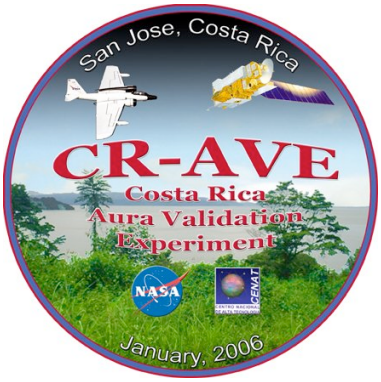
CR-AVE: Costa Rica - AURA Validation Experiment

The Costa Rica Aura Validation Experiment (CR-AVE) mission was conducted from January 14 – February 11, 2006 at the Juan Santamaria airport in San Jose, Costa Rica. The purpose of the mission was to explore the tropical upper troposphere and lower stratosphere (UTLS) portions of the atmosphere, and to provide information for comparison to satellite observations (especially Aura).



Interest in the UTLS comes from our understanding that this region has a major impact on both the recovery of the ozone layer and on climate change. Climate change may cause increased temperature and water vapor levels in the tropics. These increases will in turn modify upper tropospheric transport, chemical composition, and clouds, as well as the radiative balance of the UTLS. These changes will both affect the recovery of ozone and serve as potentially important climate change feedbacks. The tropical region between 30 N and 30 S comprises half of the Earth's surface, yet is relatively unsampled in comparison to the mid-latitude of the Northern Hemisphere. In addition, observations above typical aircraft altitudes (40,000 feet or 12 km) are even less frequent, making the tropical upper troposphere and lower stratosphere one of the most sparsely sampled regions of our atmosphere.

The scientific objectives of the CR-AVE mission were to: (1) examine the ozone budget at high altitudes of the tropics, (2) measure water vapor, (3) investigate high altitude "sub-visible" cirrus, and (4) measure the size and shapes of cloud ice crystals. Data collected for each of these objectives is used to understand the state of tropical clouds, ozone, and water and their role in climate change

Paul Bui preparing the MMS instrument for installation onto the WB-57F.

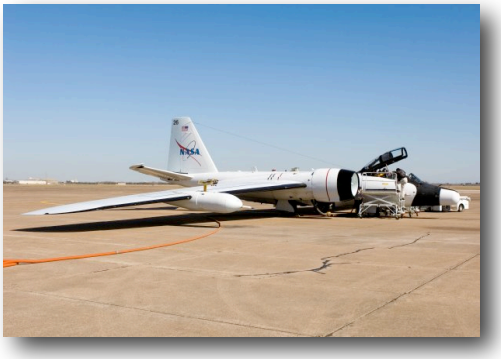
The NASA WB-57F aircraft, with a suite of 29 science instruments, was the primary research platform for CR-AVE. The WB-57F payload included instruments to analyze data related to both ozone recovery and climate change. The payload was divided into two types of science data acquisition, an in situ air sampling payload, and a remote sending payload. A unique aspect of this mission was the successful change-out of the payload during the middle of the mission at the deployment site. Twelve successful flights divided into two separate payloads, including six in-situ and six remote sensing flights, for a total of 60 flight hours.

CR-AVE

Some science highlights from the mission include:

- Good correlative measurements were made for TES, MLS, and HIRDLS instrument validation.
- UTLS temperatures were much colder than average, resulting in extensive observations of sub-visual cirrus.
- Observations of water, water isotopes, and VSLS indicates TTL impacted by convection of ice from boundary layer air.
- First observations of black carbon provide basic constraints on GHG radiative forcings.
- Particle observations show that TTL is dominated by neutral organic aerosols while the stratosphere is dominated by acidic sulfate aerosols - a scientific puzzle.
- Organic bromine in TTL is dominated by known species (methyl bromide and halons) – conclusion, if a major source of Br is being injected into the stratosphere than it must be in inorganic form (e.g., BrO).
- TTL cirrus observations indicated predominance of quasi-spherical, surprisingly large ice crystals.

For more information, the CR-AVE mission web site is located at: http://cloud1.arc.nasa.gov/ave-costarica2.



WB-57F on the ramp in Houston for instrument test flight prior to deployment to Costa Rica.

WB-57F Pilot, Bill Rieke, preparing for flight.

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