

GACP ACCOMPLISHMENT REPORT

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TITLE: The application of regional aerosol properties to AVHRR aerosol retrieval algorithms

ABSTRACT, GOALS, and OBJECTIVES:

Assessing the importance of the direct and indirect effect of anthropogenic aerosols on the radiative forcing of climate requires an understanding of the global distribution of aerosol properties and an estimate of what fraction of the total aerosol is from anthropogenic sources. Assembling a global distribution of these aerosol properties will require a combination of in-situ measurements covering a globally representative range of natural and anthropogenically perturbed environments, satellite observations and chemical transport models. As part of the NASA GACP, we are using in-situ aerosol measurements, shipboard sun-photometer measurements and high-resolution AVHRR observations collected on seven oceanographic research cruises in the Pacific (RITS-93, RITS-94, ACE-1, and CSP), Atlantic (ACE-2, Aerosols99), and Indian (INDOEX) Oceans to:

1. develop a regional database of marine boundary layer aerosol properties (number size distribution, mass size distribution of individual chemical species, and light extinction) over the oceans,
2. develop regional AVHRR aerosol retrieval algorithms for optical depth and aerosol size, and
3. perform a series of case-study analyses whereby the regional aerosol retrievals are tested with simultaneously acquired aerosol in-situ measurements, shipboard optical depth measurements and AVHRR overpasses during the five research cruises.

In addition, as part of the NASA-GARP Research Team, we plan to work with the other Team members to exploit more fully our 10 years of aerosol field data. Our data sets should be particularly useful in testing chemical transport models needed to develop a global aerosol climatology.

2nd Year Progress Report:

- 1) The PMEL data analysis efforts during year two have concentrated on the Aerosols99 and INDOEX data sets. Our Aerosols99 results have been summarized in two presentations at AGU and in four manuscripts submitted for a special section of JGR. In these manuscripts we compare the regional aerosol properties encountered along the cruise track across the Atlantic which included 7 different meteorological/oceanographic regimes ranging from background marine air masses in the Northern and Southern hemispheres to air masses containing mineral dust and the products of biomass burning. The manuscript citations are listed below.
- 2) In an effort to make our data more accessible, we are enhancing our data server on our web page (<http://saga.pmel.noaa.gov/data/>).
- 3) As of mid-April, 2000, NPS has retrieved AOD for all available midday AVHRR collected during the RITS-94 cruise (fall 1993). In addition, these data have been binned onto a 0.1-deg x 0.1-deg grid for compositing and statistical analysis. Figure 1 below shows the data coverage for RITS-94, revealing the northern hemisphere winter data void in the northeast Pacific Ocean. Attention has been focused on the midday AVHRR due to the reduced error associated with maximum daylight. In the case of RITS-94 data, the very clean conditions observed during the cruise resulted in AOD values of zero being retrieved in many places. These are regions near the minimum sensitivity of the AVHRR optical sensor, and this suggests a careful interpretation of the retrievals before performing the final composite. We are in the process of composite analysis for the RITS-93 cruise (spring 1993) dataset and the CSP cruise (spring 1996) dataset. Results from the binned and composited datasets from Aerosols99 and INDOEX (both 1-km LAC and 4-km GAC datasets) were presented at the AGU meeting in December of 1999.

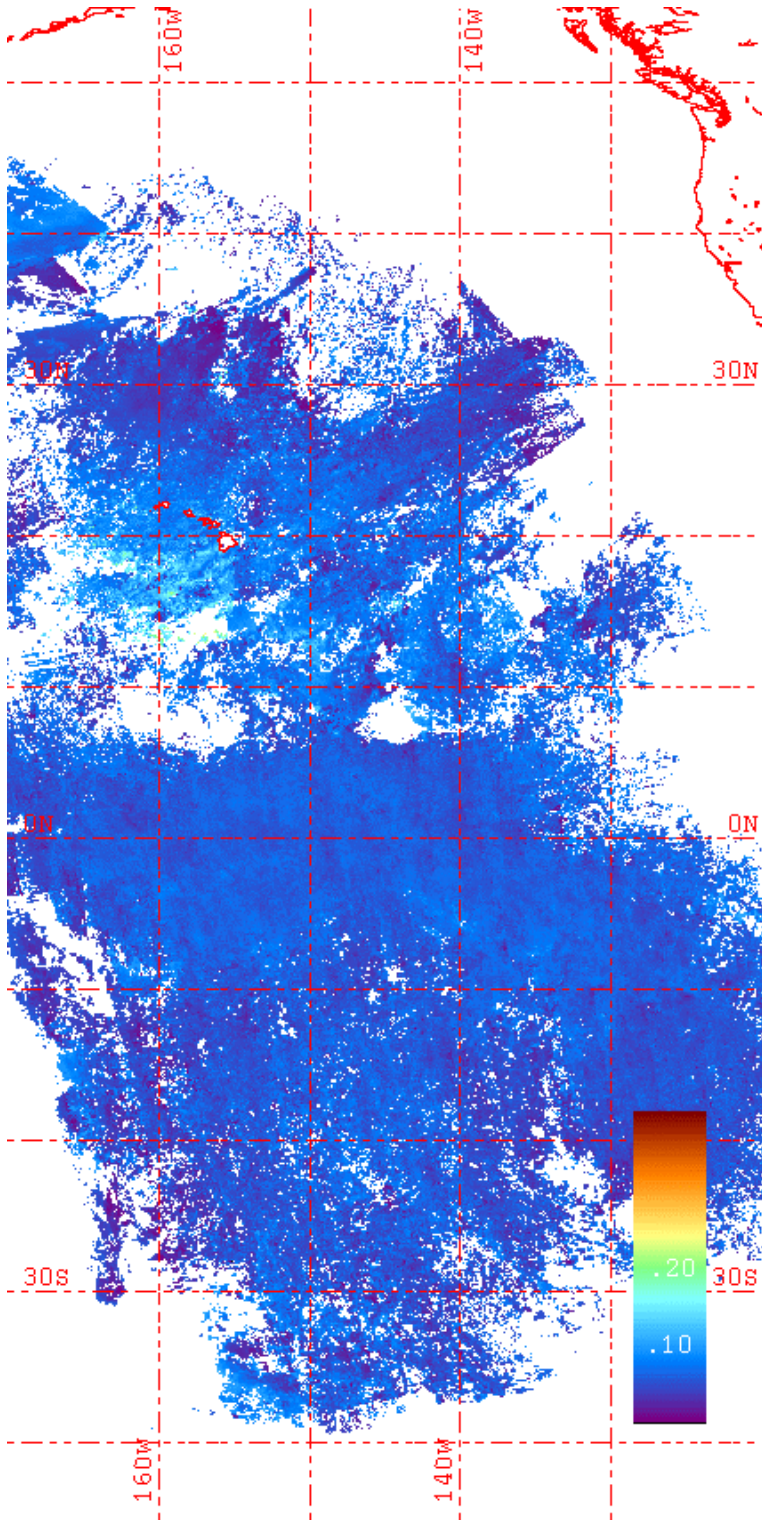


Figure 1. RITS-94 data coverage...a composite of AOD at 0.63um.

3rd Year Statement of Work

1) PMEL will continue to analyze in-situ data sets to define regional aerosol properties. As the data sets are reduced, they will be made available on our web server. We will also include summaries of regional aerosol properties in peer reviewed manuscripts.

2) PMEL and NPGS have begun the process of identifying periods for case study comparisons of in-situ and satellite retrieved aerosol properties. Our criteria are: 1) clear sky (based on shipboard observations and satellite data), 2) aerosol confined primarily to the MBL (based on radiosonde and back-trajectory data and comparison of in-situ and sunphotometer data), and 3) uniform regional aerosol optical depth. We are also trying to identify case studies with different air mass types (background marine in temperate and tropical latitudes, North American continental etc). Phil Durkee will spend a week at PMEL in mid August to facilitate the integration of the in-situ and satellite data sets.

GACP Bibliography:

1. Bates, T.S., P.K. Quinn, D.S. Covert, D.J. Coffman, J.E. Johnson, and A. Wiedensohler (2000). Aerosol physical properties and processes in the lower marine boundary layer: A comparison of shipboard sub-micron data from ACE 1 and ACE 2. *Tellus*, 52, 258-272.
2. Quinn, P.K., T.S. Bates, D.J. Coffman, T.L. Miller, J.E. Johnson, D.S. Covert, J.P. Putaud, C. Neususs, and T. Novakov (2000). A comparison of aerosol chemical and optical properties from the First and Second Aerosol Characterization Experiments, *Tellus*, 52, 238-257.
3. Durkee, P.A., K. E. Nielsen, P. J. Smith, P. B. Russell, B. Schmid, J. M. Livingston, B. N. Holben, D. Collins, R. C. Flagan, J. H. Seinfeld, K. J. Noone, E. Öström, S. Gassò, D. Hegg, L. M. Russell, T. S. Bates, and P. K. Quinn (2000). Regional aerosol optical depth characteristics from satellite observations: ACE-1, TARFOX and ACE-2 results, *Tellus*, 52, 483-496.
4. Bates, T.S., P.K. Quinn, D.J. Coffman, J.E. Johnson, T.L. Miller, D.S. Covert, A. Wiedensohler, S. Leinert, A. Nowak and C. Neusüß (2000) Regional Physical and Chemical Properties of the Marine Boundary Layer Aerosol across the Atlantic during Aerosols99: An overview, *J. Geophys. Res.*, submitted.
5. Quinn, P.K., D.J. Coffman, T.S. Bates, T.L. Miller, J.E. Johnson, K. Voss, E.J. Welton, and C. Neusüß (2000) Dominant aerosol chemical components and their contribution to extinction during the Aerosols99 cruise across the Atlantic, *J. Geophys. Res.*, submitted.
6. Voss, K.J., E.J. Welton, J.E. Johnson, A.M. Thompson, P.K. Quinn and H. Gordon, Lidar measurements during Aerosols99 (2000) *J. Geophys. Res.*, submitted.
7. Voss, K.J., E.J. Welton, P.K. Quinn, R. Frouin, and M.Reynolds (2000) Aerosol optical depth measurements during the Aerosols99 experiment, *J. Geophys. Res.*, submitted.