

## ***Interactive comment on “Search for evidence of trend slow-down in the long-term TOMS/SBUV total ozone data record: the importance of instrument drift uncertainty and fingerprint detection” by R. S. Stolarski and S. Frith***

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Received and published: 10 August 2006

The major point raised by this referee is our non-precise use of the word recovery. After going through much discussion at the recent WMO/UNEP Ozone Assessment review in Les Diablerets, Switzerland, we agree strongly with the need for precision in our terms. The dictionary definition of recovery describes it as a process of improving or getting better. At the end of the recovery process, the patient (or the atmosphere) could be said to have recovered. The attribution issue is also very important. We have gone back through our paper and tried to use consistent precise language. The whole point of the fingerprint discussion (that has been changed and improved in response to

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the other referees) was to attack the problem of attribution. If the northern hemisphere trend slow-down were due to a response to the leveling off of chlorine/bromine, then we would have expected to see a similar response in the southern hemisphere. We do see a response in the same direction, but it is not yet statistically significant.

We will follow the referee's suggestion to refer to "the increase in ozone after Pinatubo". The use of the word recovery here was actually correct since Pinatubo caused a decrease and then we saw the full recovery process. In the interest of clarity, we will choose to reserve the word recovery to describe the process of the ozone responding to the removal of chlorine and bromine from the stratosphere.

Specific comments:

We have responded to most of the referee's suggested wording changes to make the paper clearer. We have referred to both chlorine and bromine as appropriate. We have changed 'quasi-global' to 'extra-polar'.

We have clarified the issue of the sources of chlorine and bromine by rewording to say: "Measurements show that the surface levels of compounds containing chlorine and bromine have peaked and begun to decrease slowly [Montzka, et al., 1999, WMO, 2003]."

We have added the following section to discuss the issue of whether the N7 TOMS drift estimate can be used for the other instruments.

"Herman et al. [1991] did a thorough evaluation of drift uncertainty for the Nimbus 7 TOMS during its first decade of measurements. The authors estimated the drift uncertainty in each component of the calibration for the Nimbus 7 TOMS instrument and propagated these through the entire algorithm process. They estimated a 2 sigma uncertainty of 1.3%/decade or  $\sim 4$  DU/decade. In this study, we assume that the Nimbus 7 TOMS drift uncertainty estimate applies to each of the other instruments. Labow et al. [2004] showed the EP TOMS data through 1999 have a small offset, but no long-

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term drift relative to a set of ground station data. Bhartia et al. [2004] estimate a theoretical precision of 1%/decade for the Version 8 SBUV algorithm and initial V8 SBUV calibration studies and comparisons with independent data indicate a long-term uncertainty of less than 3%/decade in the profile data [Deland et al., 2004, Ahn et al., 2004]. Therefore a 1.3%/decade uncertainty for total ozone should be a reasonable estimate for all TOMS and SBUV instruments.”

The statistical model used in this study is the same as was used in Stolarski et al., [2006] and more details concerning the aerosol proxy can be found there. We were originally worried about a time-delayed response to the aerosol rather than a non-linear response. There is a small time delay, but it does not affect the results significantly. An important issue is that the response function takes nearly 6 years to get back to “normal” (i.e. no residual volcanic impact). Many other studies avoid removing the volcanic signal by cutting out 2-3 years of data from the record. This means that they pick up the ozone record again when there is still some effect from volcanic aerosols. That effect is a total ozone amount that is low. For the case of Pinatubo, the last few years of their record before cutting off the linear trend fit at the end of 1996 has ozone that is expected to have a negative deviation because of Pinatubo. This can lead to an artificially large negative trend through 1996 and a growth of CUSUM afterwards that is too fast. We think that the method of fitting the aerosol (or expected ozone) signal is better.

The data now extend through June of 2006, and the Monte-Carlo representations are shown through 2008 partially to clarify that they are not data based. Given the lifetime of these instruments, extending the N16 data another couple of years is not unreasonable. You are correct that when new data are added, such as OMI TOMS, the error may not grow as quickly as depicted here. Still we do not feel extending the Monte-Carlo results beyond the data hamper interpretation of the figure in any way.

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Interactive comment on Atmos. Chem. Phys. Discuss., 6, 3883, 2006.