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The Pacific Dust Express

Marshall Space Flight Center

North America has been sprinkled with a dash of Asia! A dust cloud from China crossed the Pacific Ocean recently and rained Asian dust from Alaska to Florida.

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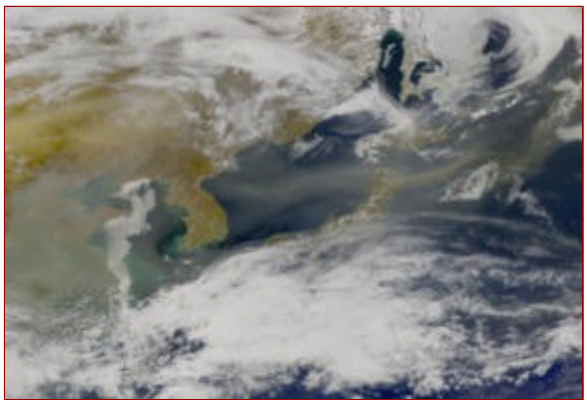


May 17, 2001 -- Springtime. Time for picnics, blossoming flowers, days at the park ... and gargantuan trans-continental dust clouds!

Scientists recently used NASA satellites to track a cloud of dust up to 2,000 km long as it left Asia, drifted across the Pacific Ocean, and traversed North America from Alaska to Florida, raining dust and possibly pollutants over the continent.

Right: This SeaWiFS image shows a sinuous trail of dust streaming east over North Korea and Japan and heading out over the Pacific Ocean. This was only the beginning of the dust's long journey, which finally came to an end in the mid-Atlantic. Click on the image for a larger version. Image courtesy NASA SeaWiFS Project and ORBIMAGE.

Dust clouds blowing east from Asia are a common occurrence in the springtime, but last month's million-ton dust cloud was surprisingly large and long-lasting.

"In terms of area covered, this was the largest dust storm we've observed in the Northern Hemisphere (since 1979). This was massive," said Jay Herman, principal investigator for aerosols for NASA's **T**otal **O**zone **M**apping **S**pectrometer (TOMS), a satellite-based instrument commonly used by scientists to track aerosols (tiny airborne particles like dust or smoke).

Left: The streets of Baichen in the Jilin Province of northern China appear almost apocalyptic on April 7 during the peak of the violent dust storms that gave birth to the dust cloud. Click on the image for a larger version. Photo by Zev Levin.

Like the lines of smoke used in wind tunnel tests to show the path of the air, these springtime dust storms give visible evidence of a "conveyor belt in the sky" that ferries air from Asia to North America in the spring. Invisible pollutants are also carried across the Pacific Ocean by this conveyor, according to Daniel Jaffe, professor of atmospheric sciences at the University of Washington.

Based on air quality measurements at Cheeka Peak at the westernmost tip of Washington state and later airplane-based measurements, Jaffe's research group has shown that a steady trickle of air pollution comes across the Pacific from Asia -- at least in the spring -- punctuated by a surge of pollutants once or twice a month.

These surges are presumably due to the wholesale movement of air from Asian urban areas across the Pacific. This prevents the pollutants from being diluted by mixing with cleaner air. During these surges, the air entering the West Coast can have pollution concentrations as high as 75 percent of federal air quality standards, Jaffe said.

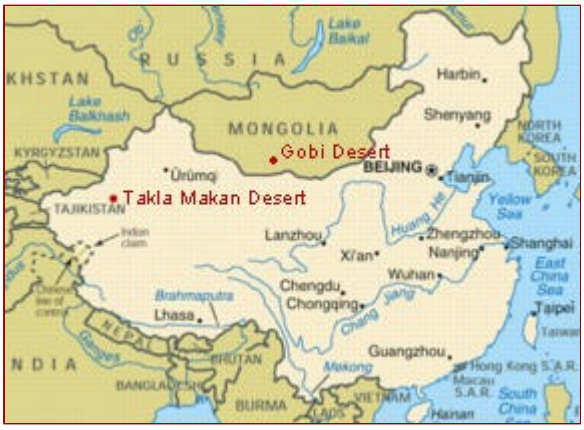
Scientists won't know the exact make up of last month's cloud until chemical analysis of dust samples collected from the cloud can be completed.

The dust cloud originated between April 6th and 9th when strong winds from Siberia kicked up millions of tons of dust from the Gobi and Takla Makan deserts in Mongolia and China, respectively. Air currents then carried the dust east. The leading edge of the cloud reached the U.S. West Coast on April 12th, and 2 days later it had crossed the East Coast shoreline and began heading out into the Atlantic.

By the time the dust cloud finally disappeared from satellite images on April 24, it had traversed two-thirds of the Atlantic toward England.

To onlookers in North America, the vast dust cloud appeared as a hazy white tint to the sky (due to the scattering of all wavelengths of sunlight by the dust particles), and in some places the dust fell to ground level and blanketed cities in a thin haze.

"You couldn't miss it," said Duane Hilton, a resident of Bishop, California, where the cloud descended in April. "We usually have 50 miles visibility, but at one point you could see dust in the air looking at objects just 8 to 10 feet away."



The health impacts of such ground-level dust are thought to have been minor.

Left: Click on the map for a larger version.

From the high perch of Earth orbit, the outlines of the cloud were more visible. Scientists used aerosol maps from the TOMS instrument and visible-light images from NASA's **Sea**-viewing **Wi**de **F**ield-of-view **S**ensor (SeaWiFS) to track the dust cloud and observe its properties.

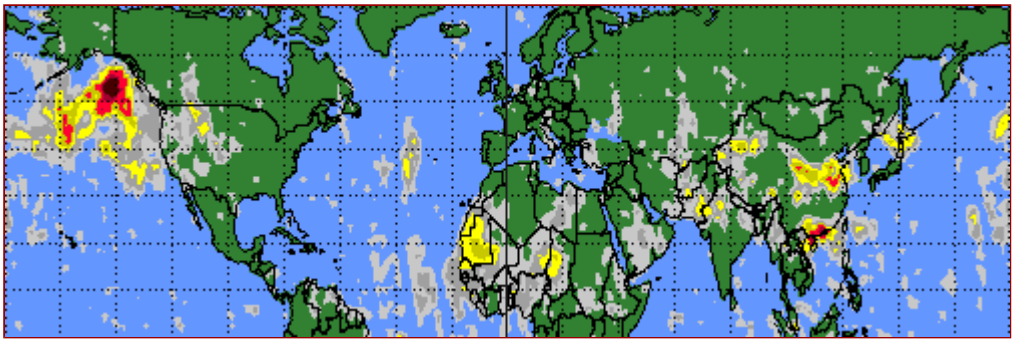
"SeaWiFS provides visible and near-infrared imagery of almost the entire globe every day, and we're able to collect, process and distribute that imagery to scientists generally within hours of observation," said Gene Carl Feldman, project manager for SeaWiFS at NASA's Goddard Space Flight Center. "This allowed researchers to track the dust cloud in near real-time, instead of days or weeks later as is so often the case with other satellites."

In the spring, conditions in the atmosphere over Asia are ripe for both massive dust storms and wholesale movement of large volumes of air across the Pacific Ocean. The combination of dry soils and high winds leads to a spurt of dust storm activity, which coincides with strong winds that carry the dust over the Pacific.

As the summer progresses, these air currents change and the Pacific "conveyor belt" fades

away.

"The big picture is that, no, these (foreign pollution influxes) are never going to be bigger than the local contributions you get from cities -- local sources such as factories nearby," Jaffe said. "But does that mean we should ignore it? No, I don't think so. It is a contribution, and once in a while it can be a big contribution."



Above: While much of the dust cloud remains over the Pacific Ocean, the leading edge has reached as far east as the American Midwest by April 13. Images such as this one are a principal tool for scientists who study aerosols.

But America isn't only a recipient of these transfers -- it's also a source. Dust is not a major North American export, but smoke from the seasonal Canadian boreal fires has been known to reach Europe, and many scientists claim that Europe inhales much of the industrial pollution that streams east from the United States. Experiments are underway to confirm this flow of U.S. pollution into Europe.

"I think it's a good example of how we're all tied together. Things that happen in Tokyo and Beijing and New York affect people on other continents in very surprising ways," Jaffe said. "It's like the bumper sticker slogan: Everybody's trash goes somewhere."

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Web Links

April 2001 Asian Dust Event -- a clearinghouse of information and images for last month's dust event, compiled by Douglas Westphal of the Naval Research Laboratory in Monterey, California.

Asian Dust Storms Across Western U.S. -- pictures and information about last month's dust cloud, from NASA's Goddard Space Flight Center

Asian Pollution Drifts over North America -- an article about Jaffe's research into trans-Pacific air pollution transport, from *Science News Online*

Asian Dust Episode of 1998 -- a detailed scientific paper about a similar dust event in 1998

Asian Dust Event, April 1998 -- information on a similar dust storm that occurred in the spring of 1998, from NASA's Goddard Space Flight Center

Desert Dust, Dust Storms, and Climate -- an explanatory website from NASA's Goddard Institute for Space Studies

Introduction to Aerosol -- general information about aerosols, including sources of aerosols,

chemical composition, and influences of aerosols on the environment and human health

Radiative Effects of Aerosols on the Environment in China -- an exploration of how aerosols over China influence its environment

TOMS -- homepage for NASA's Total Ozone Mapping Spectrometer satellite-based instrument, which scientists use to track aerosols

SeaWiFS -- homepage for NASA's Sea-viewing Wide Field-of-view Sensor, which provides daily global visible-light images of Earth

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