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Interactive comment on "Retrieving tropospheric nitrogen dioxide over China from the Ozone Monitoring Instrument: effects of aerosols, surface reflectance anisotropy and vertical profile of nitrogen dioxide" *by* J.-T. Lin et al.

Anonymous Referee #1

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The paper "Retrieving tropospheric nitrogen dioxide over China from the ozone monitoring instrument: effects of aerosols, surface reflectance anisotropy and vertical profile of nitrogen dioxide" describes strategies for an improved retrieval of NO2 from space based UV/Vis spectrometers and an evaluation of the improved retrieval. The paper contains interesting elements, however, I recommend major revisions prior to publication.

Comments:

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1) The paper is not really about China per se, but rather about aspects of the retrieval. One does not expect any errors in retrieval that are country specific, but rather errors in the incorporation of aerosol, surface reflectance etc. I recommend removing the word China from the title.

2) There are two major themes in this paper a) improving a retrieval and evaluating the improvements by discussion of what is physically reasonable and by comparison to alternate assumptions and b) evaluating that improvement against MAX-DOAS observations. The two separate issues are muddled throughout the paper making it difficult to understand what has been learned. One solution would be to separate this into two papers. Another would be to more clearly identify a single best retrieval strategy in the first part of the paper and then to evaluate that against observations in the second. In addition, the paper makes weak statements about the utility of the MAX-DOAS evaluationâĂŤreporting 20-30% differences from spatial sampling and other sources of error. Given the size of this uncertaintyâĂŤare any of the differences/similarities reported in this paper significant?

3) There are too many figures, they present obscure and difficult to parse. information and it is not obvious what the specific point being made with each figure is. At a minimum, the figures should have words explaining the parameters instead of only symbols (e.g. Pressure instead of Ps). In Figure 2, it is not clear to me, that one expects the differences between the two retrievals to be described by a linear modelâĂŤand the low correlation in Panel a), confirms that notion. A different form of presentation and analysis would seem appropriate. Perhaps, % difference as a function of the parameter change? T's not clear all of the panels are useful. The purpose should be to give the reader some intuition about the role of the parameters being tested. Figure 4, could be a table or omitted. Figure 5 should be omitted, it is not informative. Fig 6 and 7 and 12 look like noise. Case number is not a useful coordinate for thinking about these issues. If there is no coherent statement to be made, no figure is needed. Figs 9 and 10 don't appear to be teaching the reader much.

4) It is logically awkward to have a reference that is not the current standard for retrievals. It would make the paper much easier to read by starting with something standard that has been well documented in the literature and then beginning with a discussion of differences that emerge as a result of the improvements in the design of the retrieval presented herein.

5) The introduction could do a better job of describing the current state of our understanding of how to build an optimal retrieval. For example, the introduction implies that it is an open question whether higher spatial resolution a priori information gives a better retrieval. I think the literature is clear that higher spatial resolution inputs than in the current global retrievals are essential. There are at least 3 papers that make that point.

6) The discussion throughout focuses far too much on correlation, R-squared, case number and other statistical metrics and too little on conceptual explanations that interpret these numbers for the reader. The first paragraph of the discussion is an example. Paragraphs such as this should be completely revised to explain the point to an educated non-specialist.

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