环境科学学报
ACTA SCIENTIAE CIRCUMSTANTIAE

研究报告

曹玮,曾立民,吴宇声,胡敏.大气NO_x测量准确性问题分析[J].环境科学学报,2013,33(2):346-355

大气NO_x测量准确性问题分析

An comparative analysis of the accuracy of atmospheric NO_x measurements

关键词：大气 NO_x NO_y 监测技术

基金项目：东亚地区大区大气污染物跨界输送及其相互影响与应对策略研究(No.2010467002)

作 者 单位

曹 玮 北京大学环境科学与工程学院,环境模拟与污染控制国家重点联合实验室,北京 100871

曾立民 北京大学环境科学与工程学院,环境模拟与污染控制国家重点联合实验室,北京 100871

吴宇声 北京大学环境科学与工程学院,环境模拟与污染控制国家重点联合实验室,北京 100871

胡 敏 北京大学环境科学与工程学院,环境模拟与污染控制国家重点联合实验室,北京 100871

摘要：采用美国热电公司的NO-NO_2-NO_x分析仪(Model 42i TL)和NO_y分析仪(Model 42i NO_y),在2011年1月-10月期间,对北京城市大气中的NO、NO_x和NO_y进行了连续在线测量.两台仪器对NO的测量结果具有较高的一致性(r>0.998,p<0.01),说明两台仪器测量精度基本一致.将NO_y分析仪(Model 42i NO_y)采样口处安装和不安装颗粒物过滤膜两种条件下测量的NO_y结果与NO-NO_2-NO_x分析仪所测的NO_x结果分别进行了相关性分析([NO_y]=0.989×[NO_x],R^2=0.993; [NO_y]=1.134×[NO_x],R^2=0.959),得出以下两个结论:1以颗粒态硝酸盐为代表的颗粒物是造成NO_x与NO_y偏差的主要原因,其所占比例在10%左右; 2目前Model 42i-TL所测NO_x的浓度水平较真实值偏高,其测量值更接近气态NO_y的浓度水平.为估算NO_2测值被高估的程度(以2011年8月6日-15日观测数据为例),用扣除部分气态NO_z物种(HONO、HNO_3、PAN、PPN)的修正方法,推论出在夏季NO_2被高估约7%(R^2=0.968).

Abstract: An intercomparison of atmospheric measurements was conducted using the mainstream instruments of NO_x (Model 42i-TL NO-NO_2-NO_x) and NO_y (Model 42i NO_y analyzers), both by Thermo Fisher Scientific Inc., at an urban site in Beijing.During the study, concentrations of NO, NO_x and NO_y were continuously monitored from January to October 2011. Good correlation (r>0.998, p<0.01) of NO measurements produced by the two instruments was obtained, which confirms measurement accuracy of the two devices. By comparing the NO_y measurement results obtained under the conditions of attaching and removing a particulate filter from the sample inlet of the Model 42i NO_y analyzer with that of the NO_x measurements using the NO-NO_2-NO_x analyzer, the following correlation results are obtained: [NO_y]=0.989×[NO_x], R^2=0.993 and [NO_y]=1.134×[NO_x], R^2=0.959. Two conclusions are drawn from this study: 1 The difference between NO_x and NO_y is caused by particulate nitrate which accounts for around 10 percent of the total NO_x.2 Concentration of NO_x measured using the current Model 42i-TL analyzer is higher than its real values,and is closer to concentration of NO_y. Using the correction method of subtracting concentrations of the main NO_y components (e.g. HONO, HNO_3, PAN, PPN) from that of NO_2 (based on data collected during August 6-15, 2011), it could be concluded that concentration of NO_2 in summer are overestimated by 7 percent (R^2=0.968).

Key words: atmosphere NO_x NO_y monitoring techniques

主办单位：中国科学院生态环境研究中心

单位地址：北京市海淀区双清路18号 邮编：100085

服务热线：010-62941073 传真：010-62941073 Email：hjkxxb@rcees.ac.cn

本系统由北京勤云科技发展有限公司设计