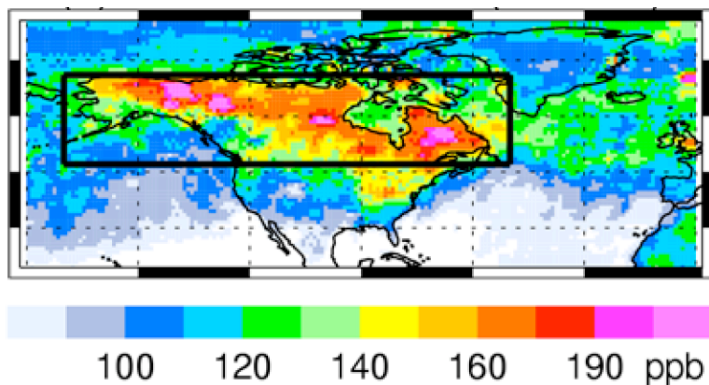


Effects of 2004 Yukon Forest Fires Reach Across North America

What happens to the emissions from large forest fires?

Large forest fires occurred in the summer of 2004 in the Yukon region in Alaska and western Canada. These fires emit large quantities of trace gases and smoke particles to the atmosphere. How far are these gases and particles transported in the atmosphere? How are they removed from the atmosphere? Can these smoke plumes affect the global atmospheric composition, with consequences for air quality and climate?

Satellite measurement of carbon monoxide (CO) in July 2004 from the MOPITT instrument. High levels (in red) show the smoke plume from the forest fires.



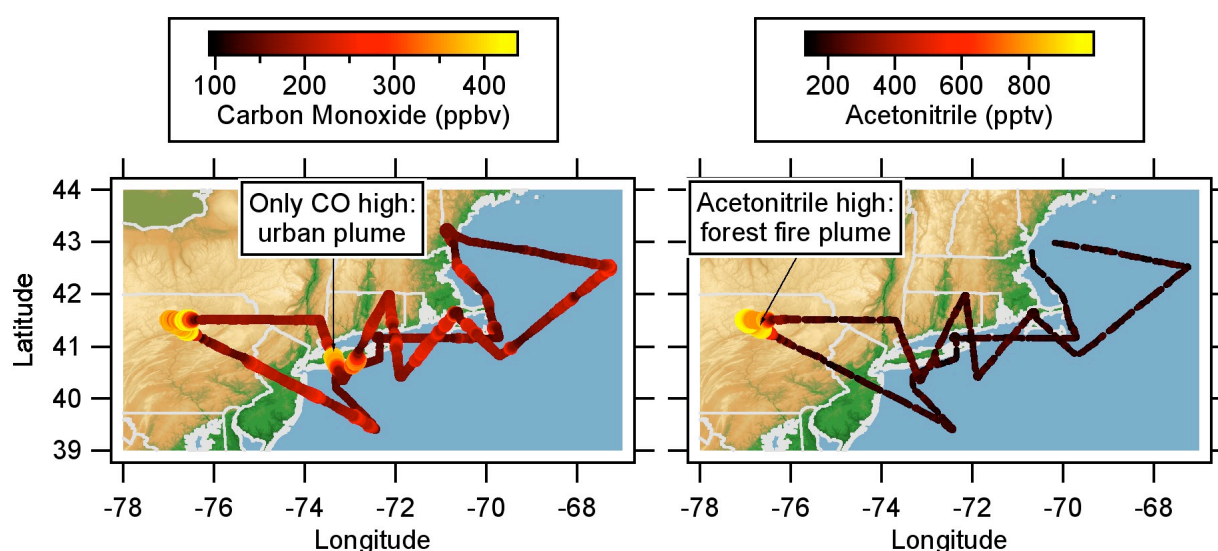
What did we do during ICARTT?

- Measured the composition of the Yukon fire plumes from several research aircraft and surface sites as they were transported to New England.
- Observed the smoke plumes from space using satellite instruments.
- Studied how the smoke was transported by comparing the observations with atmospheric transport models.
- Estimated the total emissions of trace gases from the forest fires.
- Studied the chemical transformation and removal of trace gases and smoke particles by intercepting the plumes at different distances from the source.



What did we learn?

1. The emissions from the forest fires were large. The total emissions of carbon monoxide (CO), for example, were similar to urban emissions from the entire United States for a whole month.
2. The smoke plumes remained relatively intact and were observed thousands of miles away from the fires. The figure shows an example. The map on the left shows the flight track of the NOAA WP-3D on July 20. High CO (in yellow) was seen at 3 km altitude over Pennsylvania and at 1 km over Long Island. Acetonitrile is a very specific indicator molecule in fire plumes. The map on the right shows that acetonitrile was only high over Pennsylvania. This proves that the air over Pennsylvania came from forest fires, and the air over Long Island from urban sources.



3. The transport of the smoke plumes was described well by atmospheric models. In some cases we had to assume that the heat generated by the fires lifted the air to high altitudes (10 km), allowing long-range transport and dispersal of the smoke.
4. In a few cases the smoke plumes were mixed down to the surface, which would affect air quality if it happened over urban areas.

What does it mean?

1. Forest fires are a large source of trace gases and particles in the Earth's atmosphere.
2. Forest fires can have large episodic effects on the atmosphere thousands of miles away from the sources. The effects can make it more difficult to meet air quality standards.

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