The Distribution of Tropospheric Carbon Monoxide Observed by MOPITT

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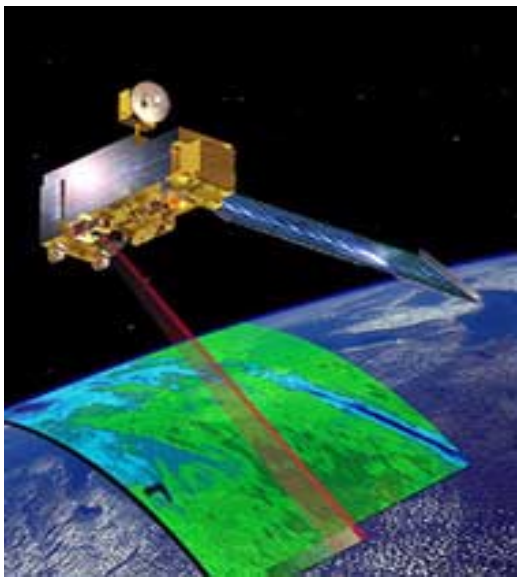
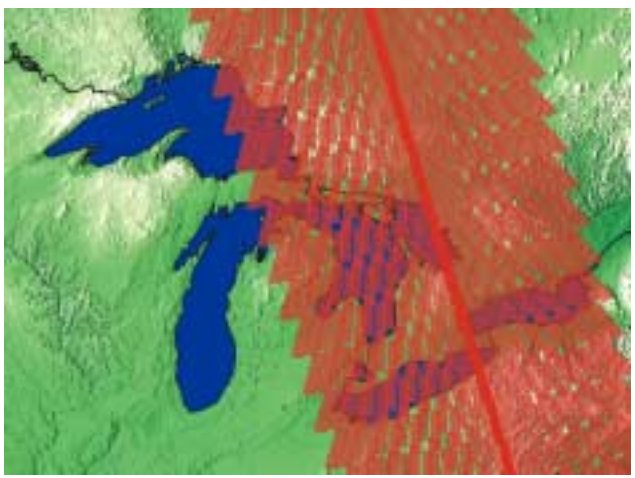
Measurements Of Pollution In The Troposphere





- **On NASA/EOS/Terra satellite, launched Dec 1999**
- **Nadir sounding**
- **22 km x 22 km pixel resolution, 300 km swath**
- **Detection of thermal radiation at 4.7μm for CO, using gas-correlation radiometry**

MOPITT Data Status

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Available Data:

Phase 1: **Mar 3, 2000 to May 6, 2001** (8 Channels)

{*cooler failure May 7, 2001*}

Phase 2: **Aug 2001 to present** (4 Channels)

Version 3 CO retrievals are being processed and archived at the NASA Langley DAAC

Post-Aug 2001 data: Expect to produce retrievals with vertical resolution comparable to the first year of data

Methane: Continuing to work on solving noise issues in the solar channels, which will allow retrieval of CH_4 columns, and improve sensitivity to the lower troposphere for CO

MOPITT Retrievals

Satellite measurements do not by themselves contain sufficient information to unambiguously determine the CO concentration

We use our prior knowledge of the physical and statistical variability of the CO distribution in the atmosphere to choose the solution that has the maximum likelihood (optimal estimation)

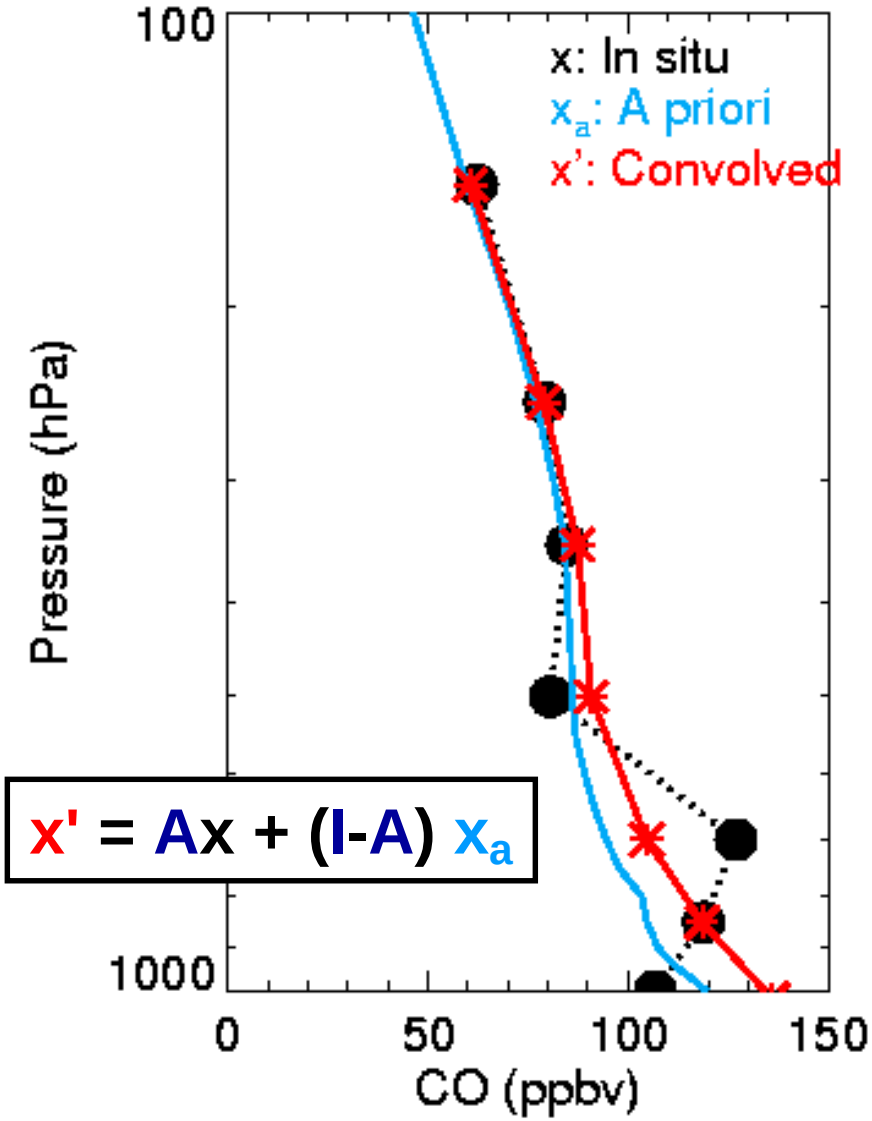
The retrieval algorithm incorporates statistical properties of the CO variability in the form of the *a priori* vertical profile and covariance matrix

The retrieved profile $\mathbf{x_{ret}}$ can then be expressed as a linear combination of the true profile **x** and the *a priori* profile $\mathbf{x_a}$

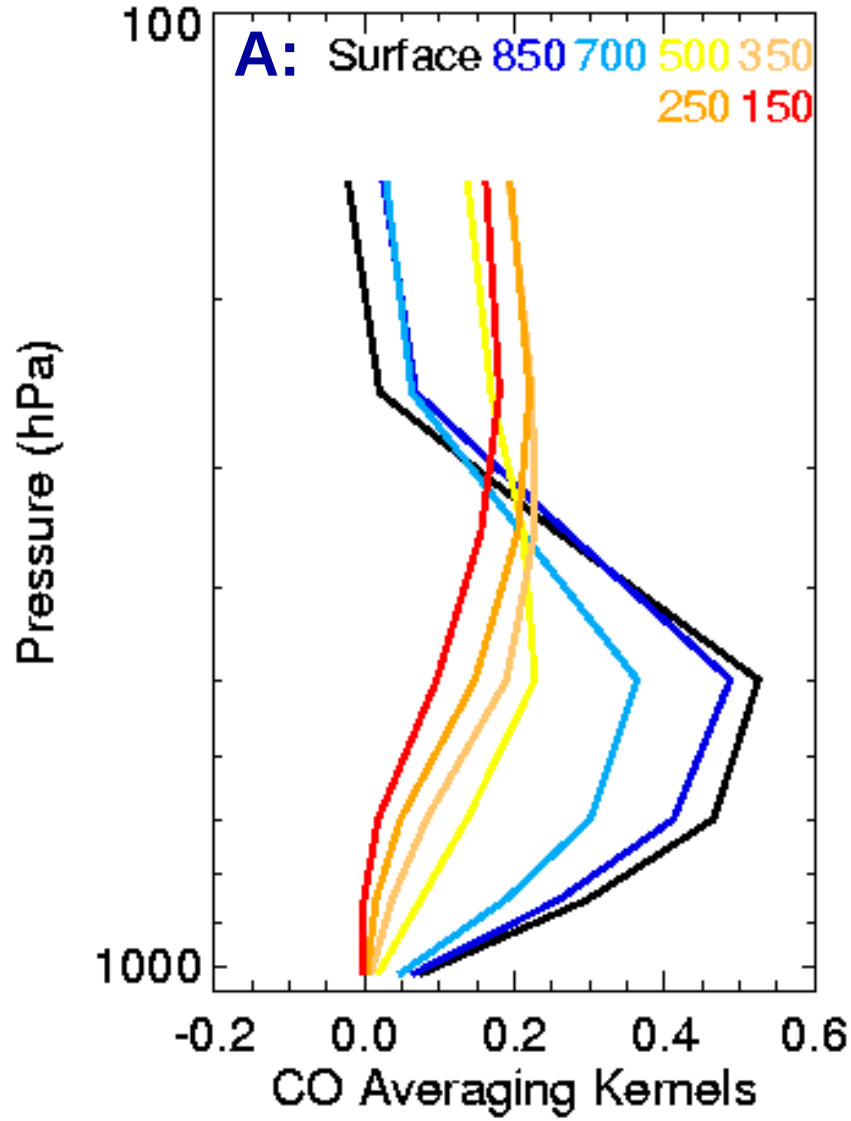
$$\mathbf{x_{ret} = A\,x + (I - A)\,x_a}$$

The Averaging Kernel **A** represents the measurement sensitivity to the true profile and depends on those factors affecting the radiative transfer of the measured signal through the atmosphere

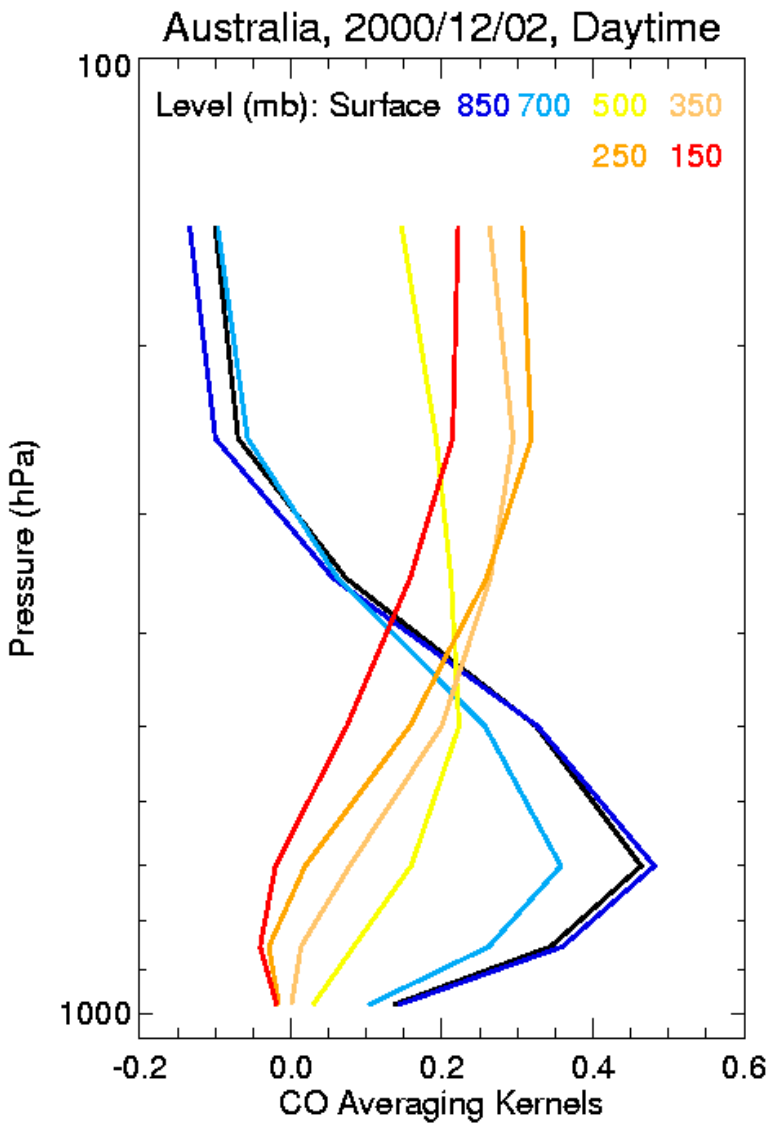
Application of Averaging Kernels

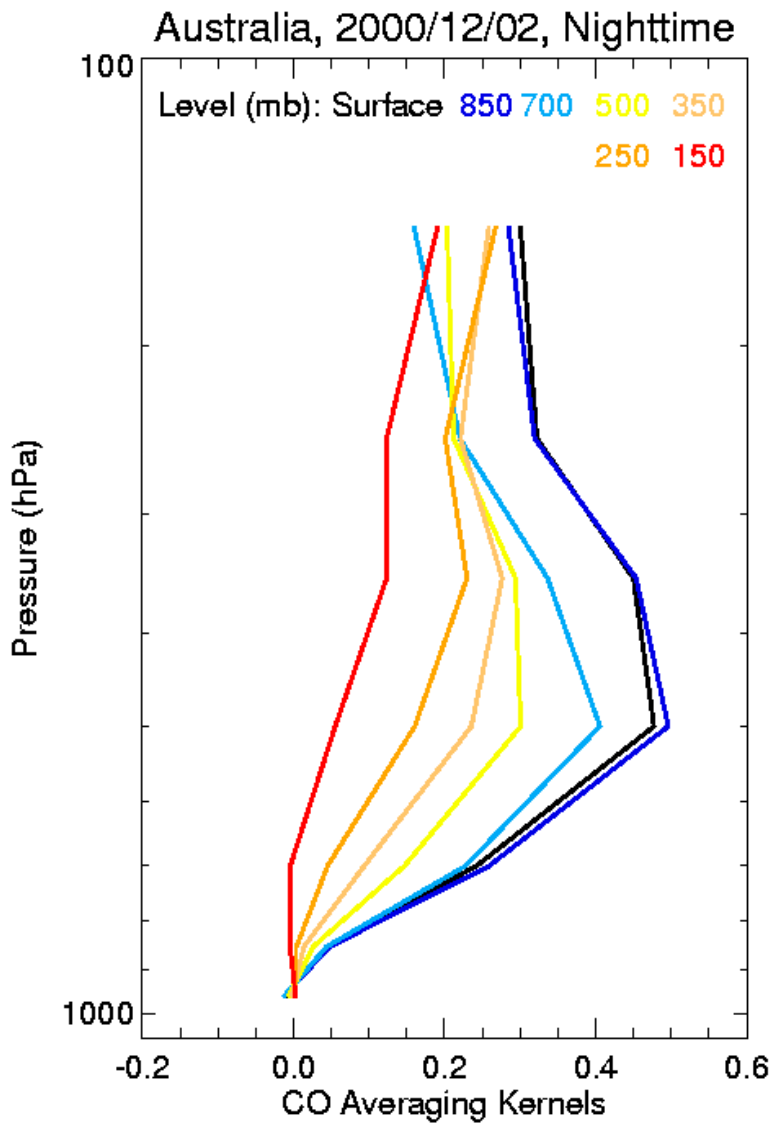


$$x' = Ax + (I-A)\,x_a$$



Averaging Kernels - Australian Desert





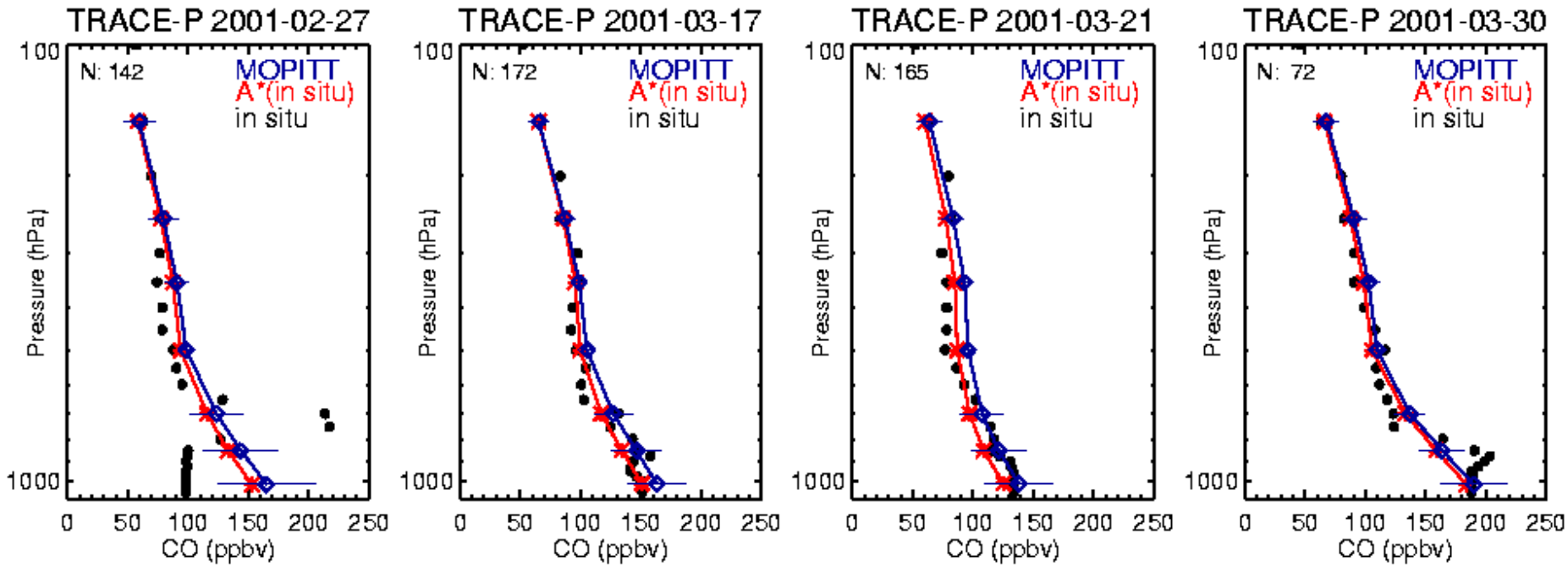
The averaging kernels for each pixel are stored in the level 2 data product.

Validation Data

MOPITT CO mixing ratio profiles are validated with **coincident** aircraft profiles:

- Regular sampling by NOAA/CMDL (Paul Novelli) at 5 sites
  - Hawaii (HAA)
  - Carr, Colorado (CAR)
  - Poker Flats, Alaska (PFA)
  - Harvard Forest, Massachusetts (HFM)
  - Rarotonga (RTA)
- MOPITT Validation Experiment (MOVE)
- Other campaigns: TRACE-P, SAFARI-2000

Validation profiles - TRACE-P



Agreement between MOPITT and TRACE-P data is quite good (~10 ppbv), although MOPITT cannot resolve thin plumes.

In situ data from G. Sachse, NASA Langley

Seasonal Variation

Ground-based spectroscopy observations

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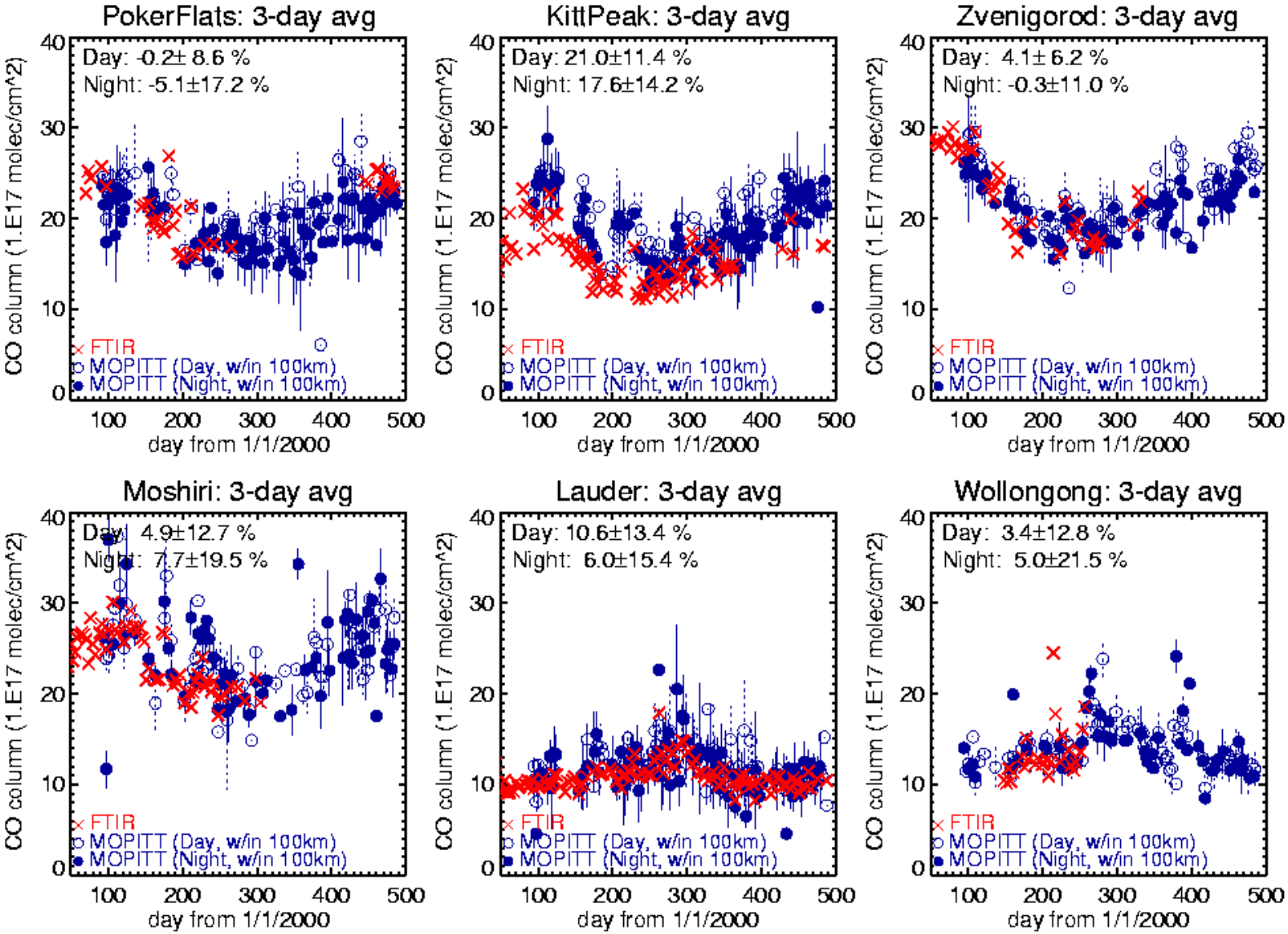

FTIR data from F. Murcray, C. Rinsland, L. Yurganov, N. Pougatchev, D. Griffith

V3 MOPITT CO at 500 hPa
Nov 1-12, 2000

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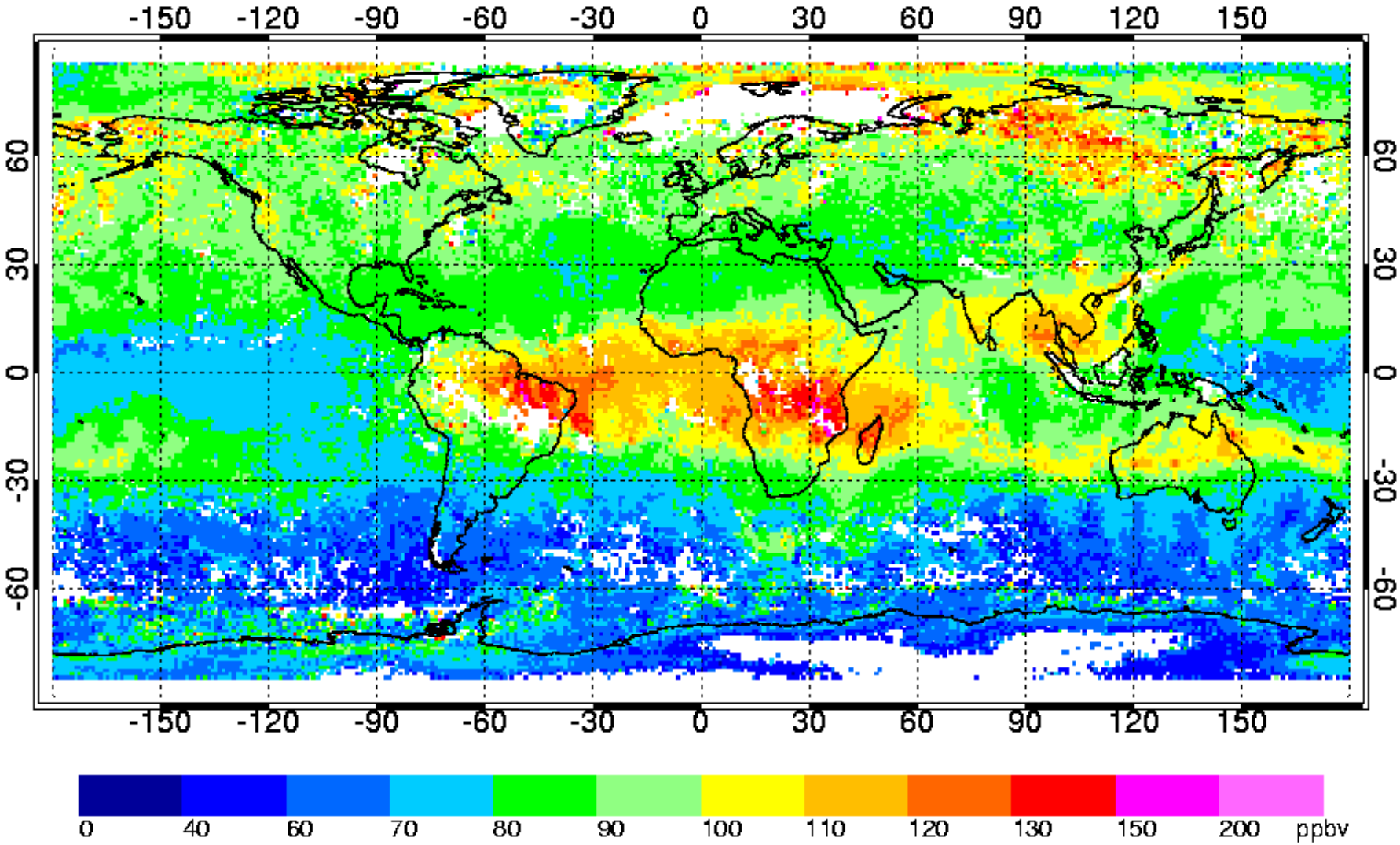

Apriori fraction < 50%

MOPITT CO Mar 1-15, 2001 at 700 hPa and 250 hPa

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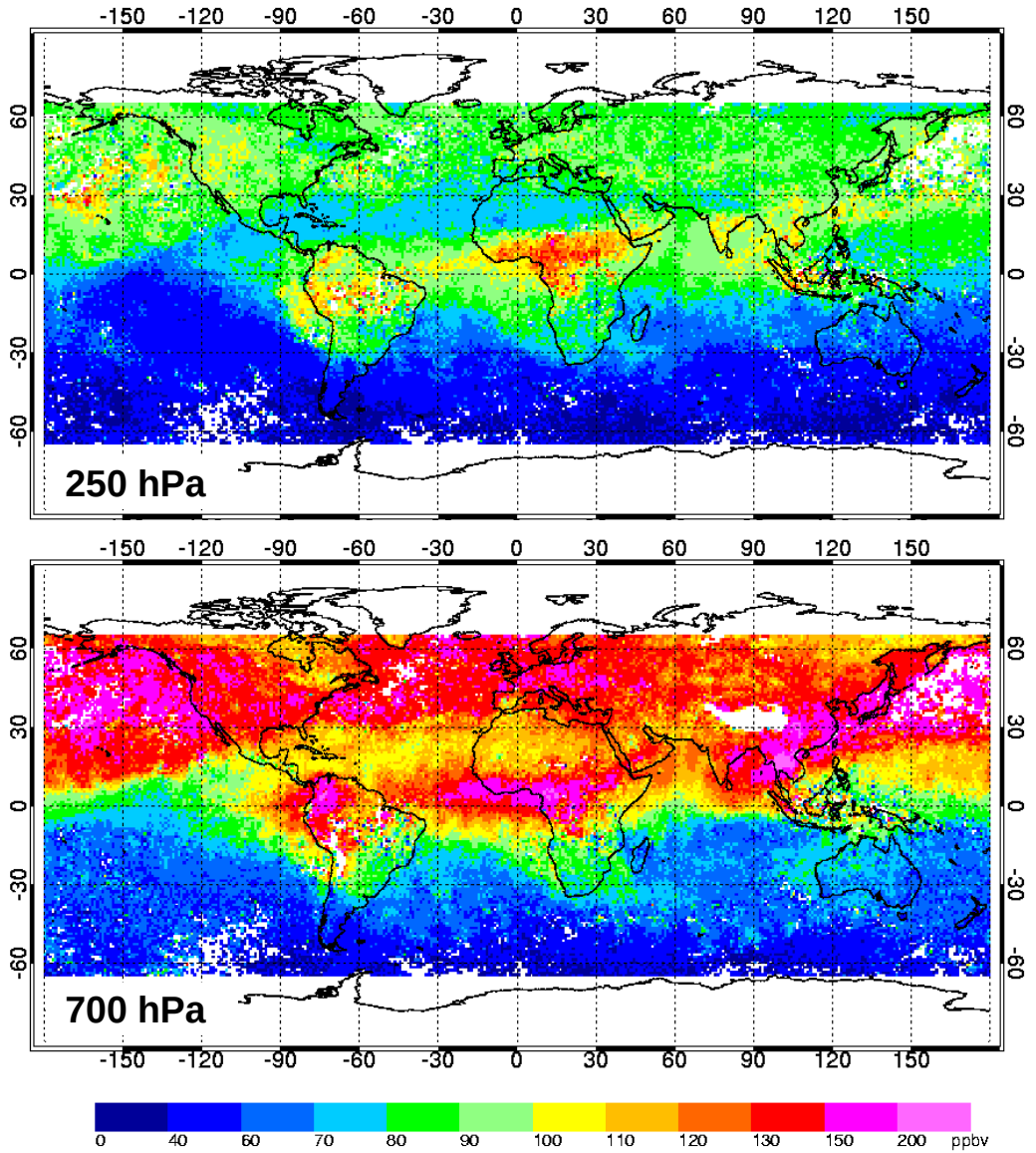
Over Africa, CO is convected to the upper troposphere. In NH, CO is more confined to the lower troposphere.

At 700 hPa, CO from African fires is comparable to levels from pollution and burning in Asia.



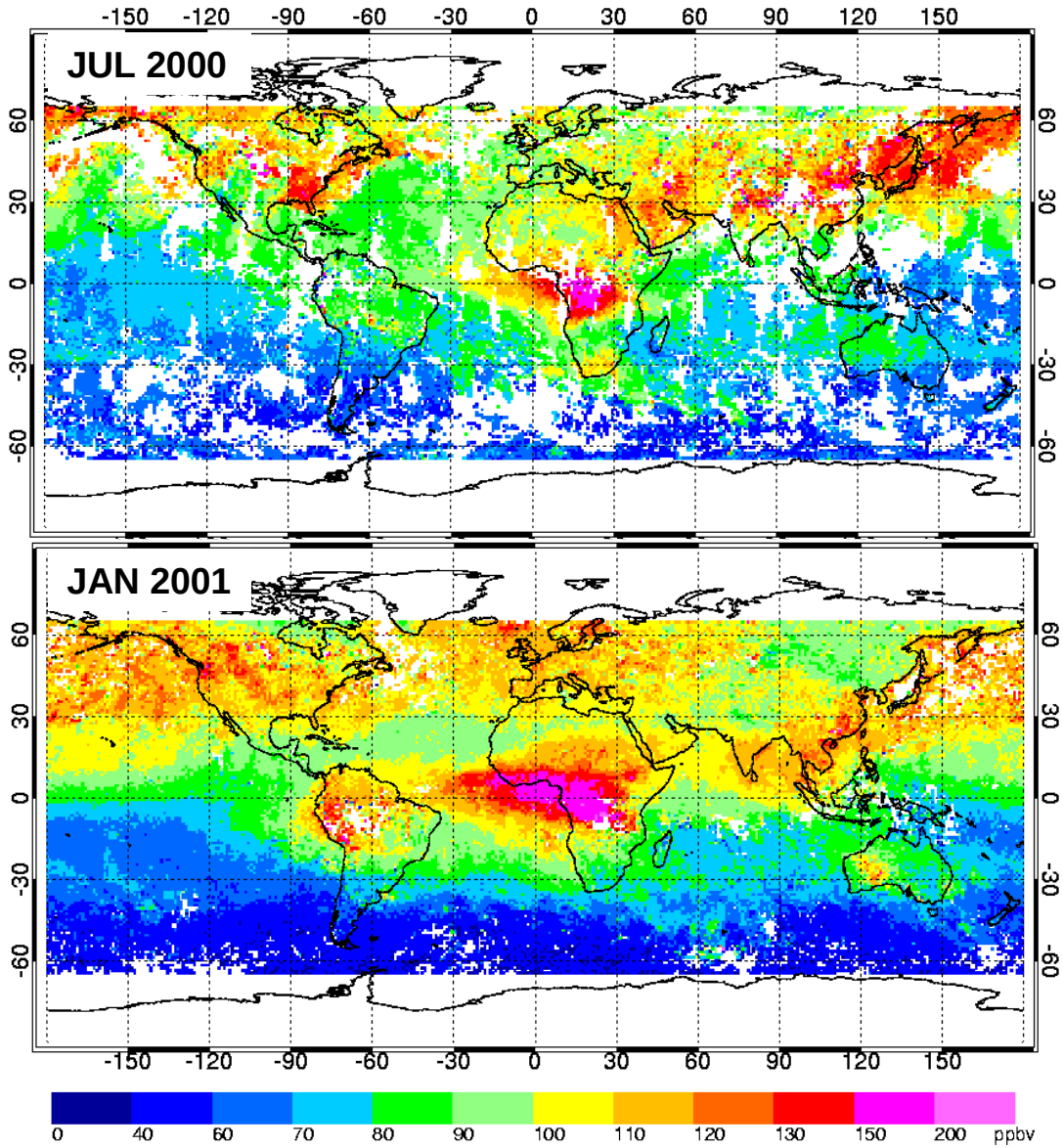
(L2V4.8)

MOPITT CO at 500 hPa
July and January

NCAR

In July, CO is high over SE US, Eastern Asia, Southern Africa, but comparatively lower over NH oceans, due to dynamics and high OH.

In January, CO accumulates in NH when OH is low. Fires in equatorial Africa are source of high CO over S. Atlantic.



(L2V4.8)

Additional Information

NCAR MOPITT web page:
http://www.eos.ucar.edu/mopitt/

- Links to data and information about data availability
- Details and example programs for calculating averaging kernels
- Quick-look images, daily and monthly

Manuscripts are in preparation:

Validation (Emmons et al.; Deeter et al.)

Description of operational retrievals (Deeter et al.)

Cloud detection (Warner et al.)

Contact the NCAR MOPITT Group