CASTNET Ozone Measurements: Network Precision, Comparability, and Transitioning to 40 CFR Part 58, Appendix A

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Abstract:
Ground-level Ozone (O3) is measured at over 1200 sites across the U.S. in both urban and rural areas. There are two main sources of surface-level ozone concentrations: data that is collected by the State and Local Ambient Monitoring Stations (SLAMS) network and data that is collected by the Clean Air Status and Trends Network (CASTNET). SLAMS sites are mostly urban-based and data is stored and managed by the Air Quality System (AQS) whereas CASTNET site measurements are regionally representative and data are managed by EPA and accessible on EPA’s Clean Air Markets Division sites.
Both networks have consistent and comprehensive quality assurance protocols with data extending back two decades. Understanding the comparability of the two data sources is important for assessment purposes and for use of these data in evaluating emission control strategies, providing data for input to and evaluation models, and for measuring overall progress of air pollution control programs. Combining data from both SLAMS and CASTNET provide greater spatial coverage and allows for assessment of transport from metropolitan areas to regional areas by local emission sources. Understanding the overall comparability of these two datasets and understanding any differences provide data users with the necessary information to perform more comprehensive ozone air quality assessments. CASTNET provides valuable information for evaluating various national and regional air pollution control programs and is the primary source for regionally representative, rural ozone measurements.

1) Comparisons of collocated pairs of ozone monitors operated by SLAMS and CASTNET are provided with information on overall precision estimates for each network.
2) Results on accuracy from the CASTNET site audit program and evaluating single point precision checks for each network.
3) Progress and plans for transitioning CASTNET ozone monitoring operations to meet 40 CFR, Part 58 (Appendix A) requirements.

CASTNET: S4 Dry Deposition and Rural Ozone Monitoring Sites

CASTNET has 75 collocated monitors across site pairs that were precision checks of each other. Most of these sites are located in lying in the 10-20% CV range. This is especially the case with the monitors located in the south of the state. However, the sites that are collocated with the monitors in the north of the state are more variable. This is likely due to differences in the type of equipment used at each site. The site audit program is designed to ensure that all sites are operating consistently with each other.

CASTNET Site Audit Program

System and performance audits are performed at all networks sites by an independent contractee (client/party) on a biannual basis. The CASTNET site audit is based on a 10-meter tower with a column filter. Each ozone analyzer is challenged with ozone-free air and four up-scale concentrations. Two challenges are in the range of 10-80 ppb, and one in each of 150-200 ppb, and 360-450 ppb. The ozone zero, span, and performance check gases are introduced at the ozone sample inlet, through all filters and the entire sample train. The ozone accuracy criterion for %difference is ≤ +/- 10% of the test gas concentration.

Analyzer Precision Checks

The data tends to be within the precision criterion of ±1.0%, but indicates a negative bias. A regression is also presented for the 2007 ozone season with a 1:1 line (figure B).

CASTNET/SLAMS Collocated Pairs

CASTNET/SLAMS collocated pairs are in Beltsville, MD. The sites are approximately four miles apart. A simple linear regression with a 1:1 line is provided for the time period June 2005 to October 2007 (figure C). Greater variance in the data can be partly attributed to the Cadiz distance between sites and their proximity to metropolitan activities.

Part 58, Appendix A Transition

CAMD has been transitioning CASTNET ozone monitoring operations to full compliance with 40 CFR, Part 58. This has required purchasing all new analyzers (Thermo 49i's) and data loggers (CR3000's) for each EPA sponsored CASTNET site. In addition to data submission to EPA’s Air Quality System (AQS), data collected at compliant sites, will adhere to the appropriate site validation procedures, calibrations and audit frequencies. This transition is underway and will be completed by the fourth quarter of 2010.

Current plans are to move to the strict criteria defined in Part 58. Therefore, CAMD and the CASTNET contractor are exploring additional options for using the current monitors to meet the precision and accuracy checks required for compliance monitoring.

CASTNET is testing the feasibility of using methods other than external ozone transfer standards at each site for the most effective assurance criteria. Current tests using alternative air compressors, external pressure regulators and an external ozone standard are being explored by the CASTNET contractor. A method that proves to be successful in the laboratory will then be tested in the field at the current CASTNET site(s) for two months or more to measure the feasibility of long-term deployment throughout the network. At this time, EPA finds the network will be ready for compliance monitoring. The fourth quarter of 2010 provided the funding and resources are available to meet the QA criteria. In addition, one of the methods being tested as a way around the current 40 CFR monitory processes is successful, EPA has a goal of running 10 to 15 pilot sites meeting all Part 58 compliance requirements by March 2010.

Conclusions:
Network Precision

A rigorous analysis of the two networks is necessary to further demonstrate the comparability of the two networks and understand the quality of each dataset however; based on the estimated network precision and direct collocated comparisons there is evidence of good overall comparability with regard to ozone measurements.