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Atmospheric Chemistry and Physics Discussions

Interactive comment on "NO_2 climatology in the northern subtropical region: diurnal, seasonal and interannual variability" *by* M. Gil et al.

Anonymous Referee #2

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Title: NO2 climatology in the Northern subtropical region: diurnal, seasonal and interannual variability

General comments

This paper presents 14 years of high quality stratospheric NO2 column observations performed at the subtropical station of Izana. This data set constitutes a useful reference for the validation of atmospheric chemistry satellites and models in an important latitudinal belt where comparable measurements are only sparsely available. The au-

thors present a convincing analysis demonstrating the quality of the reported data set. They also provide an original and interesting analysis of the main factors that control the variability of the subtropical NO2 column at various temporal scales. The measurements are used to discuss the accuracy and mutual consistency of the GOME and SCIAMACHY NO2 column measurements. Finally comparisons with long-term SLIMCAT three-dimensional chemical transport model simulations are presented showing the positive impact of assimilating long-lived tracers in the model. To my opinion, such results are fully relevant to the ACP readership.

I found the manuscript well organized and generally clearly written, despite the fact that the English language is rather poor in many places (e.g. in the abstract). Although this can be understood since the first authors are not native English speakers, several co-authors are of English nationality and could therefore provide assistance to improve the text. I recommend publication in ACP after improvement of the English and proper attention to the comments given below.

Specific comments

P. 15071, L. 8: please add general references for the GOME, SCIAMACHY and OMI instruments

P. 15071, L. 14: this sentence can be hardly understood. What is the meaning of the wording "useful in extreme"? Please rephrase to improve clarity.

P.15071, L. 23: remove "...from diurnal to interannual scales". The whole sentence should be re-written for clarity.

P. 15071, L. 15: typo –> change "Differencial" by "Differential"

P. 15072, L. 19: what is the photochemical box model used in this work?

P. 15074, L. 24: add "nm" after "325-460". Also the "RASAS" acronym should be introduced.

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P. 15076, L. 15-18: what is the rationale for using different fitting intervals with each instrument? Please comment on possible instrumental reasons and how this could possibly affect the consistency of the combined data set.

P. 15075, L. 18: to my knowledge, the NO2 absorption cross-sections are far from being Gaussian in shape. I suggest to leave this consideration off.

P. 15076, L. 1: add more details on the nature of the cross-section used to correct stray-light effects, or provide adequate reference

P. 15076, L. 5: justify why a single scattering approach is accurate enough for NO2 AMF calculation. What is the error due to the neglect of multiple scattering effect?

P. 15076, L. 20: I find the wording "observational error" not precise enough. Why not simply use "errors on slant columns"?

P. 15076, L. 27: If possible give a reference where the need for daily profiles is highlighted. In the same paragraph, the discussion on the NO2 retrieval errors misses to address errors due to rotational Raman scattering (Ring effect) and the smoothing effect it induces on the NO2 absorption structures. This effect is systematic and highly significant (approx. 5% at twilight) as first reported in a paper by Fish et al. in the mid-nineties.

P. 15079, L. 24: it is maybe worth to stress the fact that this is only true as long as the noon measurements are not contaminated by tropospheric NO2 contents (which is usually the case at Izana, as indicated before in the text)

P. 15082, L. 24: please add a reference for the gradients effects

P. 15083, L. 8-15: what about the possible impact of the different NO2 absorption cross-section data sets used for GOME, SCIAMACHY and the ground-based measurements? How consistent are these data? If I remember well, the GOME FM98 cross-sections display significant differences in comparison to Vandaele et al. (in the range of 15%). Could this partly explain the observed disagreement?

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Interactive Comment