

NO / NO₂ Research and Intercomparison at Hohenpeissenberg Meteorological Observatory_York (CV-HOHEN-COMP)

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- *Introduction and motivation*

The University of York run an atmospheric observatory on the island of Sao Vicente, Cape Verde, in the tropical North Atlantic Ocean. Measurements of NO_x, O₃, CO, VOCs and oxygenated and halogenated VOCs have been at the station almost continuously since October 2006, with a wide range of air masses sampled. Being a remote marine site, levels of NO_x are very low (typically <30pptv), leading to consistent observed O₃ destruction. NO_x levels of this magnitude are close to the compensation point for O₃ destruction, therefore accurate measurement of both NO and NO₂ are crucial for understanding of O₃ photochemistry. Background O₃ levels in the Northern Hemisphere have increased by more than a factor of two over the last century and it is believed that this is strongly tied to the increase in and distribution of anthropogenic NO_x emissions, something the long term measurements in Cape Verde were setup to investigate.

- *Scientific objectives*

NO measurements are made in Cape Verde using a custom built, high sensitivity chemiluminescence analyser, with a diode based blue light converter to convert NO₂ to NO and provide the NO₂ measurements. NO_y is also measured using a heated quartz and molybdenum converters. In this proposal, we wish to bring an identical instrument to the Hohenpeissenberg observatory to take part in the research and intercomparison exercise. This will give us a unique opportunity to measure NO_x alongside a series of other instruments, in an environment which can exhibit a wide range of NO_x levels (albeit usually higher than we observe in Cape Verde). The exercise will also allow us to exchange ideas with other groups concerning the operation, calibration and data QA/QC of long term NO and NO₂ instruments, with the ultimate aim to improve the quality of the measurements.

- *Reason for choosing station*

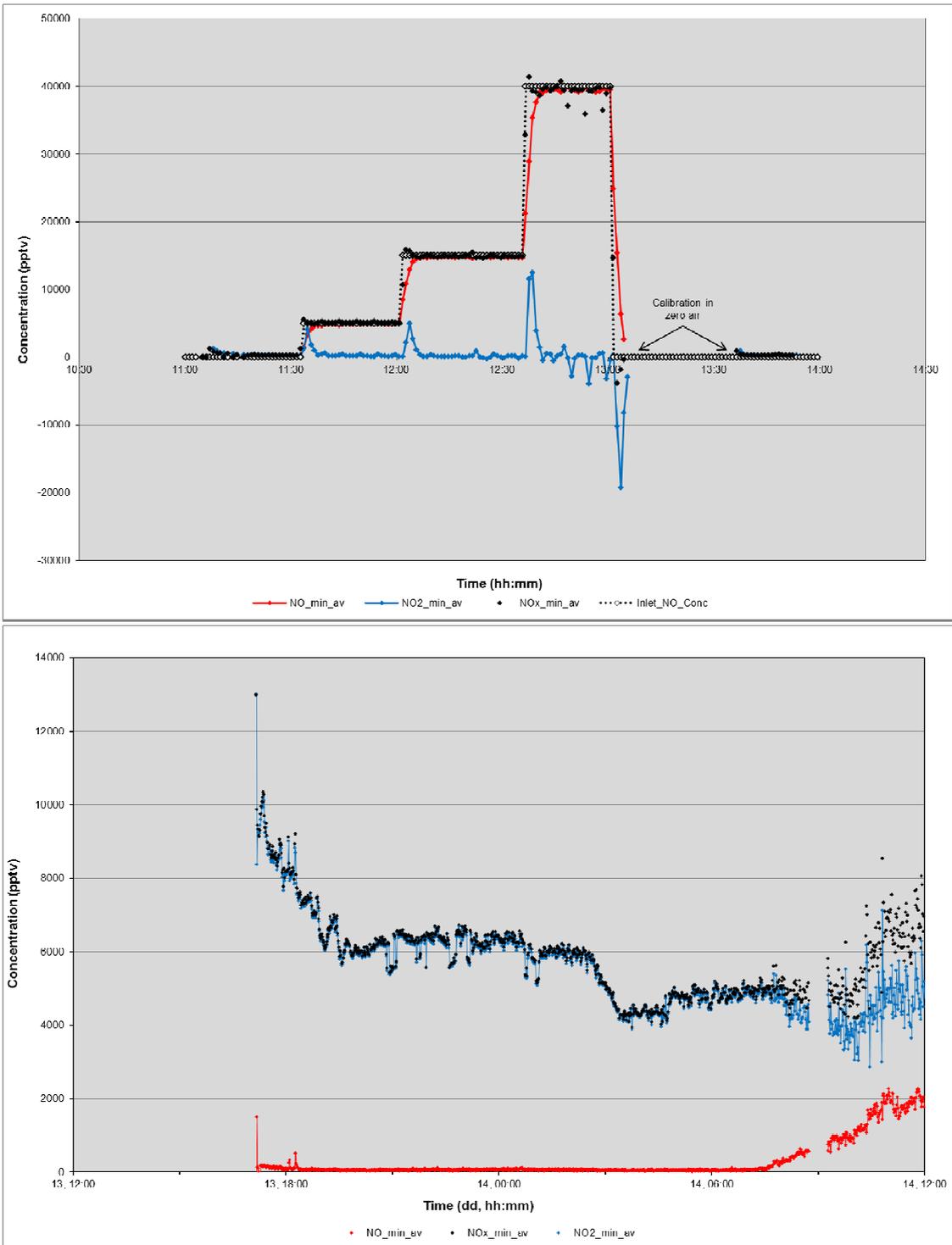
The Hohenpeissenberg observatory was chosen as it is an established long term measurement station for NO_x. The side by side comparison exercise was setup within ACTRIS WP4, with Hohenpeissenberg being the host for its suitable laboratory space and calibration equipment. The exercise involved over 10 other NO_x instruments from other ACTRIS partners all working at this observatory at the same time.

- *Method and experimental set-up*

The York – Cape Verde instrument is a custom built high sensitivity analyser, based on chemiluminescence measurements of NO, with a photolytic blue light converter for NO₂ measurements. Detection limits are around 3 pptv for NO and 7 pptv for NO₂ (based on 10 minute averaging). This work involved the setup and testing of the NO_x instrumentation and a series of comparisons with other instruments sampling synthetic air and calibration mixtures as well as ambient air sampling at the Hohenpeissenberg observatory. Experiments also took place sampling some of the known interferences with NO and (more importantly) NO₂ measurements (e.g. PAN, HNO₃, NH₃). All sampling took place through the main site sample manifold, which could be filled with zero air or known concentrations of NO, NO₂ and other species. This allowed all instruments to sample exactly the same air at the same time. Calibration of the York instrument was carried out independently using our own 5ppm NO in N₂ calibration standard (BOC, NPL scale). This calibration was also compared to the calibration standard from FZG Juelich.

- *Preliminary results and conclusions*

The York – Cape Verde instrument was initially calibrated using its own internal dilution system and gas standard, however a discrepancy was seen between the readings given and concentrations sampled from the manifold (and also measured by other instruments). It was decided to calibrate the instrument using a diluted gas standard provided by FZG Julich. Differences in instrument sensitivity of around 15% were observed and attributed to a faulty mass flow controller in the York system. Following the new calibration, results showed good comparison between the York – Cape Verde instrument and others while sampling both known concentrations of NO and NO₂ and ambient air. Below shows plots of a typical days experiment, with sampling of different known concentrations of NO and NO₂ (top graph), as well as ambient air (bottom graph).



Results are still being analysed, however a poster will be presented at the EGU meeting in April; 2013 (Session AS3.8 - EGU2013-8403)

- *Outcome and future studies*

The NO_x intercomparison at Hohenpeissenberg has proved to be a useful exercise in terms of knowledge exchange of the operation, calibration and analysis of NO_x instrumentation. The results will show how different instruments (including several different techniques) compare when measuring both known standard concentrations and ambient NO and NO₂. Getting together with scientists from other observatories also enabled excellent discussion about the various measurements. All of this will help to ensure that measurement stations across Europe (which nominally includes the Cape Verde observatory operated by the University of York) produce data that is comparable and thus useful for atmospheric interpretation. The results (along with results from the round robin calibration exercise which took place earlier in the year), will provide the basis for a joint publication and, in addition, the Cape Verde instrument will be described in a separate instrumental paper which will include results from this work.

- *References*

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