FRD Activities Report
June 2002

Research Programs

CLAST-High

Calibrations of the instruments to be used in the upcoming CBLAST-High field study were completed. Preliminary testing was completed on the instruments and data system interface at FRD. Installation of the instruments on one of the NOAA P3's (43) began in earnest, after overcoming some initial hurdles regarding AOC concerns of the structural integrity of the instrument package. A trip to MacDill AFB in mid-June allowed Jeff French to work with AOC engineers to install the wiring and roughly half of the instruments on the P3. The installation work was hampered by the requirement that AOC have the aircraft 'Reconnaissance Ready', pushing the CBLAST install to a lower priority at that time. The CBLAST install is now on track, with the physical mounting of the BAT probe and the sea-surface mperature radiometer the last two items yet to be installed. Back at e FRD facility, work continues on the data system. The rack-mount ases were re-built with aircraft-standard locking hardware. Software sting also continues this month. (Jeff.French@noaa.gov)

Figure 1. IRGA mounted on the forward situated down-ward-pointing camera port.

Figure 2. P3 Noseboom. The BAT will be mounted here. New wires were run and tested during this install.

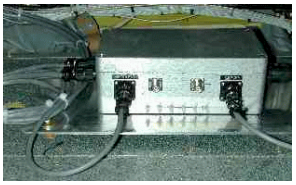

Figure 3. BAT electronics modules located in the forward load center of the P3.

te th c te

CBLAST-Low

Preparations continue for the upcoming CBLAST-Low field study that will be conducted during August 2002 off the coastal waters south of Martha's Vineyard. Detailed calibrations have been conducted over this last month on the BAT probe pressure sensors, accelerometers, temperature probes, humidity sensors, pyranometers, infrared radiometers, laser altimeters, analog-to-digital (A/D) boards, and amplification circuits. (Jerry.Crescenti@noaa.gov, Jeff French, Tim Crawford, Tami Grimmett).

Refractive Turbulence

Because of LongEZ contract delays, the spring refractive turbulence study was not flown. Resources from this experiment are being redirected to the August study, using Airborne

Research Australia's high-altitude Egrett research aircraft. The Australian study has been expanded to run from August 20 through September 18. The Egrett's older BAT electronics are being updated and calibrated for the study. (TLC@ida.net).

ET Probe

Field tests of the ET probe continued during June in an effort to track down the cause of the data dropouts that have dogged the system. Most of the dropouts were traced to calibration problems in the acquisition software, and these have been fixed. The system is now working more or less as designed, and the output winds look qualitatively reasonable. However, the probe has not yet been compared with reference instruments (e.g., a sonic anemometer) to determine whether the turbulence and flux estimates are reasonable. Several probes have now been sent to ATDD in Oak Ridge, TN to prepare for possible deployment during this hurricane season. ATDD is much closer to the hurricane action than FRD, so it was decided to run the ET probe deployment out of ATDD. If a hurricane makes landfall in the U.S. this year, the intention is to deploy 3 ET probes near the coast in its path. (Richard.Eckman@noaa.gov, Tom Strong, Tim Crawford; Ron Dobosy and Dave Auble [ATDD])

IMS Development Project

The IMS prototype is now running with a polonium-210 ionization source. Initially, the Ion Mobility Spectrometer (IMS) with this ionization source produced a number of peaks, but did not give any observable response to SF_6. Dr. Atkinson from the INEEL was able to help us identify the peaks as contamination in the IMS drift cell and identify the electronic circuit board and an electronic insulating compound used on the ion gate as the source of some of the contamination. After the gate was redesigned to prevent these materials from being exposed to the drift region and the entire IMS was cleaned and baked out, peaks may be observed on the introduction of relatively high levels of SF_6. (see Figures 4 and 5) However, one contaminate peak remains in the system and must be removed before it will perform correctly. We are working with Dr. Atkinson to identify the source of the problem. We will be testing samples of the adhesives used in the polonium source in the next few days. (Roger.Carter@noaa.gov, Shane Beard, Debbie Lacroix)

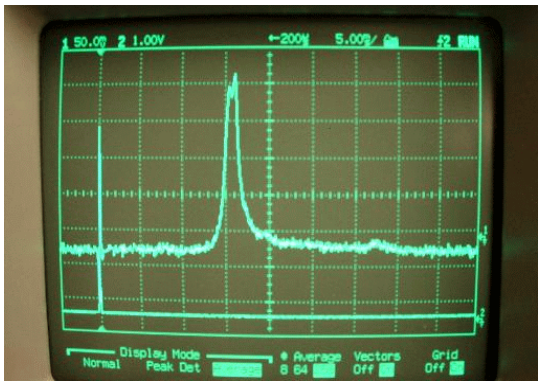

Figure 4. IMS response to air.

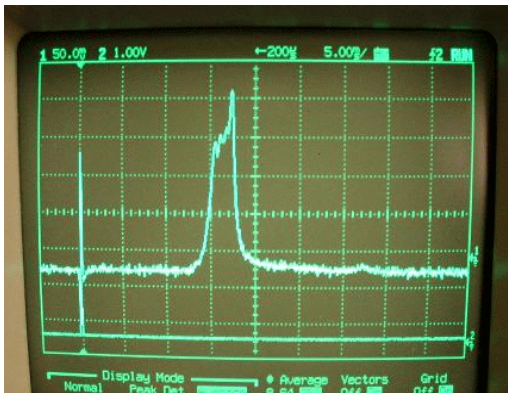

Figure 5. IMS response to 20 ppm SF_6 in air.

URBAN-2000

During the quality assurance review of the URBAN-2000 data, it was discovered that some of the samplers labeled as samples had reduced recoveries as compared to the samplers labeled as duplicates. The reduced recoveries occurred only with the samplers placed in the downtown areas closer to the release site. Tests were conducted during 2001 to determine the cause of the discrepencies. Samplers were tested and compared for consistency, holding time studies were conducted, different concentrations of SF6 were sampled, diffusing studies were conducted and SF6 gas was sampled continuously and then pulsed at different times. All test results showed that the sampling system was consistent, with differing concentrations and flows of SF6 and that there was no appreciable diffusion or change in concentration over a two month period. The sampling and analysis methods did not appear to be the cause of the discrepencies. Finally at the end of May of 2002, an idea occurred that the CATS tubes that were attached only to the samplers labeled as samples might be the cause of the poor recoveries. The CATS tubes were only attached to samplers located in the downtown areas. URBAN-2000 data was sorted on the basis of samplers with and without CATS tubes. The average recovery of those labeled as samples and that had CATS tubes attached was 63% as compared to their duplicate concentrations. The linear regression of the sample concentration results as compared to the duplicate results is shown in Figure 6, with the solid line showing the data results. The average recovery of the duplicates that did not have CATS tubes attached was 104%. A graph of the linear regression of those results is shown in Figure 7.

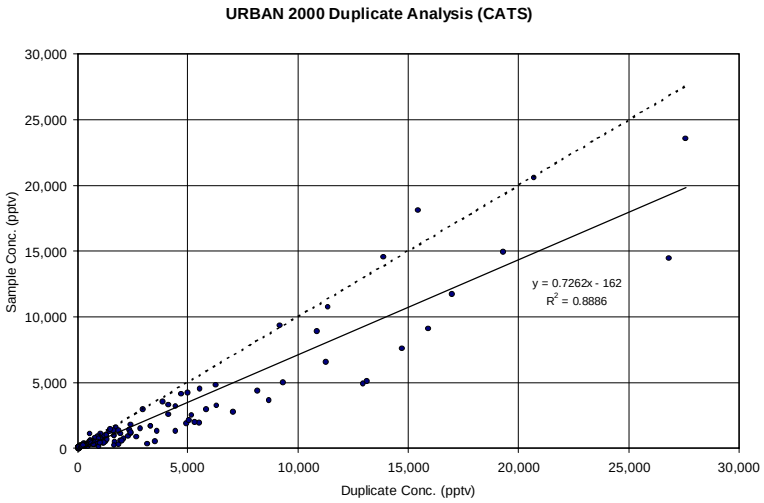

Figure 6. Urban 2000 duplicate analysis (CATS)

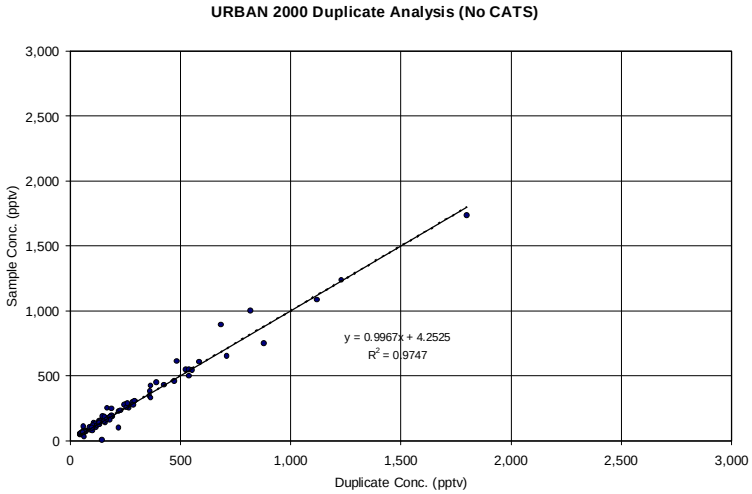

Figure 7. Urban 2000 duplicate analysis (No CATS)

Although these results showed a very high probability that the CATS tubes were the cause of the poor recoveries, studies were then conducted during the month of June to undeniably determine if the CATS tubes, that were attached to some SF6 samplers, were indeed the cause of the reduced duplicate recoveries in the URBAN-2000 study and if they were, what extent they played in reducing recoveries of SF6. CATS tubes were sent from the same source as those that were used for the URBAN-2000 study to use as a test bed and studies were initiated immediately after their receipt.

Concentrations ranging from 83.5 ppt to 103,600 ppt, were pumped from a source cartridge through a sampler then into a receiver cartridge. This test was conducted to verify that the sampling method would provide acceptable recoveries without the CATS tubes in place. The average recovery without the CATS tubes was 94%. The CATS tubes were then placed on the sampler in a series of two for each outlet to mimic their placement for the URBAN-2000 studies as shown in Figure 8. The average sampling temperature was 14 degrees celcius. The average recovery of SF6 at different concentrations ranging from 83.5 ppt to 103,600 ppt was 61%. To determine if SF6 is desorbed during continuous sampling periods, a nitrogen blank was then analyzed and resulted in an SF6 concentration of 24% of the expected value of standard. Another blank was analyzed with an SF6 result of 8%. Another blank was analyzed with a result of 2% and finally one more blank was analyzed with a result of 1%. The CATS tubes had adsorbed some of the SF6 and it was slowly desorbed as nitrogen was sampled.

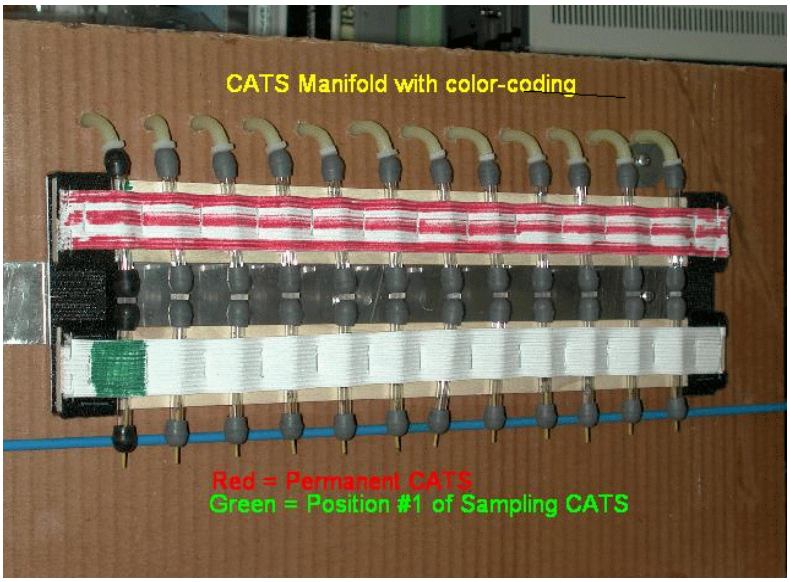

Figure 8. CATS with red stripes are the guards CATS.

Other tests were conducted at different temperatures to confirm that there was indeed a change in the average recovery due to CATS tubes and if there were any changes due to temperature and to determine how much the guards CATS tubes affected the SF6 results. The guards CATS were the CATS tubes attached between the sample CATS tubes and the sampling pump (see Figure 8). They were placed in line to adsorb any perfluorocarbons that might diffuse from the pumps. The average temperature at 11 degrees celcius produced an SF6 recovery of 55% while a temperature of 31 degrees celcius produced a recovery of 72%. The guards CATS had an SF6 recovery of 10%.

The results of these tests proved that the CATS tubes did indeed have a large affect on the recovery of SF6 during the URBAN-2000 study and explained the large differences seen between

the samples and their corresponding duplicates. Temperature may have some affect on the desorption of SF6 with better desorption at higher temperatures. The guards CATS seemed to adsorb a smaller portion of the SF6 than the sample CATS.

Rain In Cumulus over the Ocean (RICO)

Investigators from several universities, NCAR, and NOAA gathered in Ogden during the AMS Cloud Physics Conference in June to discuss plans for an upcoming cloud study to take place in Puerto Rico in 2004. The focus of the project is to investigate the initial formation of drizzle and raindrops in trade-wind maritime cumuli. Aircraft slated for the project include the Wyoming KingAir and the NCAR C130. During the planning meeting, several investigators expressed interest in getting a third aircraft instrumented to investigate the turbulence in small cumulus. Turbulence has been proposed as a possible mechanism responsible for the often observed, but as of yet unexplained, broadening of the cloud droplet size distribution in small, warm clouds. ARL scientist Jeff French is teaming up with Gabor Vali from the University of Wyoming to use the Wyoming cloud radar and the Wyoming KingAir to investigate small scale structure of cumulus clouds. (Jeff.French@noaa.gov)

Cooperative Research with INEEL

Emergency Operations Center (EOC)

Jerry Crescenti and Brad Reese represented FRD during an all-day EOC exercise on June 12, 2002. The drill scenario involved a meltdown of the Test Reactor Area (TRA) reactor. A special 48-hour "canned" meteorological data set was prepared by Roger Carter for the drill. The simulated data was based on typical summer days which experience moderate southwesterly winds up the Snake River Plain in the afternoon and light northeasterly drainage winds in the morning. The drill was conducted in two parts. In the morning, the simulation was a "real-time" emergency as EOC personnel had to respond to the crisis at hand. In the afternoon, the scenario was pushed 48 hours into the future with a slow but continuous leak of radioactive materials from TRA. Numerous MDIFF simulations were made during the exercise in order to assess the potential for contamination and for use in evacuation. Plume projections from the simulated meltdown presented a challenge to EOC personnel. Several modifications and enhancements will be made in the next few months to MDIFF from the lessons learned during this exercise. (Jerry.Crescenti@noaa.gov, Brad Reese, Neil Hukari, and Rick Eckman).

Rick Eckman and Debbie Lacroix were called to the EOC on June 20, 2002 due to a wildfire that began at the side of U.S. Highway 20 near the border of the INEEL. As luck would have it, the EOC activation occurred with just one hour left in Rick and Debbie's duty period. After about two hours, they were relieved by Jerry Crescenti who stayed until the fire was contained. (Rick Eckman@noaa.gov, Debbie Lacroix, and Jerry Crescenti)

INEEL Support

FRD held another of its regular training sessions for INEELViz and the MDIFF model in mid June. This session was attended by staff from the Air Quality Department of the Shoshone-Bannock Tribes. (Brad Reese, Richard Eckman)

INEEL Mesoscale Modeling

The Alpha workstation used for mesoscale modeling at FRD suffered another malfunction in June. It appears that the CPU fans were the culprit on this occasion, and the system was up and running again after a couple of days. The repeated problems with the Alpha system has led to investigations into running the MM5 model on a fast PC system or a Beowulf cluster. Intel has recently released a FORTRAN 90/95 compiler for Linux that is highly optimized and has the features required to compile the MM5 source code. This compiler was used to compile MM5 on a PC with a single 1.3 GHz Pentium 4 CPU. For a MM5 test run involving 1 hour of simulated time, the PC took about 13.5 minutes to complete the test. The same test run required about 9.5 minutes on the dual-processor Alpha workstation. A single-processor Alpha workstation would have required about 18 minutes to complete the run, so individually the 1.3 GHz Pentium 4 appears to be roughly 25 per cent faster than the Alpha processor in running MM5. Extrapolating to the fastest Intel processors now available, it appears that a single-processor PC with a 2.4 GHz CPU may be slightly faster than the dual Alpha workstation, and a PC with dual 2.4 GHz CPUs may be over twice as fast as the Alpha. Dual-processor PCs with this performance are now relatively inexpensive. (Richard.Eckman@noaa.gov)

Other Activities

Papers

Clawson, K. L., and G. H. Crescenti, 2002: Meteorological measurements during the URBAN 2000/VTMX field study. NOAA Technical Memorandum OAR ARL-243, Silver Spring, MD, 45 pp.

Mahrt, L, D. Vickers, T. Crawford, W. Drennan and H. Graber. Flux Measurements from moving platforms, In final draft

Travel

Jeff French to Ogden, Utah, on June 5 to participate in the initial planning session for the RICO experiment to be conducted off the coast of Puerto Rico in 2004.

Jeff French to MacDill AFB (AOC) on June 16-21 for initial installation and testing of instruments on the NOAA P3 (N43) for the upcoming CBLAST-High field study.

Tom Watson returned to FRD on June 10 after participating in the BRACE study in Tampa, Florida, during May and June.

Training

Debbie Lacroix took the DOT Hazardous Materials Transportation Online Course offered by Eduwhere.com on June 26, 2002. This training was paid for by the NOAA training team. The training is useful in helping to understand DOT requirements for hazardous shipments that FRD makes when field projects are done. The training covered shipping papers, emergency response and placarding, labeling, identifying hazardous materials, preparing hazardous materials for shipment and how to use 49 CFR Parts 100-185. (Debbie@noaa.inel.gov)

Visitors

Hydrologist Melissa Claghorn from the National Weather Service (NWS) office in Riverton, Wyoming, served as a Survey Feedback Action (SFA) facilitator for FRD. She conducted a meeting with staff members on June 4, 2002 in which results were reviewed and action items discussed.

Air Resources Laboratory (ARL) Director Bruce B. Hicks visited FRD on June 28, 2002. An all hands meeting was convened in which various ARL programs and initiatives were discussed.

Awards

Tim Crawford was awarded a 30-year service pin for federal service. Tom Watson and Jerry Crescenti were awarded 10-year service pins for federal service.