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**Geoscientific
Model Development
Discussions**

Interactive comment on "Attribution of ozone changes to dynamical and chemical processes in CCMs and CTMs" *by* H. Garny et al.

Anonymous Referee #2

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This study introduces a new diagnostic to analyze origin, and mass fluxes of ozone in chemistry climate models (CCMs). The tendencies of ozone change are separated into those caused by chemical production and loss as well as by transport from different regions. It is also shown how this method must be applied to analyze the differences between two different periods of simulation. The method is applied to the ECHAM model with the Lagrangian advection scheme ATTILA, however it is formulated such that in can be applied to other models.

The paper is well written and contains sufficient new and interesting material. The described mathod is a valuable tool for the interpretation of simulations of ozone. I recommend it for publication in GMD, after the points listed below have been clarified.

1. Initialization of ozone fields and convergence:
   It is not clear to me, how the different ozone fields are initialized. It is said, that the ozone diagnostic converges exponentially to the full ozone field, but the timescales must vary with altitude according to the difference in ozone lifetime. What is the convergence time (that is probably needed for a model "spinup")? Please clarify.

2. Potential accumulation of errors:
   Due to gradients of the individual ozone tracer fields and possible numerical diffusion and due to other numerical problems, some scaling and adjustments are introduced (p.6, line 9ff; p.12, line 19ff). If there was an mass flux error of around 10%, it is not clear, whether this would cause a larger error in the mass itself as the errors may accumulate over the period of simulation.

3. Figure 3:
   The unit (kg) for the top panels is not clear to me. Is it kg ozone per grid box or per m^3? And is this the production over the 3-month periods? Please clarify.

4. Figure 4:
   It is confusing that the caption mentions "northern mid-latitudes (black)" and "colors follow fig. 2". Thus one must think that the black line corresponds to the black NH troposphere. Please add "stratosphere" to "northern mid-latitude" in the caption and in the relevant locations in the text (e.g. p.9, line 2). Also misinterpretations could be avoided, if the (almost) black color in figure 2 for NH troposphere would be replaced.
   Are the numbers average mixing ratios over the "yellow domain" or a different quantity? Or is it for a certain altitude? Please clarify.

5. Figure 7:
   It is not clear to me, why in this schematic the ozone change from the last time step of a month to the first time step of the next month is not recognized. If one

would add up the three values for dO_3 it would not represent the total ozone loss over the 3 month period.

Interactive comment on Geosci. Model Dev. Discuss., 4, 1, 2011.