New Capabilities For Interpreting Comparison Data

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Through The Years …

- NOAA Comparison Activity: Are we closer to the required measurement accuracy? (Finland 2007)
- Making Quality Measurements without a Data Management Strategy (Canada 2003)
- A Web-based Interactive Atmospheric Data Visualization Tool: Near real-time access to data from the NOAA CMDL CCGG Observing Network (Canada 2003)
- GLOBALVIEW-CO$_2$: Past, Present and Future (Japan 2001)
- GLOBALVIEW-CO$_2$: An Update (Australia 1997)
- An Update on the Ongoing Flask-Air Intercomparison Program between NOAA and CSIRO (Australia 1997)
- Extension and Integration of Atmospheric CO$_2$ Data into a Globally Consistent Measurement Record (U.S. 1995)
Motivation: Cooperative Observing Systems

Regional and Local Networks

Current Tall Towers
Current Aircraft
Future Tower & Aircraft
Local Networks?
Motivation: Global Network of Regional Networks

Cooperative Global Network

conceptual
Motivation: Multiple Comparison Strategies

EC / NOAA
- WMO RR
- CE Sausage
- CE Cucumber

Same Air (ALT)
- Flask/In Situ (ALT)
- Flask/In Situ (LLB)

Every 3-4 years

Co-located Ambient Air Comparison

~Weekly

Bi-monthly

CE Sausage Comparison

WMO/IAEA Round Robin

Every 3-4 years

ATMOSPHERE
## ESRL Inter-Laboratory Comparison Activities

<table>
<thead>
<tr>
<th>Partner</th>
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Looking For A More Flexible ICP Application

- View results from multiple ICPs among multiple labs
- Accommodate many same-air and co-located ICP strategies
- Scale to a 10-fold increase in ICP experiments
- Automate data transfer and archive, and DB and Web updates
- View key images and statistical summaries (Production)
- Create custom comparisons and images (Interactive)
- Web-based, Fast, Free, Robust
- Minimal Software/Hardware Requirements
- Portable
Interactive ICP Framework

1. Data Transfer (FTP or HTTP)
2. Data Archive
3. Web App

Host Lab

Production

Interactive
Interactive ICP Framework

FAIL TO AUTOMATE Data Transfer

Data Archive → ICP DB → WEB App → Production → Interactive

Host Lab
Production Images

EC data courtesy of D. Worthy
ICP Between co-located In Situ Systems

Results - Image

NOAA co-located In Situ/In Situ ICP
Walnut Grove, California [91 magl]

ΔCO₂ (µmol mol⁻¹)

2009-03-10 to 2009-03-17 [UTC]

Results - Statistics

ESRL data courtesy of A. Andrews
Multiple ICPs Between 2 Labs
Multiple ICPs Among Multiple Labs

EC data courtesy of D. Worthy
MPI-BGC data courtesy of A. Jordan
“Production” to “Interactive”
Example: A First Look (Production)

ESRL data courtesy of P. Novelli
CSIRO data courtesy of P. Krummel
A Closer Look (Interactive)

ESRL data courtesy of P. Novelli
CSIRO data courtesy of P. Krummel
NOAA CO Detection (RGA and VURF)

NOAA data courtesy of P. Novelli
CSIRO data courtesy of P. Krummel
NIWA/NOAA ICP Results - CO

NOAA data courtesy of P. Novelli
NIWA data courtesy of G. Brailsford
MPI-BGC/NOAA ICP Results

Results - Image

Results - Statistics

NOAA data courtesy of P. Novelli
MPI-BGC data courtesy of A. Jordan
EC/NOAA ICP Results

See Poster (P4) …

P.C. Novelli, P.M. Lang, K.A. Masarie, A.M. Crotwell, B.D. Hall and D. Guenther, Carbon monoxide measurements at NOAA/GMD: calibration and analysis
Direct Comparisons of Atmospheric Air

- ICP results suggest a problem
- ICP tools help identify possible causes
- Return to lab to evaluate hypotheses using fundamental methods
- Correct experimental problem if confirmed within the lab
- Edit existing data if defensible

→ improved confidence in measurements
→ may or may not improve ICP results!
ICP Results are Dynamic

CSIRO/NOAA Same Air Comparison
Cape Grim, Tasmania

ΔCO₂ (μmol mol⁻¹)

CSIRO minus NOAA as of October 2008

Year
ICP Results are Dynamic

CSIRO/NOAA Same Air Comparison
Cape Grim, Tasmania

Δδ^{13}C CO₂ (per mill)

Year

CSIRO minus NOAA as of June 2005
Summary

- Merging independent observations into cooperative data sets must be defensible.
- Ongoing and direct comparisons of atmospheric air measurements are essential.
- ICPs provide independent feedback on how we are doing.
- ICPs motivate to identify and solve problem.
- Complementary comparisons can help narrow possible causes of observed differences.
- ICP application to help us manage and visualize comparison data from many ICP strategies between many labs.
- Tool that will scale to a major (10-fold) increase in the number of ICPs.
- Success completely depends on data availability and readability (self-documenting files?)
- Next steps?
Thank You
Co-located Comparisons – WGC Tower

Intra-laboratory

WMO Experts Meeting – September 2009

Courtesy: Steve Montzka