VII. STANDING COMMITTEES

A. Academic and Student Affairs Committee

Faculty Presentation

For information only. Professor Jaffe's biographical information follows.

Professor Dan Jaffe

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http://faculty.washington.edu/djaffe

Dr. Jaffe is a Professor of Environmental Chemistry at the University of Washington-Bothell. He is an expert on environmental chemistry and global pollution. Dr. Jaffe is the author of more than 90 publications on ozone, aerosols, mercury and other pollutants and has been the Principal Investigator on 14 projects at the UW since 1997 bringing over 4 million dollars of federal funding to the University. He enjoys teaching chemistry, applied sciences, environmental policy and other classes and has an active research team with graduate and undergraduates students. Dr. Jaffe is currently serving on the National Academy of Sciences panel on "The Significance of International Transport of Air Pollutants."

Education

B.S. Chemistry, February 1979, Massachusetts Institute of Technology
M.S. Chemistry, December 1983, University of Washington
Ph.D. Chemistry, June 1987, University of Washington; graduate work in inorganic, analytical and atmospheric chemistry, atmospheric sciences, environmental sciences and policy.

Professional Positions Held

Professor—University of Washington-Bothell, Interdisciplinary Arts and Sciences, September 1997-current. (Promoted to full Professor in September 1999).
Adjunct Professor, Environmental Science and Regional Planning, Washington State University, Nov. 2001-present.
Adjunct Professor of Atmospheric Sciences, University of Washington-Seattle, December 1997-current.
Full/Associate/Assistant Professor of Chemistry--University of Alaska Fairbanks, Department of Chemistry/Geophysical Institute, June 1993 - September 1997. (promoted to full professor June 1997).
Teacher- North Andover High School, North Andover, MA, September 1979 - June 1981.

"MADE IN CHINA"

Global Influences on Local Air Quality

Dan Jaffe, UWB Program in Science and Technology

Acknowledgements:
My students!
Funding: NSF, EPA, NOAA, NPS

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Air

- Basic necessity for life (without O_2 we get brain damage in ~3 minutes);
- Lungs are readily irritated by noxious gases (e.g. O_3, SO_2, smoke, etc.);
- Lungs are also a good conduit for absorption into bloodstream of toxics such as Pb, CO, benzene, etc.
- Extensive evidence for health effects from polluted air, including premature death.
- In the US, regulations on air quality through the Clean Air Act.

US air quality standards getting tougher

O_3	Particulate matter*
• 1979: 120 ppb -1 hr	• 1979: 90* ug/m^3
• 1997: 85 ppb - 8 hr	• 1997: 65 ug/m^3
• 2008: 75 ppb - 8 hr	• 2008: 35 ug/m^3

Despite significant improvements, there are still ~150 million people in the US that live in areas that do not meet the standards.

**This column shows the 24 hour PM2.5 standard. Note that the 1979 standard was 150 ug/m^3 for PM10. An equivalent PM2.5 level is estimated based on a PM2.5/PM10 ratio of 0.6*

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Observations in Beijing by the BBC during the 2008 summer Olympics (August 2, 2008)

PM10 was 15 ug/m3 at mid-day. For reference, the WHO guideline is 50 ug/m3 averaged over 24 hours .

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Observations in Beijing by the BBC during the 2008 summer Olympics (August 4, 2008)

PM10 was 292 ug/m3 at mid-day. For reference, the WHO guideline is 50 ug/m3 averaged over 24 hours .

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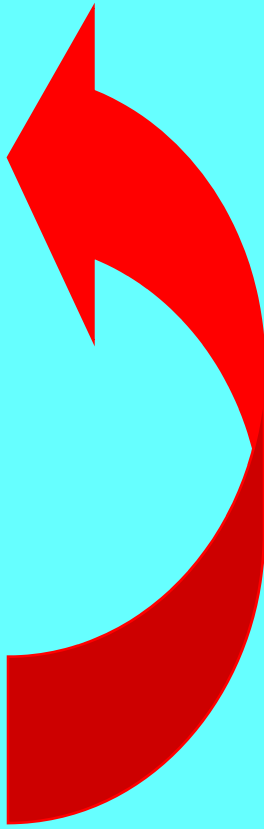
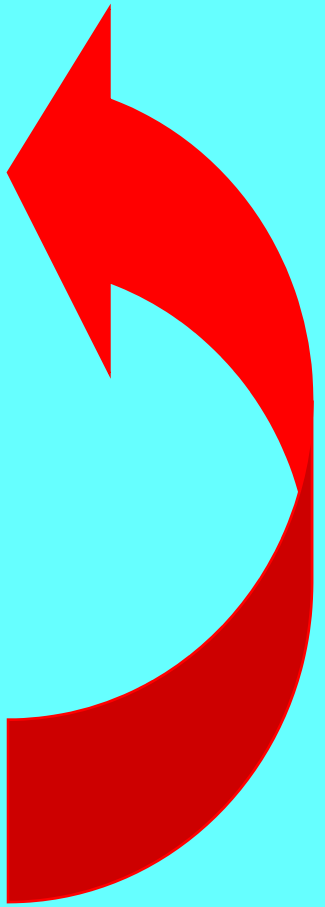
The Scientific Method

1. Unexplained observations
2. Questions
3. Hypotheses
4. Design experiment
5. Evaluation of hypothesis
6. New questions, go back to step 1



The Scientific Method

1. Unexplained Observations
2. Questions
3. Hypotheses
4. Design experiment
5. Find funding!
6. Evaluation of hypothesis
7. New questions, go back to step 1



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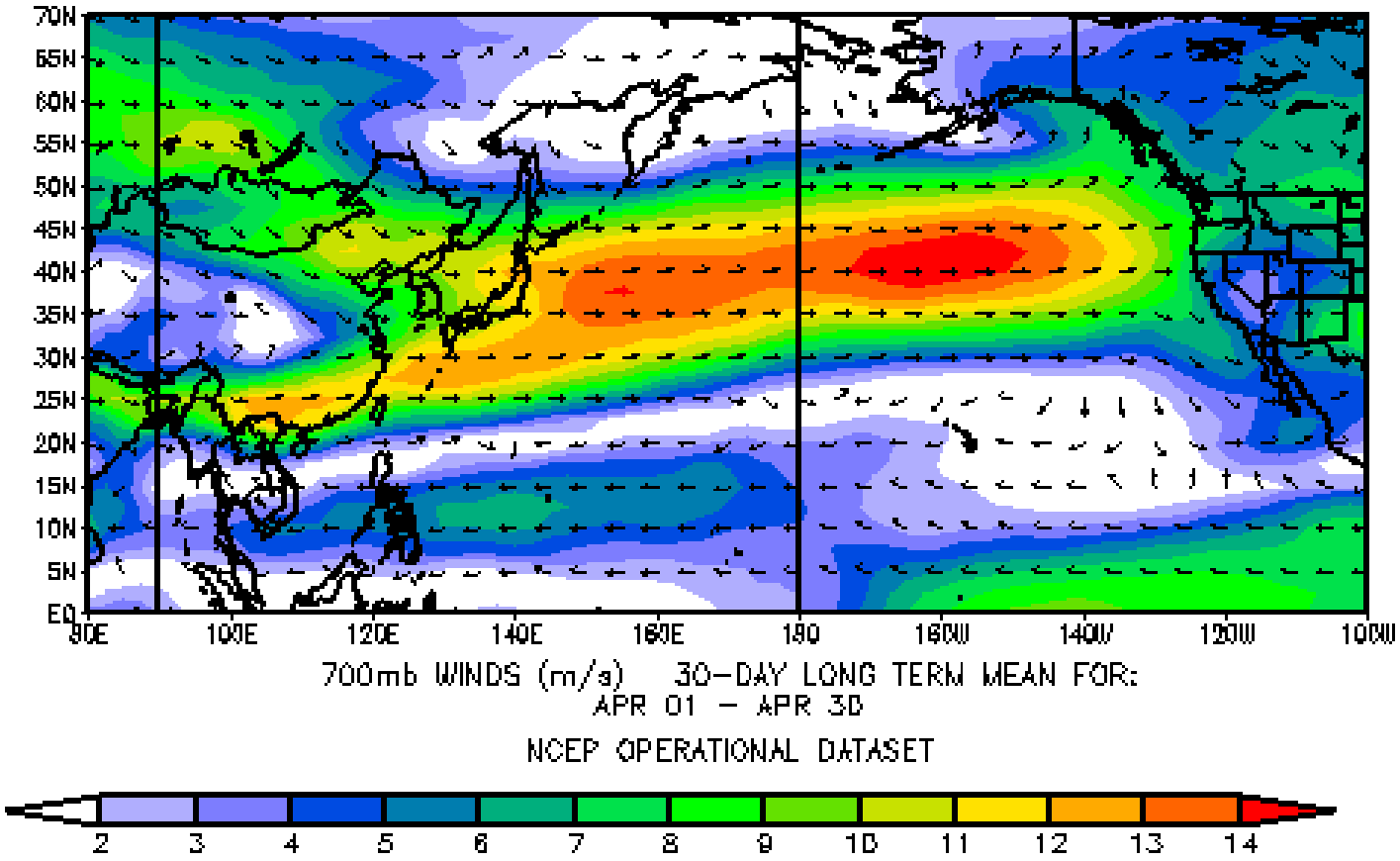
Average winds for April at 700 mb (~10,000 feet)



On average, air crosses the Pacific in about 10 days.

Could air pollutants from Asian be detected in the US?

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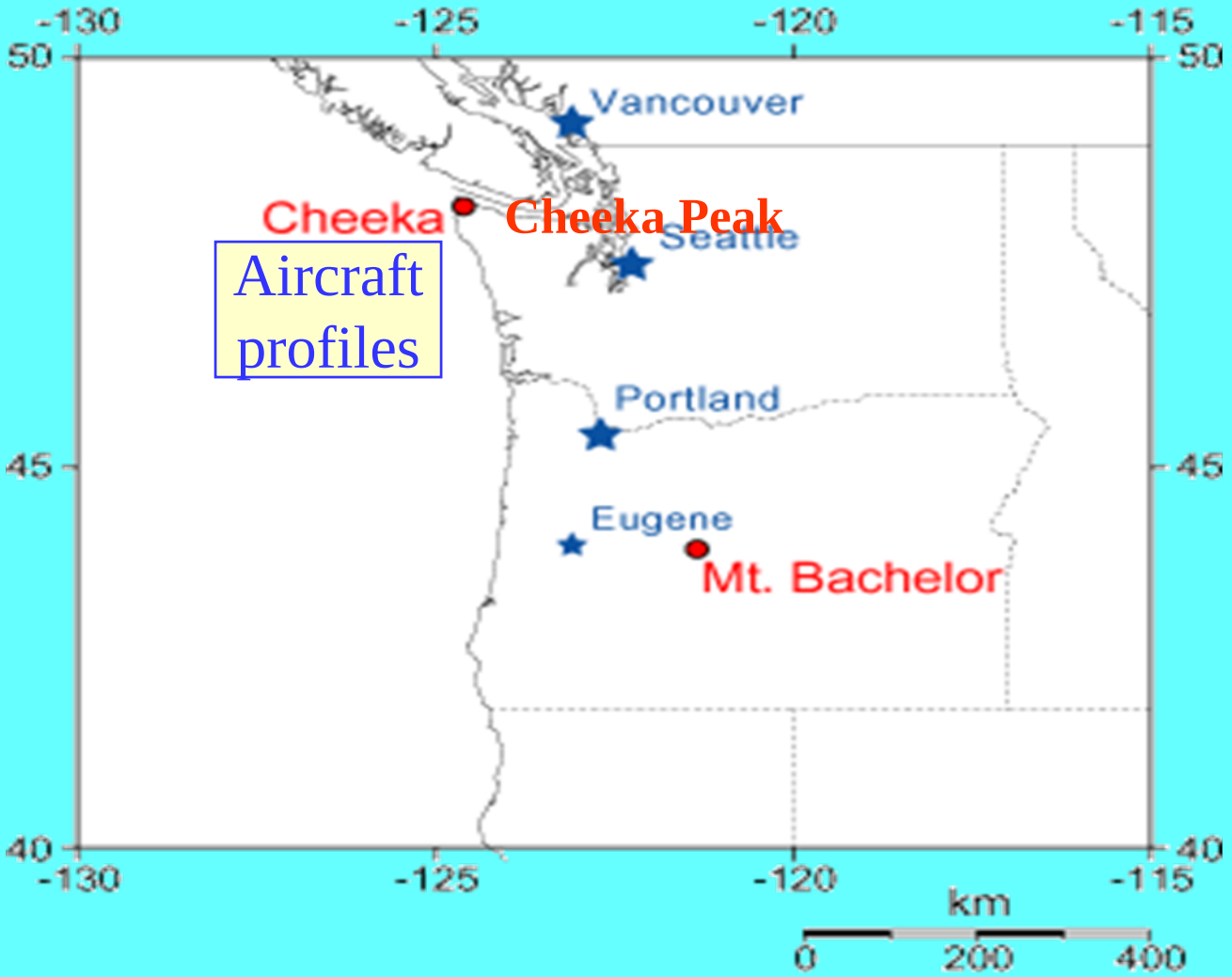
Our first project “PHOBEA”



*The PHOBEA project (Photochemical Ozone Budget of the Eastern North Pacific Atmosphere) was funded by NSF between 1997-1999.

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The view from Cheeka Peak, Washington

We first made measurements here in 1997 and published our findings in 1999. This paper has now been cited over 200 times.

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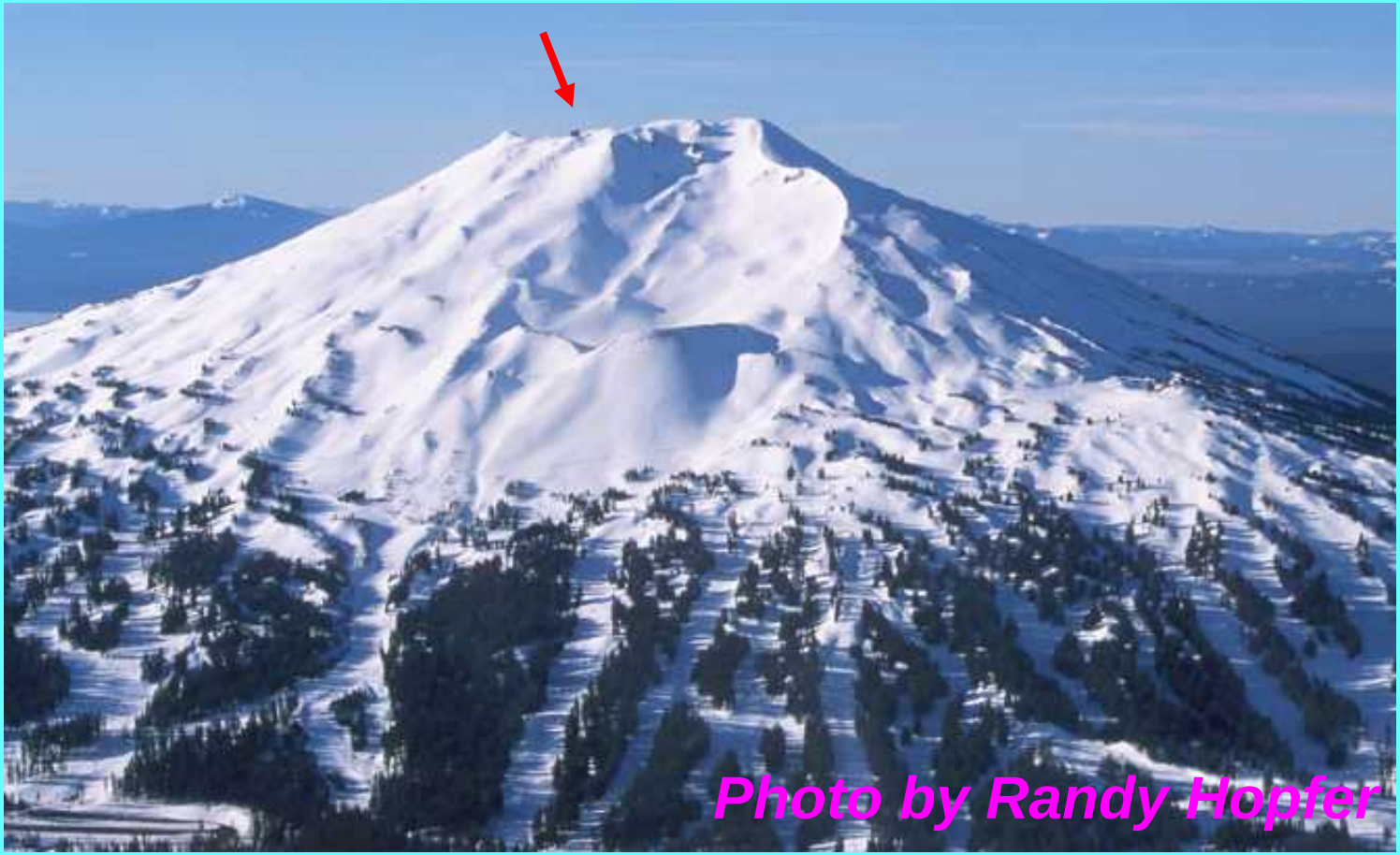
Mt. Bachelor, Oregon, 2.7 km above sea level



Only high elevation/free tropospheric atmos. research site in western U.S.

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Beechcraft Duchess

- Twin (piston) engine aircraft (unpressurized)
- Maximum flight altitude 6km, 4 hours useable flying time
- Maximum instrument payload ~240 kg
- Maximum power ~1 kw
- Owned by Northway Aviation, Paine Field, Everett
- $250/hour including pilot.

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Chemical measurements

- CO: Infra-red spectroscopy
- CO_2: Infra-red spectroscopy
- O_3: UV spectroscopy
- Mercury (Hg): Cold vapor atomic fluorescence (UV)
- Hydrocarbons: Gas chromatography/mass spec.
- Nitrogen oxides: Chemiluminescence spectroscopy
- Acids (H_2SO_4, HNO_3): Ion chromatography
- Peroxyacetyl nitrate: Gas chromatography
- Particulate matter: light scattering, light absorption

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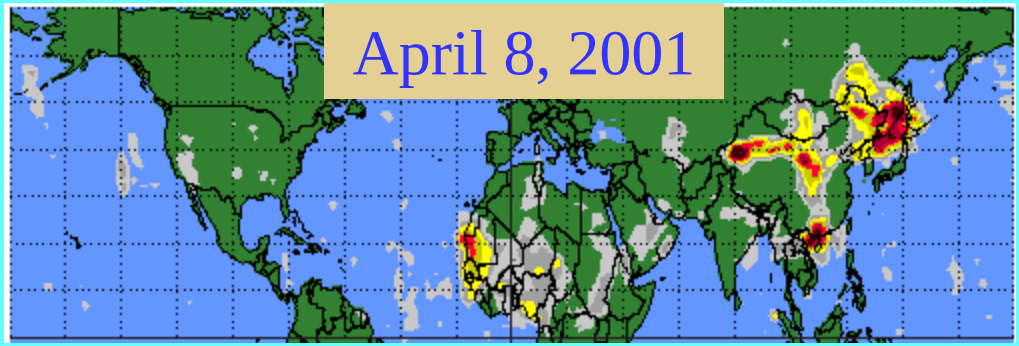
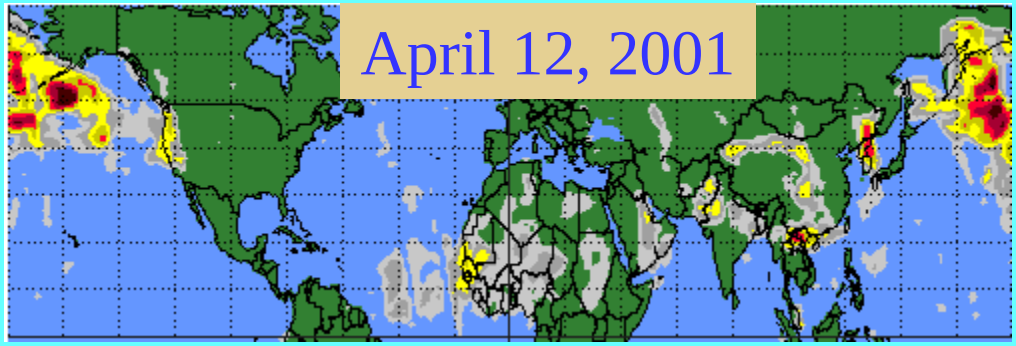
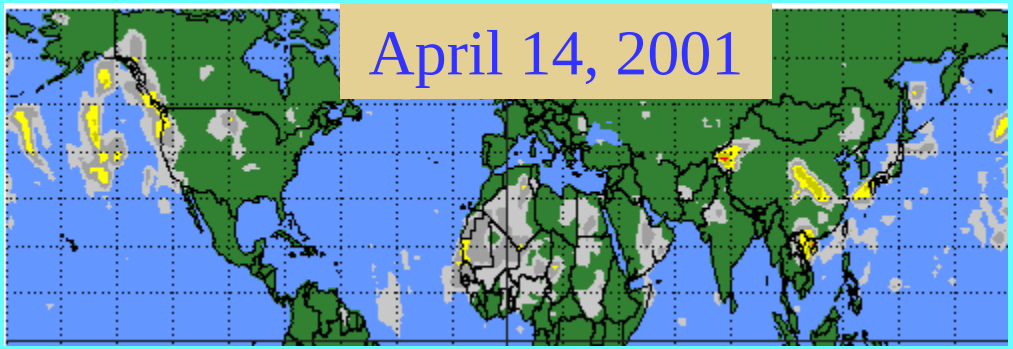
Asian dust observed by the “Earthprobe” satellite







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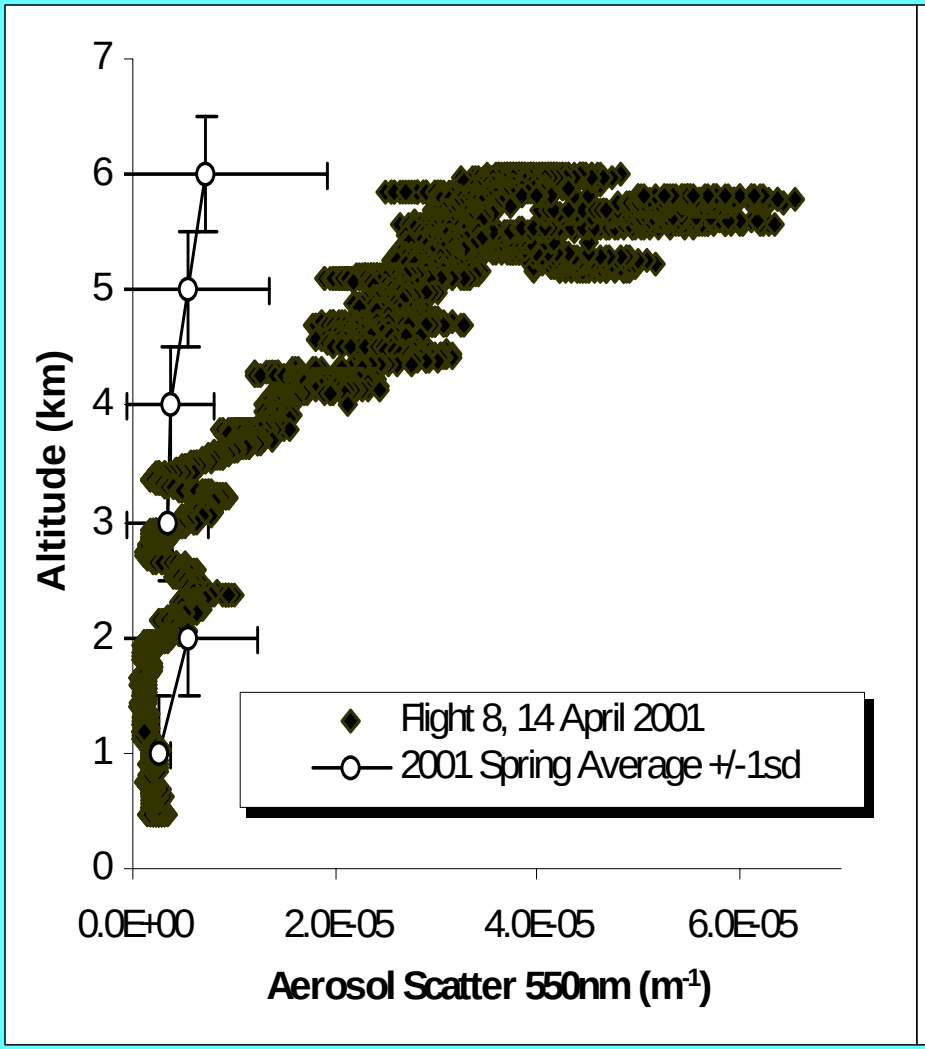
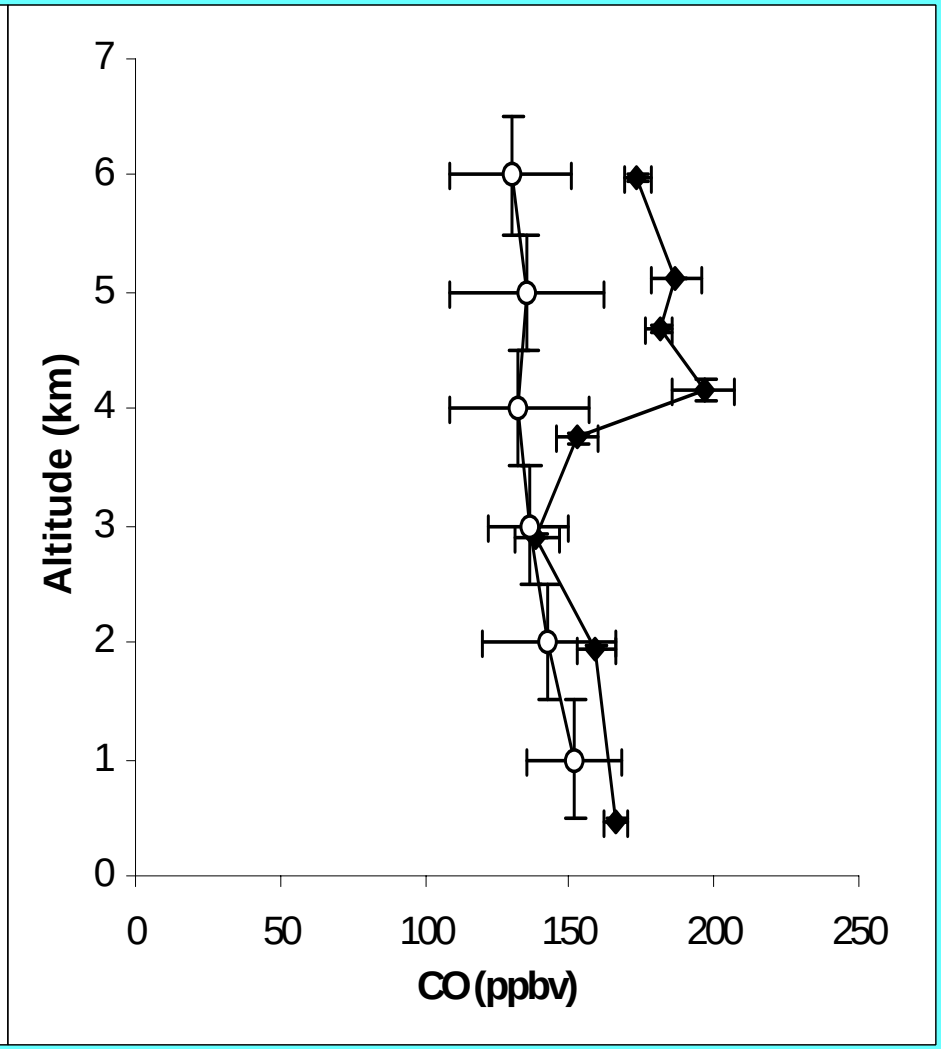
Vertical profile off Washington coast: April 14th, 2001





Does the dust and pollution pass overhead and never reach the surface?

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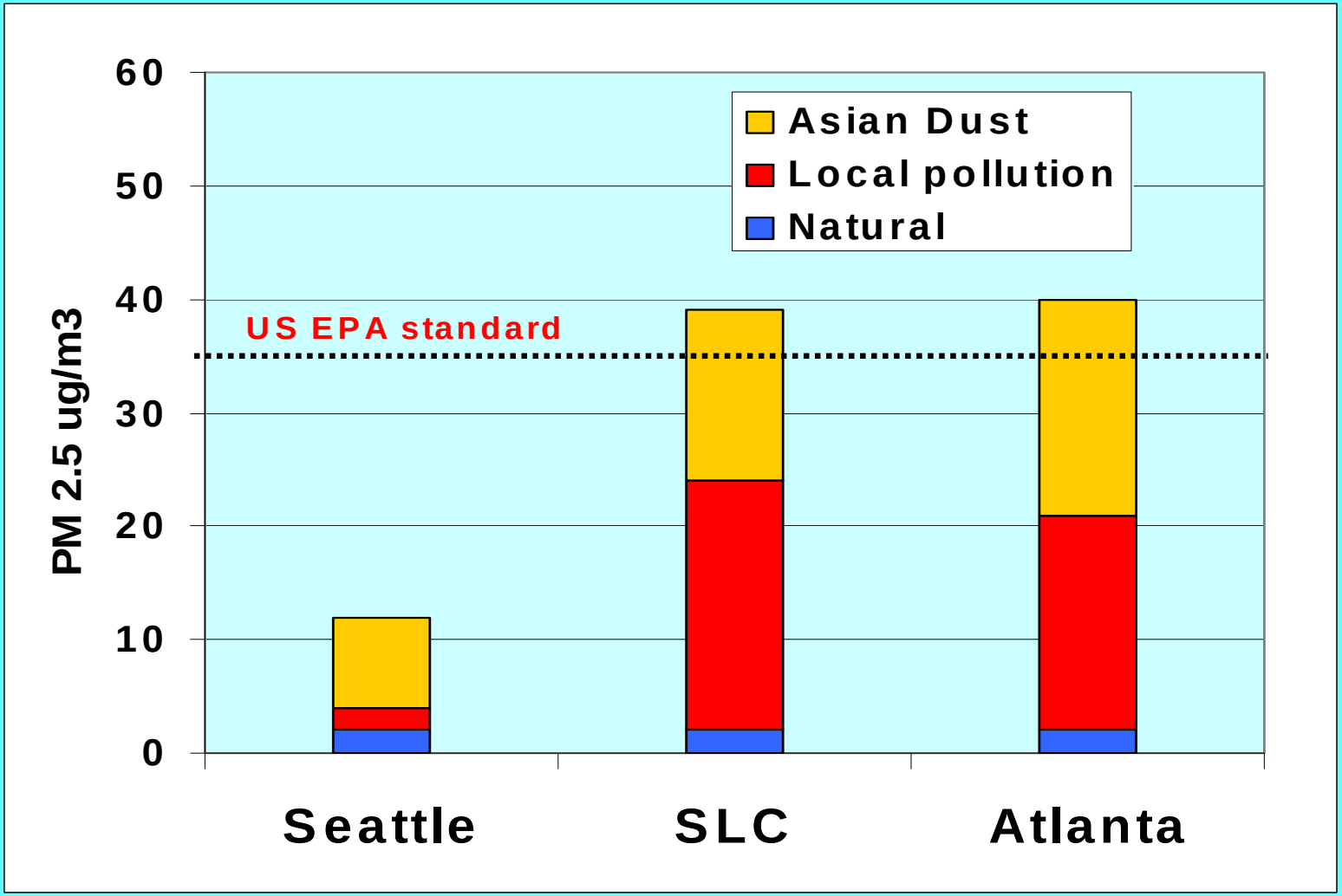
How did the April 2001 Asian dust event impact air quality at the surface?



As the air quality standards get lower, global pollution becomes more important.

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How does mercury get into our fish?
What are the sources of this mercury?

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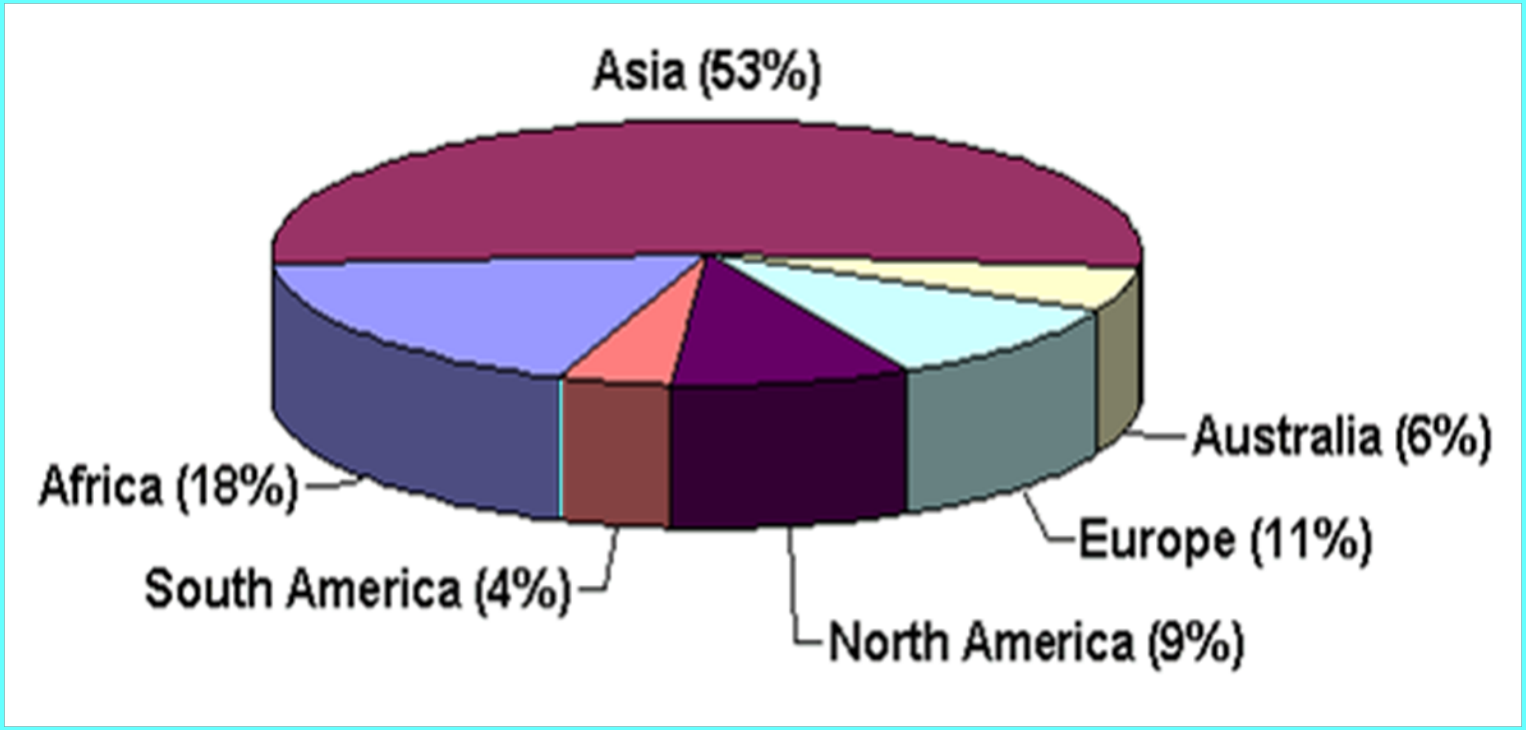
Global industrial emissions of Hg



China is about 1/3 of global total and increasing ~3%/year.

Sources: Pacyna et al., 2006; Streets et al., 2006, US EPA 2007

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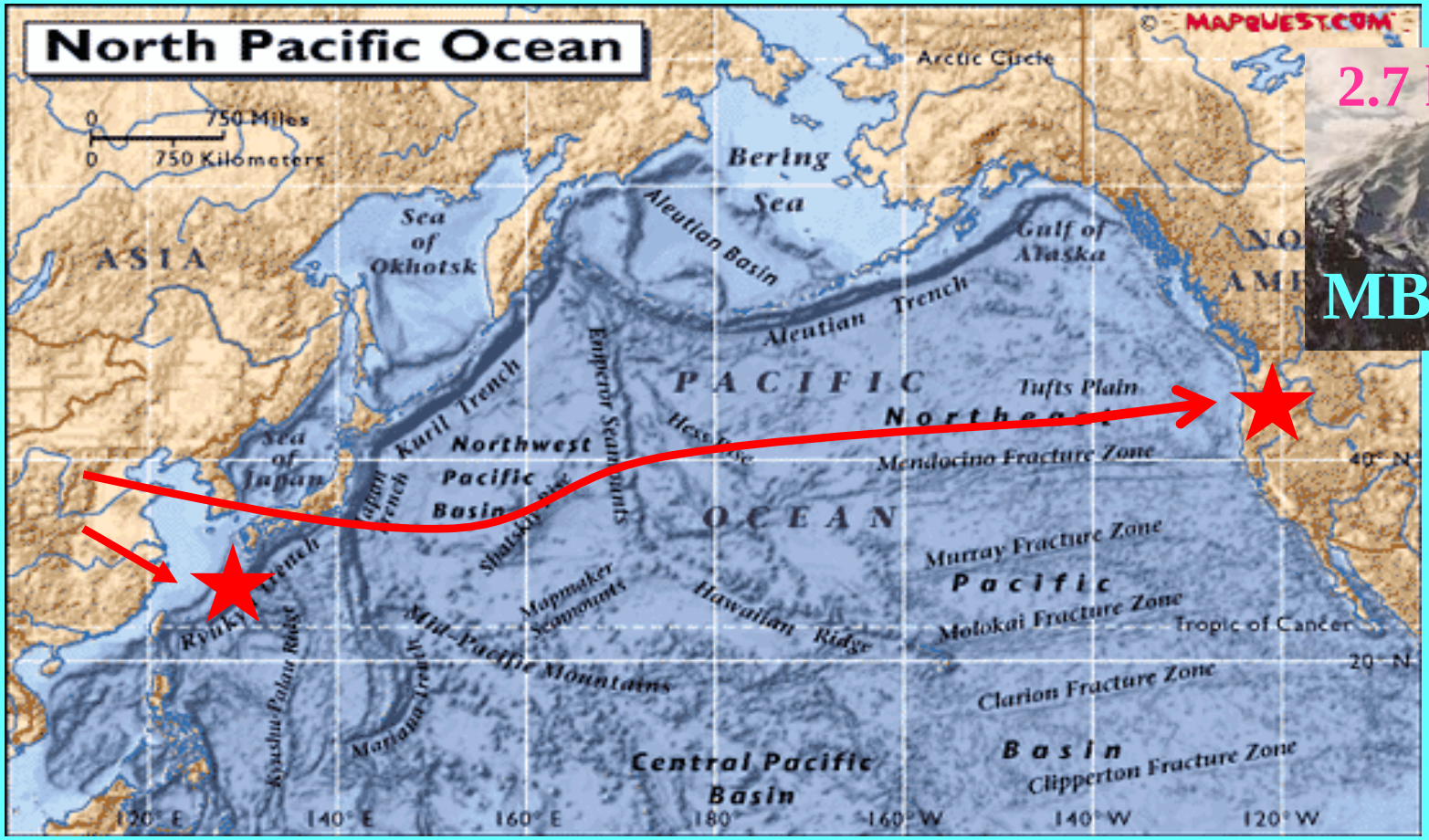
Spring 2004 experiment: simultaneous observations of Hg at Mt. Bachelor and Okinawa, Japan



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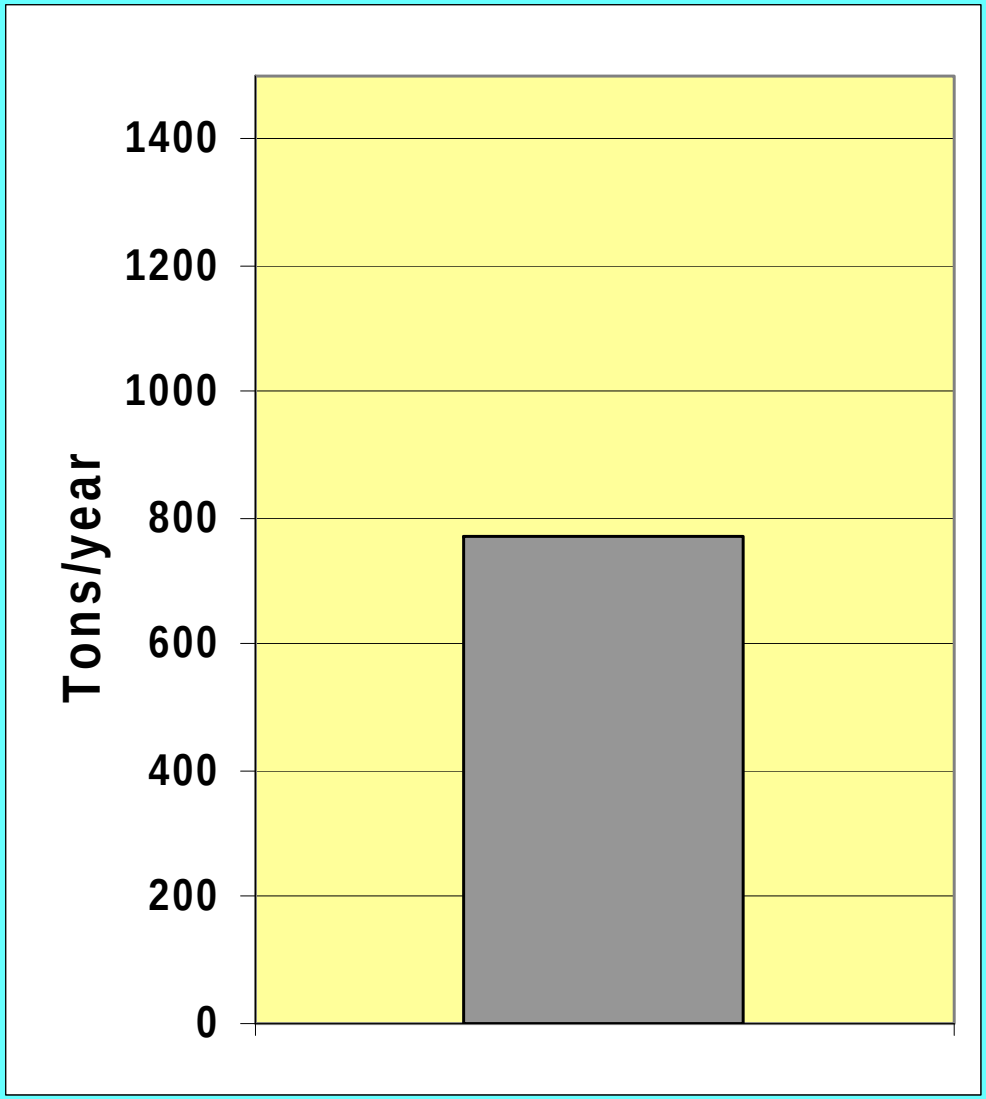
Asian emissions of mercury (initial estimate)



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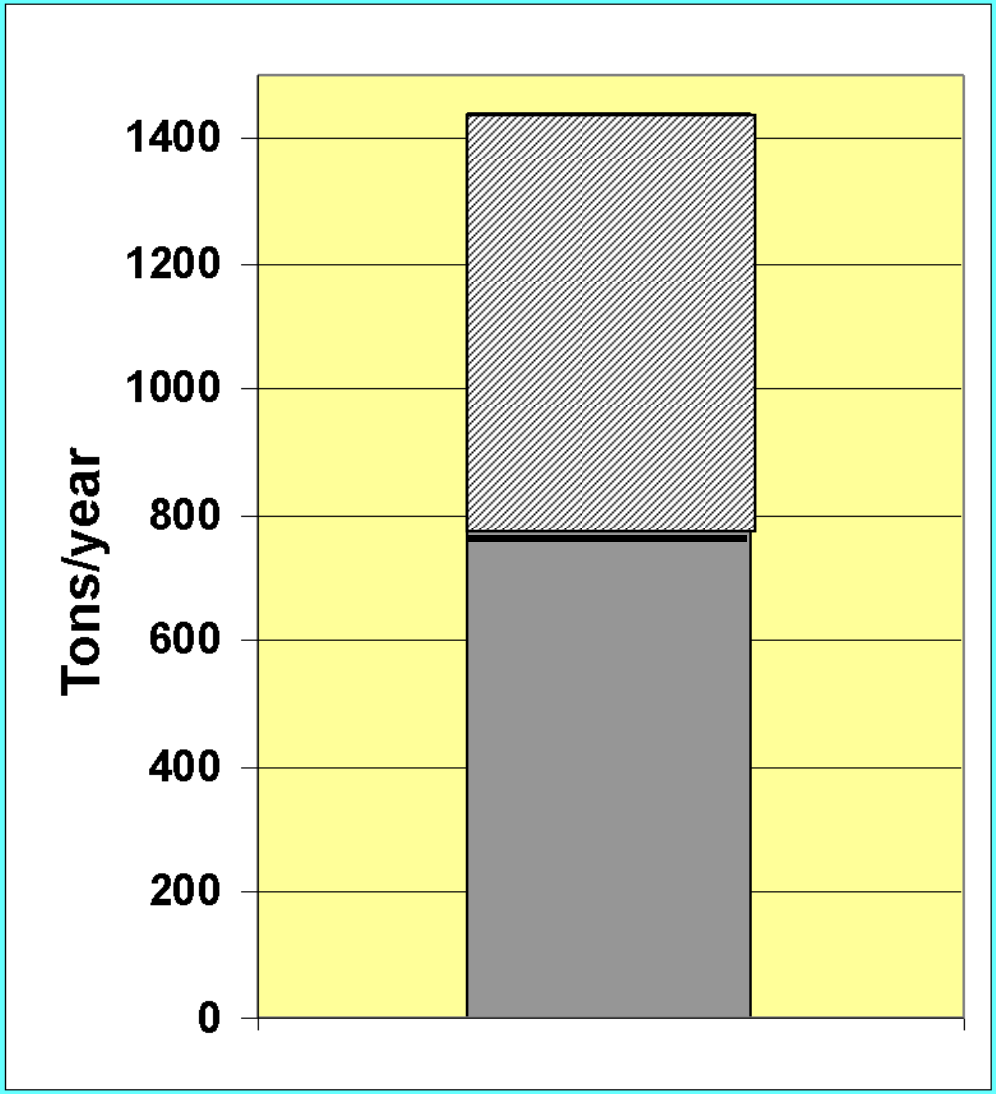
Asian emissions of mercury
New calculation based on our observations



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Small scale Zinc smelting in Guizhou, China

Photo courtesy of Xinbin Feng

State Key Laboratory of Environmental Geochemistry, Institute of Geochemistry,
Chinese Academy of Sciences

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Summary

1) We have identified numerous long-range transport episodes coming from the Asia continent;
2) These episodes indicate multiple source types including industrial emissions, biofuels/biomass burning and mineral dust;
3) While most pollution is local, we occasionally observe significant enhancements in pollutants from Asia and these can contribute to violations of US air quality standards;
4) Our work has identified a significant underestimate of emissions of mercury from China.
5) Global cooperation on environmental matters is clearly essential for long-term sustainability of the planet. We even have a model... the Montreal Protocols which have virtually eliminated chlorofluorocarbons and saved the ozone layer.

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Involvement by UW students

Graduate student Phil Swartzendruber (left) getting ready for a flight at Paine Field

UWB undergraduate J.B. Dennison at Mt. Bachelor

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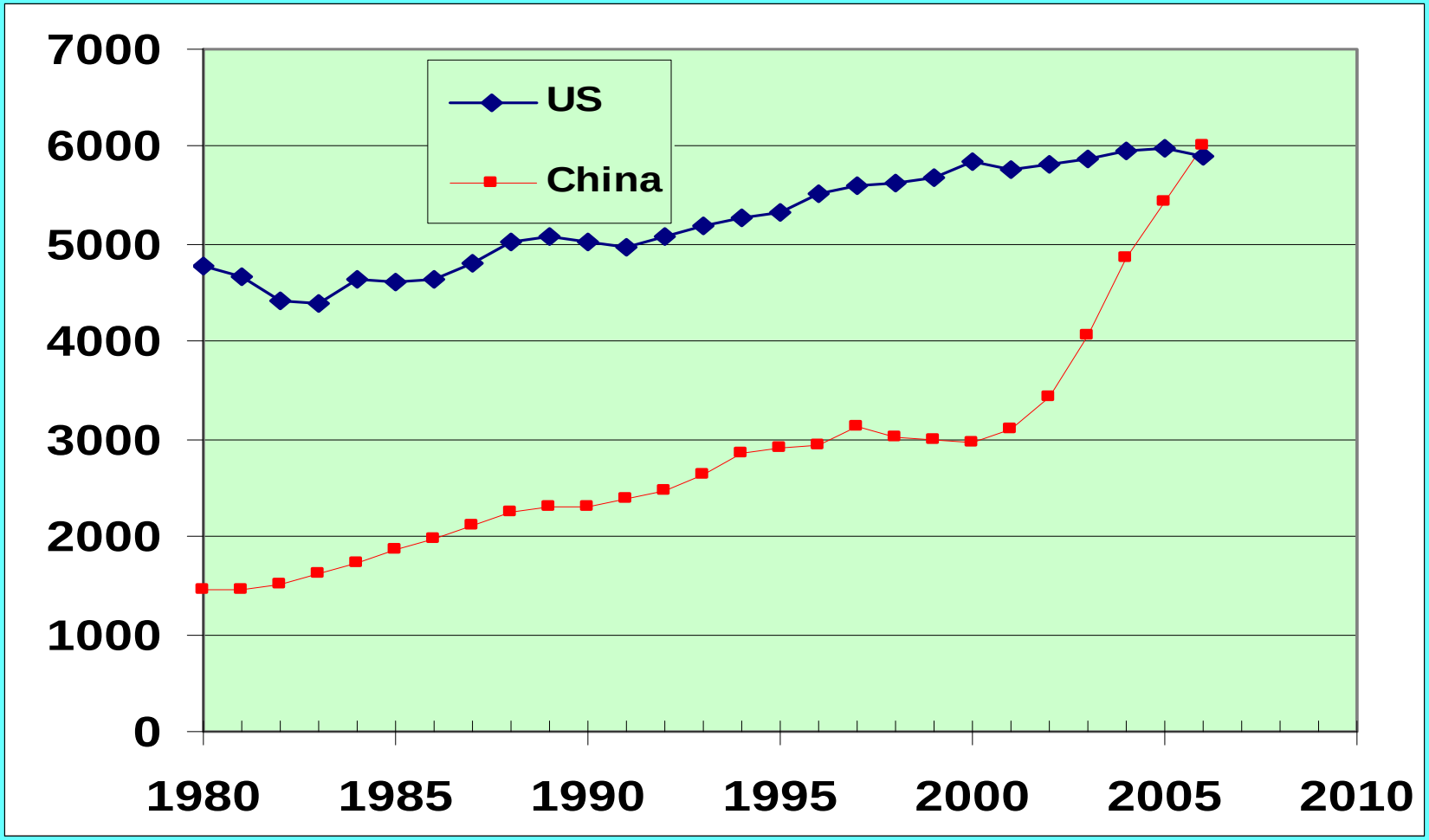
CO2 emission (million metric tons CO2)



The US and China contribute 41% of all anthropogenic CO2.

Source: US EIA

Solving global environmental issues will require global cooperation. We should increase opportunities for UW students to get involved!

- China study abroad program focused on energy and environment.
- Engagement with Chinese scientists on energy technology, air pollution and greenhouse gases.
- UW center on China and the global environment?

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“Class will be outside today”

For more information please see:
http://resarch.uwb.edu/jaffegroup

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