

NOAA scientists to search tropical skies

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Scientists from NOAA's Earth System Research Lab (ESRL) will be among 400 researchers in Costa Rica this summer to probe one of the most complex and least observed regions of Earth's atmosphere during the rainy season. Based in San Jose, Costa Rica, the NASA-led field study will shed light on key processes related to climate change, the stratospheric ozone layer, and global chemistry. The study runs from July 2 through August 15.

The Tropical Composition, Cloud and Climate Coupling (TC4) experiment will use a large array of instruments to observe a part of the atmosphere above the eastern Pacific Ocean 8 to 13 miles above the surface of the Earth during the rainy season. This zone is a layer of the atmosphere nicknamed the "gateway to the stratosphere." The tropic's powerful convective engine drives water vapor and other gases and material into the stratosphere here, where their impacts may be global. One overarching question is whether this transition layer will warm or cool with climate change.

ESRL's David Fahey and colleagues from NOAA and the University of Colorado will fly instruments aboard NASA's high-altitude WB-57 aircraft to gather data on black carbon particles, ozone, water vapor and particle composition, as well as air pressure and temperature.

"We'll be fishing around in a key part of the atmosphere at a key time of year," said Fahey. "Casting a wide net and being open to whatever comes could lead to surprising and important findings."

Fahey will observe black carbon, or soot, produced by fossil fuel burning. By absorbing sunlight and heating the air, black carbon can change atmospheric circulation and precipitation, but the processes involved are unclear. For example, how black carbon influences clouds and how clouds remove it from the atmosphere remain an unsolved puzzle. Scientists know so little about black carbon that any direct observations are important, Fahey said.

On the same aircraft, a team led by NOAA/ESRL scientist James Elkins will measure nearly 20 gases, including ozone-destroying chlorofluorocarbons and their substitutes, the greenhouse gas methane, carbon monoxide, and peroxyacetyl nitrate (PAN) – a component of smog at lower altitudes. Elkins will track natural and human-produced PAN as it moves over land, changes altitudes, then travels long distances. It finally descends over the ocean, forming surprisingly high levels of ozone above the remote, pristine Pacific.

Elkins will also monitor methyl iodide, another compound with little known about it. Depending on the lifetime of the gas, an iodine atom can attack Earth's protective ozone layer 200 times more effectively than a chlorine atom, the primary ozone destroyer. How much methyl iodide is getting into the stratosphere and exactly how it gets there are unknown.

“Until recently we thought oceans were the only important source of methyl iodide. Now we know the Amazon can be a big source,” Elkins said. “We now have to look into what it means for the ozone layer.”

Among substitutes for human-made ozone-depleting compounds, Elkins will study HCFC-22. Commonly used in room air conditioners, the compound was introduced as a shorter-lived, less-harmful substitute for ozone-eating chlorofluorocarbons, but it's also a greenhouse gas. Now levels of HCFC-22 are rising rapidly as the demand for air conditioning soars in China and India.

Water vapor, the most powerful and most prevalent greenhouse gas, is a primary focus of TC4. In the study layer of the lower stratosphere, air is far drier than at the surface, but the exact numbers are questionable. Six water vapor instruments on board the WB-57 will help scientists verify satellite data and resolve inconsistencies found in previous measurements.

Holger Vömel with the Cooperative Institute for Research in Environmental Sciences (CIRES), a partnership between NOAA and the University of Colorado will measure atmospheric water vapor and ozone up to 17 miles above the surface with instrumented balloons launched from the San Jose airport. These measurements will help resolve discrepancies between instruments that measure water vapor, Vömel hopes to shed light on cloud formation and track rising and sinking air parcels.

The total stream of TC4 measurements from space, aircraft, balloons, and ground stations will help researchers understand their own data and provide long-awaited accuracy checks for satellite instruments.

“Everyone wants to know how accurate the satellites are,” says Fahey. “It’s incredibly important.”

Source: NOAA Research

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