Aero-Laser VUV Fluorescence Carbon Monoxide Instrument

•Aero-Laser AL5002 has a 1-second time resolution and a 3 ppbv lower detection limit and an overall uncertainty estimate: ± (3 ppbv + 5%) .

•In-flight calibrations consist of a single calibration gas and a zero measurement using a catalytic scrubber to remove CO quantitatively from either ambient or standard gas. A full calibration cycle will be conducted approximately twice hourly.

•The secondary standard concentration will be verified using two NOAA CMDL primary standard gases.

•To operate over the full HIAPER altitude range, ambient air will be sampled through an inlet compressor. During ground calibrations, standard gas will be introduced both upstream and downstream of the inlet compressor giving confidence that the compressor does not modify the CO mixing ratio prior to analysis.

Picarro G1301 Airborne CO_2 and Methane Analyzer

The Picarro G1301 measurement principle is based on Wavelength-Scanned Cavity Ring Down Spectroscopy (WS-CRDS). The analyzer maintains high linearity, precision, and accuracy over changing environmental conditions with a 0.2-second time resolution.

- Precision: 250 ppbv CO2 and 3 ppbv CH4 over 0.2 sec averaging time.
- The NCAR version has been ruggedized for aircraft use.
- The instrument utilizes an inlet compressor (shared with VUV CO instrument).
- In-flight calibrations are conducted using a working standard and a catalytically scrubbed zero trap for background subtraction. A series of NOAA ESRL/GMD primary standard compressed gases are used in lab measurements to quantify the concentration of the working standard cylinder.

Sources

Continental Surface:

- Natural and anthropogenic Combustion (CO, CO_2 , CH_4)
- Natural gas fugitive emissions (CH_4)
- Microbial activity (CO_2 , CH_4)

Marine:

- Air-sea exchange (CO , CH_4 ,CO_2)
- Clathrates (CH_4)
- Dissolved organic matter photolysis (CO)

Atmosphere:

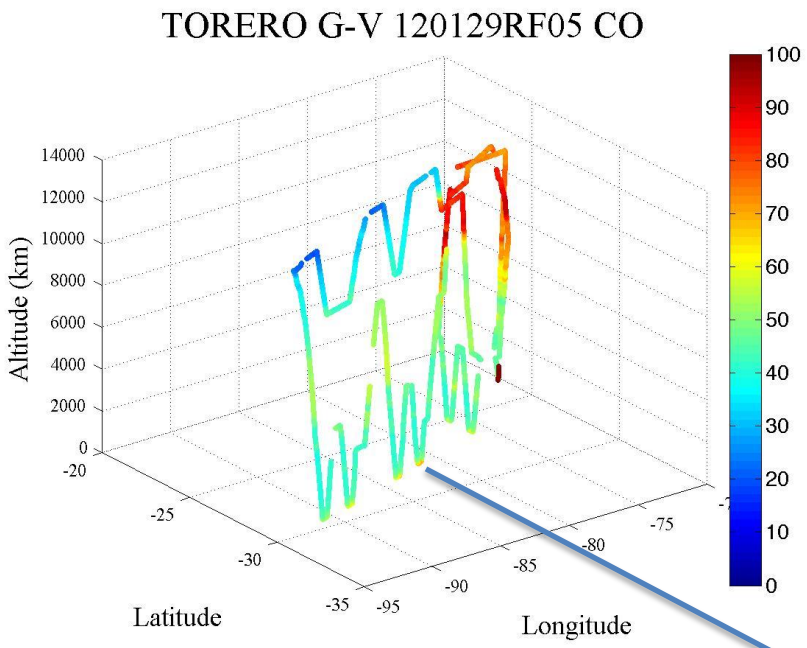
- Photochemical HC oxidation (CO, CO_2)
- Advection (CO, CO_2 , CH_4)

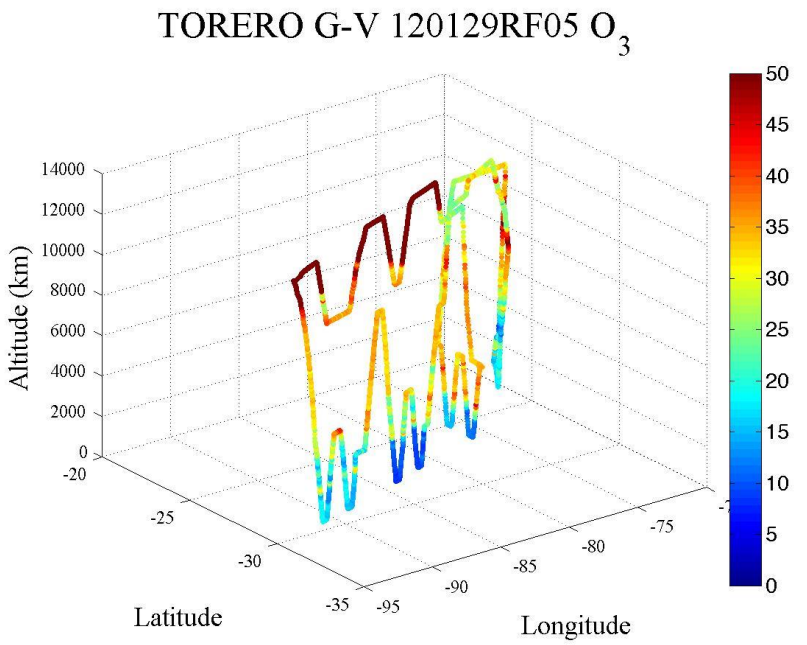
Sinks

- Air-sea exchange (CO_2)
- Photosynthesis (CO_2)
- Methanotrophic bacteria (CH_4)
- Photochemical oxidation (CO, CH_4)

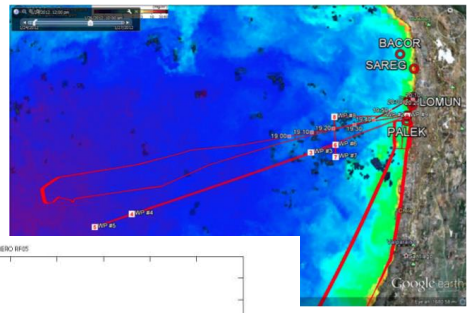
In combination with other tracers

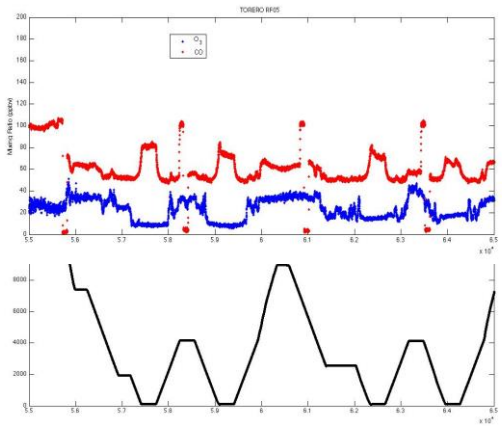
- establish relative stratospheric and tropospheric influence
- infer relative contributions of transport and chemical or physical transformations

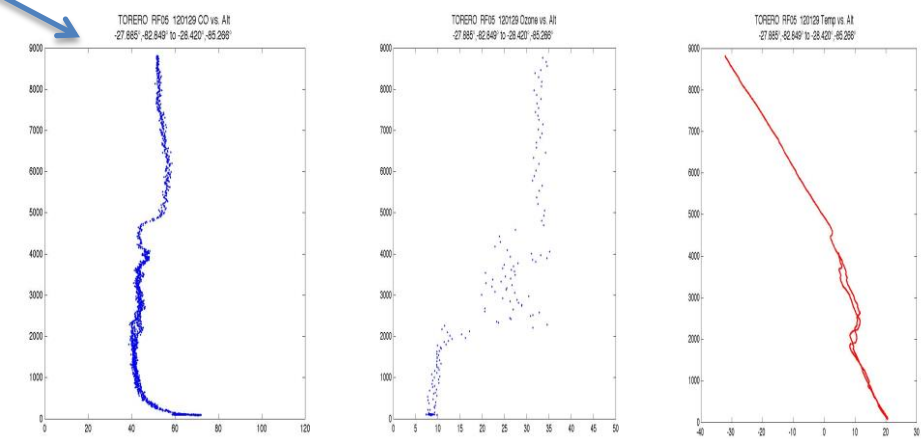




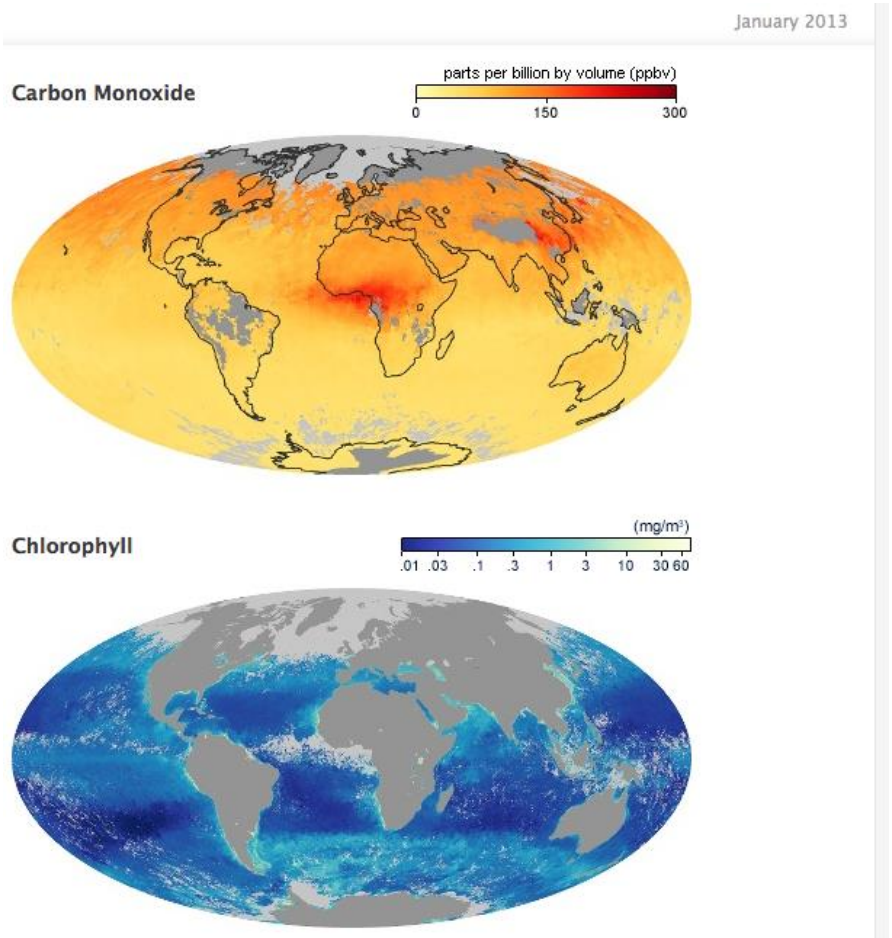
Flight track overlaid on chlorphyll-a distribution from satellite data (Courtesy of Rainer Volkamer)

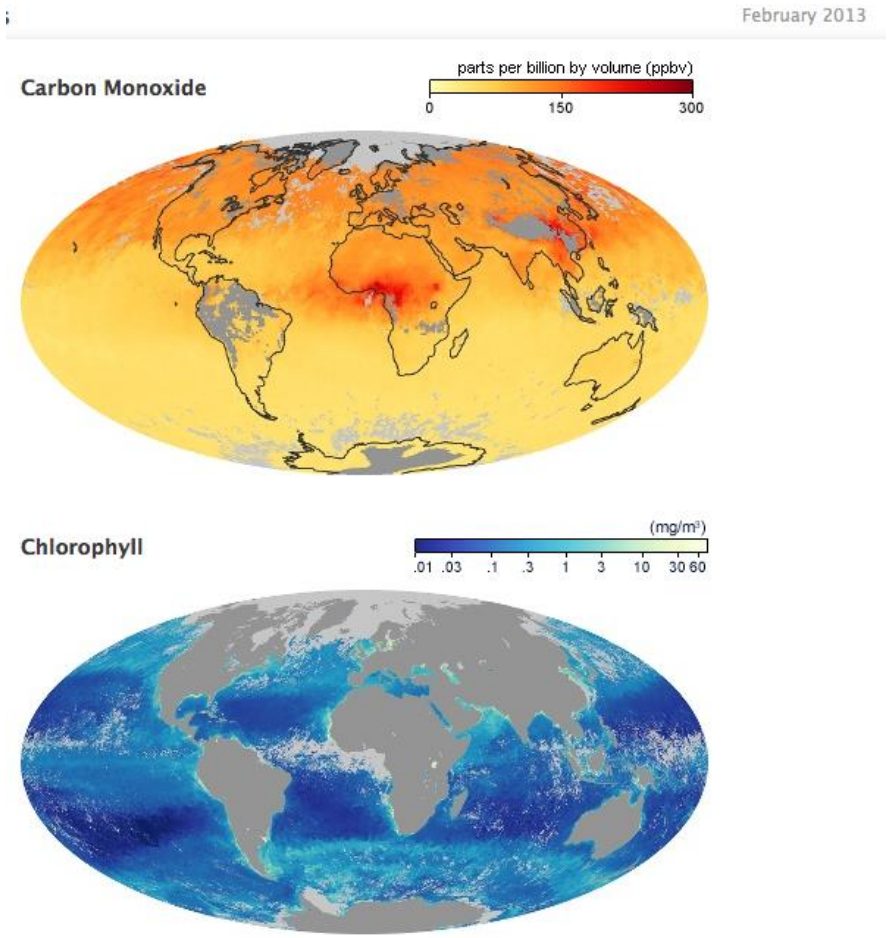




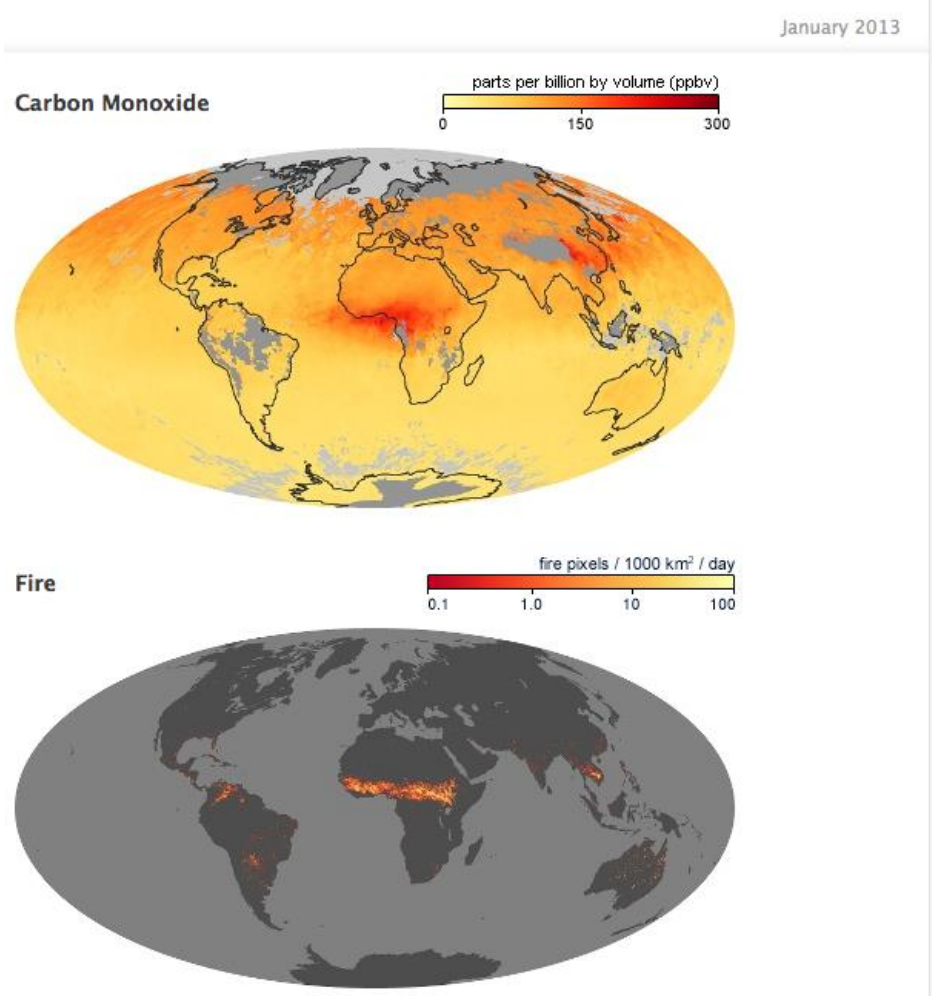


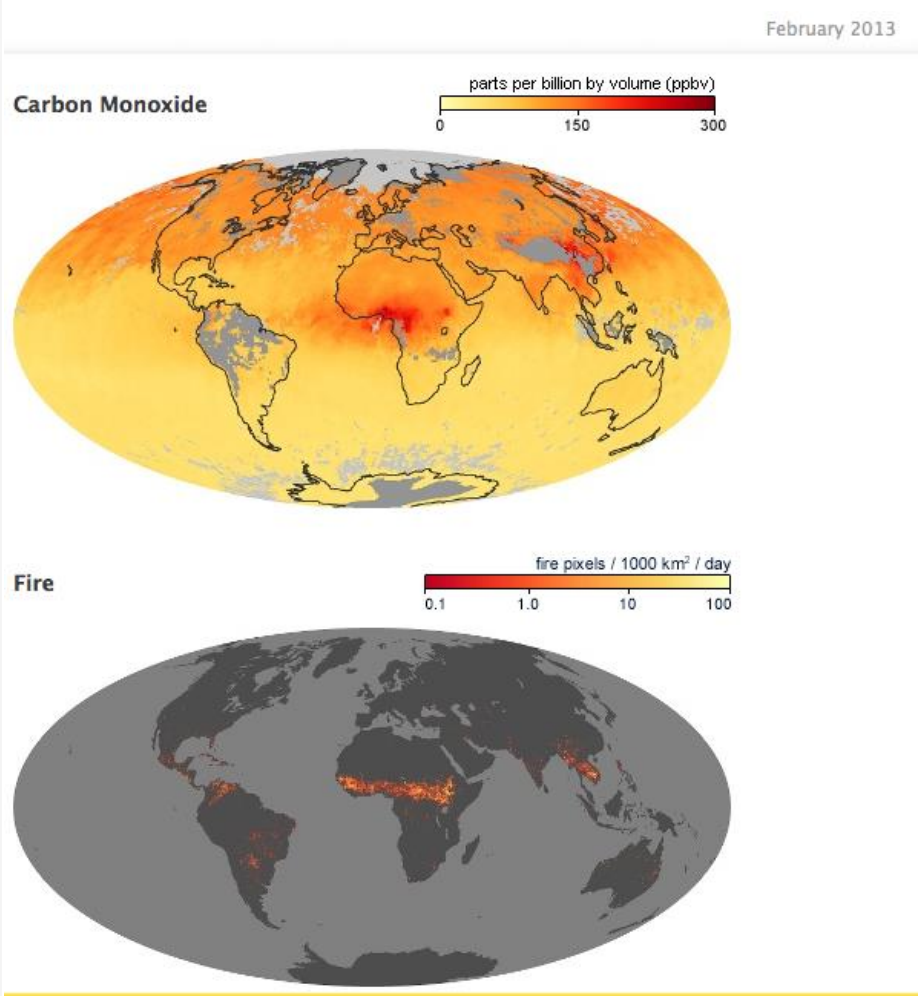
2 profiles of CO, O_3, and Temperature





January and February, 2013, global NASA MOPPITT CO and MODIS Chlorophyll maps





January and February, 2013, global NASA MOPPITT CO and MODIS Fire maps