". Continental air masses can transport VOC from pollution, from biogenic sources or from fires, especially in summer. Section 2.1: The references of the two satellite products used in the study should be mentioned earlier in section, before detailing the retrievals (after line 21, p17917). Section 2.1, p17917, line 24: Both retrieval algorithms (OMI and SCIAMACHY) are based on a non-linear least-squares fitting of the recorded spectra (the DOAS technique). Please give a reference for the OMI HCHO retrieval procedure. Section 2.1, p17918, line 16: There is a mistake here. SCIAMACHY retrieval is using the IMAGES chemistry transport model and the LIDORT radiative transfer code for the AMF calculation (and no correction for aerosols is applied) [De Smedt et al., 2008]. Section 2.1, p17918, line 29: Remove the words "daily swath data: "while for SCIAMACHY, the TEMIS level 2 HCHO product (version 1.2) is used (http://www.temis.nl/airpollution/ch2o.html)." Section 2.1, p17918, line 18: The description of the GEOS-Chem version used in the present study should come after the description of the satellite products, at the end of section 2.1. Table 1 of the supplement: Why the formaldehyde yields are they taken from Dufour et al. (2009), while the authors used the GEOS-Chem model? It would be more logical to provide the yields calculated with the GEOS-Chem chemistry. Section 2.1, p17919, line 4: I don't understand how the detection limits are evaluated. For which spatial and temporal resolution are they given? a single observation, an averaged column in a grid cell, other? Do they correspond to the random errors? The given numbers seem small for a single slant column. Please clarify and give an estimation of the errors correspond-

ing to the satellite gridded data at 0.25° resolution and averaged over 8-days or one month, plus an approximation of the number of OMI and SCIAMACHY observations in a grid cell. Section 3.1, p17922, last paragraph: - Can you conclude that the OMI HCHO columns are currently too elevated over the Mediterranean Sea? - When the new AMFs are used, the east-west difference in the formaldehyde distribution over the Mediterranean Sea disappears (Figure 3). Please elaborate on this.

Section 3.2: Please precise which OMI HCHO columns have been used for the estimation of isoprene emissions (the original level 2 columns or the recalculated columns with reduced Saharan dust sources). Does the reduction of the vertical columns using the newly calculated AMFs bring the isoprene emissions to more realistic values?

Section 3.3: We suggest showing a plot with the simulated GEOS-Chem HCHO columns. Section 3.4: The authors should state clearly if the enhanced summertime concentrations of HCHO over the Mediterranean Sea is also observed in the SCIAMACHY data (possibly by showing maps similar to Figure 1, together with the GEOS-CHEM columns). Section 3.4, Figure 5: - Considering the sampling time of SCIAMACHY (global coverage in 6 days, at best), and considering the noise inherent to formaldehyde retrieval, 8-days averaged columns are not a fair representation of the SCIAMACHY formaldehyde observations. Monthly averaged columns are much more suitable in order to catch the seasonal variations. It is also recommended not to use the SCIAMACHY results for solar zenith angles larger than 60°. This could explain the abnormally high value in winter time over the Mediterranean Sea. Please, modify the figure accordingly. - Furthermore, the SCIAMACHY AMFs are not corrected for aerosols. An additional test with OMI AMFs calculated for aerosol optical thicknesses switched to zero would be more appropriate for the comparison with SCIAMACHY. Figure 1S: SCIAMACHY HCHO slant columns are normalized with the reference sector correction above the Pacific Ocean. As can be seen on the figure, the SCIAMACHY normalized slant columns are around zero in regions A, B and H. The final HCHO vertical columns in the Pacific Ocean are taken from the IMAGES model. It is therefore

meaningless to show comparison of slant columns and this figure has to be removed. It would be more appropriate to show comparison of AMFs (with and without aerosols for OMI). Technical corrections p17917, line 24: short lived VOCs with high HCHO yields... p17926, line 12: SCIMACHY -> SCIAMACHY

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 17913, 2011.