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Interactive Comment

Interactive comment on "Global distribution of tropospheric ozone from satellite measurements using the empirically corrected tropospheric ozone residual technique: Identification of the regional aspects of air pollution" *by* J. Fishman et al.

J. de Laat

a.t.j.de.laat@sron.nl

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First of all, I would like to thank the authors for their quick response. I think I now have a clear picture of the way the algorithm works.

Seconly, based on the author comment I still have serious doubts whether this product really reflects the tropospheric O3 column.

If we combine equation 1) and 2) from the author comment, we get for the total ozone residual (TOR):

TOR = TOMS -SBUV + cC* + bB* + A

With TOMS the total ozone column from TOMS and SBUV the total ozone column from SBUV.

The paramters b and c reflect fraction of the SBUV layers 2 and 3 that are tropospheric ($0 < b,c < 1$).

A*, B* and C* are defined as:

A* = R1(A+B+C)

B* = R2(A+B+C)

C* = R3(A+B+C)

in which A,B and C are the SBUV layers 1,2 and 3 respectively, and the coefficients R1, R2 and R3 are defined as:

R1 = X/(X+Y+Z*)

R2 = Y/(X+Y+Z*)

R3 = Z*/(X+Y+Z*)

Z* is then defined as:

Z* = Z + AZ = Z +(A+B+C) - (X+Y+Z) = (A+B+C) - (X+Y)

in which X,Y and Z are the three columns that total the Logan climatology, with thicknesses of 1000-253 hPa, 250-125 hPa and 125-100 hPa.

If we now substitute the expression for Z* into the expressions for R1, R2 and R3, we get:

R1 = X/(X+Y+(A+B+C)-(X+Y)) = X/(A+B+C)

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R2 = Y/(X+Y+(A+B+C)-(X+Y)) = Y/(A+B+C)

R3 = Z*/(X+Y+(A+B+C)-(X+Y)) = (A+B+C-X-Y)/(A+B+C) = 1 -(X+Y)/(A+B+C)

Subsequently, we can use these expressions for A*,B*and C*:

A* = X(A+B+C)/(A+B+C) = X

B* = Y(A+B+C)/(A+B+C) = Y

C* = (1-(X+Y)/(A+B+C))(A+B+C) = (A+B+C) - (X+Y)

in which case the expression for TOR becomes:

TOR = TOMS - SBUV + c(A+B+C) - c(X+Y) + BY + X

Let's assume for the moment an ideal case: TOMS = SBUV. Then, TOR becomes:

TOR = c(A+B+C) - c(X+Y) + bY + X

There are two possibilities here:

1) the tropopause is located below 126 hPa, in which case c equals zero in which case "TOR" equals "bY + X", which is the Logan climatology below the tropopause. 2) the tropopause is located between 63 hPa and 126 hPa, in which case b equals one and "TOR" equals "c(A+B+C) + (1-c)(X+Y)", a weighted mean of SBUV layers 1,2,3 and the Logan climatology. The weighting is according to how much of SBUV layer 3 is tropospheric.

For the non-ideal situation the differences between TOMS and SBUV total o3 columns are superimposed on cases 1) and 2)

From this line of reasoning it should be no surprise that one sees the "GHOST" feature in Figure 2 of the article; the "GHOST" feature is present in TOMS but not in SBUV.

At mid-latitudes the tropopause height is generally below 126 hPa (15 km). In those situations one expects to see the Logan climatology and the tropopause height distri-

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bution. The interpretation of figure 2 in the article is then that the continental northern hemispheric regions with high O_3 columns are the regions for which the surface temperature is high (high tropopause). Over mountaineous regions the columns are smaller, over the oceans the temperature is lower, therefore the tropopause is lower and thus the TOR.

In the tropics the tropause height is generally higher than 15 km (125) hPa, but rarely above 17 km (90 hPa). Thus, in the tropics one sees a combination of both the Logan climatology and the SBUV layers 1,2,3.

However, based on this analysis I would argue that there is no information added from TOMS. Also, I would argue that it is not possible to see "real" tropospheric O_3 pollution from this TOR.

In which case I wonder what the value of this product is.

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 1453, 2003.

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