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**Atmospheric Measurement Techniques Discussions**

# *Interactive comment on* "Validation of SCIAMACHY limb $NO_2$ profiles using solar occultation measurements" *by* R. Bauer et al.

**Anonymous Referee #2**

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The objective of the paper is the evaluation of SCIAMACHY NO2 limb daytime measurements by comparison with sunrise and sunset solar occultation observations of the same species by SAGE II, HALOE and ACE. The paper is well written and fully understandable but requires major revision before being publishable. Indeed, as outlined by the first reviewer, the mean relative difference between all collocated profiles at all seasons and all latitudes cannot be conclusive. I will not repeat his arguments with which I fully agree, but will add several other comments and recommendations.

General comments

Missing first is a definition of latitude, season and local time where collocated measurements are available and the latitude/season SZA dependence of SCIAMACHY



observations (which could be at least summarised in Tables). For example SAGE II observations north of 60°N are available in April and September, and those of HALOE in June and October. No occultation measurements are of course available during the polar night or north of 80°N at all seasons. This explains the maximum NO2 concentration at high latitude compared to others, which would be the opposite in the winter.

Another concern is the correction for NO2 diurnal cycle, which amplitude is limited at high latitude in the summer, is very different in summer and winter at mid-latitude, and is the largest in the tropics. In addition, since SCIAMACHY is passing at 10h in the morning at the equator it is likely that the correction of occultation measurements will be smaller at sunrise than at sunset. Since the correction for diurnal variation is said to be likely the major source of error, I would recommend separating summer and winter, and sunrise and sunset. In addition the authors should be aware that because of errors in altitude registration, sunset solar occultation measurements are often of better quality than at sunrise. The addition of the southern hemisphere will be also a plus.

Finally, systematic differences between SAGE, HALOE and ACE are known to exist and available from the literature, as well as the origin of the HALOE V19 underestimation of concentration at lower (Borchi and Pommereau ACP 2007), which could help better understanding what could be attributed to SCIAMACHY and the others in the mean differences.

Minor comments First reviewer very complete. I will only add:

P 4755, l12 ... contribute to the NO2 loading (and not to ozone depletion) P 4769, l14. The SCIAMACHY error at low altitude is systematic. Fig1. Retrieval at 77.5°N. At which season?

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 4753, 2011.