Review: Daytime formation of nitrous acid at a coastal remote site in Cyprus indicating a common ground source of atmospheric HONO and NO, by Meusel et al.

General comments

In this manuscript the authors present results of HONO and other trace gas species from a study performed in Cyprus as part of the CYPHEX campaign in 2014. During the measurement period they observed a high HONO/NOx ratio and a large daytime source of HONO. A budget analysis is performed and a missing source of HONO up to 3.4×10^6 molecules cm^{-3} s^{-1} calculated, which is comparable to values reported in mountain and forest sites. Under humid conditions the HONO source correlates well with NO and the authors attribute this missing HONO source to emissions from soil. Finally, the impact of the HONO on OH production rates is calculated and the results show that the HONO photolysis contributes, on average, 30% to OH production during the morning and evening. Understanding the daytime source of HONO is important due to its role in OH formation and this study provides important data on HONO sources in a location which is not strongly impacted by combustion sources.

The manuscript is well written, with appropriate sections and easy to follow. I recommend the manuscript for publication in ACP after addressing the comments below:

Specific comments

One of the main concerns is that no uncertainty analysis has been performed for the HONO/NOx ratios or the HONO budget and calculation of the missing HONO sources. This should include instrument uncertainties in the HONO and NOx measurements along with errors in the PSS calculation. It would then be beneficial to include error bars on Figure 5a and b, to show the upper and lower limits to the estimated unknown HONO source.

In section 5.1, the heterogeneous reaction of NO2 to form HONO is estimated by applying an NO_2-HONO conversion rate of 1.6% h^{-1} overnight. Under humid conditions the estimated values agree well with measured values. A much lower rate of 0.22 % h^{-1} was applied in the drier period, which the author's state matches better to their observations. However, Fig 4. shows the measured HONO is still lower than the estimated values during some periods overnight. Perhaps it would be better to determine a conversion rate under dry conditions for this site using the NOx scaling approach (e.g. Sorgel et al., 2011) to compare with other studies, as I expect it is lower.

Pg 3, L25-26. Please state the uncertainty of the HONO measurements here too.

Pg 6, L18. The ± values in the parenthesis should be clarified. Are these 1-sigma standard deviation of the mean?

Pg 7, L7. It is stated that the mean NO mixing ratios are close to the detection limit at 2 pptv, however, this is actually below the detection limit, which is given as 5 pptv on Pg 4, L13.

Pg 8, L5-7. Here, HONO mixing ratios are estimated and compared to the measured HONO overnight using a conversion factor between NO_2 and HONO of 1.6% h^{-1}. The authors cite three studies where this value has been determined, although, it should be made clear here that a range of values were reported across these studies.

Pg 9, L25. Please state the values for k_1 and k_2 used in Eq. 2.

Fig 4: The error bars in figure 4b for the 0.2% rate are difficult to see, please use a darker color or use thicker lines.

In Figure 5, the caption states that a conversion rate of 1.6% h^{-1} is used for S_{Het_NO2} , however, Figure 4b shows that a lower rate (0.22% h^{-1}) is more appropriate for the dry period. Please clarify which rate you use for Fig 5b.

Fig 6. Include units for NO_2 in the legend.

Fig. 4 and Fig 7. Please state in the figure captions what the error bars represent.

References

Sörgel, M., Trebs, I., Serafimovich, A., Moravek, A., Held, A., and Zetzsch, C.: Simultaneous HONO measurements in and above a forest canopy: influence of turbulent exchange on mixing ratio differences, Atmos. Chem. Phys., 11, 841-855, doi:10.5194/acp-11-841-2011, 2011.