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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Improving the seasonal cycle and interannual variations of biomass burning aerosol sources" *by* S. Generoso et al.

S. Generoso et al.

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Dear Dr Gregoire,

We really appreciate the extensive work that you have made for the review of our manuscript. We would like to discuss here about the further analysis that we have conducted to follow your suggestions. For the sake of clarity this discussion will follow the different points that you have emphasized in your specific comments.

1. The positioning of the ATSR imagery during the year 2001.

We are aware that the geo-location precision of the ATSR has been significantly affected during the year 2001 with a maximum misregistration of 40 km. This maximum is small in comparison with the sizes of our boxes and typical size of fire areas, so that we believe that this problem has small impact on our results. Nevertheless, this may have an impact, when we remove flares from the dataset (as we remove fires which

has been detected at the same position during several months).

2. The selected large regions.

We agree that some of our regions include different vegetation types, in particular in Africa and South-East Asia. As you suggest, we have used MODIS vegetation cover maps to better take into account the vegetation homogeneity in these two regions. In our previous African box (north of the Equator), for instance, we now better take into account the gradient of vegetation, which exists from North to South.

3. Specificity of the night-time fires.

You suggest to assess the representativity of the night-time fires that we have used in our study. We have therefore compared the global fire count products from the AVHRR (daily), ATSR (night-time), and the GLOBSCAR and GBA2000 burnt area products. We have plotted the number of fires for ATSR and AVHRR and the burnt area for GLOBSCAR and GBA2000 (in arbitrary units) as a function of time and for the year 2000. The comparisons are made within the large regions used in this study. We discuss the main results that we have obtained. The plots could not be presented in this short answer (ACPD format) but they will be added to the revised version of the manuscript.

For the main biomass burning regions, the agreement between the 4 datasets is good, although the maximum of the burning season is sometimes slightly different from one dataset to the other. Indeed, in the known biomass burning regions of Africa (North of Equator), South America, Indochina (plus South-East of China), Mongolia, and Australia the 4 datasets show similar seasonal cycles.

Nevertheless some differences between the datasets do exist in some regions. For instance, in Africa (South of the Equator) GLOBSCAR and GBA2000 agree concerning the burning season, which has its maximum in June (GLOBSCAR) or July (GBA2000) whereas the ATSR fire counts show a maximum in July-August and decrease less

ACPD

3, S753–S757, 2003

rapidly. Judith Hoelzemann and her co-authors, in a manuscript that has been submitted recently to JGR, explain the differences between GLOBSCAR and ATSR by the fact that the fires which occur in June in the northern countries of this region are of small extension, low temperature, and day-time ones and thus possibly not totally caught by the ATSR. We agree that smaller extension together with lower temperature may explain the differences but we believe that the night-time detection may not be imputed as the ATSR seasonality does not differ from daily AVHRR products.

You said that for high latitudes, there are very few night-time fires detected by ATSR. Indeed, in the "Russian" box, the ATSR shows a burning season, which starts two months later than shown by AVHRR and GLOBSCAR. Nevertheless GBA2000 shows a burning season which has its maximum two months earlier, so that the differences may apparently not been explained only by the night-time detection. Note also that in the Mongolian box (between 47°N and 52°N) the agreement between the ATSR and the two burnt area products is excellent whereas the AVHRR daily product show a burning season that ends 2 months after.

In Indonesia, the discrepancies between the active fire count products and the burnt area products are large. The burnt area products show a clear burning season lasting from July to October whereas the fire count products do not even show a clear burning season. We acknowledge that in this case our method will give results that are completely different to what would be obtained with the burnt area products but this may apparently not be imputed to the night-time detection as it is totally in agreement with the daily AVHRR products.

Finally, in Alaska, the comparisons show that the burning season seems to start in June and ends in August although differences exist between the 4 datasets. The ATSR instrument shows in addition to this "regular" burning season a maximum in October. This maximum is due to the detection of a large number of fires, which is probably due to an error of the sensor (one full scan of hot spot in a single orbit). In this case, the comparisons have allowed us to detect a problem that we have corrected in the

ACPD

3, S753–S757, 2003

dataset.

These further analysis have shown that in most cases, the night-time and the daily fire products show seasonal cycles that are similar and often consistent with the daily burnt area products. Moreover, these comparisons show that the differences between the observed and simulated aerosol optical thickness (after having applied our method) in terms of the position of the fire season are smaller than the differences between the datasets. Finally, these analysis show that the assumption that we have made on the night-time detection (the ratio between the night-time and the day-time fires is considered as constant within our large regions) will not have an impact on our results. We are aware that problems remain in some regions, whatever dataset is used, and this further analysis will allow us to discuss them in the revised version of the manuscript. Nevertheless, we believe that our method has significantly improved the representation of the seasonal cycles in the original inventory of Liousse et al (1996).

4. Discussion on the seasonal cycle.

- South America region. You said that the activity derived with the "new sources" and with the "old sources" starts at the same time of the year and that the maximum is reached at the same time (right in 1999 and 2000 over Abracos Hill but not over Alta Floresta). We would like to stress the fact that with the "old sources" half of the emissions are between May and August (year 1999 over Abracos Hill). The activity derived from the "new sources" starts indeed in May-June but gives negligible aerosol load before July. Moreover the major part of the aerosol load is between August and October, which is in complete agreement with AERONET data. We believe that this is a significant improvement to the original inventory since the emissions are absolutely not following the same distribution in the year. Finally, year 2000 is particular since large discrepancies between observed and simulated curves are seen. Nevertheless such high aerosol loads observed until January or February 2001 are not explained and may probably not be imputed to biomass burning since none of the 4 global fire products studied show a large number of detected fires in December 2000.

ACPD

3, S753–S757, 2003

Hoelzemann J. J., Brasseur G. P., Granier C., Schultz, M. G., Simon M., The Global Wildfire Emission Model GWEM: a new approach with global area burnt satellite data, submitted to JGR, april 2003.

The data are available at:

ATSR: http://shark1.esrin.esa.it/ionia/FIRE/AF/ATSR/

AVHRR: http://www.gvm.jrc.it/tem/wfw/wfw.htm

GLOBSCAR: http://shark1.esrin.esa.it/ionia/FIRE/BS/ATSR/

GBA2000: http://www.gvm.jrc.it/fire/gba2000/index.htm

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 1973, 2003.