

## ***Interactive comment on “Development and application of the WRFPLUS-Chem online chemistry adjoint and WRFDA-Chem assimilation system” by J. J. Guerrette and D. K. Henze***

**Anonymous Referee #2**

Received and published: 14 April 2015

The paper documented the development and a preliminary application of the WRFDA-Chem assimilation system. The details of the WRFPLUS-Chem adjoint model and its sensitivity analysis performance will definitely help others in their similar endeavors. The proposed weighting scheme to increase adjoint sensitivity robustness can be valuable to the future data assimilation applications. Publication is recommended while some minor modifications are needed to address several specific issues raised below.

Specific:

Page 2316, line 28: WRF-4-DVar -> WRF-4D-Var

Page 2318, line 8: WRF is spelled out here, but it appeared earlier in text. Some other  
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abbreviations and symbols (e.g. FWM,  $Q_v$ ,  $\sim$ ) are not spelled out or explained.

Page 2327, lines 1-5: Please specify how many 3-D state variables are there for the example that requires 1.46 GB per core on 64 cores.

Page 2331, line 29: Missing reference in "()".

Page 2336: Equation (19) and  $L_{\max}=9$  seems pretty arbitrary. The authors need to justify their choices here. In addition, this is not how representative errors are defined.

Page 2343: Apparently, Eq.(30) does not hold for the weekday/weekend anthropogenic emissions, which  $d=1, \dots, 7$  does not apply.

Figure 1: A table would be more appropriate for this.

Figure 3: Please specify the meaning of "m" (slope) in caption.

Figure 5: Can plots be arranged in a way that the same row/column represents the same  $J/x$  ? The case  $[J=BC1, x=U]$  looks really bad. Will smaller perturbations ( $\Delta x < 1\%$ ) generate better results? Are the authors confident that there are no mistakes made in this calculation? For instance, the adjoint boundary conditions could be wrong.

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Interactive comment on Geosci. Model Dev. Discuss., 8, 2313, 2015.