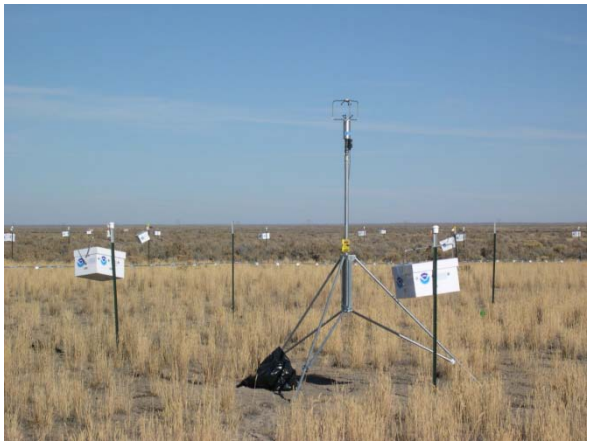
Tracer Technology and Research



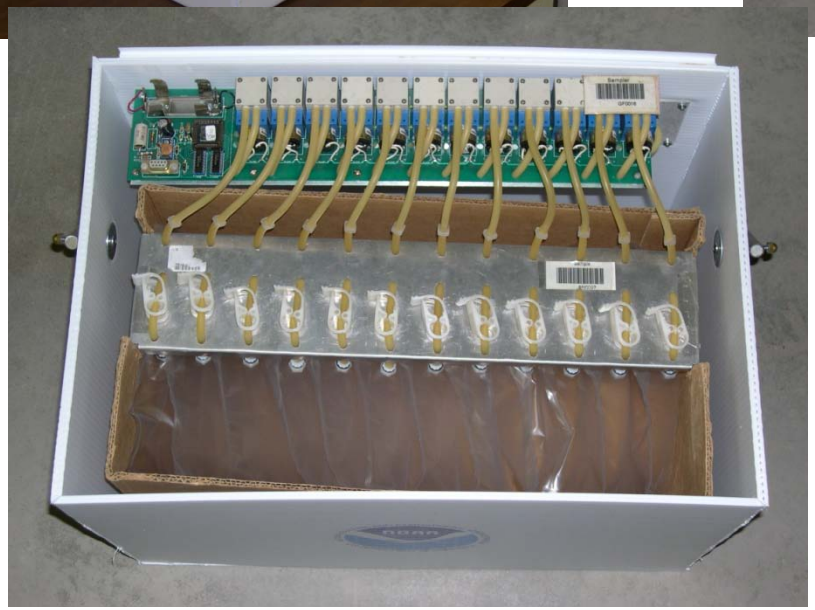
Richard M. Eckman
Air Resources Laboratory

ARL Laboratory Review
May 3-5, 2011

Science Goals

- Evaluate atmospheric dispersion models
  - Air quality applications (chronic exposure)
  - Toxic releases (acute exposure)
- Improve model parameterizations
- Fill knowledge gaps in complex environments—cities, complex terrain, coastal areas
- Study atmospheric processes with instrumented balloons
  - Originally tracers for dispersion applications
  - Lagrangian observation platforms for air quality and hurricane boundary layer

Approach: Bag Samplers



Time integrated concentrations

12 bags each

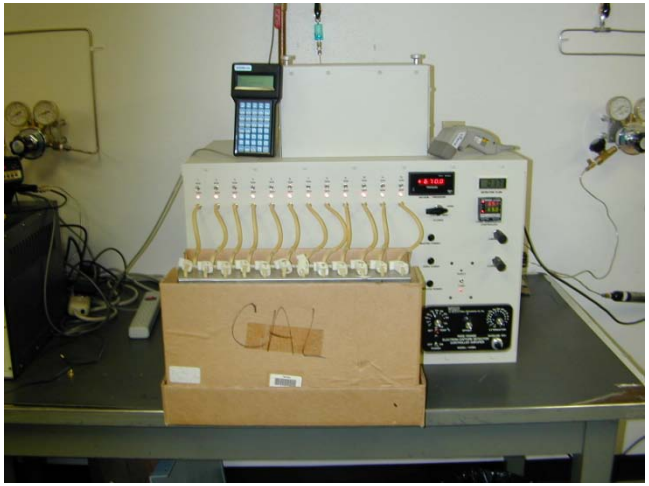
Analysis not in real time

Approach: Field Deployment and Analysis

Release Mechanism

Sampler Deployment

Sample Analysis



Approach: Fast Response Samplers

1 s response time

Mobile

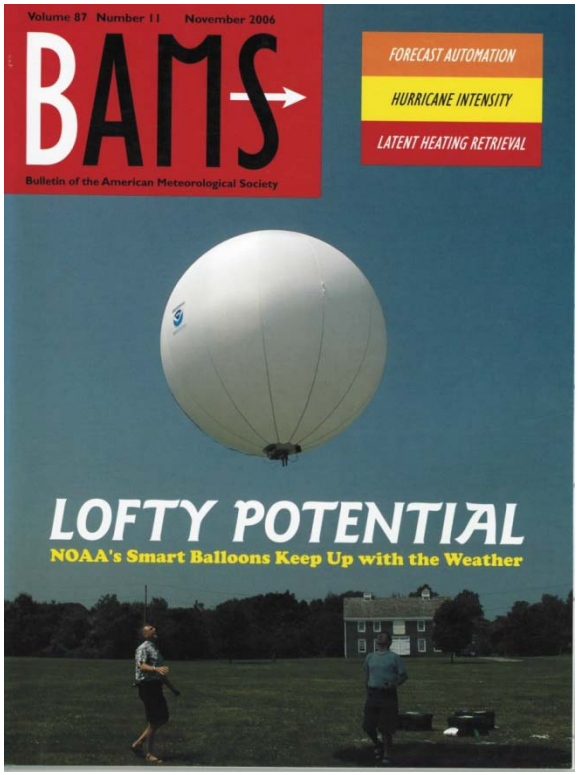
Near real time analysis

Balloon Systems

Tetroon

Hurricane balloon

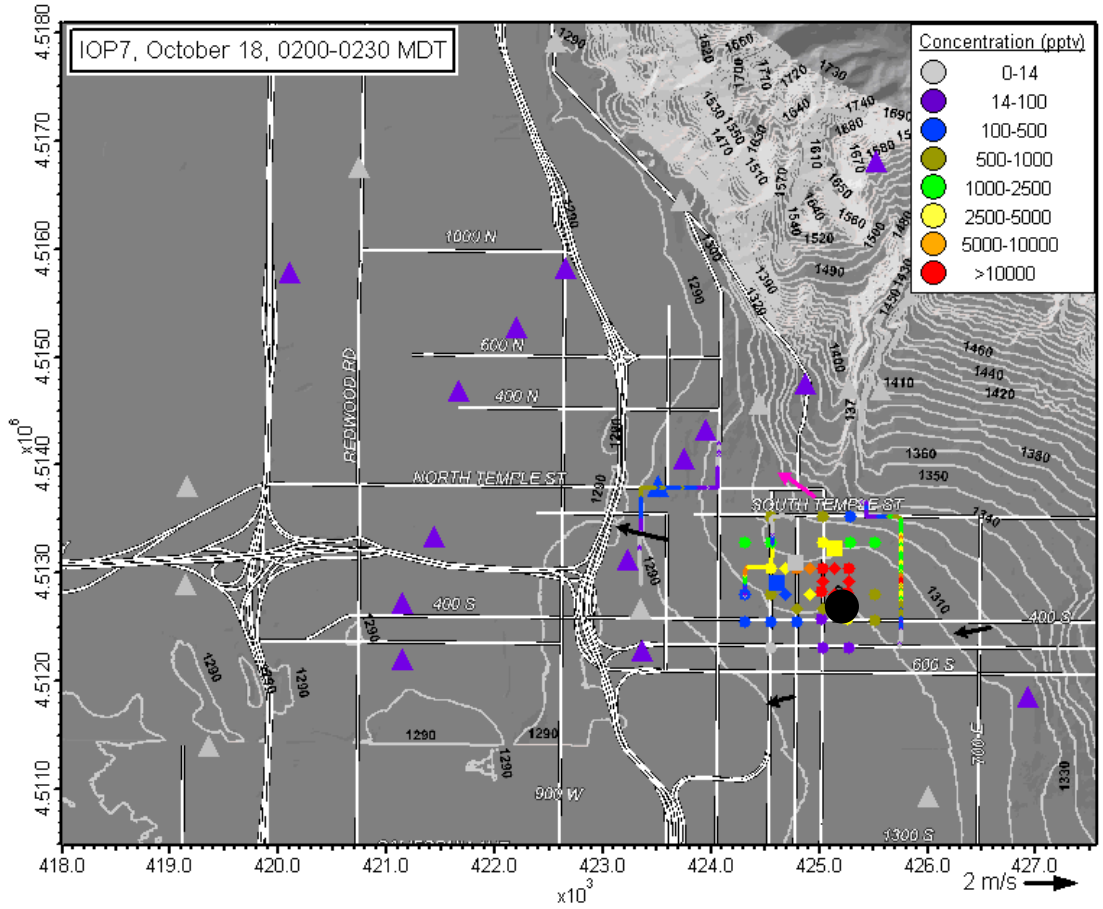
2006 cover Bulletin of the AMS



Major Accomplishments and Findings

- Participated in all major U.S. field studies
- Added ability to detect multiple perfluorocarbon tracers
- Greatly expanded urban tracer datasets
- Observed rapid vertical transport in high-rise areas
- Observed “upwind” and “lateral” urban transport
- Provided new information on the effect of roadway sound barriers on pollutant concentrations
- Developed guidance for first responders in urban areas
- Developed low-cost prototype detector for measuring concentration fluctuations

“Upwind” Dispersion of Plume

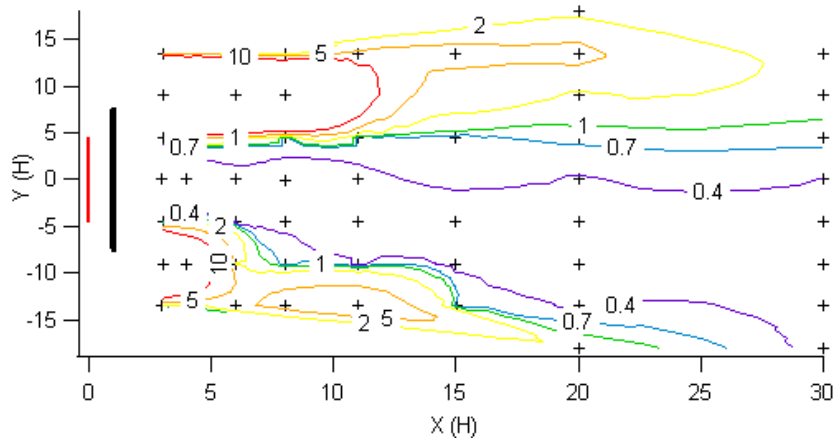


Urban 2000 Salt Lake City

Dispersion Effects of Roadway Sound Barrier

2008 collaboration with EPA

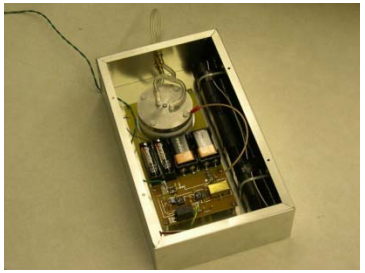
Mock sound barrier
1 ton straw bales



Concentration ratio barrier to non-barrier neutral case

Indicators of Success

- 9 journal publications since 2000 (17 conference papers)
- 8 NOAA Technical Memorandums since 2000
- Over 150 paper citations
- 2007 NOAA Bronze Medal
- Patent for prototype fast-response detector (X-6)
- Widespread media coverage
- Requests for collaboration from external organizations



Collaborators

- Federal
  - Department of Defense
  - Environmental Protection Agency
  - Department of Energy
  - Department of Homeland Security
- Academia
  - University of Utah
  - Washington State University
  - National Center for Atmospheric Research
  - Desert Research Institute
- Private Sector
  - Hanna Consultants
  - Northrop Grumman

Future Directions

- Need for new generation of tracers with lower Global Warming Potential (GWP)
  - Low background, easy to detect, nontoxic
  - Both integrated and real-time sampling
  - Inexpensive to release and analyze
- Lower cost fast-response measurements
  - Current systems cost > $30K and require constant supervision
  - X-6 prototype detector
- Urban dispersion, chemical cartography