

Title of Investigation:

Summer Air-Quality 2004 Data for University of Maryland-College Park and the Maryland Department of Environment

**Principal Investigator:**

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Other In-House Members of the Team:

Si-Chee Tsay (Code 913)

External Collaborators:

Professor R. R. Dickerson (University of Maryland-College Park), G. T. Aburn (Maryland Department of Environment), and Professor E. Joseph (Howard University)

Initiation:

FY 2004

FY 2004 Authorized Funding:

\$17,000

Actual or Expected Expenditure of FY 2004 Funding:

\$17,000 (\$11,000 to the University of Maryland-College Park and \$6,000 to Howard University)

Status of Investigation:

Completed in FY 2004

Purpose of Investigation:

This investigation had several purposes: (1) To distribute to the University of Maryland's Meteorology Department and its co-funded policy customer, the Maryland Department of Environment (MDE), NASA Earth science satellite data showing the movement of pollutants; (2) To measure pollutants—principally ozone—in the Greenbelt-Beltsville area in conjunction with the University of Maryland's Air Quality Aircraft Sampling group and the Howard University's undergraduate Summer Workshop; (3) To train undergraduate students in remote sensing and chemical measurements to introduce them to Earth science; and (4) To post all results on Web sites where policymakers and educators have access.

FY 2004 Accomplishments:

All elements of the project were completed successfully. Instead of ground-based chemical measurements, the students were trained to take ozone soundings with the Goddard ground station-sounding system at the Howard University Physics Department's Beltsville field site. In this way, we took the first ozone soundings ever in the Greenbelt-Beltsville region to complement the long-term ozonesonde record at Wallops Island. Wallops increased its soundings from one to three weekly. Both sets of measurements were part of a larger NASA-funded project, entitled "IONS = INTEX (Intercontinental Ozonesonde Network Study = Intercontinental Transport Experiment).

The IONS project amassed nearly 300 soundings from a dozen stations over a 6-week period (July 1-August 12) —coverage never before achieved in North America. The INTEX project was part of a larger NASA investigation that studied transport of pollution from North America to the North Atlantic and Europe and from Asia to North America.

Each day, the sondes sent real-time data during their ascent on the ozonesonde-bearing balloon. By early evening, the Goddard INTEX Meteorological Support group received forecast analyses and a series of physical parameters. Satellite data were posted at the local INTEX Web site, <http://croc.gsfc.nasa.gov/intex>. Trajectories run in a forecast mode allowed us to predict the movement of pollution so that high-ozone layers in the Washington area could be tracked downwind. These forecasts and ozone-profile images also were posted at the Goddard Space Flight Center's Web site at: <http://croc.gsfc.nasa.gov/intex/ions.html>.

By the following morning, the NASA DC-8 INTEX flight planning team, based at Pease Air Park near Portsmouth, New Hampshire, was able to direct aircraft sampling into or away from the pollution as it traveled over the Gulf of Maine. Thus, our Director's Discretionary Fund (DDF) money allowed education and outreach in the context of a major NASA field effort. Figures 1 and 2 show examples of ozone, temperature, and humidity data from the Beltsville site. Forward trajectories for the date illustrated predicted that layers of ozone pollution would find their way to the New England-Gulf of Maine INTEX sampling region within 2 days. Indeed, sondes launched in Rhode Island and from the National Oceanic and Atmospheric Administration's (NOAA) research vessel, *Ronald H. Brown*, intercepted the Beltsville pollution.

In addition to two University of Maryland-College Park students, three Howard University students worked on the IONS sonde project, extending the training to members of a department consisting of traditionally under-represented minorities. Training took place June 14-28, with J. Witte (SSAI) assisting (Figures 3 and 4). An illustrated training guide was produced and the students presented their first results at the conclusion of Howard's Workshop on Atmospheric Sciences, an event geared to undergraduates from a range of national Historically Black Colleges and Universities (HBCUs). The five students made plots of ozone pollution in the format requested by MDE and posted data and photos of their activities at: <http://atmos.umd.edu/~lieschjl/hublab>.

Publications and Conference Presentations:

The following presentations were made based on the summer DDF-sponsored research. In addition, the principal investigator briefed NASA, NOAA and Environmental Protection Agency (EPA) Program Managers on October 16, 2004 at the monthly meeting of the Interagency Subcommittee on Air Quality Research, White House Conference Center, Washington, D.C.

A. M. Thompson, "The Integrating Role of Ozone Soundings: Illustrations from SHADOZ (Southern Hemisphere Additional Ozonesondes and IONS (INTEX [Intercontinental Transport Experiment] Ozonesonde Network Study)," International Summer School on Atmospheric and Oceanic Science, University of L'Aquila, L'Aquila, Italy, September 23, 2004.

A. M. Thompson, et al, "Insights into Tropospheric Ozone from the INTEX Ozonesonde Network Study (IONS)," Fall AGU Meeting, San Francisco, December 17 2004.

A. M. Thompson, et al, "Insights into Free Tropospheric Ozone Sources and Transport in July-August 2004 from IONS=INTEX Soundings," American Meteorological Society (AMS) Annual Meeting, San Diego, January 10, 2005, presentation by student L. M. Zamora

Planned Future Work:

The regional air quality research demonstrated through this DDF is being proposed for Aura spacecraft validation.

Summary:

The success of the DDF pilot can be gauged in three ways. First, the MDE and the University of Maryland-College Park were enthusiastic about having soundings in the Washington, D.C., area. Next year, it is expected that MDE will support Howard and the University of Maryland in taking soundings on a regular basis, starting in May. Second, we demonstrated the value of the Beltsville site to a consortium of universities working on air-quality measurements for remote-sensing validation. Members include the University of Maryland, Howard University, and the Goddard Laboratory for Atmospheres, as well as the University of Maryland-Baltimore County, Johns Hopkins University, Washington State, and Penn State. All are planning to make air pollution measurements in the Beltsville-Greenbelt area over the next several summers, while NASA's Aura satellite follows pollution globally. Third, the DDF encountered a risk that we overcame. The COMMIT (Chemical, Optical, & Microphysical Measurements of the In situ Troposphere) facility, which was planned for deployment during the pollution season, was not available. Therefore, the project adapted by using sondes. Another element of risk was whether the Aura spacecraft would launch and produce data in time for IONS to serve as validation. Aura instruments were turned on only near the end of INTEX.

Figure 1. Beltsville sounding of July 8, 2004. Ozone in partial pressure, relative humidity, temperature on left; ozone in mixing ratio (ppmv (part-per-million by volume for stratosphere; ppbv for troposphere) on right

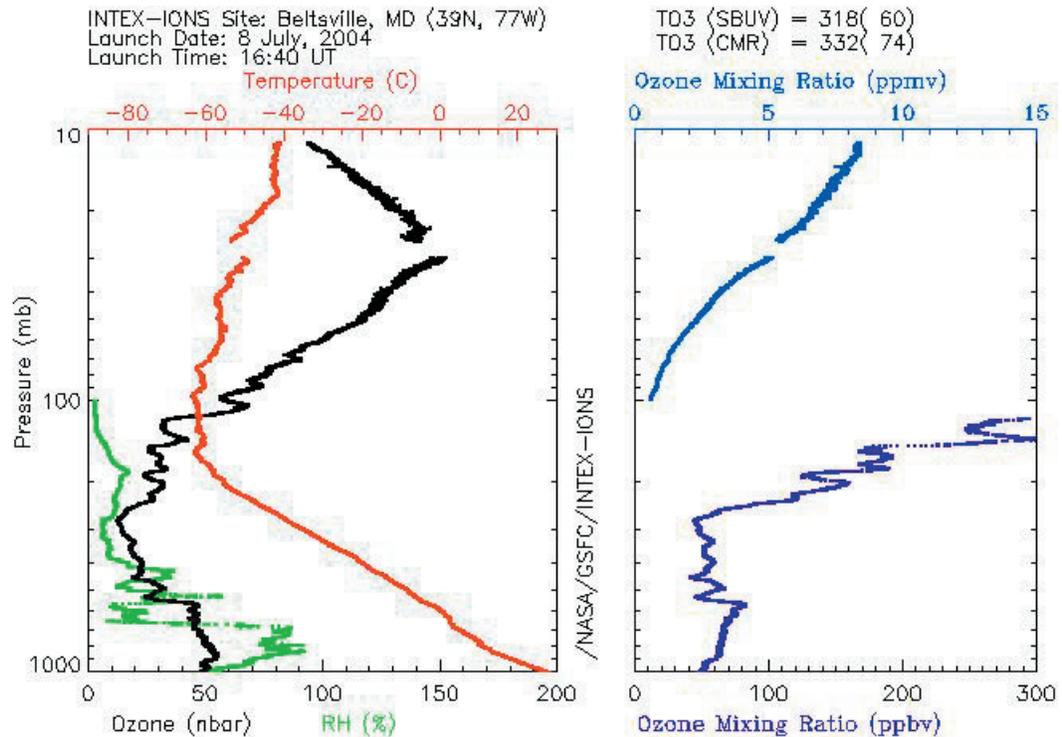


Figure 2. Forward trajectories from July 8, 2004 Beltsville sounding ozone layers. At 500 and 600 hPa (hectopascals), forward trajectories showed air parcels arriving two days later in the New England-Gulf of Maine region where other sondes and NASA aircraft sampled.

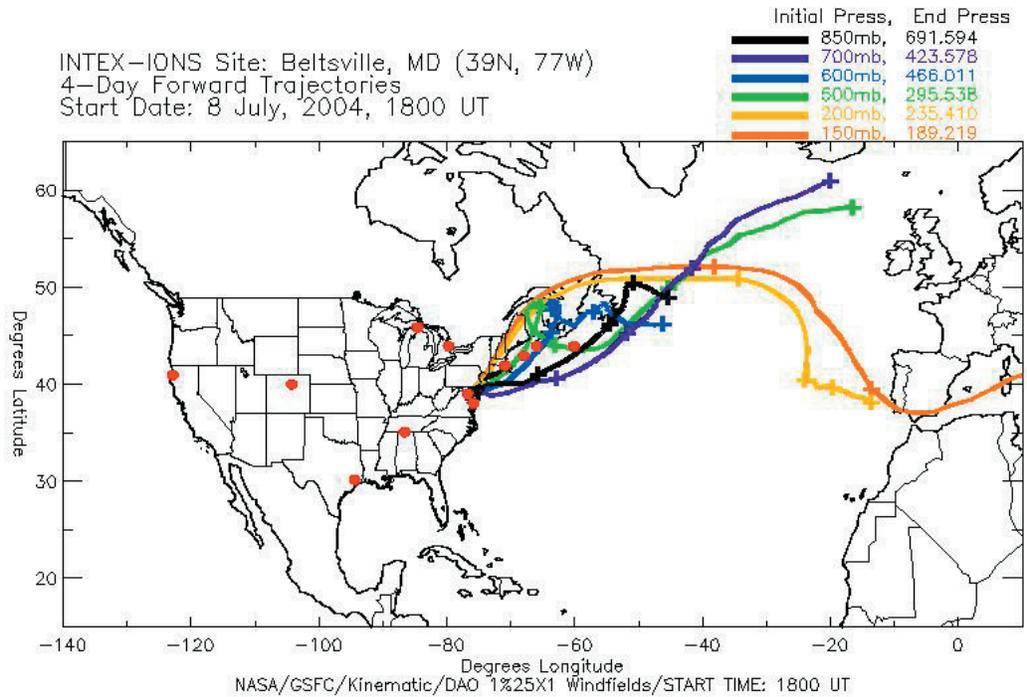


Figure 3. Training at Howard University Physics Department, Beltsville facility, showing students and SSAI's J. Witte pre-conditioning ozonesondes



Figure 4. Lesson in filling balloon designed to carry sondes to the stratosphere, 12,5000 feet above surface. Principal Investigator A. Thompson and Howard students shown.

