

Improving Measurement for Smokestack Emissions

June 28 - 29, 2017
Gaithersburg, Maryland

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Astronomy picture of the Day, 8/11/2016

www.nist.gov/topics/greenhouse-gas-measurements

NIST
National Institute of
Standards and Technology
U.S. Department of Commerce

NIST: National Metrology Institute of the U. S.

- A non-regulatory agency of the U. S. Department of Commerce
- We develop state-of-the-art measurement science to advance U. S. technology infrastructure



Mission:

- Promote U. S. innovation and industrial competitiveness,
- advance measurement science, standards, and technology in ways that...
- enhance economic security and improve our quality of life,
- promote fairness in the marketplace, trade, and regulation.

Scientists and Society Need Reliable Data

BIPM Workshop on Global to Urban Scale Carbon Measurements

<http://www.bipm.org/en/conference-centre/bipm-workshops/carbon-measurements/>

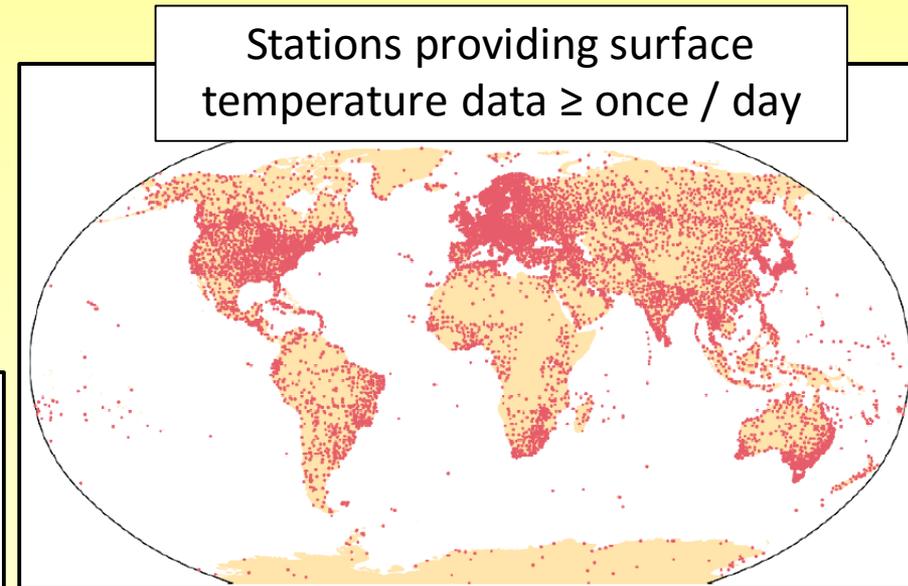
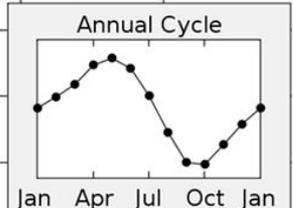
Keeling Curve



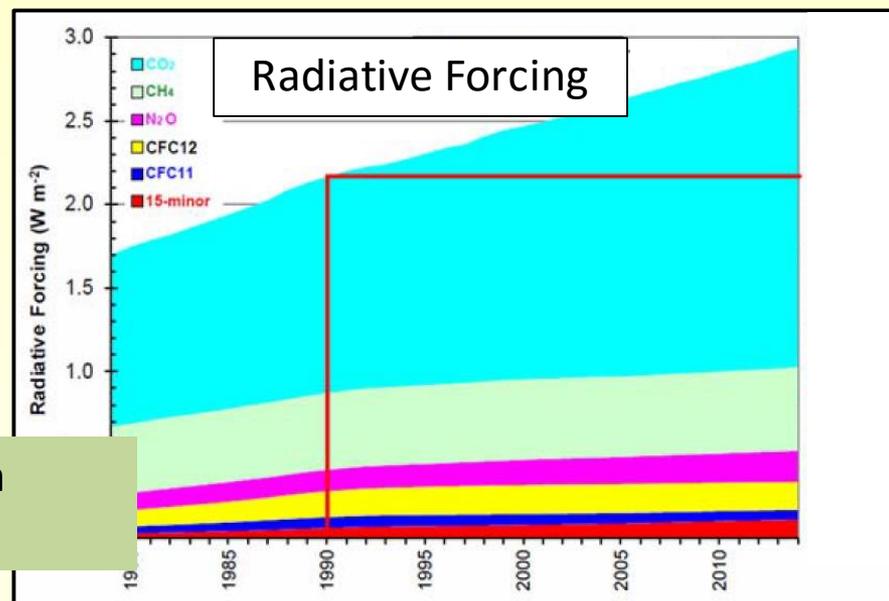
Atmospheric Carbon Dioxide
Measured at Mauna Loa, Hawaii

Carbon dioxide concentration (ppmv)

1960 1970 1980 1990 2000 2010

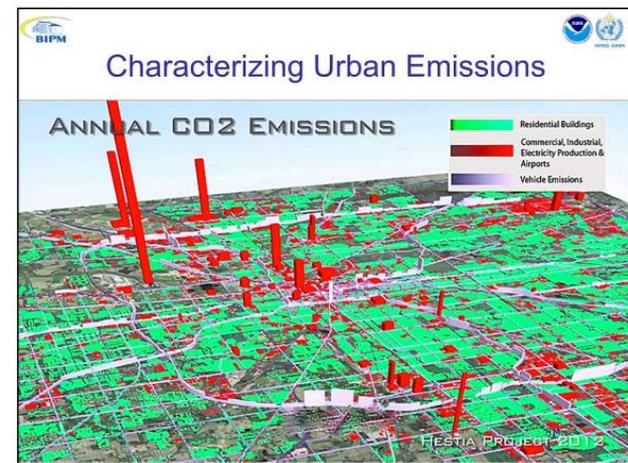
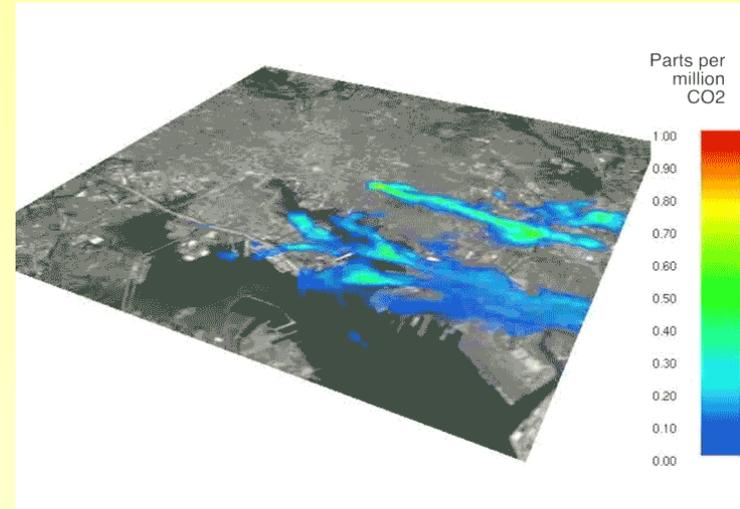
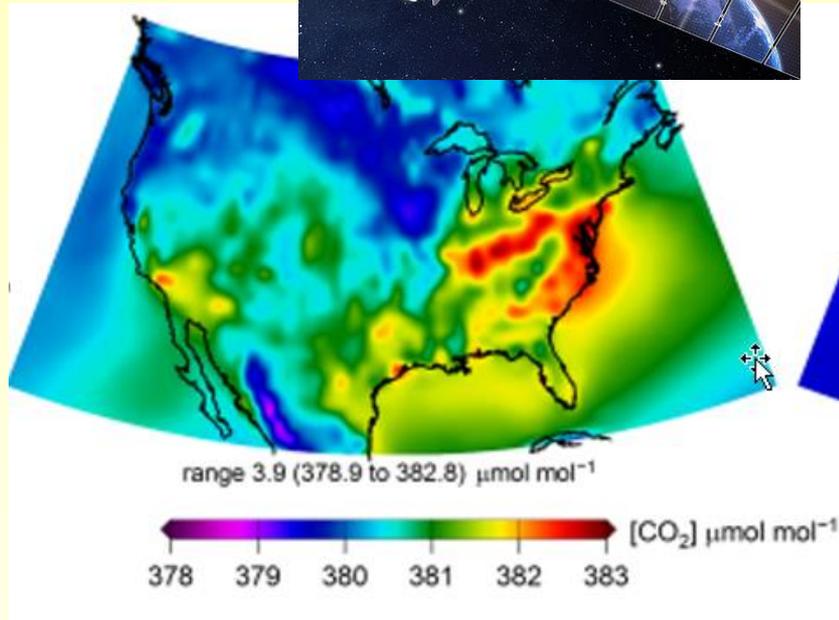


NIST Greenhouse Gas Measurements Program
objective: Improve emissions metrology



1) Advanced Satellite Calibration Standards

2) Measurement Tools & Testbeds for Urban Emissions Quantification



70% of GHG emissions come from urban areas, yet we really understand them poorly.

3) Standard Reference Gases and Property Databases

4) Carbonaceous Aerosols (Black Carbon)

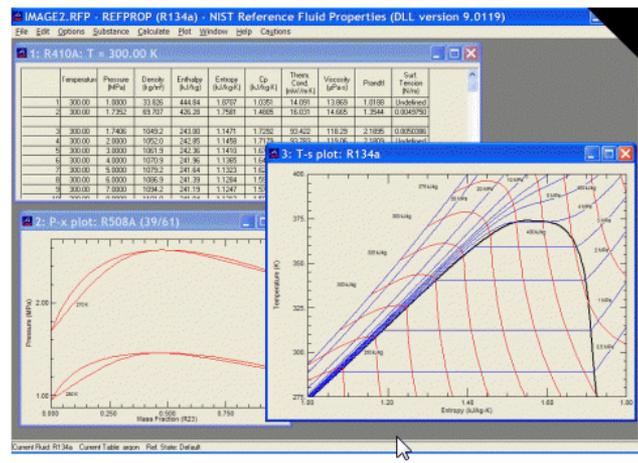


REFPROP

NIST Reference Fluid Thermodynamic and Transport Properties Database (REFPROP): Version 9.1

[Click here for additional information concerning frequently asked questions.](#)

Customers who purchased version 9.0 can receive version 9.1 for free. Please email to data@nist.gov with SRD order number for version 9.0.

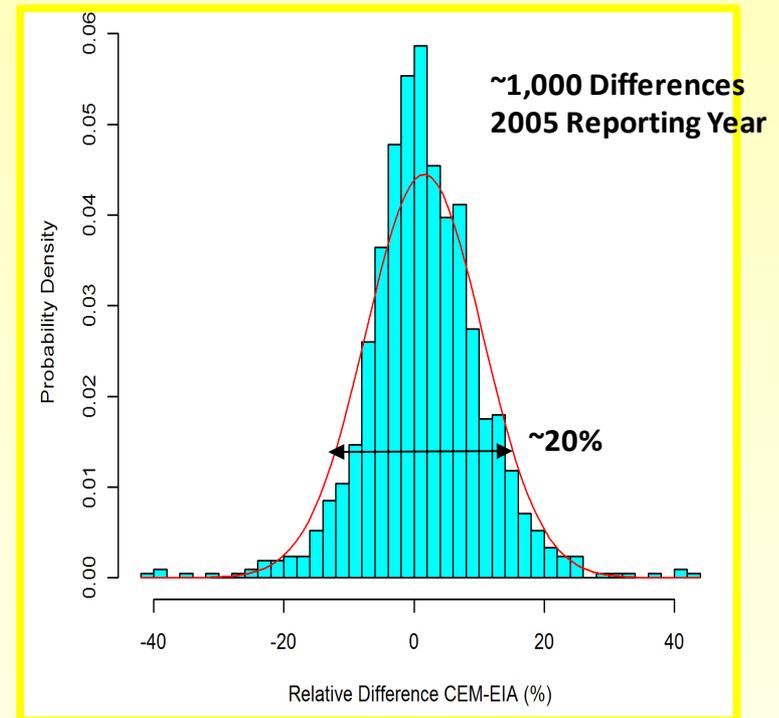
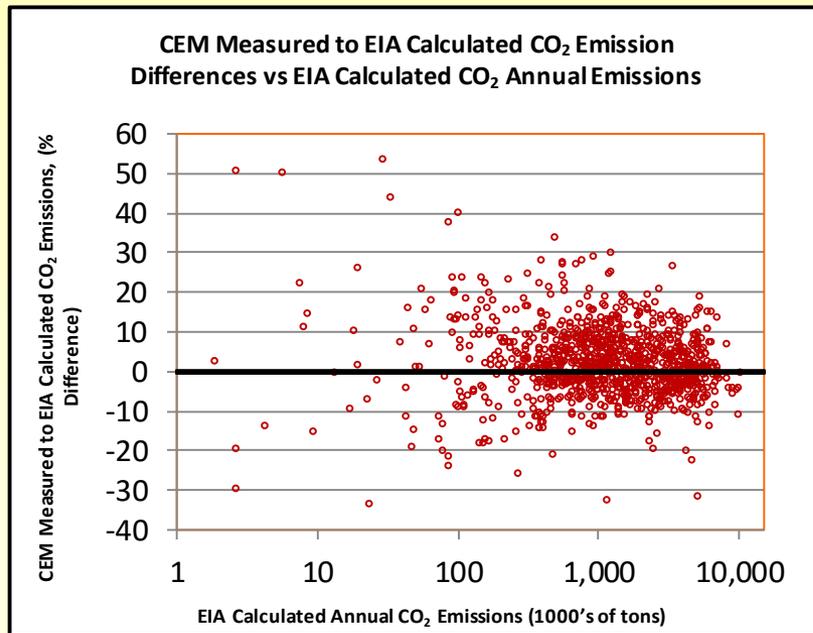


CO₂ Concentrations are traceable to NIST standards via NIST Traceable Reference Materials (NTRM) Program, ± 2% traceability level for CO₂, SO₂, & NO_x

5) Stationary/Point Source Metrology

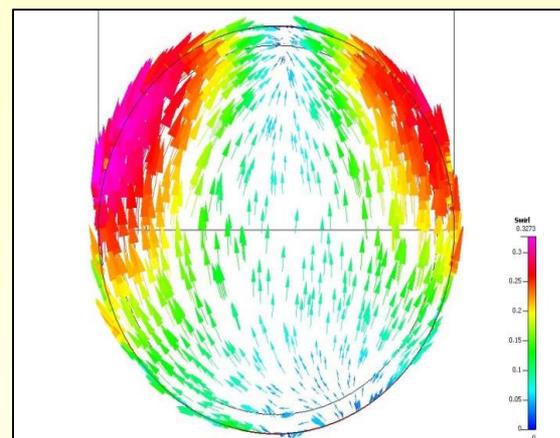
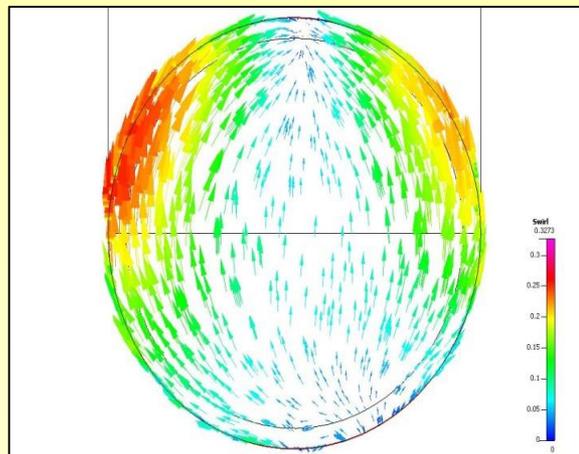
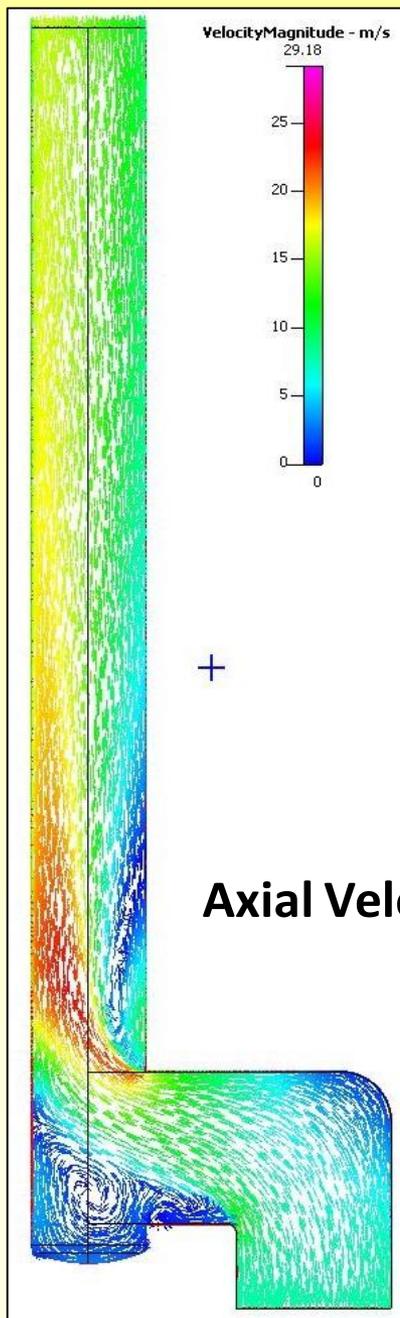
Agreement between 2 methods of CO₂ emissions reporting?

- 1) Pre-Combustion – Fuel Calculation Method
- 2) Post-Combustion – CO₂ Measurement via CEMS (flow x mole fraction)

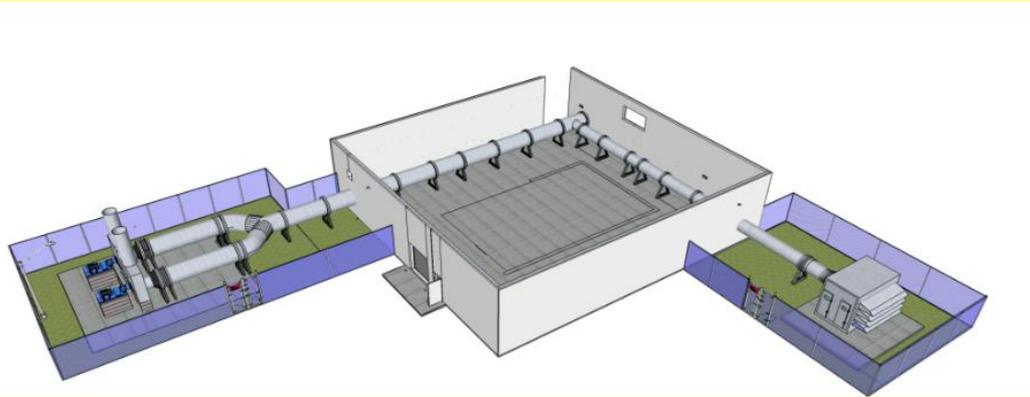


Measurement challenges: 1) carbon content of coal, 2) flow measurement in stacks, 3) Pitot velocity measurements, 4) better methods, 5) composition, 5) other?

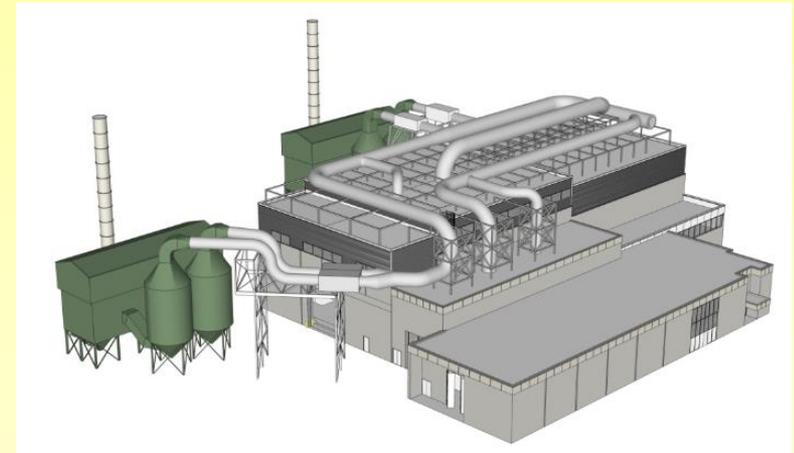
Distorted, swirling profiles: Stack flows will have significant “installation effects” on flow meters



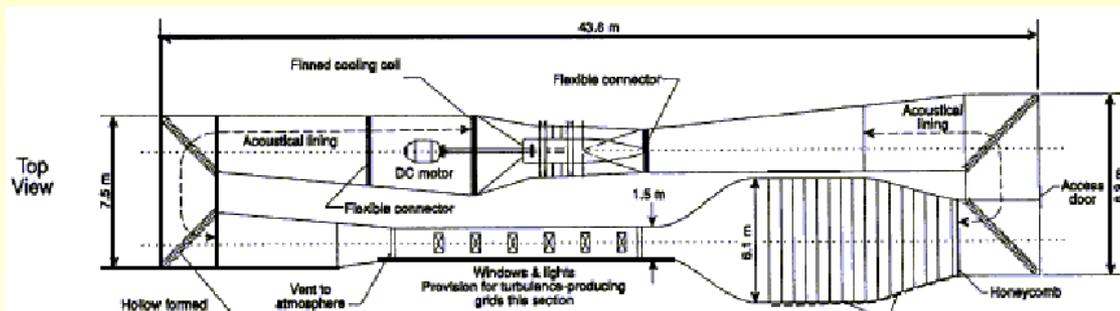
5) Stationary/Point Source Metrology



NIST Smokestack Simulator
(profiling methods, ultrasonic flow meters, installation effects)



National Fire Research Laboratory
(pre- vs. post-combustion methods, tracer methods)



NIST Wind Tunnel and Air Speed Calibration Service
(performance of air speed sensors, tilt & turbulence response, non-nulling methods)

Thanks for your Attention

Best Wishes for a Successful Workshop and Discussion

Workshop purpose: share information, gather ideas, coordinate research

Welcome international guests!