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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.

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A. GENERAL COMMENTS

This work confirms previous studies, done by Schultz (2002), Hoelzemann (2002) or Carmichael (2002), which concluded at the usefulness of satellite derived fire maps in constraining the existing global inventories, both on an inter and intra-annual basis.

I fully agree with the first conclusion of the authors: "the method described in this paper provides a simple way to introduce fire seasonal cycles into already existing inventories and to take into account interannual variations." However, the type of satellite fire maps used in this work is really quite specific and can introduce strong alterations which make somewhat questionable the results obtained when using them. This is discussed in details in the "Specific comments" section below.

I strongly recommend to the authors to complete their analysis by using, in addition to the ATSR night-time fire maps, other global maps of fire activities which are of public access on the Internet.

A second aspect should be considered by the authors: the geographical regions (boxes) chosen for the analysis cannot be considered "fairly homogeneous in terms of vegetation cover and fire season" (section #2 Method). In most of them, there is in fact a large range of vegetation cover type and of fire seasonality (see Specific comments below). Here again, I would recommend to exploit the existing products (global scale vegetation cover maps, for instance) for improving the results.

In more general terms, this paper is really interesting, and deserves to be published in ACP after some additional analysis, because it integrates the methods and results made available by two disciplines: modelling and remote sensing. However, it also shows that the dialog between these two communities ("remote sensers" producing the global dataset on surface conditions and "modelers") should be strengthen: to make sure that the first ones understand the needs of the modelers and that the modelers themselves understand the limitations of the environmental information derived from Earth observation techniques.

B. SPECIFIC COMMENTS

1. The authors should be aware that the positionning of the ATSR imagery has been fairly unreliable for a long period of time during the year 2001: due to problems of absolute geolocation, the ATSR data have been misregistered (from a minimum of 5 km to a maximum of 40 km) since the beginning of 2001 (see the ESA-ESRIN web site for more information: http://shark1.esrin.esa.it/ionia/FIRE/).

2. The Emission Constant (ratio between the annual emitted quantities of carbonaceous aerosols and the annual number of fire events) is rather discutable as the vegetation cover conditions and the fire seasonality are quite heterogeneous within the boxes selected by the authors. If we consider the African continent, for instance, 1 box

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includes all sub-saharian Africa North of the equator from Lake Chad to Lake Victoria. This corresponds to a range of vegetation cover (and therefore of fuel) which goes form a dry steppe in the North to the rain forest in the South, with all intermediate situations. The same remark is valid for the second African box (South of the equator), where the range of vegetation cover types is just as large as in the North. In addition, there is a seasonality problem within this second box: the peak of the fire season shifts from May, in the Southern region of the D.R. of Congo, to September in Mozambic.

Similar comments could be done for other boxes, in particular within the tropical belt.

3. Specificity of the night-time fires. The authors mention quite rightly (section #3 Discussion) the problems linked to the use of night observations only. Four important remarks must be done regarding the use of night-time fires inventories:

- it introduces a quantitative bias in the analysis: night-time fires represent usually a small fraction (˜50%) of the fire events in many regions of the globe; particularly in tropical environment.

- for high latitudes (for instance the geographical area included in the "Russian" box on figure 1), there are very few "night-time" fires detected by the ATSR instrument. Not that the instrument performs badly at these latitude, but because it is switched off for many hours during the day (due to the sun-light which persists late in the day during the potential fire season).

- it lowers the reliability of the Emission Constant: in fact, the ratio between the number of night-time and day-time fires varies a lot, depending on the ecosystem. This ratio is totally different in a grass savannah ecosystem and in a woodland ecosystem, for instance. It varies also depending on the land use practices, and therefore with the time of the year within a given region.

- last but not least, night time fires are usually intense fire events, happening often in forest or woodland cover types characterised by a quite high fuel load. The emissions

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from night-time and day-time fires can't therefore be considered in the same way.

It would therefore be useful to assess the representativity of these night time fires. To do so, the authors could analyse the year 2000 period for which it exists both the night time fire product (from ATSR) and the Global Burnt Area 2000 product (map of area bunt globally for the year 2000 derived from SPOT-VGT: see http://www.gvm.jrc.it/fire/gba2000/index.htm). The authors could derive a set of correction factors (per ecosystems and per time of the year) which could then be applied to the other years of their time series.

4. Discussion on the seasonal cycle The results shown on Figure 2 do not support the conclusions presented by the authors in section 4.1 "season cycle".

- South America region: the corrected emission maps do not improve significantly the simulated seasonality. Figure 2 shows clearly that i)the activity derived with the "new sources" and with the "old souces" start at the same time for the 3 years, but with a lower amplitude with the "new sources"; ii)the maximum is reached at the same time in 1999 and 2000; iii)the slowing down of the activity, after the peak month, is almost the same when using the "new" and "old" sources in 2000 and 2001.

- Australia/Jabiru: here again, it is difficult to see "a clear improvement of the seasonal cycle" introduced by the "new sources" data. The results presented on Figure 2 show almost no difference for the year 2000 and a strong discrepancy between the measured and the simulated data in 2001.

- Africa: the authors conclude quite rightly that there is no improvement or degradation of the simulated results when using the "new sources" map.

- Figure 3 (comparison with POLDER AI data): the conclusion regarding Northern Australia ("corrected sources indicate that the fire activity starts in August in agreement with AERONET data") seems to confirm the bias introduced by the night-time fire maps. In fact, fire activity in this part of Australia does start at the end of May, beginning of June;

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but the intense fire events (which last several days and therefore can be detected by the ATSR system at night) appear later in the burning season (August or even September). The analysis done by the authors on the Indonesain fires (figure 4) seems also to confirm that the ATSR-based emission maps are improving the simulation when the fire activity is very intense.

It is difficult in these conditions to evaluate the degree of improvement introduced by the "new sources" compared to what is obtained with the "old sources". This is partly due to the limitations attached to the night-time fire maps derived from ATSR data. One would strongly recommend to the authors to introduce other global fire products in their analysis, in addition to the night-time data: the day-time fire products derived from the AVHRR time series; the burnt area maps derived from the ATSR (GLOBSCAR) and VGT (GBA2000) time series.

TECHNICAL CORRECTIONS

Not applicable

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