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Comment

## ***Interactive comment on “Historical (1850–2000) gridded anthropogenic and biomass burning emissions of reactive gases and aerosols: methodology and application” by J.-F. Lamarque et al.***

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Received and published: 12 April 2010

This paper is extremely important as it will provide an essential reference for modelling groups undertaking CMIP5 simulations and anyone using the output from these simulations. This is the first time that a consistent dataset for historical ozone precursor and aerosol emissions has been created, so it is highly likely the emissions will also be a key resource for tropospheric chemistry and aerosol modelling outside CMIP5.

It is not obvious whether the chemistry modelling should form a separate paper. Leav-

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ing it provides useful validation of the emissions trends, separating it would allow greater detail on each part without becoming too unwieldy.

It is not clear whether this will also be the reference to be used for the tropospheric ozone dataset supplied as forcing data to the CMIP5 runs.

The combination of emissions and models here fail to reproduce the trends in the northern mid-latitude background ozone, or the CO levels in this region. These are long-standing issues so it is not surprising that they are not solved in this paper, but it would be useful to understand whether this paper brings any new information on these problems and whether it implies there are still issues with the emissions.

### Specific comments

Section 1: I would suggest starting this section with an introduction as to what gases and aerosols are needed by climate model, and which will be provided in this study.

Page 4966, line 6: It needs to be made clearer that 1850 is not pre-industrial.

line 8 "air pollutions": It is not all air pollutants that are important here, it is aerosols (and precursors) and ozone precursors.

Line 25: I wasn't sure if energy use in mobile sources included transport. If not, transport needs to be added to the list.

Page 4967, first paragraph: Again this paragraph might start with setting out the needs for climate modelling. This could then be used to justify the choices for spatial and temporal resolution and the choice of species. Note "All emissions necessary" is a bit strong, maybe "Emissions required by the current generation of coupled climate-chemistry models"

Section 1.2: This is much too short for a description of the 2000 emissions. These are the basis for the whole dataset. There needs to be at least a table listing which referenced datasets are used for the different regions, species and sectors. A table of

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the emission totals is needed too. For the BC and OC more detail is needed about what the updates are, how the data from the two studies are combined and how the emission factors are harmonised. For SO<sub>2</sub> more detail is needed on what the updates are, which emissions are taken from UNFCCC, which are taken from regional inventories (with references to the inventories). It is not clear where the Smith et al. 2010 reference is available.

Section 1.3: It might be useful to have a summary of what the difference between RETRO and the current study is for the year 2000. Is it the addition of the regional data?

Page 4972, first paragraph: The blue dot in figure 1 should be explained. I'm not quite sure why the black line in the right panel isn't simply a scaling of the black line in the left panel?

Page 4972, second paragraph: It is not clear why agricultural waste burning is excluded, or how it is subsequently treated.

Page 4972, third paragraph: Why is the Bond inventory preferred over Junker and Liousse, why not take an average of the two? I couldn't see the CO estimate of agricultural waste burning that is referred to as "see above".

Page 4973, first paragraph: I couldn't see any estimate of anthropogenic soil NO<sub>x</sub> on the Edgar v4 website - more detail should be given here. What is meant by "time evolution is based on Yan et al."? Is it just the seasonal cycle? If so, what meteorology is used to drive it? Or is a longer time evolution included, based on trends in precipitation and temperature over the 20th C?

Page 4976, first paragraph: Given that there is a noticeable decline in biomass burning from 1900-1950 in figure 4, it would be useful to understand why. Mieville et al. suggest it is artificial fire suppression in the boreal forests.

Page 4981, section 4.2: I would suggest stopping the runs at 2000, since continuing to

2009 doesn't add any new information but can cause confusion. Is van Vuuren et al. in preparation, submitted or in press?

Section 4.2.1: Discussion of the pre-1950 ozone is needed since these data will feed into calculations of the 1850-present forcing. Even if there are reasons not to believe the Montsouris data, the comparison needs to be shown. How do the values compare to the Gauss et al. 2006 estimate of the change from 1850-2000?

It would be very useful to have a statistical analysis of the trends in this section to see how the models and observations differ. By eye it looks as if the G-Puccini trends are significantly less positive (or more negative) since 1980 than for CAM-Chem. There are more recent references to the observed trends - Parrish et al. 2009, Oltmans et al. 2008.

Section 4.2.2: The G-Puccini CO trend from 1980 is less (more negative) than CAM-Chem. There may be a connection here with the ozone trend. I disagree with line 23 that there is a "very similar ozone change over the same period". This might be more obvious if the trends were calculated. The flux analysis is interesting. It would be useful to extend this to analyse the trends. Are the differences between the two model trends due to trends in CO removal, methane oxidation or NMVOC oxidation? Note that the Horowitz et al. paper (not in References and should be 2003) is another model study so doesn't rule out a systematic problem with modelled CO.

Page 4985, line 21: Are the natural contributions imposed as sulphate concentrations or precursor emissions? Even if the emissions don't change, the oxidation rates will change over the length of the model run.

Page 4989, line 7: This final phrase sits rather awkwardly as it is the only time in the paper that air quality is mentioned. I would suggest either removing it, or developing it to comment on whether this dataset will also be useful for simulating air quality.

Grammatical/style comments

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Page 4965, line 13: "models is used"->"models are used"

Page 4966, line 28: "And our"->"Our"

Page 4967, lines 24-26: There seem to be some words missing from this sentence.

Page 4969, line 2: "in case"->"where"

page 4969, line 9: ", are subject to expert review" doesn't fit into the sentence.

Page 4970, line 11: "dismiss"->"choose".

Page 4971, line 2: "until"->"from".

page 4971, line 22: "is therefore capturing"->"therefore captures".

page 4972, line 3: "until"->"to".

page 4972, line 4: " does not peak... larger in 1980"->"is still increasing by 1990".

page 4973, line 10: Should "Table 2" be "Table 3"?

Page 4976, line 13: "Sect. 2"->"Sect. 1".

Page 4978, line 16: "difference"->"different".

page 4978, line 18: "implication"->"implications".

Page 4981, line 21: "to long-term"->"on long-term".

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Interactive comment on Atmos. Chem. Phys. Discuss., 10, 4963, 2010.

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