

***Interactive comment on* “Evaluation of stratospheric chlorine chemistry for the Arctic spring 2005 using modelled and measured OCIO column densities” by H. Oetjen et al.**

Anonymous Referee #2

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Comments on the paper “Evaluation of Stratospheric chlorine chemistry for the Arctic Spring 2005 using modelled and measured OCIO Column densities” submitted by Oetjen et al.

The paper is to provide information on the current understanding of stratospheric ozone depletion in the Arctic from a comparison of total OCIO measured by ground-based instruments and SCIAMACHY during the cold 2005 winter on the one hand and modelled by a 1D stacked box model initialised with the SLIMCAT CTM on the other. Satellite and ground-based slant columns are shown to agree each other, but significantly underestimated by the model particularly at large SZA and during large chlorine activated

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periods. From a number of sensitivity studies based on the full examination of uncertainties on reaction rates and photochemical coefficients involved, it is concluded that "the chlorine chemistry and its relevant mechanisms for the formation of OCIO are not completely understood".

Comments The consistency between G-B and SCIAMACHY measurements is convincing (though the word excellent is a little exaggerated), but I do not share at all the conclusions made by the authors regarding OCIO photochemistry. The reason for this is the poor analysis of the difference between measured and modelled OCIO slant columns. It is not clear that the difference between them "increases towards larger SZA and chlorine activation". Instead, the data displayed in Fig 6, just show a robust linear correlation between measured and modelled columns ($ax + b$ with $a = 1.97 \pm 0.08$ and $b = -9.7 \pm 1.32$), independent of SZA, chlorine activation or sunset/sunrise. This is suggesting an error of about a factor 2 in the data or model processing as well as a significant bias (i.e. the 4 10^{13} mol/ cm^2 OCIO columns outside the vortex on 19-20 March in Ny-Alesund). Possible explanations for such a large difference needs to be discussed before stating that it is due to inadequate photochemistry. A factor 2 certainly exceeds the uncertainty of OCIO cross-sections used in the spectral analysis of both instruments but other sources of errors are possible, which requires discussion, e.g. the way model slant columns are calculated from the vertical profile of the species, which is not explained. An easy way to check this could be a comparison between ozone or NO₂ slant columns available from both the measurements and the model. Until differences between observations and model are not properly analysed and discussed, the conclusions of the paper are irrelevant.

My recommendation is thus not to accept the paper until this is done convincingly.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 26539, 2009.

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