INTRODUCTION

Recent studies of \( \text{NO}_2, \text{N}_2\text{O}_5, \text{PANs} \) and trimethylamines at background sites are important for understanding the Reactive N cycle in the troposphere. The background EMEP supersite 'Auchencorth Moss' in South East Scotland routinely measures \( \text{NO}_2, \text{NH}_3, \text{HONO} \) and \( \text{HNO}_3 \) in gas phase and particulate (PM\(_{10}\), and PM\(_{2.5}\)) \( \text{NH}_4^+ \) and \( \text{NO}_3^- \).

A study in spring 2014 aimed to:

1. Develop a better understanding of the N budget at Auchencorth Moss (to refer to N cycle).
2. Identify potential artefacts in the routine N measurements.

METHODS

The table lists N species measured and the instrument used.

Due to issues with baseline drift in the ANNO\(_3\)- data, the data hasn’t been presented.

\( \text{PAN} \) GC measured from 24 April 2014 to 06 May 2014

All other instrumentation operated for the length of the campaign.

INTERCOMPARISON OF INSTRUMENTATION

**Thermo Scientific analyser** systematically reports higher values than the TDLIF.

**TDLIF** NO\(_2\) vs **Thermo Scientific** NO\(_2\)

**Good correlation**

**Thermo scientific analyser** reports higher values than the TDLIF.

**TDLIF** NO\(_2\) vs **Thermo Scientific** NO\(_3\)

**Good correlation**

**Thermo scientific analyser** reports higher values than the TDLIF.

**TDLIF** ZP\(_2\) vs **GC PANs**

**Poor correlation**

**GC reports higher concentrations**

**TDLIF** HNO\(_3\) vs **MARGA** HNO\(_3\)

**Poor correlation**

**TDLIF** reports higher concentrations.

**TDLIF** ZP\(_2\) vs **MARGA** HNO\(_3\)

**MARGA** HNO\(_3\) correlates with the ZP\(_2\) reported by the TDLIF.

**CHALLENGES OF DERIVING A SPECIFIED N BUDGET: WHAT IS HNO\(_2\)?**

Di Carlo et al. (2013) demonstrated from flights over the UK that N\(_2\)O\(_5\) dominated the ZP\(_2\) at night measured by the TDLIF. Phillips et al. (2013) provided evidence to suggest night time HNO\(_2\) reported by MARGA may include N\(_2\)O\(_5\), where:

\[ \text{N}_2\text{O}_5 + \text{H}_2 \rightarrow 2 \text{HNO}_2 = \text{additional measured HNO}_2 \]

This work suggests a relationship between the MARGA HNO\(_3\) and ZP\(_2\) measured by the TDLIF.

5 consecutive nights were plotted (see LHS graph) assuming ZP\(_2\) = N\(_2\)O\(_5\).

Molar N\(_2\)O\(_5\) was used to calculate the molar HNO\(_2\), assuming a 100% capture efficiency and compared to the measured HNO\(_3\) by the MARGA.

Night time HNO\(_3\) measured by the MARGA correlates well with the additional measured HNO\(_2\) derived from ZP\(_2\).

This suggests that the HNO\(_3\) reported by the MARGA at Auchencorth Moss may additionally contain N\(_2\)O\(_5\), though further studies are required to confirm this.

INTERCOMPARISON STUDIES

**Poor correlation** between the MARGA and TDLIF for HNO\(_3\) measurements.

**Thermo Scientific analyser** reports higher NO\(_2\) compared to the TDLIF most likely due to interference at low NO\(_2\) concentrations previously demonstrated by Steinbacher et al. (2007).

**NEXT STEPS OF THIS STUDY:**

**Determine if the GC overestimates PANs**

**Assess the potential interference of particulate NO\(_2\) in the TDLIF measurements of HNO\(_3\).**

CONCLUSIONS

**MARGA** HNO\(_3\) may have an N\(_2\)O\(_5\) artefact in the measurement at night.

**NEXT STEPS OF THIS STUDY:**

**Determine the N species to be used to derive a N budget**

**Investigate the chemical transformations of N species at the site**

**Examine the influence of long range transport of air masses on the specified N composition at this background site**

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