Background observations of air quality at Cheeka Peak, Washington and Mt. Bachelor, Oregon

Dan Jaffe, J.B. Dennison, Peter Weiss-Penzias, Jeremy Smith and Phil Swartzendruber

Cheeka Peak, Washington (CPO) 0.5 km asl

Mt. Bachelor, Oregon (MBO) 2.7 km asl

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Why measure background air quality in the PNW?

1) **Long-range transport of pollutants from Asia:**
   - **can influence surface air quality in urban areas of the PNW (e.g. Jaffe et al., 1999; 2001; 2003; Price et al 2003; Jaeglé et al., 2003; etc.).**
   - **becomes especially important as we move to lower AQ standards (e.g. O_3 and PM2.5).**
2) **Necessary to establish boundary conditions for regional AQ modeling (e.g. AIRPACT)**
3) **Important platform to study the meteorological and photo-chemical environment of the Pacific**
4) **Only way to evaluate long-term trends in global air quality**
5) **Continuous, long-term observations provide important context for short-term research campaigns using aircraft (e.g. UW-PHOBEA, NOAA-ITCT, NASA-INTEX, etc).**

Background AQ Sites

- Under westerly winds CPO receives clean marine air. During easterly winds, CPO receives polluted air from the Puget Sound corridor. Changes are driven by synoptics, with little diurnal pattern.
- At 2.7 km, MBO is often in the free troposphere, except during summer, when strong convection can bring locally polluted air to the site. During summer, the diurnal cycle becomes apparent.

Mt. Bachelor Observatory

Current Measurements:

- CO
- CO_2
- Aerosol Scattering (sub-micron)
- NO_y
- Radon
- Hg(0)
- H_2O (Licor)
- Temperature
- Relative Humidity
- Wind Speed
- Wind Direction

Cheeka Peak Observatory

Current Measurements:

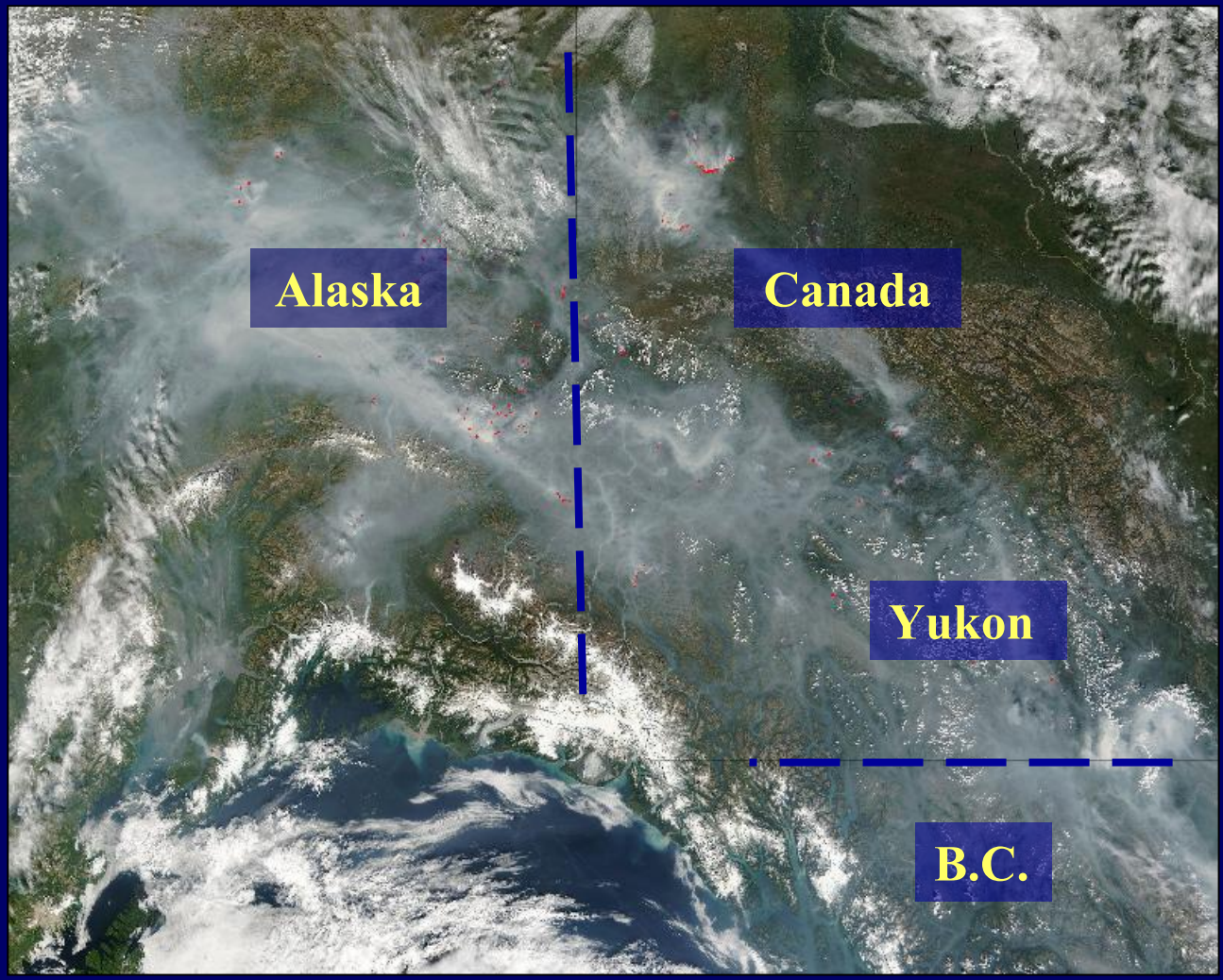
- CO
- O_3
- Aerosol Scattering (sub-micron)
- PM2.5 (WA DOE neph method)
- Temperature
- Relative Humidity
- Wind Speed
- Wind Direction
- Rain

Results from 2004

- **Transport of Alaskan smoke to Cheeka Peak and the Puget Sound: August-Sept. 2004**

- **Transport of Asian pollution to Mt. Bachelor: April 2004**

Smoke from Alaskan fires (2004)



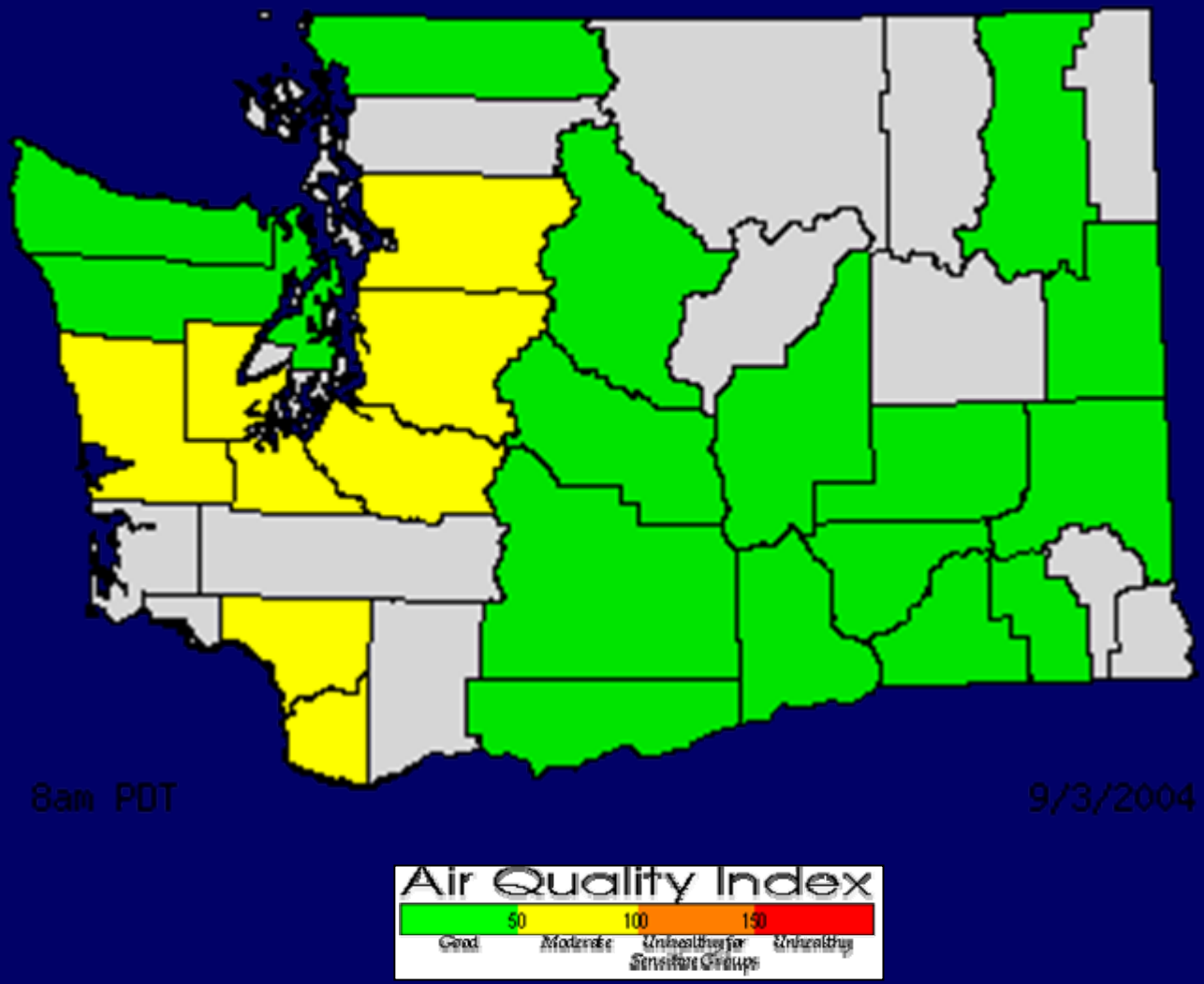
The 2004 Alaskan fire season was the worst on record, with 6.6 million acres burned.

Smoke over the Wrangell Mountains, Alaska

Fairbanks, Alaska June 28, 2004

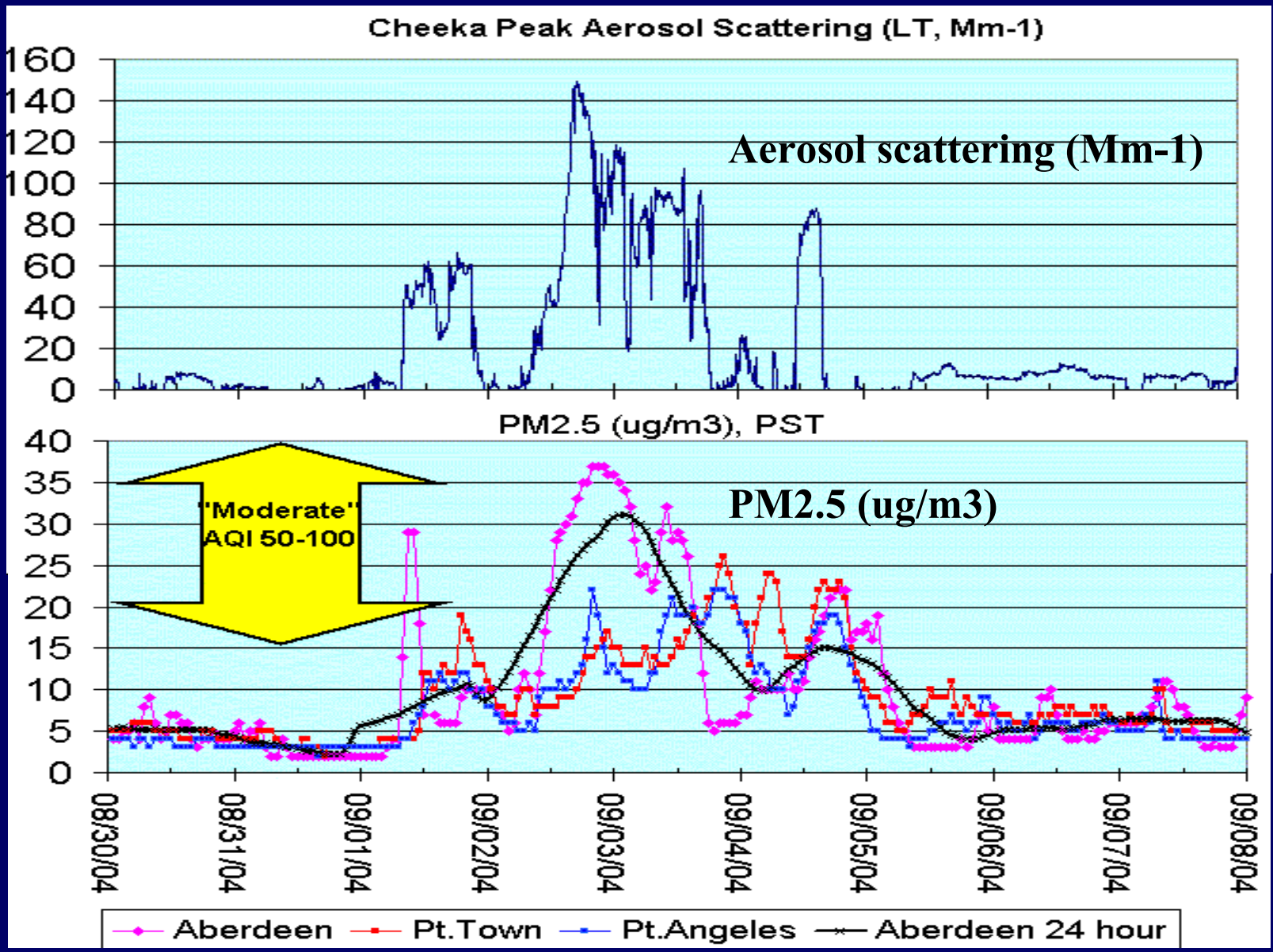
PM10 ≈ 900 ug/m^3 or approximately 6 times the air quality standard

Air Quality Index, Sept 3, 2004



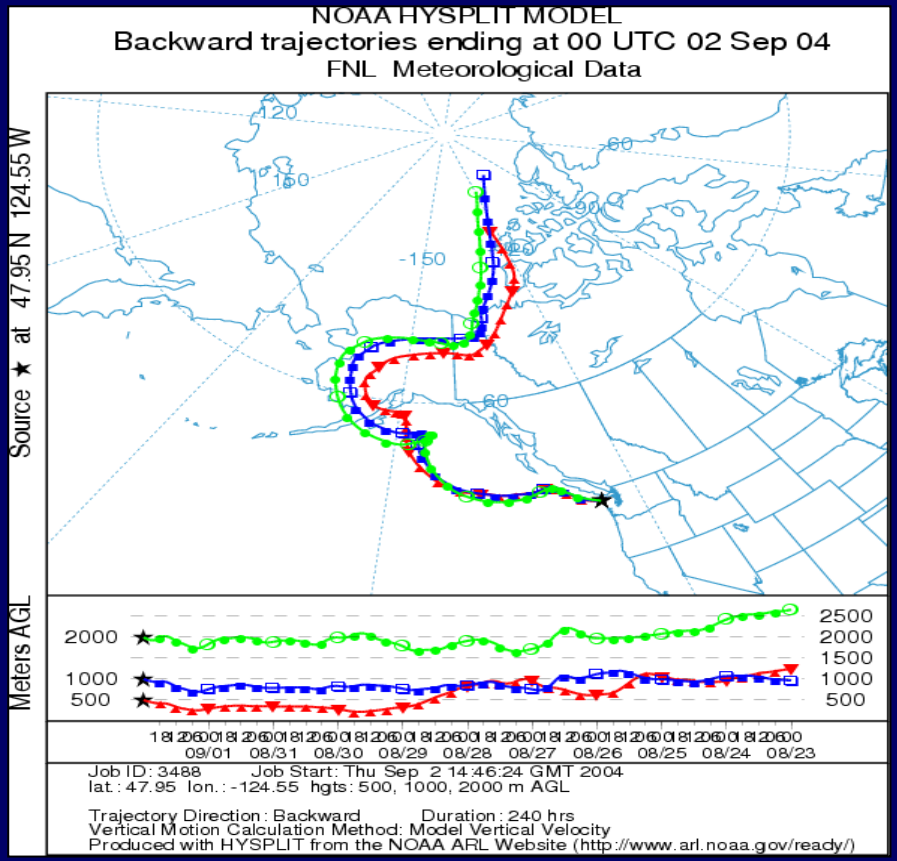
From statewide PM2.5 network

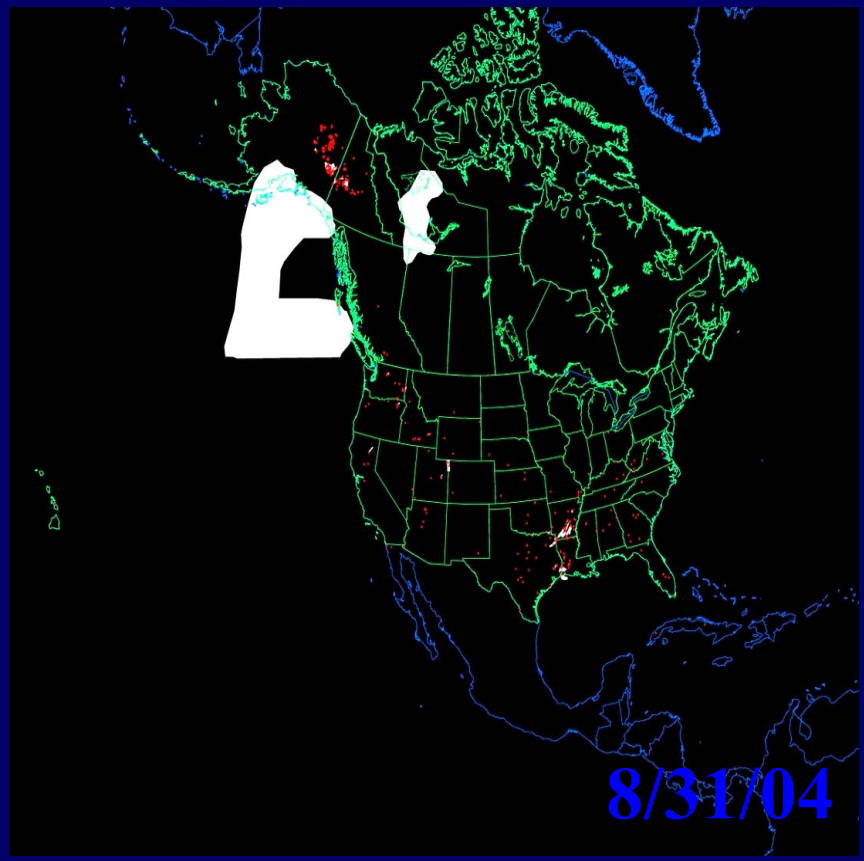
CPO and Washington DOE PM2.5 data



HYSPLIT back-trajectory

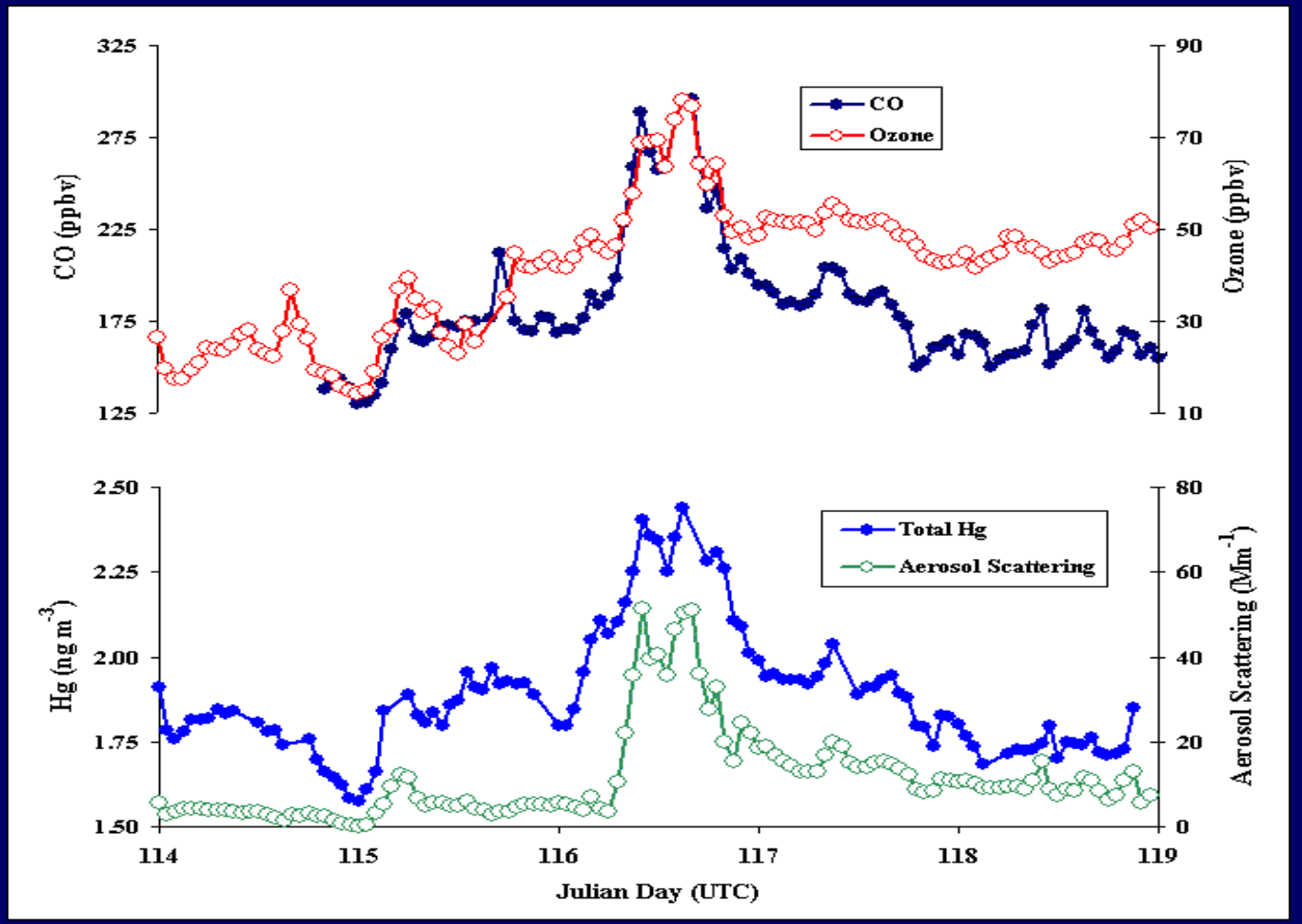
NOAA/NESDIS/HMS Fire locations and smoke transport





The trajectory and Satellite imagery confirm the source of aerosols seen in the Puget Sound region

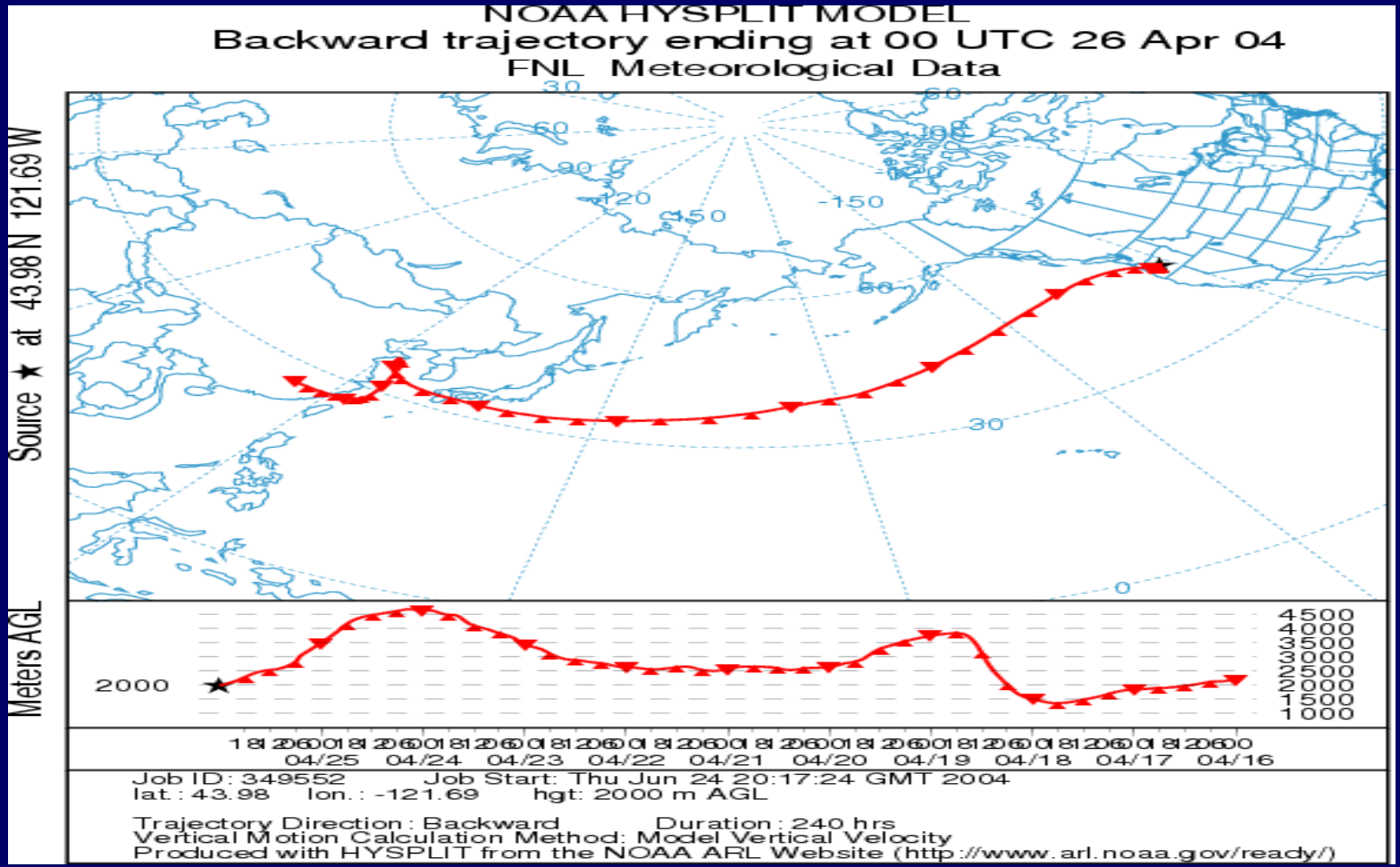
Transport of Asian Hg to Mt. Bachelor: April 25-26th, 2004



A substantial Asian LRT event (ΔCO > 100 ppbv).

Asian source confirmed by trajectories and Hg/CO ratio. (Jaffe et al, 2005)

Mt. Bachelor back trajectory, April 26, 2004



Hey what happened to our anemometer?

Summary, challenges and an invitation….

1) We have detected several dozen episodes of long-range transport to the PNW at our ground stations, as well as by aircraft.

2) The chemical components detected during long-range transport include CO, O_3, aerosols, mercury, hydrocarbons, nitrogen oxides and others, with variable ratios depending on the source and chemical processing en route.

3) Sources of pollution include Asian industrial emissions, Asian mineral dust, as well as Siberian and Alaskan biomass burning emissions.

4) Chemical observations at Cheeka Peak and Mt. Bachelor provide important background air quality data for our region, but there are challenges at both sites:
   - How to identify free-tropospheric air at MBO?
   - How to make accurate wind observations at MBO?
   - How can we make better use of meteorological information to understand local topographic effects and/or mixing during transport?

Collaborations with the meteorological community are welcome!

MBO and CPO data are available on our public website at:

http://faculty.washington.edu/djaffe

except for wind data, which is accessible by password only due to request by Mt. Bachelor Inc.