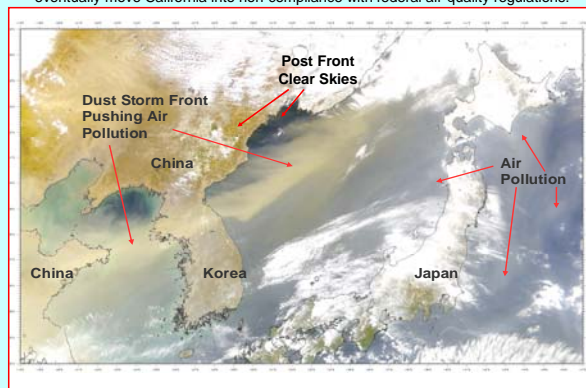


Russ C. Schnell, James H. Butler, and Patrick J. Sheridan  
 NOAA Earth System Research Laboratory, Boulder, CO 80305  
 Elisabeth Andrews, CIRES, University of Colorado, Boulder, CO 80309

## I. Introduction and Background

- Long-range transport of dust and air pollution from Asia to the Mauna Loa (MLO), Hawaii, Atmospheric Baseline Observatory has been documented since the 1970s.
- In a single year, as many as 30 distinct pollution events have been observed at MLO.
- Some flows at MLO last a few hours, whereas others persist for up to 3 days.
- Measurements and satellite photos show that air pollution from Asia also flows into North America impacting areas from the North Slope of Alaska to Southern California.
- There is a valid concern that ozone and ozone precursors advecting from Asia could eventually move California into non-compliance with federal air-quality regulations.



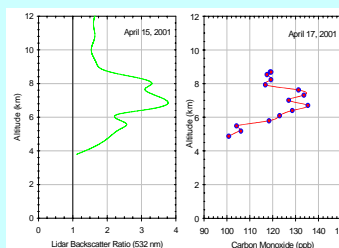
**Figure 1.** Windstorms in China and Mongolia move east across the Asian continent stirring up dust. As they move into the heavily populated regions of eastern China, the storms entrain air pollution from the urban areas and push the "soup" over the Pacific Ocean. Post front air quality in Asia is excellent. Many of these events reach the United States within 5-7 days where the pollution and dust may be visible from California to the Rocky Mountains. The above event in April 2001 crossed the entire United States (GSFC SeaWiFS image).

## II. Asian Air Pollution and Dust Transport Into The Western United States

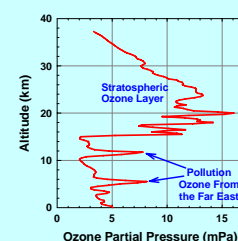
- The pollution and dust shown in Figure 1 crossed the coast of California April 10, 2001, and began flowing over Colorado April 15. The flow persisted through April 17.



**Figure 2.** Asian air pollution and dust haze in Denver, Colorado, April 16, 2001 within a dry air mass that had been transported 17,000 km from Asia to Colorado (Photo courtesy of the Denver Post).



**Figure 3.** (Left panel) Lidar backscatter profile through an elevated Asian pollution event as it flowed over Boulder, Colorado the night of April 15. (Right panel) Carbon monoxide concentrations in the layer from flask samples collected by a light aircraft above Boulder.



**Figure 4.** Ozone profile over Trinidad Head, California, measured with a balloon-borne ozonesonde showing ozone pollution effects from Asia, March 25, 1999.

## III. Trinidad Head (THD), California, Atmospheric Baseline Station

### Objective

- Established a U.S. West Coast site in March 2002 to determine properties and trends of the gases and aerosols in the effluents flowing onshore from the Pacific.

**Station:** Latitude 40.8° N ; Longitude 124.16° W; elev. 107 m

- Instrumentation is mounted in a 7 m long modular unit and a 10 m tower located on the top of a hill at the end of a spit in Humboldt County northwest of Eureka, California.



### NOAA Measurements at THD

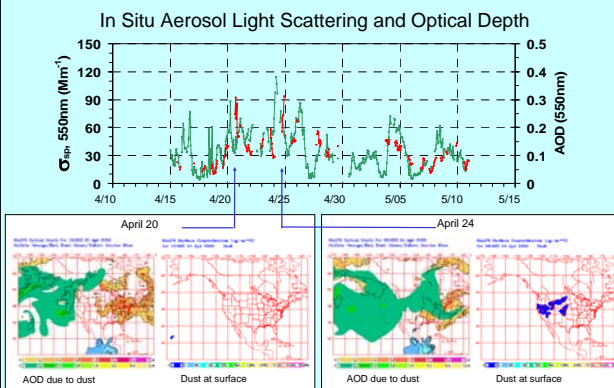
- Aerosols (scattering and absorption, condensation nuclei; major ions from filter samples).
- Solar radiation (irradiance: direct, diffuse, global, terrestrial, downwelling; optical depth).
- Ozone: continuous surface, daily column ozone (Dobson); weekly ozonesondes.
- Gas flask sampling: greenhouse and ozone-depleting gases (e.g. carbon-cycle gases, CO<sub>2</sub> isotopes, CFC's, HCFC's, HFC's, N<sub>2</sub>O, SF<sub>6</sub>, COS, for a total of 38 species).
- Meteorological state parameters (T, P, RH, WS, WD).
- Micropulse aerosol lidar (continuous from surface to 20 km, operational December 2005)
- Weekly vertical profiles of trace gas species and ozone with a light aircraft (surface to 5 km).

Cooperative Program with the ABC Project, Scripps Institution of Oceanography.

- Multiple filters for size segregated aerosol mass, inorganics, and aerosol OC/EC mass ratios.

## IV. Evolution of an Asian Dust/Pollution Event Observed at THD, April 2002

- On April 20, 2002, high aerosol optical depth was measured at THD along with low aerosol light scattering (550 nm) indicating the presence of an aerosol layer aloft.
- On April 24, 2002, high aerosol optical depth was associated with high aerosol light scattering indicating the presence of dust aerosol at the surface (Figure 5).
- Data from the Naval Research Laboratory aerosol model predicted dust aerosol aloft THD on April 20 and at the surface on April 24.



**Figure 5.** (Top panel) Aerosol optical depth (red) and aerosol light scattering (green) measured at THD April 15-May 11, 2002. The optical depth data are for clear, daylight hours. (Lower panel) Naval Research Laboratory aerosol model results in which the green field represents aerosol optical depth from dust and the purple field represents dust at the surface. Note that the measured aerosol properties at THD closely follow the modeled values.