

**First Tropospheric Airborne Measurement**

**Evaluation Panel Meeting**

**– Objectives and Framework –**

**Presented by G. Chen**

# Background

- The TAbMEP meeting is an important part of NASA MEaSUREs' project "Creating a Unified Airborne Database for Assessment and Validation of Global Models of Atmospheric Compositions". The project is conducted by a team NASA Langley scientists, including Drs. Gao Chen, Mary Kleb, Margaret Pippin, Jennifer Olson, and SSAI support contractors.
- NASA MEaSUREs (Making Earth System data records for Use in Research Environments) intends to fund the project for four years. We plan to host four annual TAbMEP meetings.
- This project and TAbMEP meeting are endorsed by NASA, NOAA, NSF, and EPA. We intend to continue this effort beyond this project and seeking resources from NASA and the partner agencies.

# Tropospheric Airborne Observations

- **Advantages:**
  - Long history, e.g. ~ 3 decades for CO.
  - Sole source of detailed data for certain locations.
  - Extensive species and parameters.
  - Detailed spatial profiles.
- **Limitations:**
  - Limited temporal and spatial coverage.
  - Lack of centralized data portal and standardized data format.
  - Analysis requires metadata which is sometimes incomplete.

# Objectives

- Review the *datasets* available for model assessments (a tentative list will be presented by M. Kleb).
- Establish procedures for assessing measurement uncertainties and consistencies (use ICARTT as an example).
- Review the ICARTT data analysis and measurement comparison results to quantify measurement uncertainties and consistencies for the *species/parameters of interests*.
- Make recommendations for format and variables/parameters of the unified airborne observational database and panel recommended database.
- List action items for generating the TAbMEP Recommendation Report (public release in ~9 months).
- Make recommendations for future field campaigns: improvement to metadata and measurement comparison activities.
- Determine the follow-up activities, *e.g.*, panel recommendation report and next TAbMEP meeting.

# Species/Parameter of Interest

- Gas Phase measurements:  $O_3$ ,  $CO$ ,  $NO$ ,  $NO_2$ ,  $HNO_3$ , PAN,  $CH_2O$ ,  $SO_2$ ,  $H_2O$  vapor, Methane, Ethane, Ethyne, Propane, n-Butane, Benzene, Toluene, and Isoprene.
- Particulate Phase measurements: total number density, submicron and total volume densities, sulfate, ammonium, nitrate mass concentration, scattering coefficients, and absorption coefficients.
- Met and Radiative measurements: temperature, wind speed,  $jNO_2$ , and  $jO_3$ .

# Panel Meeting Approach

- Open, constructive, focused Panel discussions on four topics for measurement of each species/parameters:
  - **Measurement uncertainty (both random and systematic).**
    - Are PI reported uncertainty and LOD representative?
    - Can we estimate random uncertainty through internal check of the actual data?
  - **Measurement consistency.**
    - Do multiple measurements for the same species/parameter from different instruments/platforms agree within the reported uncertainties?
    - How can we use other intercomparison results to help evaluate the ICARTT results?
  - **Suitableness for model assessment, unified database, and panel recommended database.**
    - Is this measurement suitable for model assessment?
    - Can we identify if some measurements are better than others?
    - Should datasets be combined with adjustments? If so, how to make these adjustments?
  - **Action items for further analysis.**
- Discussion content should be kept within this panel.

Species: CO  
Campaign/Year: ICARTT/2004

Airborne Platform:	NASA DC-8	NOAA WP-3D	FAAM BAE-146	DLR Falcon
Instrument	DACOM			
PI/Institution	Sachse/LaRC	Holloway/ESRL		

Random Uncertainty PI  
Panel

Systematic  
Uncertainty PI  
Panel

Total Uncertainty PI  
Panel

Limit of Detection PI  
Panel

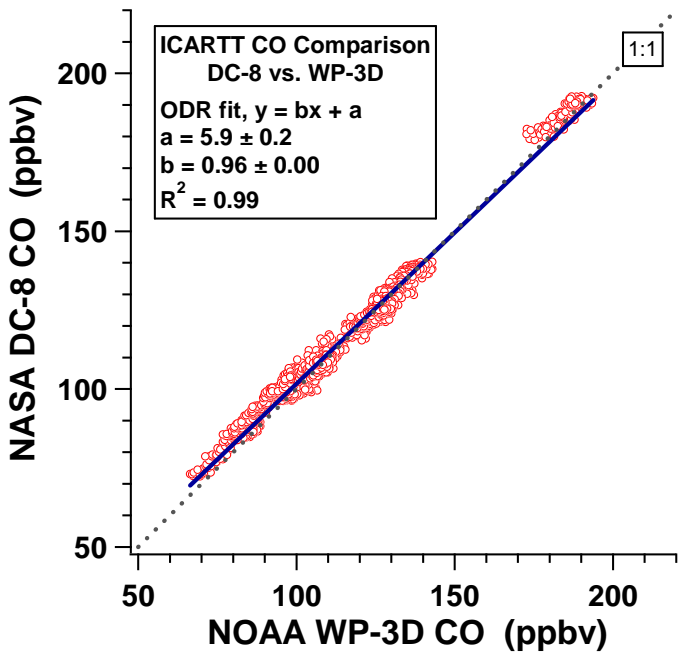
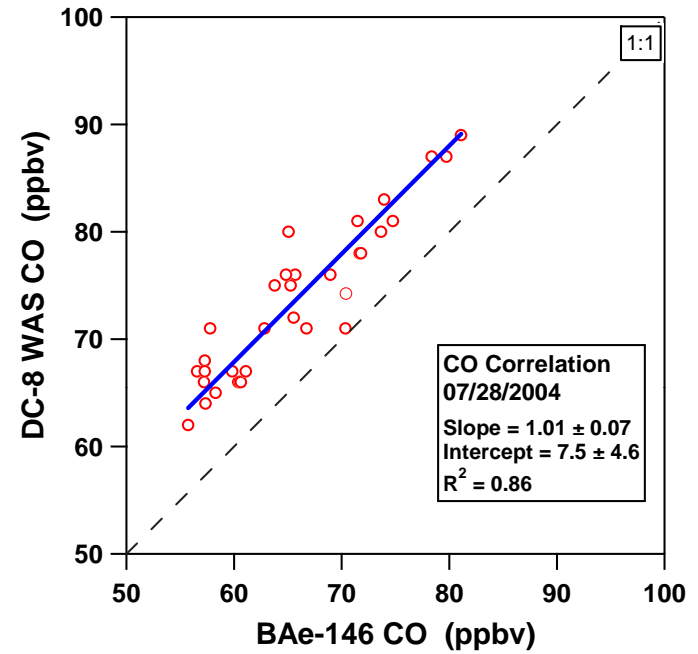
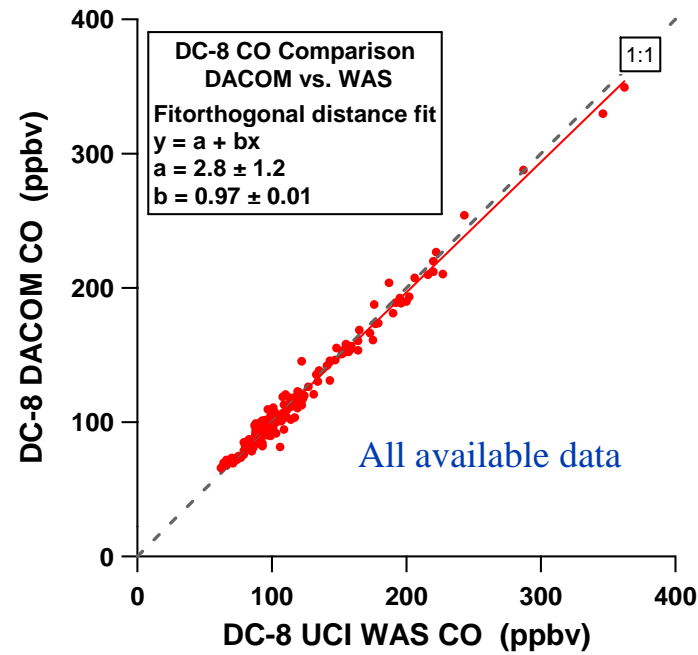
#### Comparison Results

NASA DC-8 (y)	N/A		$y=(0.98\pm 0.07)x+(10.1\pm 4.6)$	
NOAA WP-3D (y)		N/A		
FAAM BAE-146 (y)			N/A	
DLR Falcon (y)				N/A

Panel  
Recommendations:

Panel Notes

## ICARTT CO Measurement Consistency Assessment Summary



It can be derived:

**DC-8 DACOM vs. BAe-146**

$$y = (0.98 \pm 0.07) x + (10.1 \pm 4.6)$$

**WP-3D vs. BAe-146**

$$y = (1.02 \pm 0.01) x + (4.3 \pm 4.8)$$

Projected CO measurement difference

DC-8 DACOM	WP-3D	BAe-146
60	56	51
120	119	112
360	370	357



# Unified Airborne Observational Database

## - proposed framework-

- **Format:**
  - NetCDF and/or ASCII with standardized format.
  - Temporal and spatial resolution suitable for model assessment.
- **Content:**
  - Variables of interest originally reported by PI.
  - Merged with house-keeping variables, e.g. date/time, latitude, longitude, pressure altitude, static pressure, temperature, water vapor mixing ratio, etc.
  - Complete metadata, including PI contact information, field campaign, aircraft platform, the panel assessed precision and accuracy (or total uncertainty) for each measurement as well as the quantitative consistency between the measurements by different instruments and/or platforms.
- **Access tools:**
  - User will be able to retrieve data for specified variables at a given location and time of interest.

# Panel Recommended Database

- *Definition: Original data are adjusted using the intercomparison results so that the entire database is self-consistent, regardless of the instruments and airborne platforms, even across field campaigns.*
- *Benefit: More suitable to assess temporal and spatial gradients.*
- *Difficulties:*
  - *Can we determine if some measurements are better than others, if not, is the middle ground data more useful for model assessment?*
  - *Do we need this database?*

# Panel Recommendation Report

- Brief review of instruments/techniques involved.
- Classify measurements according to suitability for model assessment.
- Review for each species/parameter of interest in terms of uncertainties associated with each instrument and the measurement consistency/diversity between the instruments and/or aircraft platforms.
- Make recommendation for future field campaigns.
- Sections of the panel recommendation report will be drafted by assigned and volunteered facilitators and reviewed by this panel in ~6 months.
- The report will be distributed to the modeling communities and placed with the data archive.

# Plan for the Future

- tentative timeline -

- **Near future – TAbMEP Recommendation Report.**
  - Distribute meeting notes to everyone ( 1 – 2 weeks).
  - Further analysis (1 – 3 months).
  - Facilitators recommendation draft on corresponding species/parameters (1 month).
  - Panel review of the draft report (1 – 2 months).
  - Seeking comments from PIs (1 – 2 months)
  - Panel finalize report with consideration of PI comments (1 – 2 months).
  - Release the report to modeling communities (e.g. AC&C, HTAP, and AeroCom) within ~ 9 months.
- **A little further – the next TAbMEP meeting (~ 12 months)**
  - Suggestions for next meeting?
  - More European participations!

Go TAbMEP!!