Session 3: AOT In Situ Measurements
Chairpersons: R. Frouin and M. Miller

RF - Robert Frouin
MM - Mark Miller
AS - Alexander Smirnov
CP - Christophe Pietras
KK - Kirk Knobelspiesse
MJB - Mary Jane Bartholomew
JW - Judd Welton

Error Sources / Uncertainty Budget

SIMBAD (R. Frouin)

Total SIMBAD error for airmass=1, "typical" AOT
443nm - 0.021
560nm - 0.016
670nm - 0.015
865mn - 0.010

Error calculation specifics:

1. Calibration
-SIMBAD calibration by Langley plot method at Mt. Laguna
-Calibration error is standard deviation of calibration coefficients after de-trending
-Max standard deviation about 0.03 in blue

2. Field of view effect on sensor - due to multiple scattering into entrance aperture of sun photometer
-For continental aerosols, ranges of values for SIMBAD FOV (3 degrees) are:
450nm - for AOT 0.05: 0.0008; for AOT 0.2: 0.0034
850nm - for AOT 0.05: 0.0004; for AOT 0.2: 0.0018
-For maritime aerosols with more forward scattering phase functions, these values could be much higher

Other issues related to calibration

1. Clouds near sun can have effect on scattering, AOT values, showed Monte Carlo simulation of cloud optical thicknesses.

2. Angstrom coefficient error values presented. Values decrease with larger angstrom values and larger AOT values used to compute angstrom coefficients. Results presented for angstrom coefficients calculated with two bands, A. Smirnov makes point that Angstrom coefficients calculated with more than two bands will have lower error.

Fast Rotating Shadowband (M. Miller)

Error sources:

1. Calibration coefficient error ~ 2%

2. Big issue - error varies with orientation of radiometer with respect to ship motion and sun position.

3. Can track calibration drift by comparing to broadband radiometer included in instrument package

4. Instrument calibrated every 6months - year

5. Error values are not in bulk - specific for each measurement.

Microtops II (C. Pietras)

1. Calibration based on AERONET cross calibration to a "Master" CIMEL sun photometer.

2. With calibration from master CIMEL, calibration error about 0.05. When calibrated with respect to cross calibrated CIMEL, error is 0.1.

3. Also based upon: TOMS (Ozone) value error, NCEP Pressure error

Micro Pulse Lidar (J. Welton)

Lidar instrument very different, much more complicated than sun photometers. Data organized in levels:
L0 - raw data
L1 - Normalized Relative Backscatter (currently archived in SeaBASS)
L2 - Cloud heights, aerosol profiles, boundary layer heights
L3 - Continuous, gridded L2 values

Note that SeaBASS only archives L1 data, but full data set available at MPL-net web page.

Errors by level

L0: includes values for laser beam crosstalk, optics focusing for less than 5km, laser energy, solar background'

L1: Calibration constant value (C) from sun photometer - needs Microtops error.

-Welton, E.J. and J. R. Cambell. "Micro Pulse Lidar Signals: Uncertainty Analysis," J. Atm. Ocean Tech., submitted 2001
-Makes fractional L1 uncertainty images
-Problems include cheap telescope on SIMBIOS MPL, with parts that can come loose during transport.
-Another problem - detector in instrument that can fail, but is buried within and requires extensive work to replace. Now optical fiber system is installed, so detectors can easily be switched out during a cruise.

PREDE (C. Pietras)

Error not yet calculated for PREDE, requires more communication with manufacturer and more control over software parameters and measurement protocol.

QC, Processing Code, Cloud Screening

Microtops protocol change (K. Knobelspiesse)
Presented revised protocol for Microtops, intended to remove pointing errors. Works by tightening measurement protocol, applying post processing algorithm.

-question PREDE pointing errors? C. Pietras answers that PREDE used before, calibration problems. Wants to do sphere calibration with PREDE to compare size distribution results to CIMEL.

-Much discussion about value of instrument specific cloud screening algorithms vs. screening algorithms intended for entire set.
KK mentions using wavelet screening to bring all datasets to common denominator.
JM & MM say that parameters used for wavelet screening may not apply in all areas of world, therefore one protocol and screening wouldn't be sufficient.
A.S. AERONET CIMEL algorithm will work for Shadowband instrument if set to not integrate over a period as long as two minutes
MJB disagrees, need two minutes to average and reduce errors
(no real conclusions made)

2002 cruise schedule

-MM, RF mention desire to make aerosol diagnostic data set on cruise off US east coast... MM and MJB may know of ship to use.

-JW needs to resolve Lidar deployment SOON, need to speak w. Giulietta

Other Issues

-Christina Hsu mentions confusion about choosing proper AOT value for matchup when several instruments are used - which is right? Can SIMBIOS have a higher level data product with just best AOT values for specific time?

-MM, MJB mention desire to have matchup files contain TOA satellite values used to create L2 data (KK speaks with Sean Bailey about this later, involves calling both L1 and L2 files).

-KK opens a can of worms by asking about agreeing upon a standard method to calculate Angstrom coefficient. Satellite people used to using just two bands in NIR for value. Aerosol people use more bands and do best fit. AS,JW thinks better to use multiple bands, lower error, two band method used only because of tradition. CP argues that two band method compares better with satellite data. MJB and KK later decide that it might be best to calculate several different Angstrom types and include them in files sent to SeaBass. That way, the user can decide depending upon application.

-RF brings up issue of writing article about the SIMBIOS maritime AOT dataset, along lines of TMs about SeaWiFS atmospheric products. JW mentions applicability of this data set to many others besides SIMBIOS Ocean Color (MODIS atmospheres group, validation data sets for upcoming LIDAR satellite missions). RF and MM agree to take the lead on writing this paper.