

Long Range Transport: The NOAA Baseline Observatory Perspective

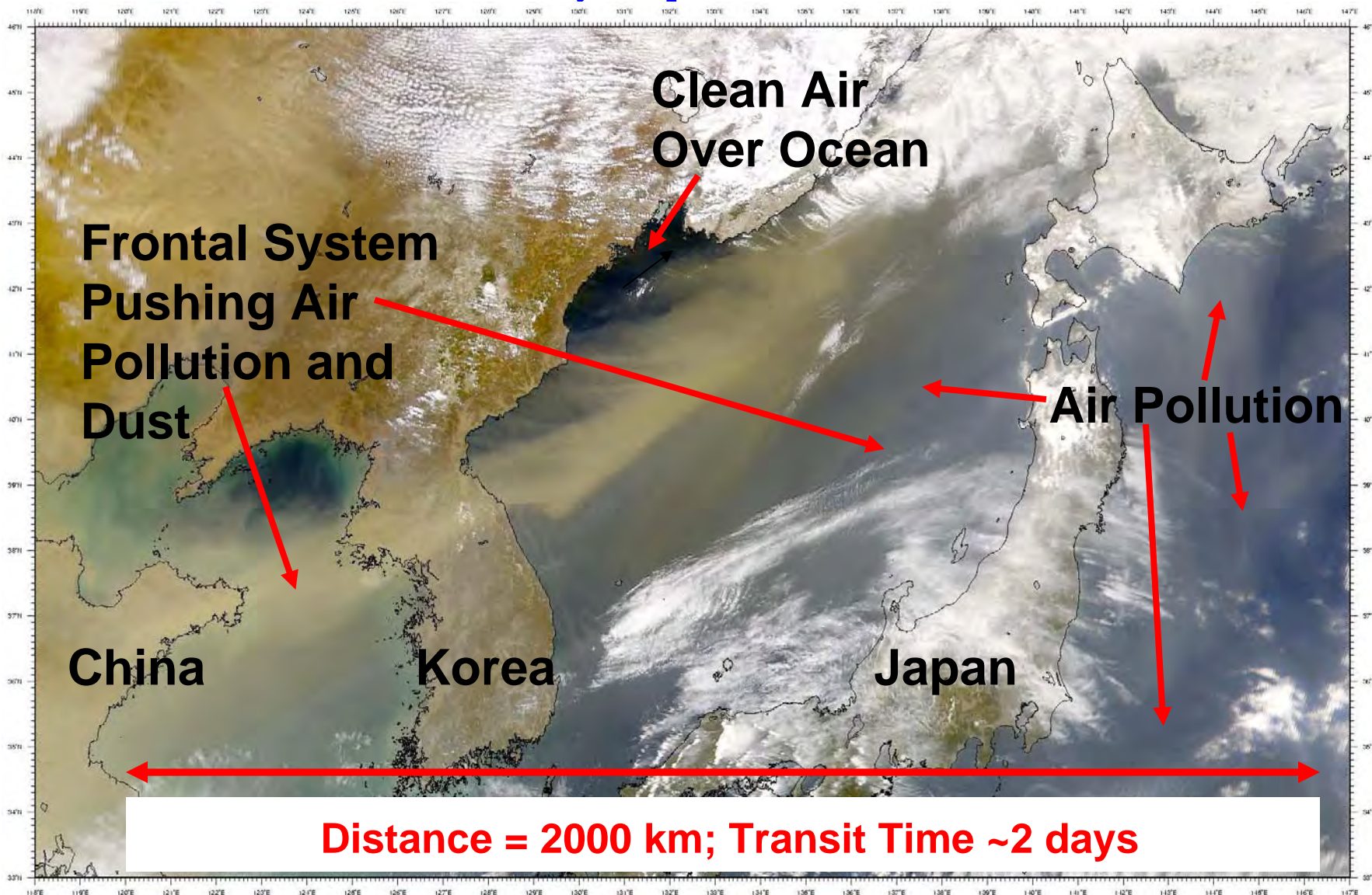
Presented by Russ Schnell for the
ESRL Observatory and Global Network Operations Group

Mission: Acquire and make freely available accurate, long-term records of atmospheric **gases, aerosols and solar radiation** which affect *climate, the ozone layer and baseline air quality*.

Means: Operate six staffed remote atmospheric **baseline observatories** that are relatively free of regional anthropogenic effluents.

Outcome: Some of the longest and best calibrated **long-term data sets** on the composition and radiative properties of the global atmosphere.

Dust and Air Pollution Flowing Out of Asia, April 2001



Mauna Loa Aerosol Samples: Passage of a Pollution/Dust Event, April 1997



**Air Pollution
Pushed by
the Front**

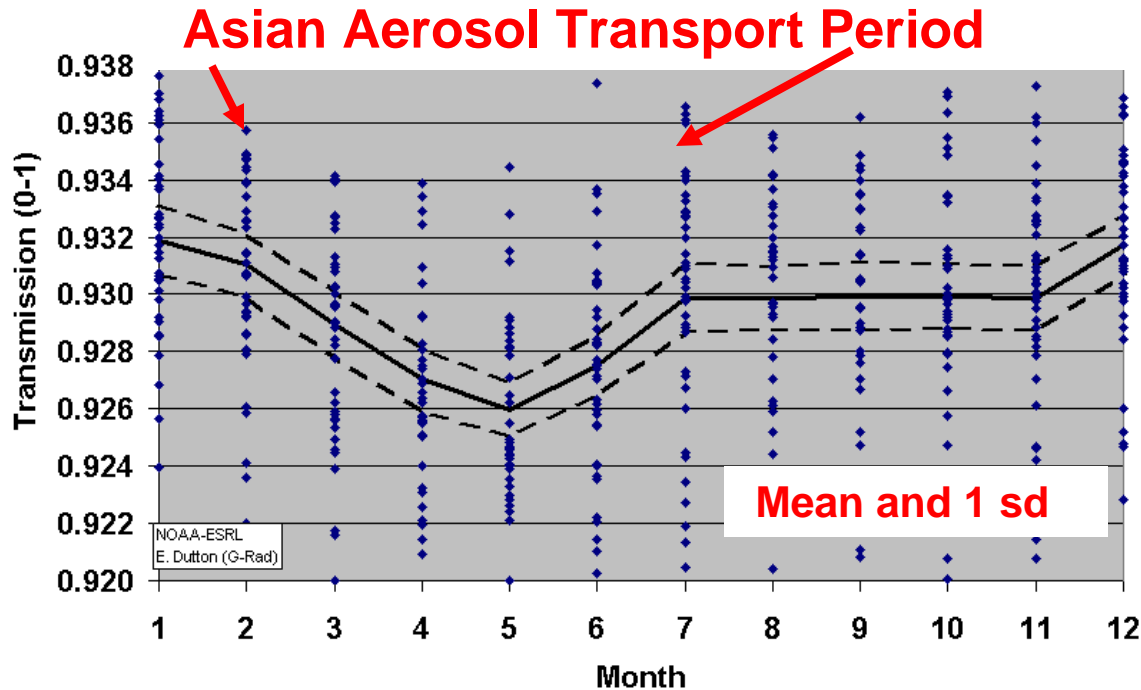


**Air Pollution
and Dust Mix**

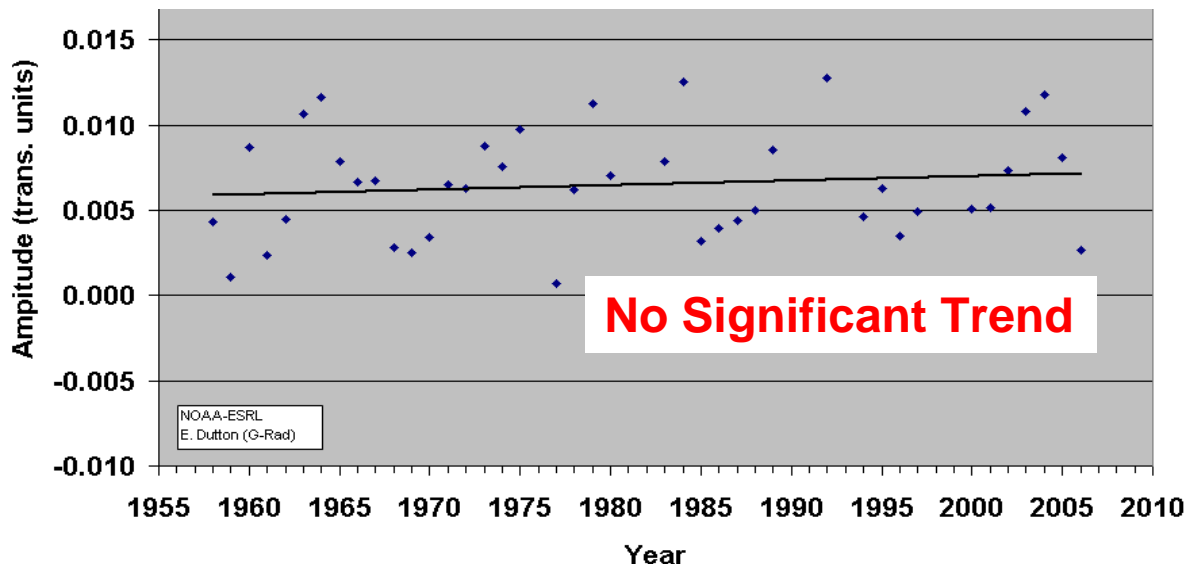
In the Dust Front



Aerosol Radiative Effects: MLO

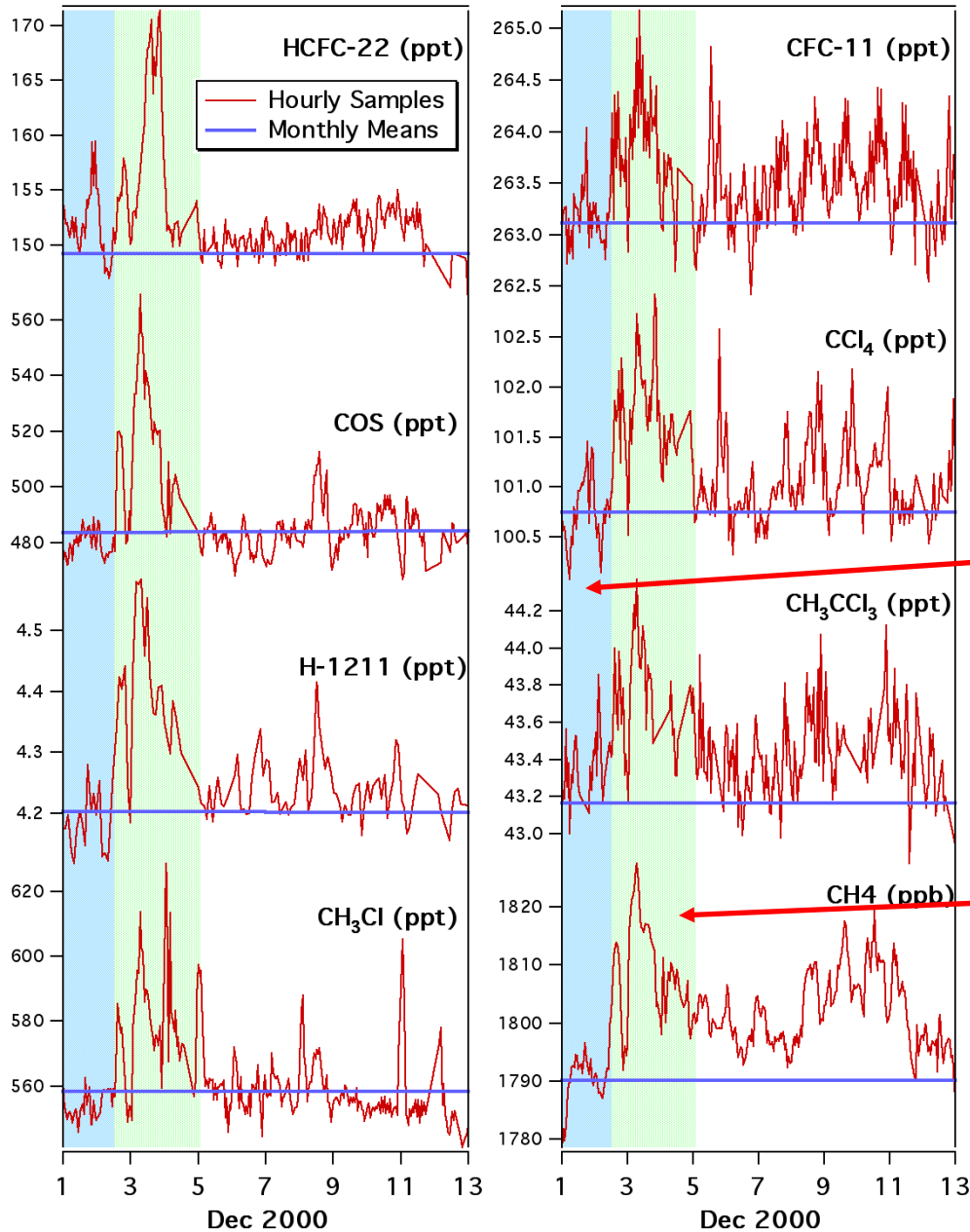


Monthly average solar transmission for cloud free days: 1957-2007. This is the **longest such record on earth.**

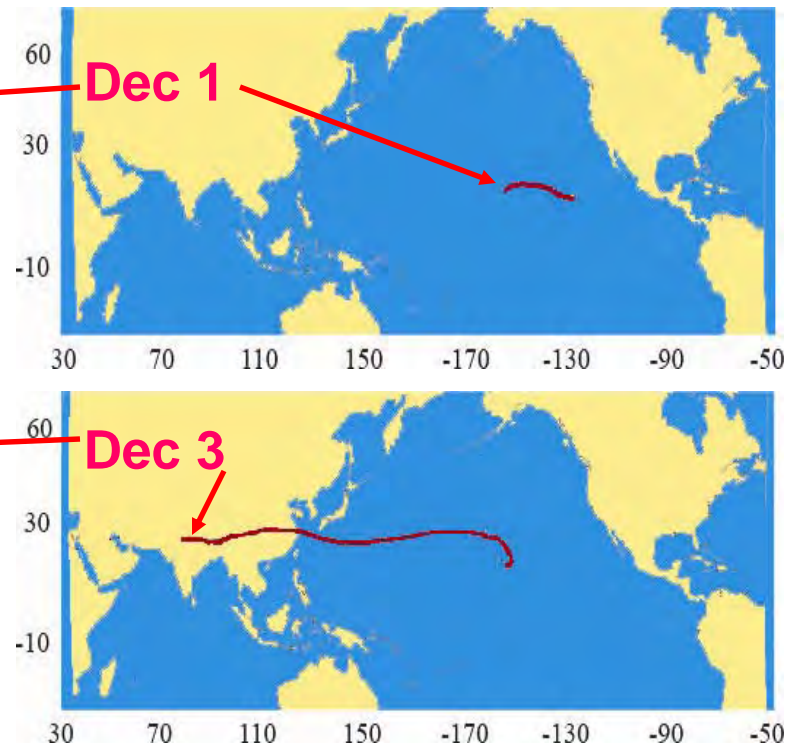


Annual amplitude of solar transmission shown as the difference between clean and polluted times of the year: **1957 to 2006.**

Anthropogenic Gases From Asia to Mauna Loa

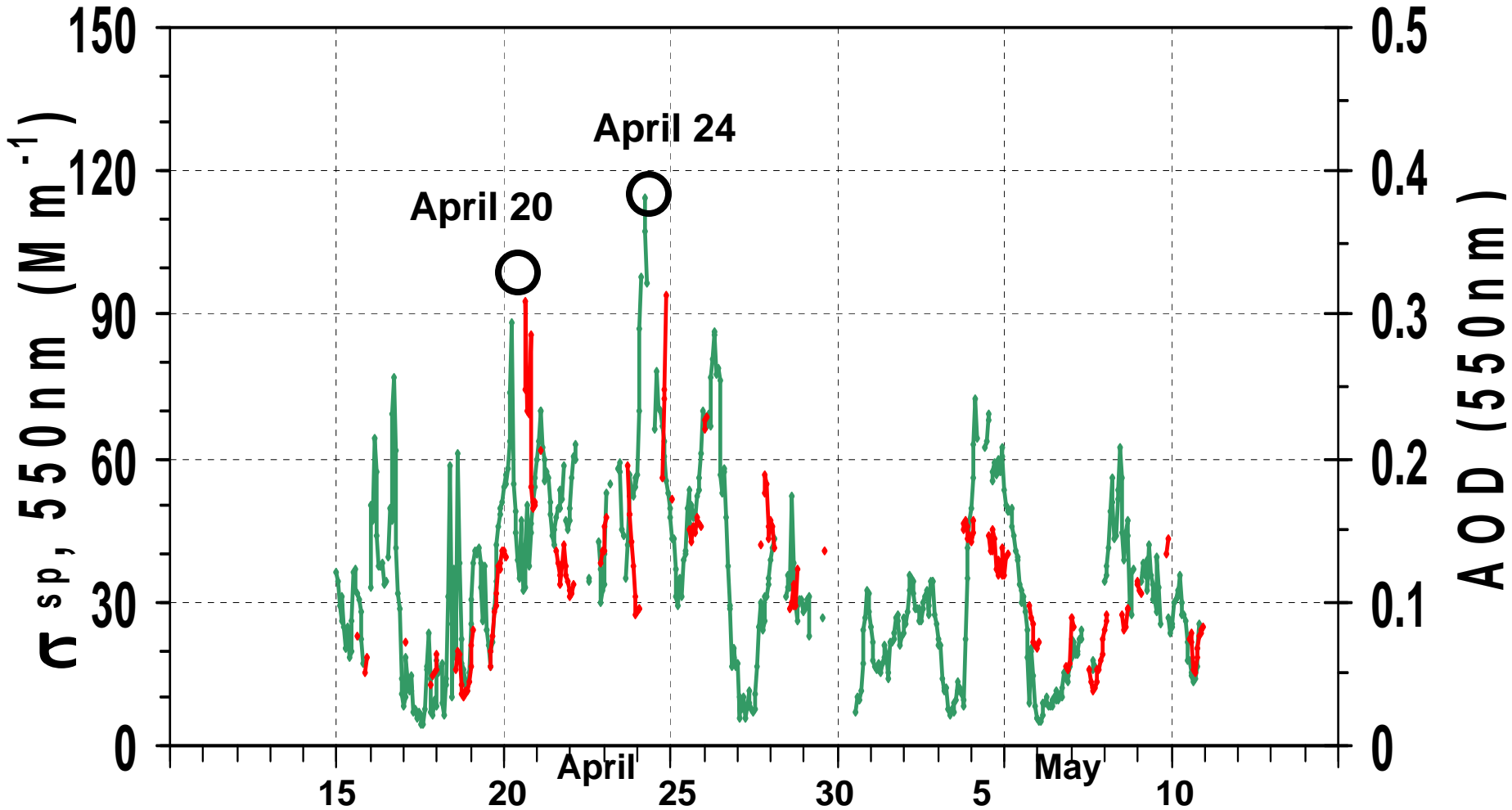


On December 1, 2000 the 5 day trajectories to MLO ended in the Pacific. On December 3 they came from **India across China** to MLO. Aerosol levels were not elevated at MLO.

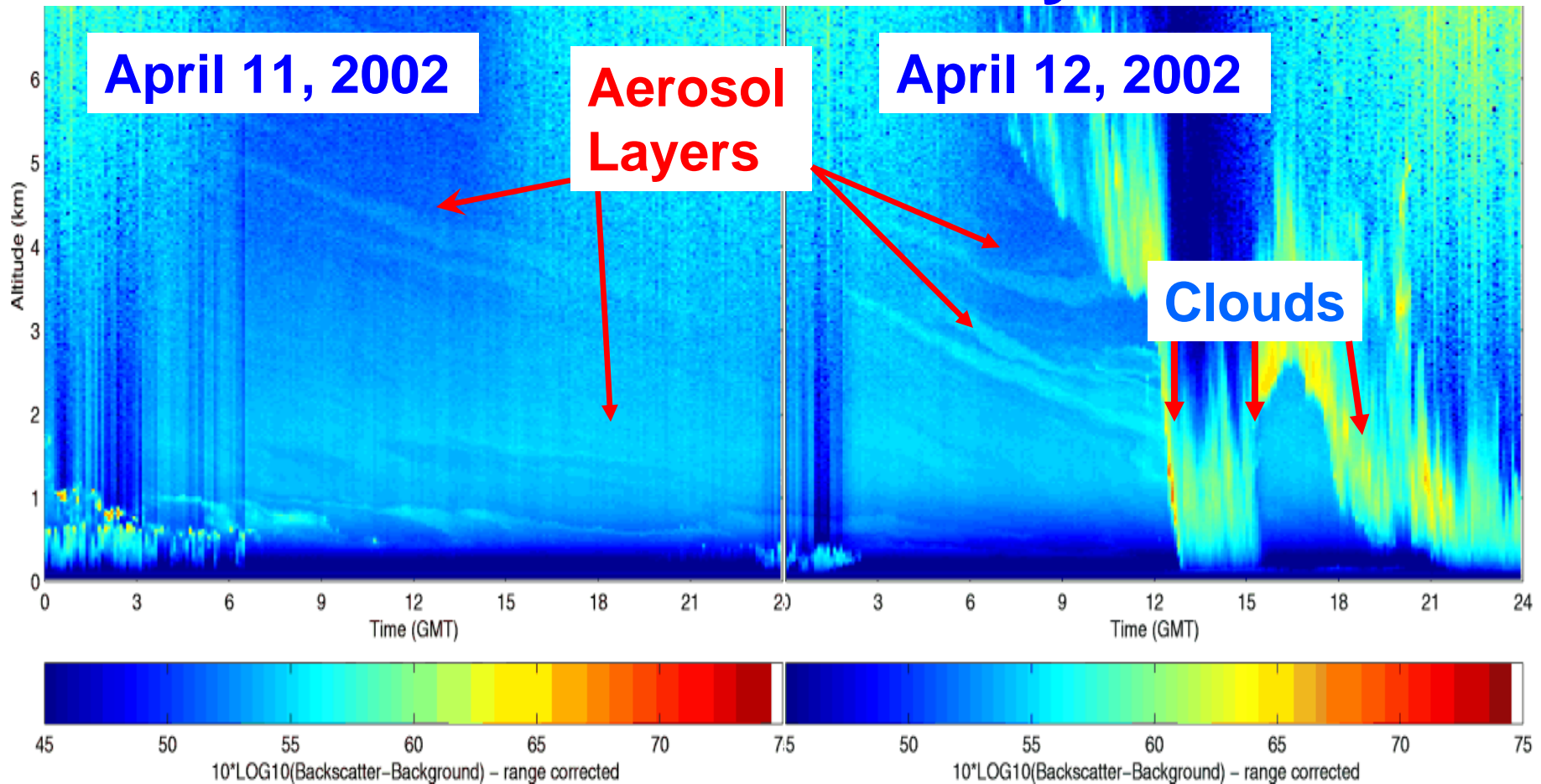


Asian Dust and Air Pollution, Trinidad Head, California, April 2002

Light Scattering (green), Optical Depth (red)

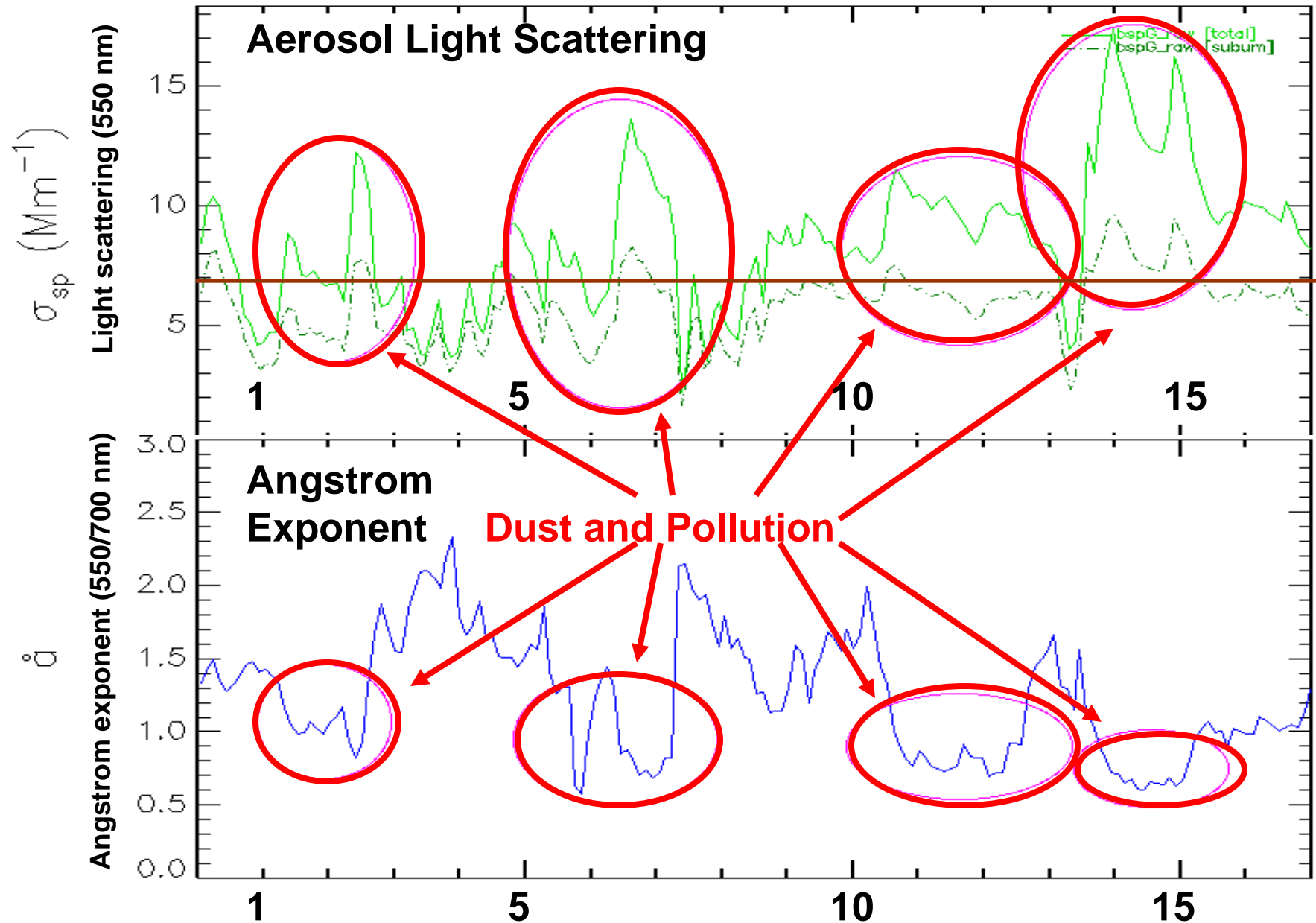


Lidar Observed Asian Aerosols, Barrow Observatory



- Asian gases and aerosols flow to the Arctic.
- The gases and aerosols may be transported in thin layers.

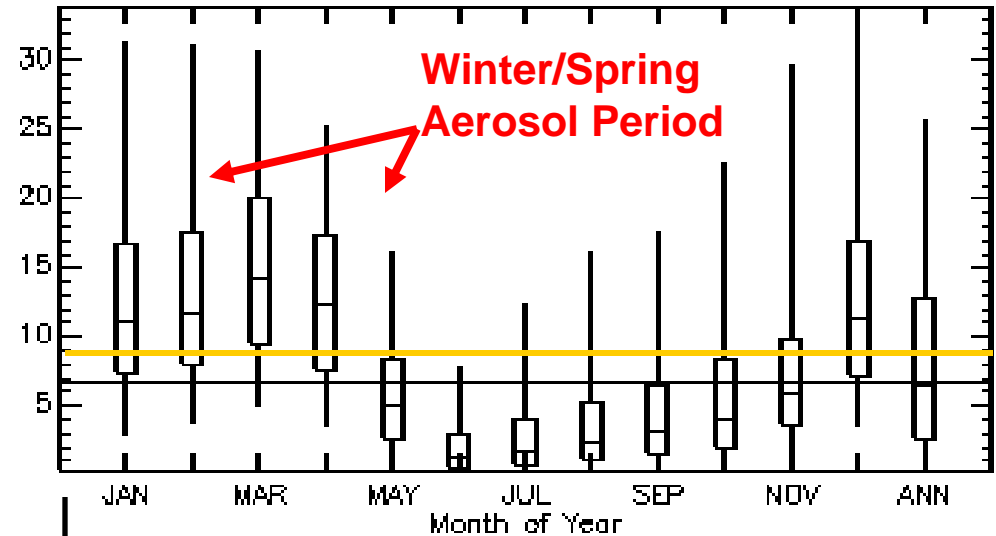
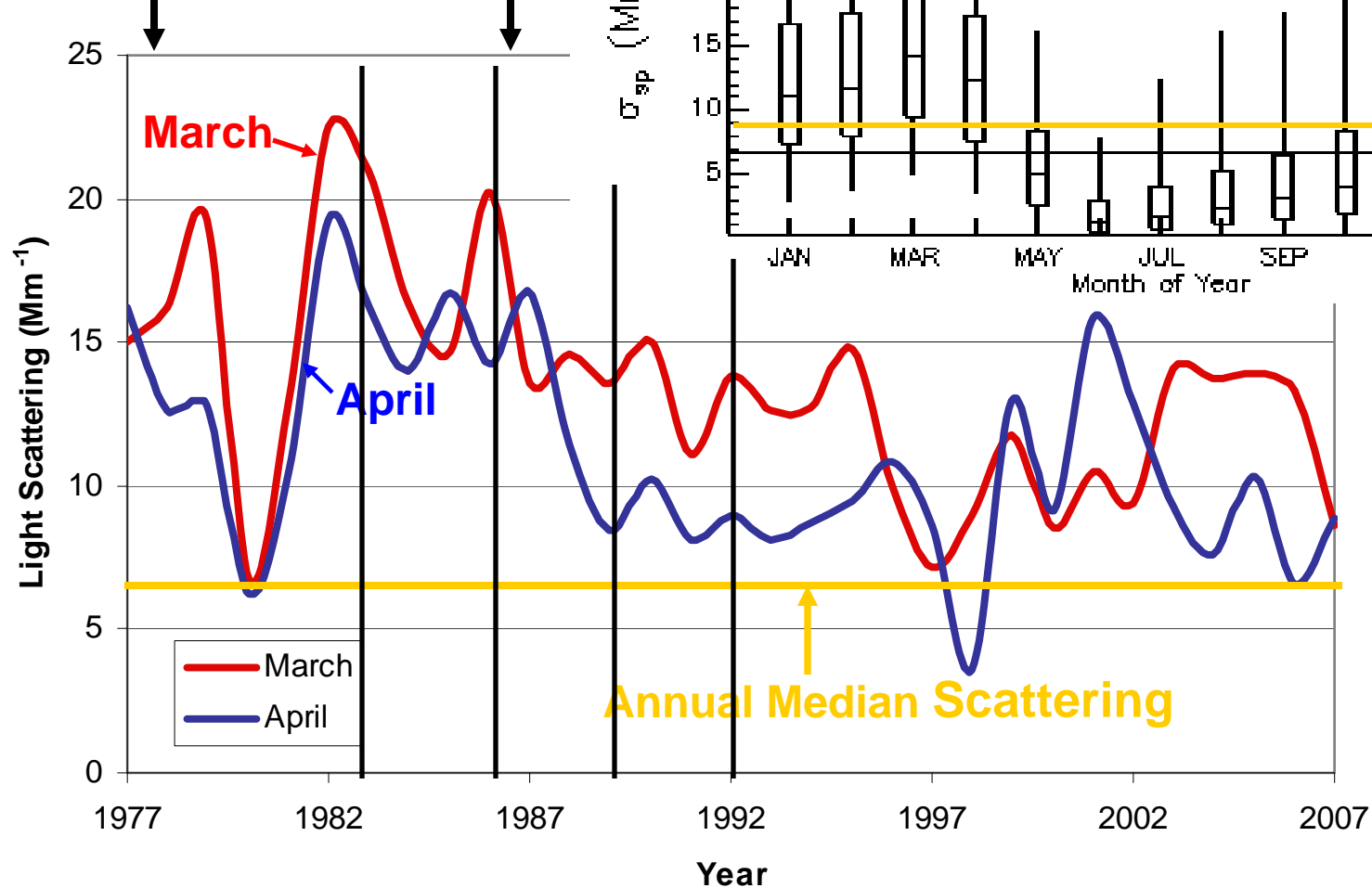
Asian Aerosols , Barrow, AK, April 2002



Barrow Aerosol

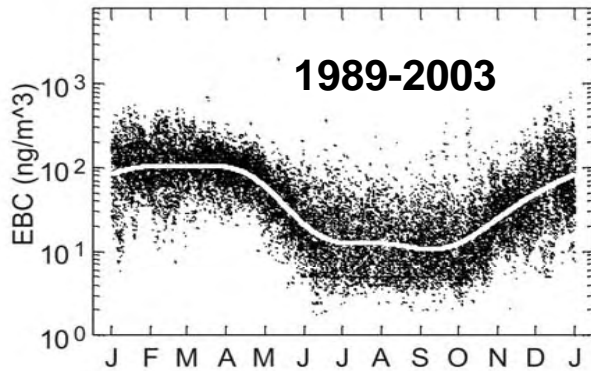
Annual Light Scattering

Monthly Averaged Scattering
March and April, 1977-2007

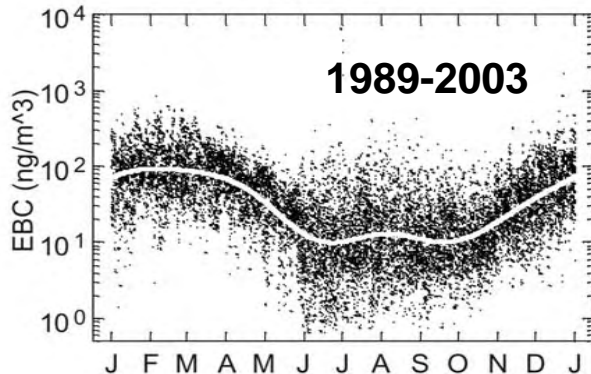


Arctic Black Carbon and Aerosol Optical Depth

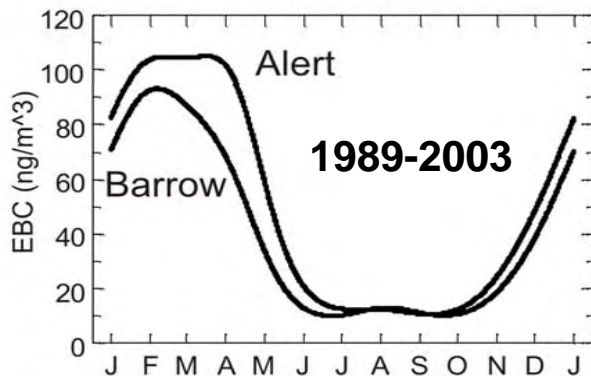
Alert



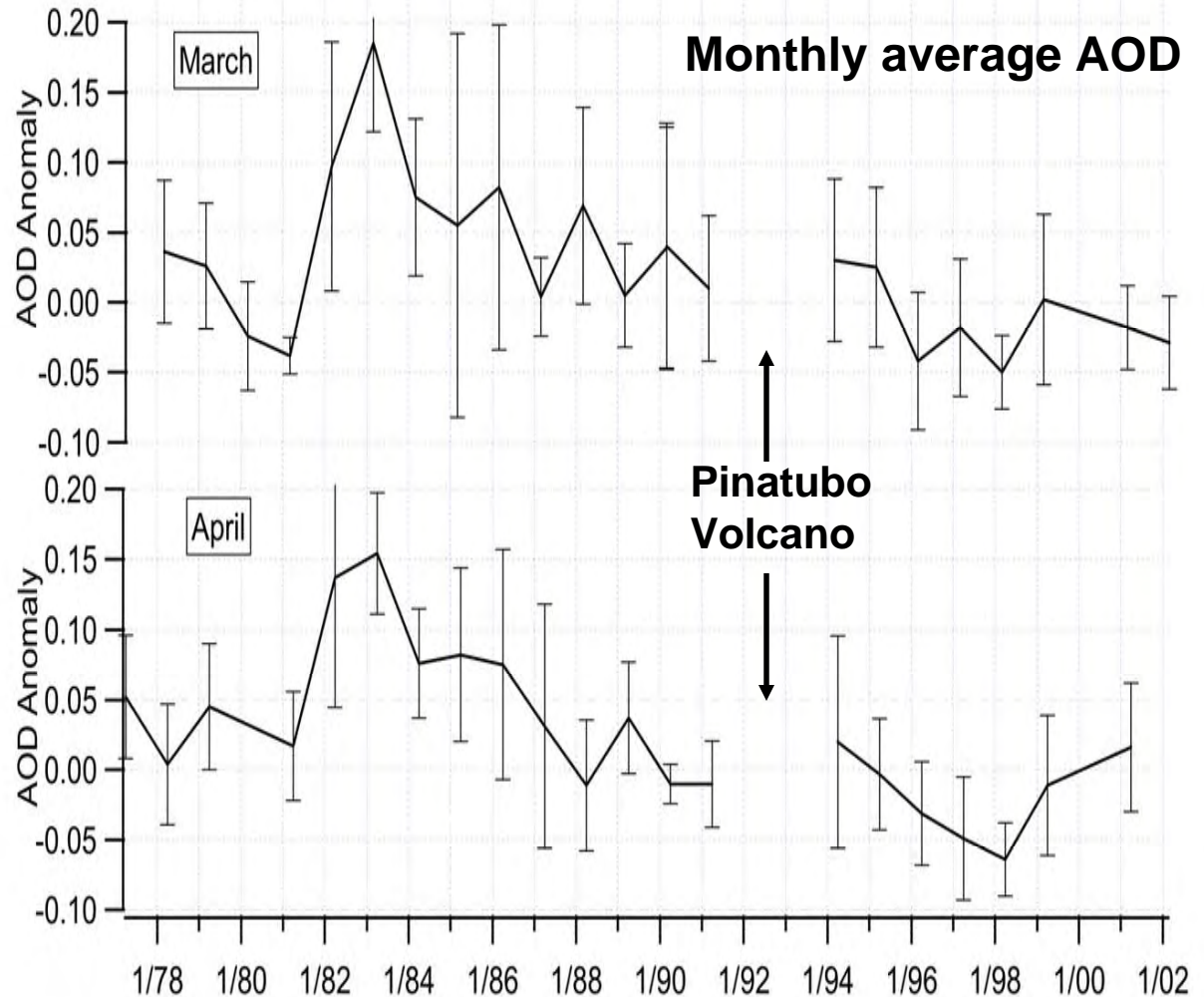
Barrow



Alert and Barrow



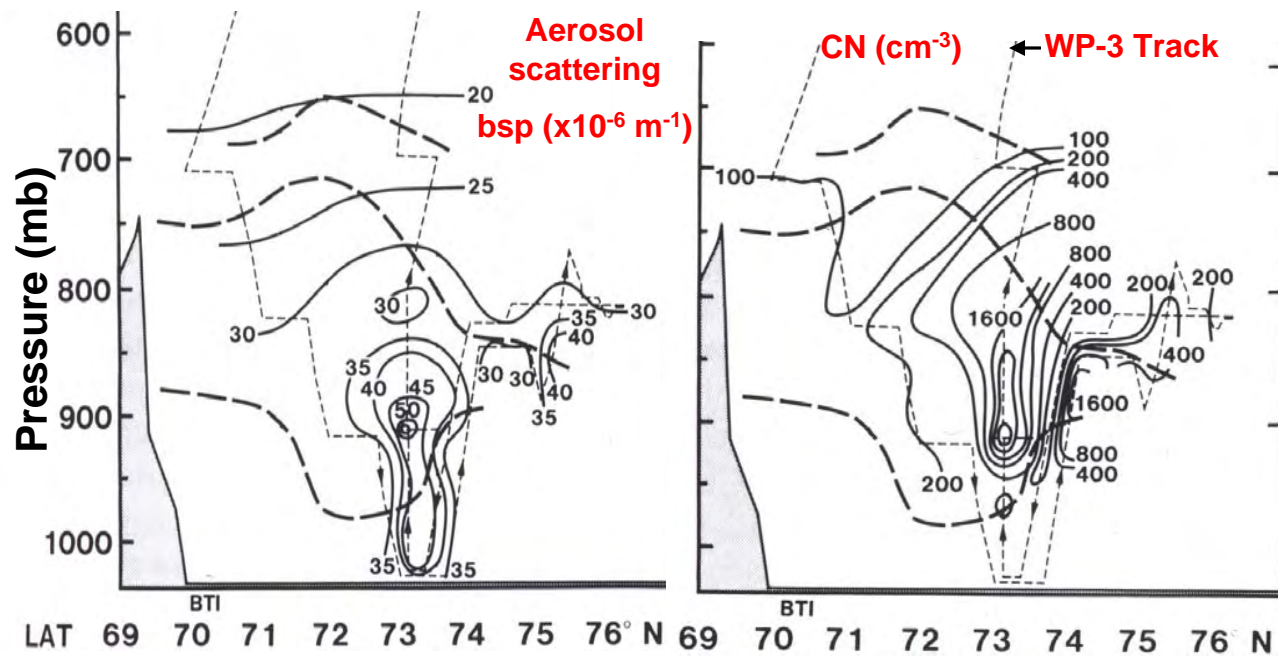
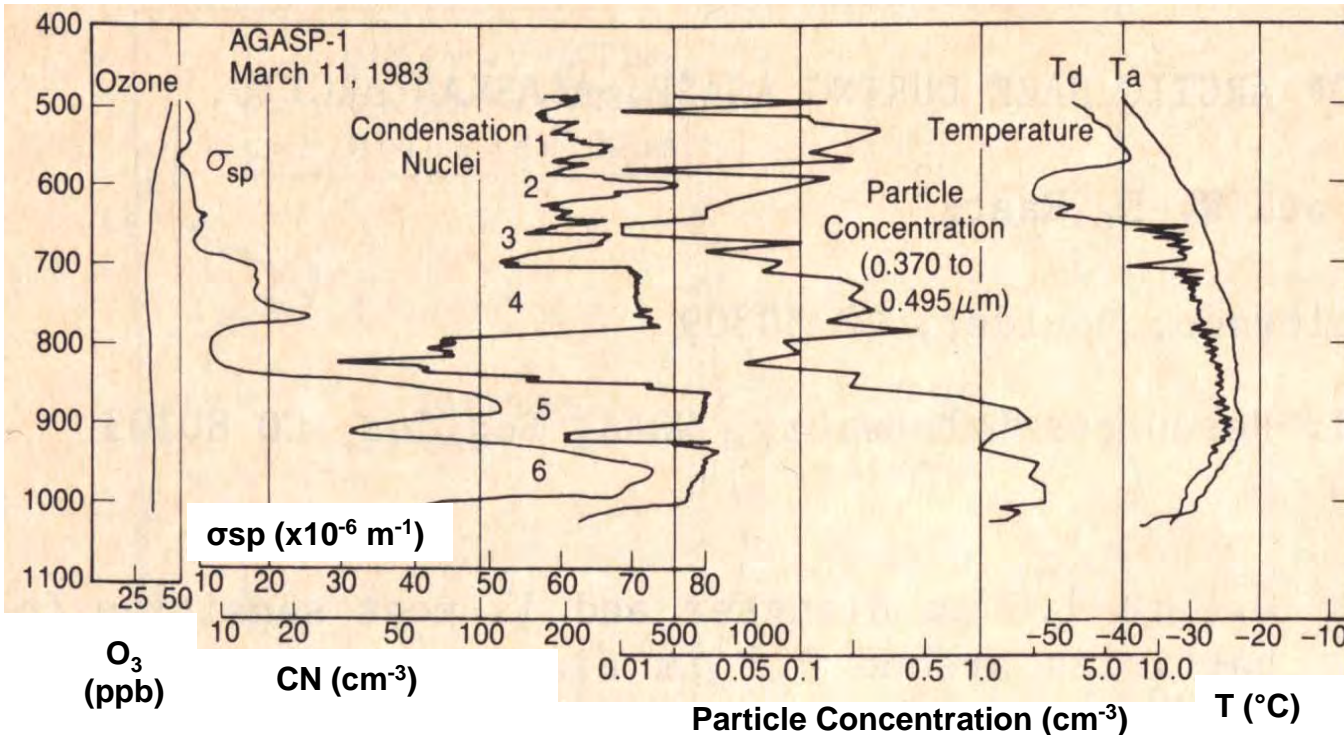
(left) Annual black carbon at Barrow and Alert.
(below) Barrow aerosol optical depth (1978-02).



Arctic Haze

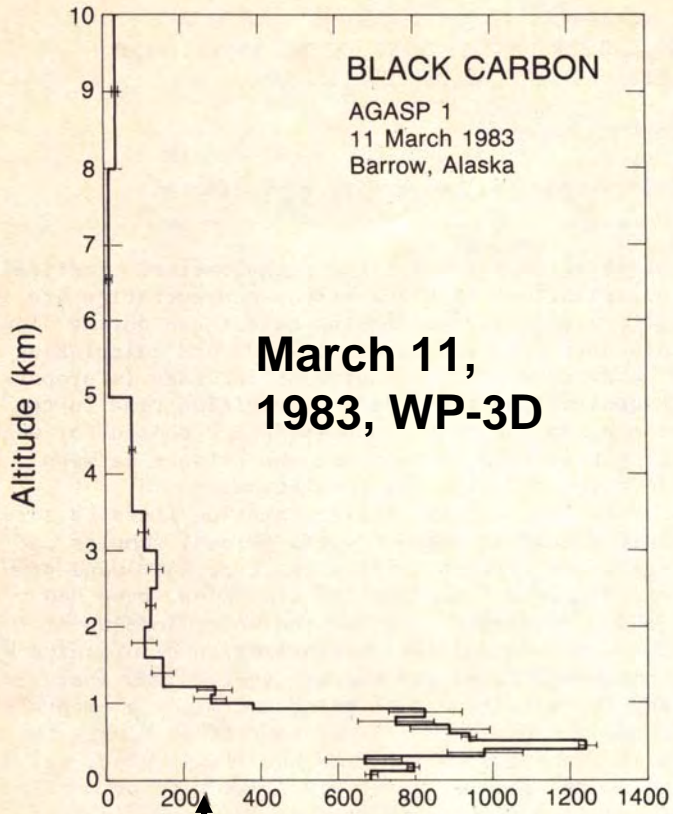
Six distinct layers over Barrow, WP-3, March 11, 1983.

Schnell and Raatz, G.R.L., 1985.

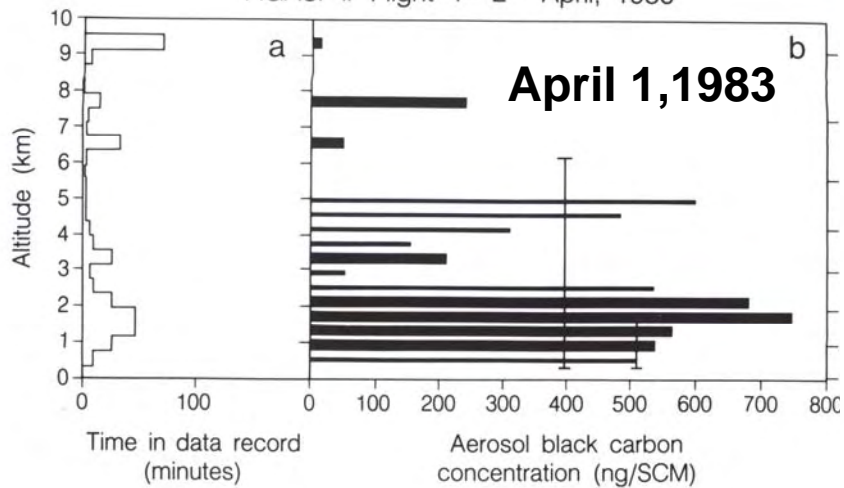


Plume of gas and aerosol at 140W, north of Alaska: Plume source was likely 8,000 km distant in the USSR. Herbert et al., Jr. Atmos. Chem., 1989.

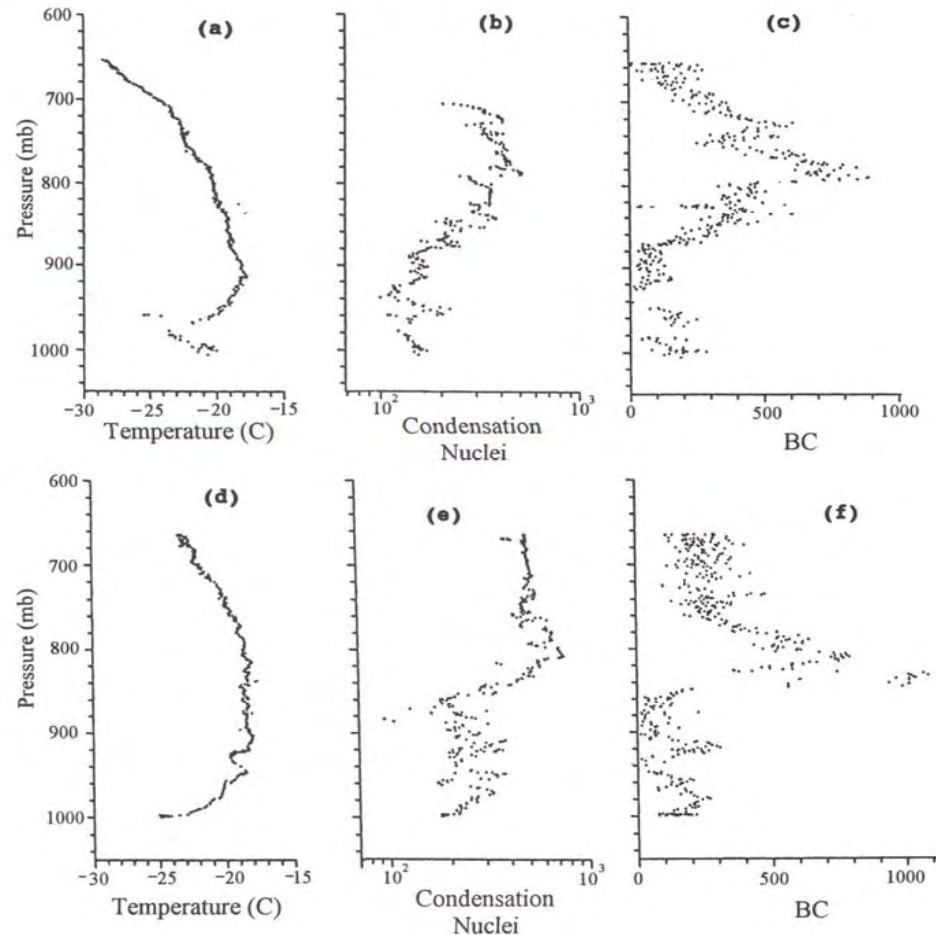
Arctic Black Carbon Profiles



AGASP-II Flight 1 - 2nd April, 1986

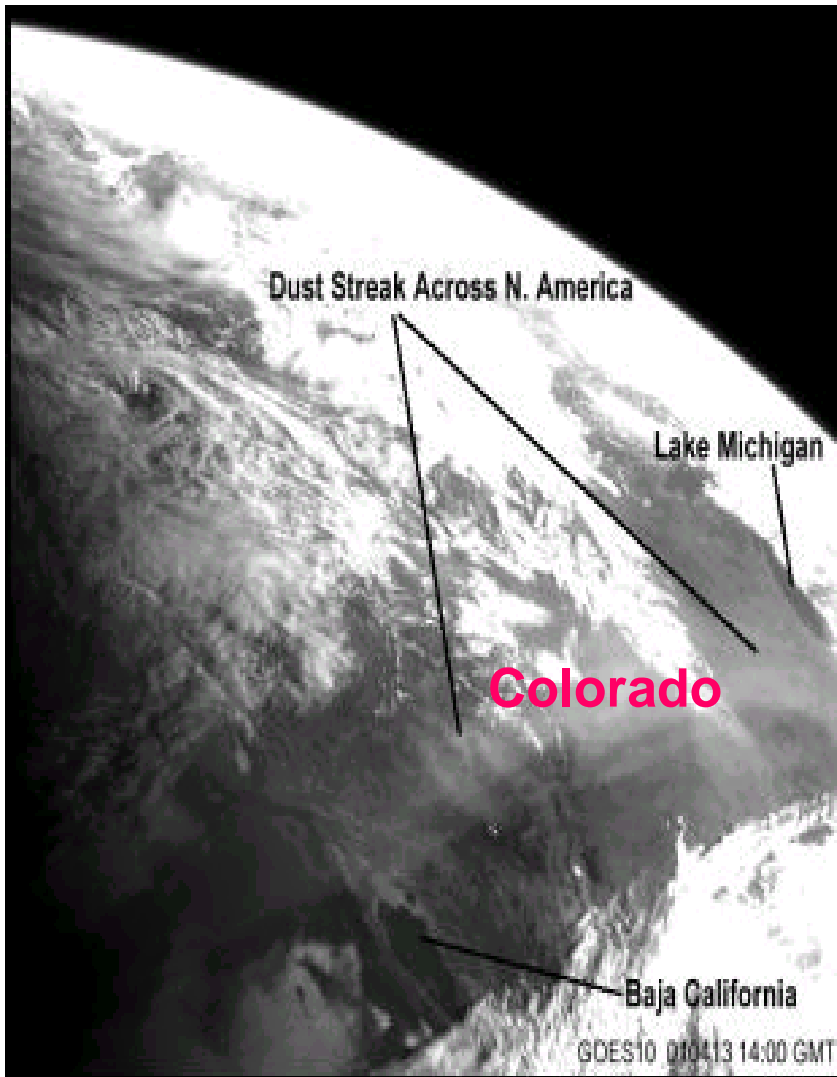


Russian Arctic, AN-12

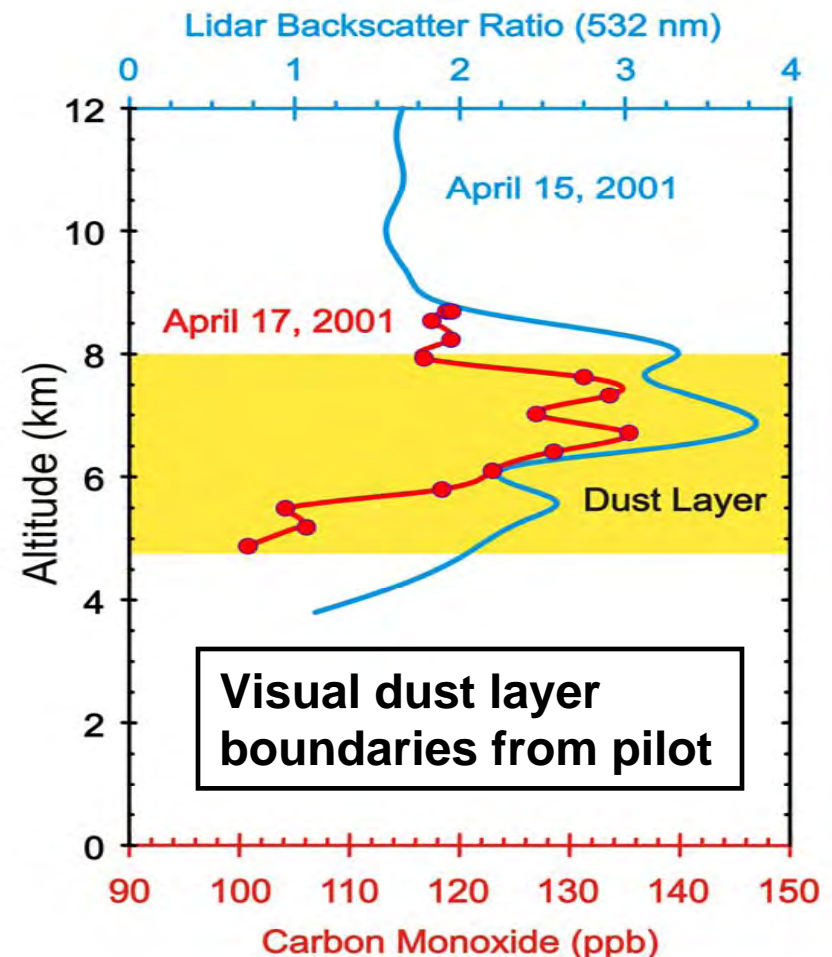


Dust/Pollution Event over Colorado, April 13, 2001

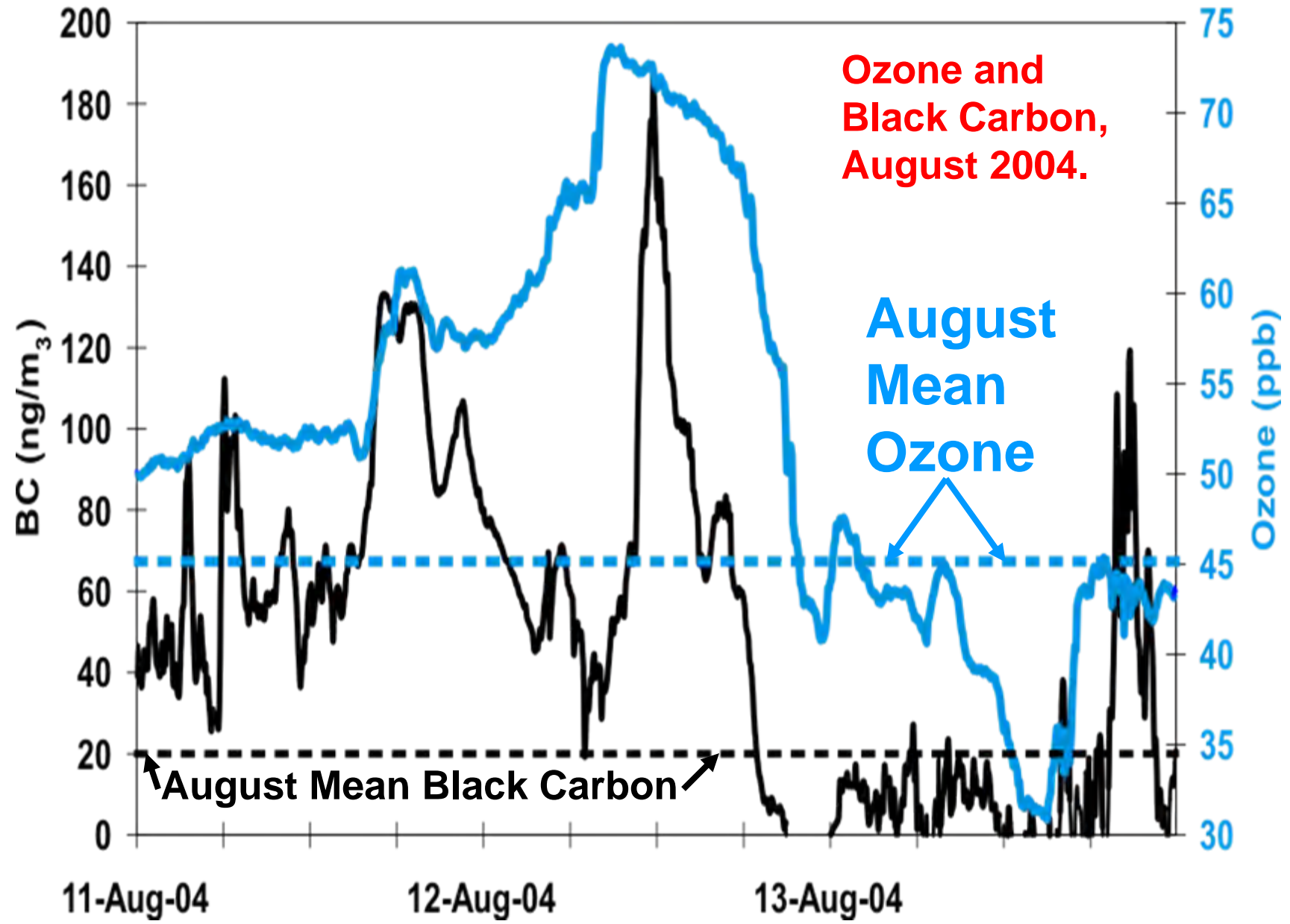
GOES 10, 1400 GMT,
April 13, 2001



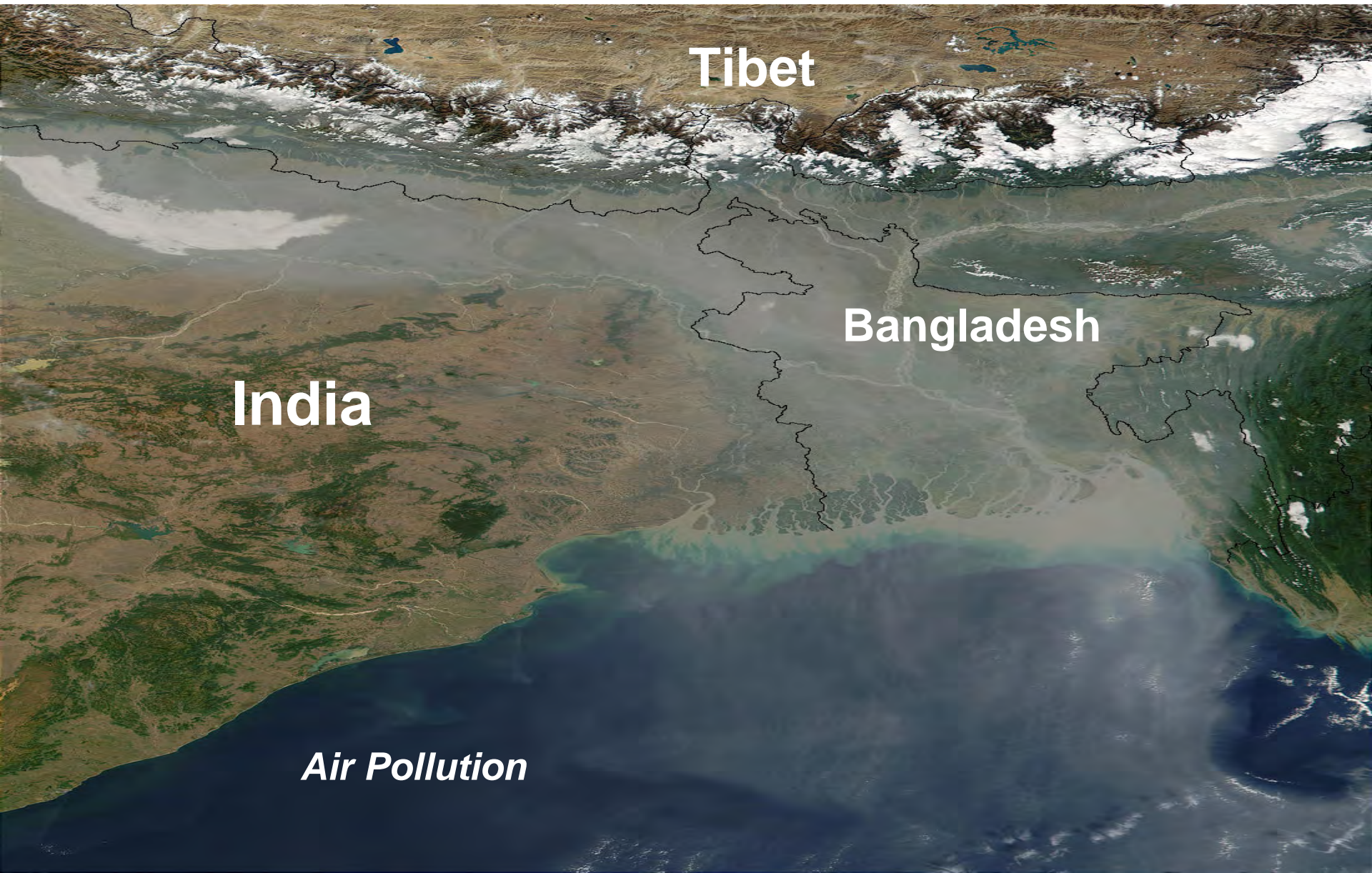
ESRL lidar backscatter of an Asian aerosol layer above Boulder, and CO concentrations in flasks collected in the layer from a light aircraft.



European Air Pollution At Summit, Greenland



South Asian: Aerosol



Tibet

Bangladesh

India

Air Pollution



Observatories and Long Range Transport



Observatories

- **Stay the course.** MLO, SPO (1956); BRW, SMO (1973); TDH (2001); SUM (2005). MLO makes ~ 250 different measurements.
- Maintain traceable calibrations so that data are comparable for the duration of the measurement series (**century or more?**).
- Ensure data **remain** freely available to the public, and stored in national and/or international archives.
- **Add a mountain-top site to the Trinidad Head Observatory, 2008.**
- **Expand Summit Observatory with full aerosol program, 2009-10.**

Transport

- Transport events generally consist of well defined, streaming lamina of gases and aerosols, **often multi-layered, not in blobs.**
- The Arctic Basin receives direct injection of gases and aerosols from Asia, Europe and North America.

END