FORM A: GACP ACCOMPLISHMENT REPORT

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TITLE: Characterization of Aerosol Radiative Impacts Using Data from LITE

ABSTRACT:
In September 1994 the LITE instrument was flown on Space Shuttle Discovery as part of the STS-64 mission. During this mission, LITE acquired a unique set of near-global observations of the geographic and vertical distribution of aerosols and clouds. Correlative surface and airborne measurements acquired during the mission provide a complementary data to validate LITE retrievals and to relate the LITE data to aerosol loading and composition. The 3D spatial distribution of aerosol and clouds from LITE provides important constraints for estimates of aerosol radiative forcing deduced from other satellite observations and from models. Information on the distribution and variability of aerosol based on this set of worldwide lidar observations will allow an assessment of the uncertainties in aerosol products from existing and future satellite missions. It will also result in algorithms which can be applied to future satellite lidar aerosol measurements.

GOALS: Our long term research goal is to develop techniques for the retrieval of aerosol properties from space lidar systems and to collaborate with modelers to develop methods of incorporating these results into regional and global models. The LITE data represents a first opportunity for these activities. Techniques developed will be applied to and further developed for the PICASSO-CENA mission.

OBJECTIVES: Under this proposal, we will (1) process LITE Level 1 data to derive tropospheric aerosol optical depth, as well as other optical parameters, and then validate those parameters; (2) compare LITE aerosol data with coincident TOMS aerosol index data; (3) statistically characterize the spatial variability of the aerosol observed by LITE; (4) use LITE aerosol data to assess the performance of wind-driven models of the marine boundary layer aerosol and the radiative effects of elevated layers. Data products and results from this effort will be made available to other members of the investigative team.

APPROACH: We have taken a standard lidar solution to the lidar equation, the Fernald 2-component solution, and are adapting it to the retrieval of boundary layer aerosol extinction and optical depth from LITE. This involves the application of previously developed cloud detection algorithms for cloud-clearing, modification of the Fernald solution to account for multiple scattering of the lidar beam and to accommodate the presence of overlying clouds, and the development of appropriate aerosol models.

TASKS COMPLETED: In the first year of the effort we have developed a retrieval methodology and begun the analysis of LITE return signals for aerosol extinction and optical depth. The orbit track segments appropriate for the planned studies have been identified and prioritized. Specific tasks which have been completed or initiated are:

- The retrieval software which was originally developed to use LITE Level 0 data has been modified to use the Level 1 data archived in the LaRC DAAC.
- A new two-component aerosol retrieval algorithm has been developed which accounts for multiple scattering.
- Initial retrievals have been performed on all the LITE observations of dust, including dust originating from Africa, Arabia, and Asia.
- Work has begun on an optical model for dust aerosols appropriate for lidar which accounts for non-sphericity and is consistent with observations
- A quantitative analysis of the sources of uncertainty in the retrieved optical depths has begun.

FORM C: FUTURE PLANS

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In the next year we will complete our initial retrieval of the LITE nighttime aerosol data; assess the uncertainties in these retrievals; begin intercomparisons; assess the relative contribution of continental sources to marine aerosol optical properties; identify and quantify geographical variability of boundary layer optical properties; and begin the assessment of radiative forcing of overlying elevated aerosol layers. The results of the initial analysis of LITE dust observations will be published as part of the JGR Mineral Dust Workshop special issue.

FORM D: GACP BIBLIOGRAPHY

Name: David M Winker

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BIBLIOGRAPHY:

b. List of printed technical reports and non-refereed papers:

D. M. Winker and M. A. Vaughan: Observations of Desert Dust from LITE - paper in preparation for JGR

c. List of oral presentations or posters at professional society meetings and conferences:

D. M. Winker: Observing Sahara Dust with LITE - talk at the Mineral Dust Workshop held at the University of Colorado in June 1999