MIRA Newsletter

November 10, 2021

This is the first newsletter of the *Models, In situ, and Remote sensing of Aerosols (MIRA)* working group. The purpose of MIRA is to foster international discussions between aerosol science specialties, and it follows an effort that was started with the CALIPSO Version 5 Aerosol Lidar Ratio Virtual Workshop on March 9-11, 2021 (*link*), and the MIRA side meeting on September 17, 2021 (*slides*), at the virtual International Global Atmospheric Chemistry (IGAC) conference. Unavoidably, both meetings were unreasonable time slots for many time zones, but a 12-minute version of the MIRA talk will be repeated at 9:40 UTC on Nov 1 (2021) at the SKYNET workshop (see details in the 'Upcoming Activity' section *below*). The detailed purpose of MIRA is outlined in the last section of this newsletter (*Purpose of MIRA*).

Membership

The MIRA working group is open to all interested aerosol scientists. Registered participants at the March 2021 CALIPSO Version 5 aerosol lidar ratio workshop are automatically members, as are the people who enrolled after the 2021 IGAC meeting. This is an open working group, so we encourage you to send this newsletter to interested colleagues. Your colleagues can subscribe to the MIRA email list server by sending an email directly to calipso_v5alr-join@lists.nasa.gov with the word 'subscribe' in the subject line. Unsubscribing is accomplished by sending email to calipso_v5alr-leave@lists.nasa.gov.

Recent Activity

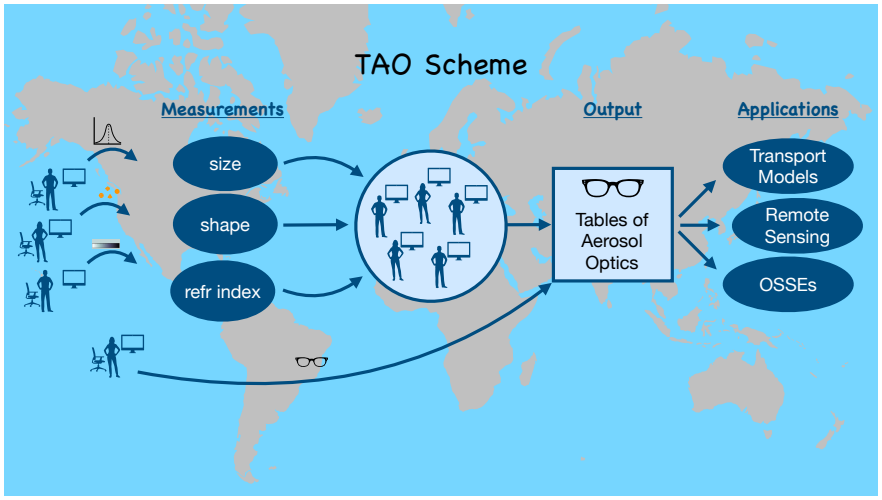
First MIRA Meeting

The first meeting under the MIRA banner was held as a virtual side meeting at IGAC on September 17, 2021. We discussed the purpose of MIRA (see below) and discussed the

challenges associated with building the framework for a global working group. Slides from the 2021 IGAC MIRA side meeting are available to registered MIRA participants at the MIRA google drive *(link)*. Send email to gregory.l.schuster@nasa.gov if you have trouble securing access.

TAO was presented at AeroCom

The Table of Aerosol Optics (TAO) is a *community* repository of optics computations (extinction, absorption, SSA, Lidar Ratio, etc) that are useful for global models and remote sensing applications. TAO expands upon historical efforts (e.g., *Shettle and Fenn*, 1979; *d'Almeida et al.*, 1991; *Koepke et al.*, 1997; *Hess et al.*, 1998) by building a database that includes recent measurements and new computational techniques for non-spherical particles. Originally conceived by Arlindo da Silva, TAO is meant to be a community repository where scientists can put their computations.



TAO provides mass extinction coefficients, mass absorption coefficients, lidar ratios, etc. at the OPAC wavelengths (0.25-40 μm; *Hess et al.*, 1998) for all pertinent species (sulfate, nitrate, sea salt, BC, OC, BrC, dust, etc.). Separate tables are provided for common remote sensing wavelengths (AERONET, MISR, MODIS, POLDER, etc.). Multiple tables for each species will be created to account for the multiple valid size distributions and complex refractive indices that we find in the literature.

At the present time, TAO includes optical tables for water-soluble and water-insoluble organic carbon (both Brown and 'White') and eight modes of hexahedral mineral dust (*Saito et al.*, 2021; *Saito and Yang*, 2021). We hope to complete computations for Black Carbon (internal and external mixtures), sulfate, nitrate, and sea salt by the end of 2022. However, TAO will remain 'live' beyond 2022 for users to add new computations as the science evolves.

It is expected that TAO will include computations for the traditional aerosol species (e.g., ammonium sulfate, sea salt, black carbon, etc.), but TAO will also accept computations for aerosol 'type' (e.g., biomass burning, urban, background, etc.). At the present time, TAO is a highly fluid and loosely organized collection of optical tables that are available on the TAO google drive *(link)* for those who have joined the TAO group, but this is not permanent. TAO will eventually establish a home in the public domain (e.g., GitHub).

We welcome your contributions. We seek representative size distributions and refractive indices for atmospheric aerosols from the measurement groups, scattering and absorption computations from the appropriate computational groups (especially for irregular shapes), and a 'wish list' from the global modeling groups (e.g., how does your global model bin dust and sea salt during transport?). We also seek computations from global modelers who have computed their own optical properties, as sharing of these tables is beneficial to all.

Please send email to aerosol-optics-join@lists.nasa.gov with the word 'subscribe' in the subject line to join the TAO distribution group. This also alerts gregory.l.schuster@nasa.gov to add permissions for you to see files on the NASA Google Drive.

Upcoming Activity

The next MIRA presentation will occur virtually at the *6th International SKYNET Workshop (http://atmos3.cr.chiba-u.jp/irielab/skynetws2021/)* in Japan, November 9-11, 2021. Look for the presentation entitled *Models, In situ, and Remote sensing of Aerosols (MIRA): Formation of an International Working Group* by Greg Schuster and Chip Trepte. The 15-

minute talk begins at 9:40 UTC on November 9, 2021. *Registration* for the workshop is required, but it is free and open until noon UTC on Monday, Nov 1, 2021.

More activities will be planned for the coming year once we have feedback and can develop a plan that follows the group interests (fill out the survey – we seek suggestions!).

Communication

Email Distribution Lists

We have created a GNU Mailman list, but we don't have access to the file-sharing features of MS Teams, Google Groups, and other common platforms for MIRA participants at the present time. We encourage everyone to email postings to the MIRA and TAO lists as the groups become active (calipso_v5alr@lists.nasa.gov and aerosol-optics@lists.nasa.gov), but these email distributions don't maintain a group repository that everyone can access. So please archive the emails of interest yourselves until we can find a practical method of collecting thoughts that are shared with the group.

New subscribers can send email with the word 'subscribe' in the subject line to:

calipso_v5alr-join@lists.nasa.gov for MIRA emails and

aerosol-optics-join@lists.nasa.gov for TAO emails.

We know that you won't want to, but you can unsubscribe by sending email to:

calipso_v5alr-leave@lists.nasa.gov for MIRA emails and

aerosol-optics-leave@lists.nasa.gov for TAO emails.

MIRA webpage

We are conceptualizing a public webpage for MIRA, which will host material and news that is consistent with the scope of MIRA. Additionally, we will archive past newsletters (like this one) at the MIRA webpage.

Survey

An important part of this first newsletter is soliciting your input. Please take our short survey at this *google form*. This will help us build MIRA into a purposeful working group.

Purpose of MIRA (and SKYNET abstract)

There is a natural partitioning of scientific interest amongst three specialties of aerosol research: modeling, in situ measurements, and remote sensing. The broader aerosol community benefits when these groups interact, and this strengthens overall scientific impact on climate and air quality research and predictions. The new MIRA working group establishes a forum for identifying collaborations and improving discussions amongst specialties and across regional boundaries. MIRA is aimed at bringing aerosol specialists together to expand our knowledge base while also accomplishing specific goals.

One area of keen interest is uniting satellite and ground-based lidar groups with other aerosol disciplines. Elastic backscatter lidars depend upon *a priori* knowledge of aerosol properties to convert measured lidar profiles into aerosol extinction profiles. Acquiring additional insight on aerosol properties and transport is highly valuable to these lidar groups to improve the data quality and aid in their scientific interpretation.

Another area of interest is to facilitate the incorporation of measurements into global aerosol models. Modelers need aerosol optical look-up tables that enable quick conversions of hydrated (and dry) polydisperse size distributions into aerosol optical properties (extinction, scattering, etc.), but many of the existing tables are based upon outdated measurements. Thus, MIRA is building the Tables of Aerosol Optics (TAO), which is a community collection of aerosol optical calculations. This expands on the historical efforts of Shettle and Fenn, d'Almeida, GADS, OPAC, etc., except that TAO seeks continual input from the community. Thus, as aerosol measurement and computational techniques advance, so does the TAO collective. Since TAO is a community collective, it is expected that users will optionally upload

computations for aerosol type as well as computations for all of the traditional aerosol species (like amm sulfate, amm nitrate, organics, etc.).

The near-term purpose of the MIRA working group is to:

- ⋆ Characterize regional aerosol lidar ratios to support improvements of aerosol extinction profiles and understanding of aerosol typing.
- ⋆ Create TAO – a community cooperative of aerosol optical tables.
- ⋆ Facilitate international communications between aerosol measurement and modeling groups.
- ⋆ Encourage the use of regional knowledge to develop and improve remote sensing techniques for current and future backscatter lidars located in space.
- ⋆ Enable and foster communication between the scientists who run global aerosol models and scientists who analyze space-based lidar data.

References

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