Free Troposphere Sampling at the Mount Bachelor Observatory

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Figure 1: Summit Building- Early Fall

Figure 2: Summit Building- Winter

1. First Results from MBO

• Atmospheric observations started at the Mount Bachelor Observatory (MBO) in March 2004. We currently measure CO, O_3, aerosol scattering, Radon, NOy and CO_2. During selected campaigns we will also measure NOx and PAN. Preliminary data is posted in real-time to the Jaffe group website (**http://research.uwb.edu/jaffegroup**).

• Our observations show that the site experiences very little influence from local pollution sources.

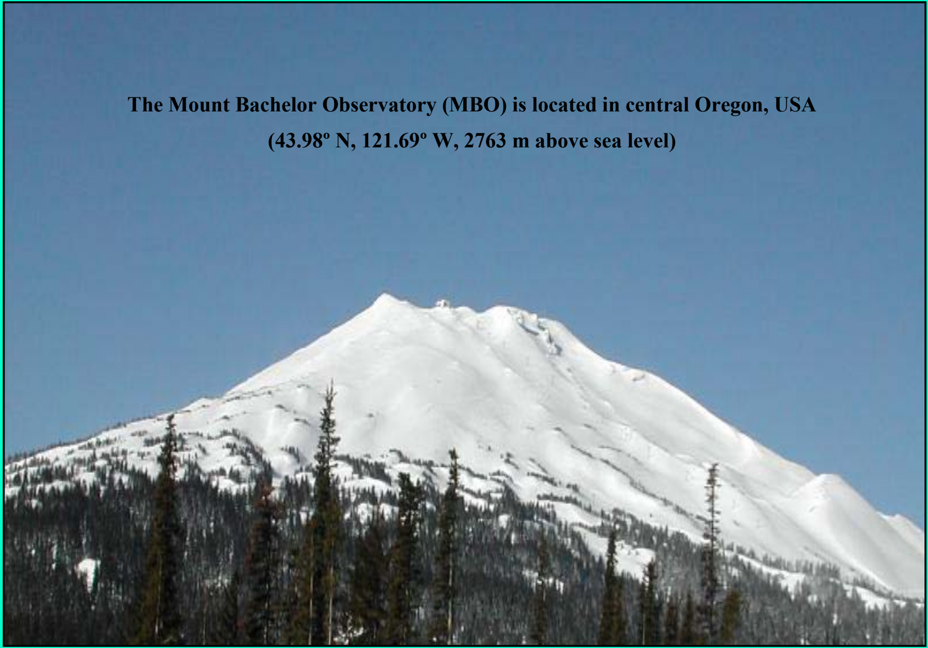
• The site samples free tropospheric (FT) air a large fraction of the time (see Figure 3 and Weiss-Penzias et al., 2006).

• Free tropospheric air typically has a higher concentration of pollution due to long-range transport (LRT) compared with boundary layer (BL) air.

• Numerous LRT events have been detected, including pollution from Asia and from forest fires (including CO, O_3, aerosols and mercury).

• Long-range transport of mercury from Asia has been identified – CO/Hg ratio is an excellent marker of the Asian plume (Jaffe et al., 2005).

•Our observations have identified high levels of Hg(II) in the free troposphere, most likely due to oxidation of Hg(0) to Hg(II).



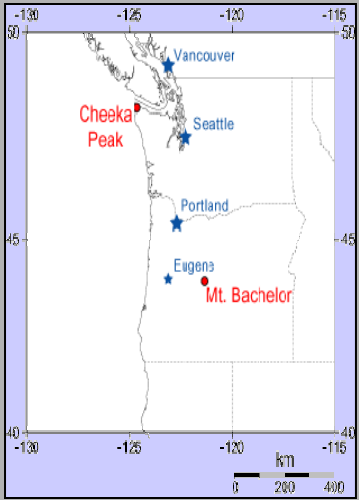


Figure 6: MBO location in relation to other key West Coast sites.

2. Assessing the Amount of Free Tropospheric Air at MBO

Water vapor is a good indicator of free tropospheric air. Rawinsonde data from Medford Oregon shows that for fall, winter and spring, average WV values (specific humidity) at the MBO altitude of 2.7 km, are below 3.5 g/kg. Measured values at MBO are similar, but have a small diurnal cycle, with drier air at night. Overall, we interpret this data to indicate that MBO samples mostly free tropospheric air, with some mixing of BL during the daytime.

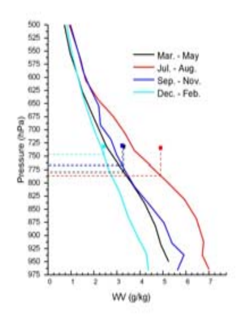


Figure 1: Comparison of seasonally averaged water vapor (WV) mixing ratios from MBO (squares) with rawinsonde data from Medford, OR. The range of "equivalent" altitudes for MBO is 782-745 hPa (2300-2600 m).

3. Spring Data Segregated by Water Vapor (WV)

By segregating the MBO data based on measured WV, we can examine air that is representative of higher or lower altitudes [*Weiss-Penzias et al.*, 2006]. The drier, subsiding airmasses show more characteristic of long-range transport and global pollution.

Table 1: Average concentrations for spring 2004 data (March 28 – May 19). Dry air is defined as WV<2.3 g/kg and wet air is defined as WV>4.2 g/kg.

	N (hours)	CO (ppbv)	O_3 (ppbv)	Hg(0) (ng/m^3)
All data	1272	167±23	44.5±7.6	1.77±0.12
Dry air (FT)	183	179±28	54.0±8.0	1.84±0.16
Wet air (BL)	183	154±22	40.0±5.4	1.69±0.08

4. Observations of a Long-Range Transport Episode at MBO during the Spring of 2004

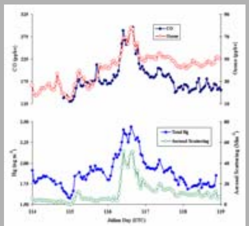


Figure 4: The LRT episode was confirmed by kinematic trajectories and the Hg/CO ratio, which matched the ratio observed during Asian outflow.

For more details, see Jaffe et al, (2005).

5. Other Jaffe Group Datasets of Interest

- **Cheeka Peak Observatory** (CPO), located near Neah Bay, Washington, USA (48.3° N, 124.6° W, 480 m above sea level).

  Spring 1997, 1998; March 2001 – present.

- **Airborne Sampling:**
  - Spring 1999
  - Spring 2001 – Huge Asian Dust Cloud
  - Spring 2002
  - Late Spring/Summer 2003 – Huge Siberian Fires

6. Some Representative Publications on Intercontinental Transport from the Jaffe Research Group

• D. A. Jaffe, et al., "Transport of Asian Air Pollution to North America" Geophysical Research Letters 26, 711-714, 1999.

• R. A. Kotchenruther, et al., "Observations of Ozone and Related Species in the Northeast Pacific during the PHOBEA Campaign: 2. Airborne Observations" Journal of Geophysical Research 106, 7463-7483, 2001.

• D. A. Jaffe, et al., "The April 2001 Asian Dust Events: Transport and Substantial Impact on Surface Particulate Matter Concentrations across the United States" EOS Transactions, 2003.

• H. U. Price, et al., Photochemistry, Ozone Production, and Dilution during Long-Range Transport Episodes from Eurasia to the Northwest United States" Journal of Geophysical Research 109, D23S13, doi: 10.1029/2003JD004400, 2004.

• D. A. Jaffe, et al., "Export of Atmospheric Mercury from Asia" Atmospheric Environment 39, 2005.

•Weiss-Penzias, et al, "Observations of Asian air pollution in the free troposphere at Mt. Bachelor Observatory during the spring of 2004" Journal of Geophysical Research, In-Press, January 2006.

• For more publications on intercontinental transport, see **http://research.uwb.edu/jaffegroup**

•To request data from MBO or any of these other campaigns, or for further information, please contact Dan Jaffe by email at djaffe@u.washington.edu or visit our website at http://research.uwb.edu/jaffegroup.