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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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. Leaving it in 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
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 SO2 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 whether 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 ex-
cluded, or how it is subsequently treated.

Page 4972, third paragraph: Why is the Bond inventory preferred over Junker and
Lioussse, why not take an average of the two? I couldn’t see the CO estimate of agri-
cultural waste burning that is referred to as “see above”.

Page 4973, first paragraph: I couldn’t see any estimate of anthropogenic soil NOx on
the Edgar v4 website - more detail should be given here. What is meant by “time evo-
lution is based on Yan et al.”? Is it just the seasonal cycle? It 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