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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Chemical contribution to future tropical ozone change in the lower stratosphere" *by* S. Meul et al.

Anonymous Referee #1

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GENERAL COMMENTS

This is a well written paper that uses novel techniques (the use of the Garny et al. method and the use of a fixed ODS CCM simulation) to diagnose the contribution of changes in chemistry to projected future changes in ozone in the tropical lower stratosphere. This work will certainly be of interest to the readership of ACP. My comments below are minor in nature and should not take long to implement.

SPECIFIC COMMENTS

The abstract is a little unsatisfying. I had hoped to see statements like: of the ozone decreases observed in the model simulations X% is due to changes in vertical transport, Y% is due to decreases in in-situ ozone production, and Z% is due to increases

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in in-situ ozone destruction. The abstract at least needs to include more of a sense of direction i.e. ozone goes down because ... goes up and because ... goes down rather than just presenting the possible mechanisms. Try to use the words 'increases' and 'decreases' rather than the word 'changes'. I think that this will improve the abstract in terms of specificity.

Line 21: I don't think you can ever use a CCM simulation to assess the success (or not) of the Montreal Protocol since you prescribe Cly and Bry in the model. Of course if you prescribe decreasing Cly and Bry then you're already assuming that the Protocol is successful. So I think that you need to be careful how you word this.

Line 24: I would advise against the use of the term 'super recovery'. What does it mean? You are ill and then you recover from the effects of the illness. What does it mean to 'super-recover'? I would advise that you read Box 3-2 of Chapter 3 of the 2010 WMO-UNEP ozone assessment. The term 'ozone recovery' has a very specific meaning. It means a response in ozone to changes in EESC. Under this definition there is no such thing as super-recovery.

Line 37: What you say here is true but you don't say why the faster the air rises the less ozone is present in this region. I think that you should.

Line 64: But almost all of the stratospheric cooling is from CO2 right?

Line 75-79: You say here that changes in CH4 and N2O affect ozone but you don't say how. Will increases in CH4 and N2O drive increases or decreases in ozone? Do the increases and decreases vary regionally?

Line 93: Just one conclusion? Not more?

Line 109: Two years seems quite short as a spin up time. Isn't 10 years more typical?

Line 123: To study the impact of increasing GHGs on what?

Line 142: I think that you need to say something about the validity of this assumption

ACPD
13, C10385–C10389, 2013

that ozone is the main constituent of Ox in the stratosphere.

Line 151-152: I don't understand the sentence "As the total loss and production rates, this separation could also be obtained during the model integration". I am guessing that there is some grammatical error that is the source of my confusion but right now I just don't understand what this sentence is trying to say.

Line 174: It's not clear to me what the 'online received terms' refers to.

Figure 1: I think that for both panel (a) and (b) the error bars are so small that they're not worth showing. I would therefore omit them and just state in the text that they're so small that they're not worth showing. It's anyway not clear to me that these error bars are in any way representative of the true uncertainty on those curves.

Line 198: Can you please give an indication of how much the total production and loss terms differ between the online and the offline calculations e.g. in percent.

Line 203: It is not clear what is meant by 'reduction of the chemical reactions to the relevant ones for stratospheric chemistry'. I am not sure what this 'reduction' refers to.

Line 294: In what way is a change from 62% to 68% 'significant'?

Lines 305-307: This sentence is a non sequitur. Essentially it says "changes in the reaction rate coefficients due to.... contribute to changes in the reaction rates". It is the temperature changes, in the context of temperature dependent reaction rates, that contribute to changes in reaction rates.

GRAMMAR AND TYPOGRAPHICAL ERRORS

Line 2: Replace 'simulations with' with 'simulations made with'.

Line 5: Replace 'Different studies showed before that' with 'Previous studies have shown that'.

Line 10: Why is the word 'relative' needed here?

ACPD
13, C10385–C10389, 2013

Line 10: Replace 'The causes for' with 'The causes of'.

Line 12: Replace 'the production' with 'the production of ozone'.

Line 13: Replace 'are determined' with 'is determined'.

Line 21: The impact of increases GHGs on what? You don't say.

Line 22: Replace 'growing rate' with 'growth rate'.

Line 30: Replace 'increase of' with 'increase in'.

Line 30: I think that this would read better if you replace 'As in the' with 'Since in the'.

Line 35: Replace 'ratios for ozone' with 'ratios of ozone'.

Line 55: Replace 'In a future climate not only the tropical upwelling and the accumulation of ozone will change due' with 'In a future climate it is not only the tropical upwelling and the accumulation of ozone that will change due'.

Line 56: Replace 'Moreover, the' with 'The'.

Line 62: Replace 'carbondioxid' with 'carbon dioxide'.

Line 69: I don't know what you mean by 'denote' here? Should this be 'are the rate limiting steps'?

Line 103: Replace 'as SW' with 'as the SW'.

Line 202: Replace 'can not' with 'cannot'.

Line 202: Replace 'lower polar wintertime stratosphere' with 'wintertime polar lower stratosphere'.

Line 208: Replace 'causes for' with 'causes of'.

Line 213: Replace 'expressed by' with 'expressed as'.

Line 234: Replace 'calculated as residuum for' with 'calculated as the residual for'.

ACPD

13, C10385–C10389, 2013

Line 237: Replace 'can not' with 'cannot'.

Line 238: Replace 'tool, which allows to identify' with 'tool which allows the identification of'.

Line 254: Replace 'causes for' with 'causes of'.

Line 299: Replace 'A decrease of' with 'A decrease in'.

Line 300: Replace 'amount of ozone molecules that is available' with 'number of ozone molecules that are available'.

Line 308: Replace 'it should be pointed to the comparison of' with 'it should be pointed out that'.

Line 328: Replace 'lower tropical stratosphere' with 'tropical lower stratosphere'.

Line 399: Replace 'enlarge the amount' with 'enhance the amount' and likewise on the next line.

Line 409: Replace 'lowermost tropical stratosphere' with 'tropical lowermost stratosphere'.

Line 429: Replace 'photolysis in 50 and 70 hPa' with 'photolysis at 50 and 70 hPa'.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 27855, 2013.

ACPD

13, C10385–C10389, 2013