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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A revised linear ozone photochemistry parameterization for use in transport and general circulation models: multi-annual simulations" *by* D. Cariolle and H. Teyssèdre

Anonymous Referee #1

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General Comments:

I think this is a timely paper given the current discussion on how complex chemistry must be in, e.g., modelling and data assimilation. The paper is suitable for ACP and should be accepted once the authors address the specific comments detailed below, most of them concern improving the clarity of the paper, and quantifying several statements.

Specific Comments:

P. 1656

L. 6: “works” -> “work”

L. 11: “resolution” -> “solution”

L. 15: Do you mean the results for the two parameterizations discussed?

L. 18: Please quantify “small”

L. 19: I suggest: “variability, notably the formation”

L. 20: I suggest: “and a seasonal evolution that follows”

L. 24: “contents” -> “content”

L. 26: “climatic” -> “climate”

L. 27: When you speak of the “present parameterization”, please compare the two parameterizations discussed in the paper

What do you mean by “interesting”? Efficient? Accurate?

P. 1657

L. 6: Provide examples/references of climate/chemistry models. Perhaps Eyring et al., JGR (2006) could be referenced

L. 15: Please quantify the “large amount of computer time” needed to run multi-decadal simulations for climate studies

Please also quantify the “biases” built up during the course of these long model integrations

L. 28: I suggest: “developed later, using”

P. 1658

L. 1-2: I suggest: “calculate the basic”

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L. 2: These parametrizations have also been used in ozone data assimilation, e.g., Geer et al. ACPD, ACP (2006)

L. 5-6: I suggest: “interactions, for instance”

L. 6: Do you mean the global increase of CO2?

L. 16: I suggest adding that Geer et al., ACPD (2006) compares various ozone chemistry parameterizations

L. 17-18: I suggest: “more than twenty years ago, and”

L. 24: I suggest: “using the linear model approach, and”

P. 1659

L. 8: I suggest: “into a Taylor”

P. 1660

L. 4: I suggest: “recommendations in the JPL-2003-25”

L. 28: “lower” -> “smaller”; “larger” -> “higher”. How much smaller and higher were these perturbations?

P. 1661

L. 14: Do you mean “net photochemical ozone” production or loss?

L. 22: What do you mean by “intensity” of transport? Rate of transport?

L. 24: “day-light” -> “sun-lit”

L. 26: Do you mean absorption of UV radiation above the level that controls the ozone production?

P. 1662

L. 23: Is the threshold temperature for PSC formation for NAT or ice clouds (or some-

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thing else)?

L. 26: I suggest: “provided they experience sunlight, and”

L. 28: “dimmer” -> “dimer”

P. 1663

L. 3-4: I suggest: “Another cycle involving bromine”

L. 7: “Upper limit” of what?

L. 11: Do you retain other terms besides A8?

L. 17: I suggest: “and stop as soon as the temperature”

L. 19: I understand from Eq. (2) that this destruction rate is set to 8 days (not 1 week)

L. 23: Do you mean the “gradual return of sunlight”?

P. 1664

L. 5: I suggest you introduce the acronym DU (Dobson Units), so you can use it later in the paper

L. 24-25: I suggest: “varies between 0 and 1”

L. 26: What is the time-scale of tau1?

P. 1665

L. 1 and L. 8: Do you mean “melting” or “evaporating”?

L. 9: The “deactivation” of what? Do you mean the “increase” of NOx?

L. 10: What is the time-scale tau2? Is it equal to the lifetime of HNO3?

L. 14: I suggest: “NOx species; about 2 ppbv are required. For highly”

L. 17: The discussion is not clear to me. Do you mean that less HNO3 means less

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NOx, which in turn means less ozone destruction? Are you referring to homogeneous or heterogeneous ozone destruction?

L. 19: Why are ozone depletion rates larger than calculated NOx restoring rates?

Eq. (3), RHS: Do you mean: (1/tau1)*(1-delta) + (1/tau2)*delta? If so, please make this clearer in the way this Eq. is written

L. 22: What is (1/tau1) for T<195 K?

L. 27-28: From the text I interpret this statement to mean that more NOx means less ozone destruction? Is this correct and, if so, are you referring to heterogeneous chemistry?

P. 1666

L. 7: Do you mean the tracer used by Hadjinocolau et al.?

L. 10: Do you mean “tenths” or “tens”?

L. 11: I suggest: “transported to lower”

L. 14: “1,2” -> “1.2”; “2,5” -> “2.5”

I found the end of the 1st paragraph rambling. Could this be made clearer?

Eq. (4): Why choose the power 4.5? I think this is explained later, but the explanation should come as early as possible

L. 24: “elevation” -> “increase”

P. 1667

L. 7: Quantify “doubled”, provide numbers

L. 11: Remind the reader what parameterizations v2b and v2a are about

L. 21: “2,8” -> “2.8”

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P. 1668

First few lines: A look at Fig. 6 suggests that the comparison is not so good for 2003 and 2004 - this should be mentioned

L. 13: Do the “weakness” refer to equatorial convection?

L. 28: Is this “process” revealed by the cold tracer?

P. 1669

L. 4: I suggest: “2001 spring periods”

L. 5: By how many weeks/months is the ozone recovery early?

L. 15: By how much is the ozone “overestimated”?

L. 23: What is the “latter”? The circulation?

L. 24: Please specify by how much is the (circulation?) more intense than that obtained from the GCM

P. 1670

L. 4: Quantify “short enough”

L. 16: I suggest: “order to use the”

L. 17: What do you mean by “some sort of”?

L. 20: “Figures 7” -> “Figure 7”

L. 21-22: More ozone compared to what?

L. 27: “Less” -> “Smaller”

P. 1671

L. 2: I suggest: “and calculations of”

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L. 4: What is the “problem”? Why does it mainly come from the Northern Hemisphere?

L. 14-15: I suggest: “polar vortex was mostly”

Figs. 8-9: Better to place TOMS and simulated ozone fields side by side

P. 1672

L. 2: “consecutive” -> “following”

L. 6-7: I suggest: “split into two”

Figs. 10-11: Better to place TOMS and simulated ozone fields side by side

L. 16: “produced” -> “simulated”

L. 20: Is the 5-year simulation for v2a?

L. 21: I suggest “analyses focuses on”

L. 22: “temperatures” -> “temperature”

L. 24: Is the value of the tracer close to 1 due to the presence of processed air?

L. 26: I suggest: “masses. Although the vortex”

L. 29: “value” -> “values”

P. 1673

L. 18: I suggest: “but does not influence much”

L. 25: v2b does not seem to have “better agreement” with observations compared to restricted v2a. What is “restricted v2a”?

P. 1674

L. 21: Please quantify the biases and drifts?

L. 26: “European center” -> “ECMWF”

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P. 1675

L. 4: “British”-> “UK”

L. 12: “modelisation” -> “simulation”

L. 13: Please quantify the computing times

P. 1676

Cariolle and Brard Ref: Is it really spelt “Zerephos”? I think Higham should be capitalized

P. 1679

Table 1: I understood that NOy included HNO3 and other compounds. Here it does not include HNO3. Perhaps an explanation would be helpful?

P. 1683

Fig. 4: I suggest including the TOMS plot, as well as a difference plot, in this Fig.

P. 1685

Fig. 6: The legend in the x and y axes is very small

P. 1687

Fig. 8: There seems to be a discontinuity in the field at the dateline. Same for Fig. 10 in p. 1689, and Fig. 12 in p. 1691

P. 1694

Fig. 15: Change the colours for the two v2b curves (they are hard to distinguish). State in the captions what the different v2b curves entail, and that the year is 2001. It would be useful to include observations (say at a representative station between 60N and 90N) in the plot. Same for Fig. 18 in p. 1697

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P. 1695

Fig. 16: The brown colour is not very different from the red colour. I suggest changing the colours

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