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Review

The effect of using limited scene-dependent averaging kernels approximations for the implementation of fast Observing System Simulation Experiments targeted on lower tropospheric ozone,

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General comment

This paper evaluates approximations used in an observation simulator in OSSE. This type of OSSE is unique. The results may be preliminary but are worth publishing. The manuscript requires some clarification.

Specific comments

1. Some abbreviations could be avoided.

Many abbreviations are used but not used consistently and more familiar abbreviations could be used. A list of abbreviations would help.

AR for Assimilation Run: uncommon and used only three times and could be avoided.

PO for pseudo-observation: unnatural and spelled out more than a dozen times in the manuscript. Could be avoided.

CR for Control Run: Used only 4 times. CTL or CTRL are more common. Definition is not clear.

LT for Lower Troposphere: Sometimes surface to 3km but sometimes surface to 6km.

RT for Radiative Transfer: RTM for Radiative Transfer Model is more commonly used. In this paper RT is used in "RT calculation" or "full RT". I wonder if they could be replaced by RTM and full RTM.

AK for averaging kernel: Defined but spelled out many times. In figure captions just "averaging" is used.

2. Descriptive comparison to RTM in forecast models.

It was not clear to me that the RTM in forecast models is similar to the full RTM or AK1 or AK2. Anything used for forecast models cannot be too expensive for an observation simulator for OSSE.

3. Definition of Control Run (CR)

P2416 L16, the Assimilation Run (AR) by means of the assimilation of the POs in a Control Run (CR).

P2416L25, The CR is a different description of the truth with respect to the NR.

I had trouble understanding what the “control run” is. I expect a control run to be an assimilation run without experimental observations. But it seems to be some thing else in this paper.

4. Use of Nature Run (NR) is not clear.

P2416 L12 The NR is used to produce the truth of our simulation world, or the pseudo-reality (Masutani et al., 2010b).

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$$x_{PO} = \mathbf{A}m_{NR} + (\mathbf{I} - \mathbf{A}')x_{apriori} + \mathbf{G}e \quad (1)$$

In this equation x_{PO} and x_{NR} are the pseudo-observation and the NR pseudo-reality,

This sentence could be clarified.

What is “m” in this equation?

Where are x_{PO} , x_{NR} and $x_{apriori}$ defined? Are they defined in the same location or different locations?

“NR pseudo-reality” is often used. Is this just the NR values?

5. The first paragraph of the conclusion can be reorganized for easy reading.

Breaking it into three paragraphs may help.