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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Analysis of stratospheric NO_2 trends above Jungfraujoch using ground-based UV-visible, FTIR, and satellite nadir observations" *by* F. Hendrick et al.

Anonymous Referee #1

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In this manuscript, Hendrick et al. report on trends in stratospheric NO2 columns observed at the station of Jungfraujoch by three independent measurement systems: FTIR, SAOZ, and UV/vis nadir satellite observations. The three time series are in very good agreement and all show a downward trend in NO2 column, in apparent disagreement with the increasing abundances of N2O. The observations are compared with previous results reported in the literature and possible reasons for the NO2 decline are discussed.

The paper is well structured and clearly written. The topic of the paper (observations of temporal changes in stratospheric NO2 columns) is interesting and fits well into

the scope of ACP. The main result of the study – a downward trend in mid-latitude NO2, consistently observed by three independent measurement systems in spite of the increase in N2O - is well supported and relevant for stratospheric research. I therefore recommend publication of the paper after minor revisions.

Major comment

The only major concern I have is the discussion of the possible reasons for the NO2 decline which I find much less convincing than the presentation of the measurement results. The discussion is completely neglecting the vertical distribution of the different species, and is thus based on the assumption that the vertical profiles are simply scaled over time. This implies that the change in NO2 column which is dominated by the bulk of the NO2 profile at higher altitudes can be linked to, for example, the change of HNO3 column which has a profile with a much lower maximum in the atmosphere. In my opinion, this is not necessarily true. The same problem arises when discussing ClONO2. Also, possible changes in temperature can have complex effects on stratospheric chemistry and in my opinion a model is needed to evaluate such effects with any confidence.

I therefore recommend either to shorten this section and emphasize that these are only plausibility arguments, or to add model based sensitivity studies supporting the arguments made.

Minor comments

- P 12362, l 15: For the satellite data, stratospheric temperature is taken into account but not for the SAOZ ground-based observations. Please comment on possible effects of this difference
- P12366, l10: Why was a simple geometric AMF used? Isn't the model vertical column used here? This sentence is not clear to me.

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- P12368, statistical model: Why are there seasonal terms for QBO and aerosols, and why are 2 seasonal terms used for the QBO and one for the aerosols?
- P12370, l11: If QBO and solar circle do not contribute significantly, wouldn't a trend model be more robust without these terms?
- P12371: formatting problem for N2O
- P12371: Why is hydrolysis of N2O5 not considered as HNO3 source?
- P12374, l22: if you consider stratospheric cooling, what about the possible impact of the temperature dependence of the NO2 cross-section in the SAOZ retrieval?

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 12357, 2012.