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This reports covers the **aerosol ocean** and **aerosol land** algorithm, the **NIR water vapor** algorithm and our involvement in the **fire algorithm**.

Main topics addressed in this period:

1. Upgraded version 1 aerosol operational code to comply version 2 requirements. All algorithms. (*Chu, Mattoo*)
2. Finished look-up tables for aerosol retrieval codes (*Chu, Mattoo, Ahmad*)
3 Derived first results of precipitable water vapor retrieval. (*Chu*)
4. Revised MODIS atmosphere QA plan. (*Chu*)
5. Validated aerosol optical thickness over land derived from SCAR-B MAS measurements against ground-based sunphotometer observations. (*Chu*)
6. Analysis of TARFOX field experiment data. (*Remer, Ji, Tanré, Li, Mattoo*).
7. Analysis of the SCAR field experiment data*(Kaufman, Kleidman, Li, Remer, Ji)*
8. Analysis of data from laboratory experiment, in the Forest Service Fire Lab. with an CIA / John Hopkins Univ. instrument. *(Kaufman, Wald),*
9. Development of a new technique for remote sensing of dust over land using IR channels, to supplement present algorithm for remote sensing of aerosol from MODIS *(Wald ,Tanre, Kaufman)*
10. Surface properties in the mid-IR and the visible: Experiment in Israel, June data collected over Charles County; analysis of CAR data*(Kaufman, Wald, Remer, Ji., Kleidman*)
11. Continued archiving and processing of TARFOX and SCAR-B MAS imagery for use as MODIS algorithm testbed. *(Kaufman, Li, Chu, Mattoo)*
12. Continued evaluation and customizing of MODIS cloud mask. (*Kaufman,Chu, Li, Remer, Mattoo*).
13. Analyzed smoke effects on column stability using soundings taken at Alta Floresta and provided by J.V. Martins. (*Remer)*
14. Study of vegetation indices. Analysis of AVIRIS images over Cuiaba and Alta Floresta. Comparison of ndvi, arvi, mivi and gari in both clear and smoky conditions. Scatter plots and color images (*Kaufman, Li*)
15 Attended meetings: AGU Baltimore, IAMAP Australia. (*Kaufman, Chu, Ji, Kleidman, Fraser, Remer, Wald*)

Topics postponed (or continued) to next quarter

1. Getting AVHRR LAC data for smoke-cloud interaction analysis
2. Dust aerosol model (Tanre, Fraser)

Plans for the next quarter:

1. Submission of six papers to SCAR-B special issue of JGR

1. Version 2 Algorithms

The version 1 code for aerosol retrieval over land and ocean have been updated to comply to version 2 requirements. Aerosol code now contains module that corrects for precipitable water vapor.

2. Aerosol look-up tables

The look-up tables for aerosol-over-water retrievals were completed. Extensive sensitivity tests performed on new look-up table to test algorithm. For the aerosol-over-land algorithm, look-up tables for continental aerosol and urban/industrial aerosol were completed with the upper bound optical thickness extended to 5.0.

3. Precipitable water vapor retrieval

Testing of algorithm with MAS imagery. Code works well. Results are not as expected. MAS imagery is limited to two channels, 0.91 μm and 0.94 μm. We are investigating the implications of using the two-channel retrieval vs the three-channel retrieval, and evaluating the testing method in light of the MAS calibration problem.

4. MODIS atmosphere QA plan

Revised.

5. Validation of aerosol optical thickness retrieval algorithms

Algorithm tested for smoke aerosol of various optical thicknesses using MAS imagery collected over AERONET sunphotometers. Results look very good despite on-going concerns about MAS calibration.

6. TARFOX data

1) AERONET size distributions compared with airborne measurements by the UKMO aboard the C130. Only one case of near simultaneous measurements. Unfortunately this case occurred on July 20, an extremely clear day. The two sized distributions do not match that closely, but both show very little aerosol. 2) Ground-based microphysical measurements were compared with similar measurements made in Brazil during SCAR-B. Results presented at Baltimore AGU. 3) The AERONET network data is being compared to the SCAR-A data base. TARFOX data show very

similar characteristics to SCAR-A data. Accumulation mode particle size grows with optical thickness. 4) MAS imagery has been used to test MODIS retrieval algorithms both over land and sea. The ocean retrieval has shown generally favorable results when compared to in situ measurements. Version 2 code correctly being tested on TARFOX data.

7.SCAR-B data

1) Fire analysis from MAS imagery. Glint problem corrected. Individual fires analyzed. 2) Smoke model completed from 3-year data base and tested. Sensitivity to refractive index and ω_0 determined. Air mass parameterization by precipitable water vapor shown to be no better than optical thickness. 3) Six papers in preparation for the SCAR-B special issue of JGR.

8. Laboratory experiment at USFS Fire Lab

Analysis of fire laboratory data show possibility of routine satellite monitoring of fires and fire products is possible. Products include total mass loss and total carbon burnt. Preliminary analysis of smoke products as function of fire temperature presented at Baltimore AGU. Further analysis pending dependent on solution of dynamic range of FTIR data problem.

9. Remote sensing of dust using IR techniques

The development of a new technique for remote sensing of dust over land using IR channels is progressing well. Retrieval of optical thickness is confirmed using ground-based sunphotometry for optical thickness. Column water vapor variability presents a limitation on technique's robustness. Other IR channels that will reduce water vapor effects are currently being explored. Simulations have begun in order to test the observations against theory. Preliminary results presented at IAMAS-IAPSO meeting in Australia.

10. Surface Properties in the Mid-IR and visible channels

The aerosol land algorithm is based on the assumption that we will be able to determine surface reflectance in the visible channels from the reflectance at 2.1 μm. The method uses an empirical relationship between the two spectral regions. In May, we collected spectrometer data from a Cessna aircraft and from a cherry picker in a desert transition zone in Israel. Over 2000 spectra were collected from the mostly barren desert scrub of the south, over wheat fields, pine forests and dry-land crops of the mid-lands to the greener areas of the north. Data was also collected over the Mediteranean at multiple altitudes and angles. In June, we collected spectrometer data over Charles County. We

continue to use the CAR instrument carried by the Univ. of Washington's C-131 aircraft to test angular characteristics.

11. Archiving of Images and Validation

MAS and AVIRIS images from SCAR-B and TARFOX are processed, resampled and archived to create a validation test bed. These data have been used for continual testing of all MODIS algorithms. A validation paper will be submitted to the SCAR-B special issue of JGR.

12. Evaluation of MODIS cloud mask

It is important that we choose the cloud mask test that screen clouds without eliminating scenes of high aerosol optical thickness. Our first attempt basically ignored the straight visible threshold test, but used the visible ratio tests and various IR tests. At the very highest optical thicknesses, this cloud mask failed. It was decided to rely on the 2.1 μm channel over land to find clouds and ignore any other visible channel tests. Over ocean, various channel combinations are being explored.

13. Effect of smoke on column stability

Temperature and humidity profiles taken at Cuiaba were analyzed in conjunction with simultaneous aerosol optical thickness and a strong correlation was found between column stability and optical thickness. A similar analysis was done for Alta Floresta and no correlation was found. This suggests a complex regional scale interaction between air mass transport, smoke and column stability. J. Josephs from Tel Aviv University intends to visit GSFC during September to continue to collaborate on this problem.

14. Vegetation Indices

Various published vegetation indices (NDVI, ARVI, GARI, NDWI etc) and a new suggested index based on the 1.2 and 2.1 channels have been tested in images from SCAR-B, SCAR-A and SCAR-C. The indices are tested on clear and hazy passes over the same location in order to test sensitivity to vegetation and atmospheric resistance.

15. Meetings attended

Our group was represented at both the SCAR-B and TARFOX special sessions at the Baltimore AGU and at IAMAS-IAPSO in Australia.

Problems, complaints

1) MAS v.s. AVIRIS calibration in SCAR-B

Submitted papers

1."Model for Urban industrial aerosol", L.A. **Remer** and Y.J. Kaufman submitted to JGR

2. "Long term trends and seasonal variations of aerosol concentration at Barrow, Alaska", A.V. **Polissar**, P.K. Hopke, P. Paatero, Y.J. Kaufman, D.K. Hall, B. A. Bodhaine, and E.G. Dutton, submitted to JGR