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Interactive Comment

Interactive comment on "Boreal forest fires in 1997 and 1998: a seasonal comparison using transport model simulations and measurement data" *by* N. Spichtinger et al.

N. Spichtinger et al.

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Response to Reviewer # 2:

We thank reviewer 2 for the constructive comments on our paper. The suggestions are very helpful for clarifying some details of the presented work, in particular concerning the influence of ENSO and NAO on the transport patterns of 1997 and 1998.

1.We agree to the point that the interpretation of Table 4 is quite difficult. Therefore in the revised version we added an additional column with percentages of the source/receptor to the total emitted mass of each tracer.

2.The ENSO and NAO indices indicate differencies between the years 1997/1998. As transport is a consequence of metorological circulation patterns and ENSO and NAO

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influence meteorology, they likely effect the transport of fire emissions as well. Therefore we prefer not to drop them out of the article. For example, El Nino caused drought conditions in Eastern Siberia in 1998 (in contrast to 1997), which were favourable for fire ignition in this region. Concerning the NAO, we found a northward shifting of the tracer plume over Europe in 1998 (please note that Figure 5 shows zonal means plotted as altitude against latitude). Figure 4 shows that the Canadian tracer plumes (1997,1998) left the North American continent at nearly the same latitude in both years (independent from the fire locations), but over the Atlantic the 1998 plume is shifted to the north. Our assumptions in terms of NAO as well as El Nino are confirmed by literature (e.g. Generoso et al., 2003, Novelli et al., 2003, Eckhardt et al., 2003). For more clarification, we added a few more sentences discussing this topic to chapter 4: "In general, drought conditions in parts of the boreal region, which were likely induced by ENSO, caused extensive burning in 1998 with a maximum in the far east of Siberia near the coast of the Ochotsk Sea. From there the emissions are directly subjected to the westerly flow. This is in contrast to 1997, when the hot spots were situated much more westerly in continental regions of Siberia. Furthermore, transport pathways are shifted northwards according to the positive phase of NAO (Eckhardt et al., 2003). This produces a shift of the tracer distribution towards higher latitudes in 1998 compared to 1997. "

3.Tropical biomass burning emissions are a very important point that we have now more fully taken into account in our interpretation of CO and CO2 anomalies. The reference proposed by the reviewer is added to the reference list and cited in text in chapter 5 as follows: "After negative CO anomalies during most of the 1997 burning season, CO increased in September 1997 when strong burning in Southeast Asia occured. The positive CO anomaly in May 1998, was likely to be caused by northward transport of emissions from the subtropics. For instance, Van der Werf et al. (2004) assume a contribution of tropical fires to boreal CO amounts of around 26%. "To explain the underestimation of CMDL data by the FLEXPART simulation we further added: "The underestimation of the CO measurement data by the FLEXPART model simulation amounts around 25%, which is comparable to the contribution of tropical fire emissions to boreal CO concentrations, mentioned by Van der Werf et al. (2004)."

4.The technical corrections, mentioned at this point, have been done for the quick reviews already.

5.The reference to Kasischke et al. dealing with ATSR data has been added and cited in chapter 2 as follows: "Because of the biases of satellite detection due to, e.g. cloud cover and smoke (Kasischke et al., 2003), the burned areas we use are rough assumptions. "

6.In addition to the temperature anomalies of Figure 1 we have added maps including precipitation anomalies (GPCC) and the sentence "In 1998 in most parts of these regions high temperatures are combined with less than normal precipitation (Figure2).".

7.The reviewer is totally right by mentioning that the GOME NO2 signal according to the seasonal differences of the two years is not the dominant feature, but over the strong Siberian burning source there is a clear signal which, we think, is worth showing. To approve the GOME signal over Siberia we complete Figure 11 with 1997/1998 averages of HCHO, which were enhanced over the same region. We have appended the following paragraph to chapter 3: "HCHO slant columns are also determined from GOME spectra by using algorithms developed at the IUP Heidelberg, with basically the same DOAS retrieval method as used for the HCHO ground measurements (Wagner et al., 2004). In contrast to NO2, the stratospheric HCHO can be neglected. This, the retrieved slant columns directly represent the tropospheric HCHO. However, we applied an offset correction to account for GOME degradation effects for each latitude: the slant column densities over oceans, supposed to be zero, have been subtracted to normalize the HCHO slant columns." Two sentences to chapter 5:" The enhanced biomass burning over southeast Siberia in 1998 can also be well identified and correlated with a high HCHO plume. The high HCHO columns over eastern USA are due to biogenic isoprene emissions (Chance et al., 2000)." Furthermore, we added some references

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according to HCHO and completed the text and the figure caption with "HCHO" where only NO2 was named so far. T. Marbach was added to the author list, as he contributed the HCHO analysis.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 2747, 2004.

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