INTRODUCTION

NO, NO2, and total reactive nitrogen oxides (NOx) measurements at the PICO-NARE station in the Azores Islands began August 2002 (Fig 1).

The objective of this research is to address the need for measurements of the impact of continental outflow of nitrogen oxides on NOx and ozone levels over the central North Atlantic lower troposphere on a seasonal basis. Here, we present the first measurements of NOx and NOy during the startup period of late August to mid-December, in conjunction with observations of CO, O3, aerosol black carbon (BC), and meteorological parameters.

RESULTS AND DISCUSSION

Four periods were selected from the Aug-Dec data for detail analysis here [Fig 6a-d].

FTML periods. Periods when the site was apparently in the FT and influenced by US air flow were characterized by relatively high levels of nitrogen oxides, and CO, and NOx and NOy were recorded (Table 1, Fig 3).

COMPARISON WITH PREVIOUS CAMPAIGNS AND MODEL ESTIMATES

Our measurements are similar to previous observations in the MBL and FT over the central North Atlantic in the sense that low mixing ratios of the species were recorded as typical for marine background air. Back-trajectories for that period show that air transported through the MBL arrived at the site when the site was in the FT (Fig 5a). Periods when the site was in the MBL and not influenced by US air flow were characterized by low mixing ratios of the species (Table 2b). However, upwarp flow from the island sometimes affected the NOx and NOy measurements when the site was in the MBL, especially in August and September.

TABLE 1. Mixing ratios during the identified FT and MBL periods. Values are the average ± standard deviation of at least 12 measurements during the period. Data obtained from Table 2a and Table 2b. Values are averaged over the observed period of 2-3 days.

<table>
<thead>
<tr>
<th>Location</th>
<th>NO (pptv)</th>
<th>NOy (pptv)</th>
<th>NOx (pptv)</th>
<th>NO2 (pptv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FT</td>
<td>200 ± 50</td>
<td>50 ± 10</td>
<td>150 ± 20</td>
<td>70 ± 15</td>
</tr>
<tr>
<td>MBL</td>
<td>50 ± 10</td>
<td>15 ± 5</td>
<td>20 ± 3</td>
<td>5 ± 2</td>
</tr>
</tbody>
</table>

NOx automated instrument

The automated NOx analyzer is the most recent addition to the observatory (Fig 3). The sample inlets, the NOx and NOy converters, and the calibration gases are located outside. The system is fully computer-controlled using LabVIEW software, and operates in a continuous cycle alternately measuring the period of calibration (~48 hrs), NO2 converter bakeouts (~every 6 days), and NOXNOy NO2 artifact measurements in zero air (~every 3 days).

CONCLUSIONS

Automated measurements of low background levels of nitrogen oxides are possible at the PICO-NARE station.

The first measurements of nitrogen oxides at the observatory demonstrate that pollutant export from North America affects the levels of nitrogen oxides at the site.

The island from the island appears to be significant at times.

FUTURE WORK

Continue measurements through 2004, to develop a seasonal climatology of nitrogen oxides in the lower FT of the Azores region.

Analyze events bringing North American emissions to the station and analyze the statistical significance of the seasonal climatology, to assess the magnitude and mechanisms of NOx and NOy export.

Use these analyses to evaluate the processes governing NOx levels in the background troposphere in chemical transport models.

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