**Atmospheric
Chemistry
and Physics
Discussions**

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Interactive comment on "What do ^{14}CO measurements tell us about OH?" by M. C. Krol et al.

M. C. Krol et al.

The reviewer suggests a number of useful additions and improvements to the paper. In the revised paper, we will take these into account.

It is important to note that the current paper is mainly about the adjoint methodology. Using this methodology, we calculated the sensitivity of one or more measurements to the 3D OH field. Relatively little emphasis was placed on forward modeling. We agree, however, that the ultimate success of a data-assimilation approach (as we propose in the last section) depends strongly on our ability to simulate ^{14}CO in the model. Uncertainties in modeling include (i) the ^{14}CO source distribution (ii) the stratosphere-troposphere exchange, and (iii) the fact that the biosphere recycles a fraction of the ^{14}C. We will add to the revised paper some sensitivity simulations in

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which we explore the sensitivity of the ^{14}C simulations for model resolution and source distribution.

Detailed replies to some of the comments:

(2) We will test a global resolution of 3x2 degrees (lon x lat) and the use of the full set of ECMWF vertical layers (60) to investigate the impact on the forward 14CO simulations.

(3) We will rewrite the abstract (complaints came also from reviewer 1). We will also replace "local OH" by "regional OH".

(4) The fact that the high latitudes show a bias and the tropics not, is indeed hard to explain. One possible explanation can be the source distribution. Depending on the solar activity, the 14CO source maximizes at different altitudes and latitudes. We will test the sensitivity of the simulations for different assumptions concerning the 14CO source distribution.

(5) The paper originally started as a description of the adjoint TM5 model. As an application we added the adjoint 14CO simulations. In due course, the application turned out to provide very interesting results and gained importance and for this reason the adjoint model description was mostly moved to the appendix. The adjoint model coding turned out to be a cumbersome task, especially for the zoom regions. The reason that remarks about the zoom option are still present in the paper are mostly historical. Nevertheless, we agree that for the current paper, the fact that our adjoint works also for zoom applications is of no importance and may lead to confusion. We will modify the text.

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(6) We will remove figure 3.

(7) (the reviewers remark links to section 3.3, page 10417, l10) A language issue. What we intend to say is that, in order to calculate the sensitivity of a measurement to OH in a particular model grid box, one would perturb the OH in that grid box and determine in a forward simulation the impact of this perturbation on the simulated measurement.

(8) We will modify 'local' into 'regional'.

(9) From figures 4 and 7 follows that the sensitivity for tropical OH is regional in nature. Therefore, more stations in the tropics would surely enhance the sensitivity to tropical OH. We will add an adjoint simulation in which we will modify the station network.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 10405, 2007.