

AEROSAT 2021 Summary

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AeroSat Goals (1)

- **Work with modelers to make satellite aerosol data as useful as possible for climate modeling (e.g., AeroCom)**
- **Achieve an open and active exchange of information**
 - Discuss retrieval advances, strengths and limitations
 - Negotiate matching user requirements with measurement capabilities
 - Share the latest technological advances
 - Work toward inter-operability (data formats & standards, terminology)
- **Forum for satellite aerosol retrieval experts**
 - Learn from each other, collaborate as appropriate
 - Initiate new developments, participate in ***AeroSat Experiments***
 - Work toward product improvement and harmonization

AeroSat Goals (2)

- **Promote the use of satellite data**
 - To support global measurements of aerosol amount, type and precursor gas 3-D distribution to the extent possible, with uncertainty estimates
 - As **complementary** to other sources of information
 - To better understand the role of aerosols in climate, climate change, air quality, and atmospheric processes
- **Forum includes satellite data users** (AeroCom / CCMI models, ICAP forecasts) **and data providers** (AERONET reference, space agencies)
 - Listen to each others' needs, any issues, and limitations
 - Discuss what is possible; Motivate new activities
 - Contribute to integration of satellite & suborbital observations
- AeroSat is an unfunded network (as is AeroCom)

AeroSat Group Dynamics

- Unlike most major meetings, AeroSat is organized as **a meeting of experts** on the topics covered, focused on **DISCUSSION** (*i.e., little-to-no time is spent on introductory material in the sessions*)
- Oral Presentations are held to a minimum (1 or 2/session @ 5-10 min each); leaving **maximum time for group participation**
- Speakers are usually asked to **briefly summarize the state of the entire field**, not just cover their own work
- In most cases, the **work of individual groups is presented in posters**
- Each session has a moderator who presents 1-2 **slides of key questions**, developed in collaboration with the speakers in the session
- The moderator also focuses the discussion on the key questions; **calls in sequence on several people who raise hands to speak**, so the discussion keeps moving and everyone who wants gets the opportunity to participate
- Each session has a **rapporteur to keep notes** on emerging ideas; the chairs subsequently edit and archive the notes*
- When possible, the **seating arrangement is in concentric circles**; 75 or more have participated this way*

* **In the virtual space**, we instead supported an on-line bulletin board (*board.net*) hosting extensive, interactive discussions

AeroSat Study Topics

- **Aerosol Typing***; Particle Property Assumptions, Retrieval Constraints, and Comparison w/Models
- **Characterizing Dust Aerosols**
- **Pixel-level Uncertainties**
- **Constraining Wildfire Smoke Injection Height and Source Strength** (*joint with AeroCom*)
- **Comparing Satellite Aerosol Retrieval Algorithms**
- **Comparing Satellite AOD Products and Trends**
- **Long-term Aerosol Data Records**

Additional AeroSat Discussion Topics

- Aerosol Vertical Distribution
- Aerosol-Cloud Interactions; CCN Retrieval
- Suborbital and Laboratory Aerosol Measurements
- Air Quality
- Climate Variables

***Related Activities:** *Commission on constraining Aerosol Properties (Y. Balkanski); Models, In situ, and Remote Sensing of Aerosols (MIRA) (G. Schuster)*

Perspectives on Collaboration with Modelers

- **Support model-satellite consistency**
 - Discuss + publish ***definition similarities & differences*** (Mod + Sat)
 - Provide ***aerosol typing information*** in a useful form
 - Includes application of ***optical vs. compositional “types”***
 - Provide ***uncertainty characterization*** in a useful form
- **Guide the use of satellite datasets**
 - Provide a ***critical assessment*** of strengths and limitations
 - Provide harmonized ***quality statements***
 - Create ***data-record ensembles*** → report the spread / confidence
- **Experiments**
 - Involve modelling to tie evaluations to critical variables
 - Develop smart ways to integrate complementary information content

Current AeroSat (*and joint AeroCom-AeroSat*) Experiment Efforts & Task groups

- *Aerosol Retrieval Comparisons* [Kinne, Schuttgens, Sogacheva]
- *Characterizing Retrieval Uncertainties* [Sayer, Povey, Govaerts, Levy, Patadia, Witek, Kahn, Dubovik, Mei, Rozanov, Thomas, Kolmonen, Stebel, Limbacher, Lyapustin, Popp]
- *Consistent Multi-sensor Trends* [Sogacheva, Schulz, Popp]
- Constraining *Aerosol Type; also, Model – Satellite Synergy* [Mona, Kahn, Tsigaridis, Balkanski, Schuster]
- Constraining *Aerosol Injection Height* [Pan, Val Martin, Kahn, Chin, Nowotnick + AeroCom modelers]
- Constraining *Aerosol Source Strength* [Petrenko, Kahn, Chin + AeroCom modelers]
- *CCN New Approach* [Rosenfeld, Christensen, Bauer, Shanzuka, Stier]

Day 2

Tuesday, October 12, 2021

UTC: 14:15-16:00

AeroCom / AeroSAT

EU:4:15–6:00pm/NY10:15am–noon/CA:7:15–9:00am/JP:11:15pm–1:00am/CN:15:00pm–midn.

Session O4 oral session

Dust

Moderator: Yves Balkanski // Rapporteur: tbd

1 14:15 Green, Robert

Earth surface mineral dust source investigations

2 14:35 Levy, Rob

Comparing assumptions for dust optical properties in various Goddard-based retrieval

3 14:50 Kok, Jasper

Contrib. of the world's main dust source regions to the global cycle of desert dust

4 15:05 Colarco, Peter

A Review of the Treatment of Dust Optical Properties in Earth System Modeling

- 15:20 Discussions

15 min break

- ISS/EMIT deployed

Hyper-spectral mineral dust source mapping

- **Dust Size & Shape** Distribution questions

- How common is **Large Dust** (>10 microns)?

Day 3

Wednesday, October 13, 2021

UTC: 11:00-12:30

AeroCom / AeroSAT

EU: 1:00–2:30pm/NY: 7:00–8:30am/CA: 4:00–5:30am/JP: 8:00pm–9:30pm/CN: 7:00–8:30pm

Session O5 oral session

Aerosol-Cloud Interactions

Moderator: Michael Schulz // Rapporteur: tbd

1 11:00 Gryspeerdt, Edward

Sampling strategies for cloud droplet number concentration in satellite data

2 11:15 Regayre, Leighton

Constraining aerosol forcing uncertainty using satellite data

3 11:30 Sorooshian, Armin

ACTIVATE: Strategy and First Results

4 11:45 Khlestova, Julia

Cloud condensation nuclei reduction impact over Moscow during spring 2020 lockdown on the cloud characteristics (simulations and measurements)

5 12:00 Jia, Hailing

Significant underestimation of radiative forcing by aerosol–cloud interactions derived from satellite-based methods

- **12:15 Discussions** (evidence by region and season of secondary effects of lifetime and precipitation)

15 min break

UTC: 15:00-17:00

AeroCom / AeroSAT

EU: 5:00–7:00pm/NY: 11:00am–1:00pm/CA: 8:00-10:00am/JP: midn.–2:00am/CN: 11:00pm–1:00am

Session O6 oral session

Processes

Moderator: Mian Chin // Rapporteur: tbd

1 15:00 Bian, Huisheng

Obs. constrained analysis of sulfur species in the marine troposphere

2 15:15 DeLessio, Meagan

Modeling atmospheric brown carbon in the GISS ModelE Earth system model

3 15:30 Neubauer, David

Climate impacts of aviation aerosol emissions

4 15:45 Torres, Omar

Temporal evolution of the stratospheric aerosol load from the Canadian 2017 and Australian 2020 pyroCb events

5 16:00 Yu, Pengfei

Persistent stratospheric warming due to 2019-20 Australian wildfire smoke

6 16:15 Zhang, Kai

The representation of natural aerosols and its impact on eff. aerosol forcing

- **16:30 Discussions** (observational evidence/relationships to constrain processes in modeling)

- Many challenges with ACI retrieval:

- representative sampling
- cloud filtering
- how to acquire & use field measurements
- how to apply reanalysis

- Critical Role for *In Situ* measurements

- In characterizing processes (e.g., A_{Tom})
- Need to add **Brown Carbon & PyroCBs** into modeling

Day 4

Thursday, October 14, 2021

UTC: 12:00-15:00

AeroCom / AeroSAT

EU:2:00–5:00pm/NY:8:00–11:00am/CA:5:00–8:00am/JP:9:00pm–midn./CN:8:00–11:00pm

Session O7 oral session

Constrain

Moderator: Thomas Popp // Rapporteur: Linlu Mei

1 12:00 Balkanski, Yves

AeroCom-AeroSat Commission on Constraining Aerosol Properties

2 12:15 Schuster, Greg

Tables of Aerosol Optics (TAO)

3 12:30 Kahn, Ralph

Systematic sub-orbital aircraft measurements (SAM-CAAM)

- 12:45 Discussions (priorities, add. needs)

15 min break

4 13:30 Schutgens, Nick

Model evaluation with satellite data of AOD and SSA

5 13:45 Sayer, Andrew

All-sky vs. clear-sky AOD and the problem of partial cloudiness when comparing model and satellite aerosol fields

6 14:00 Tsikerdekis, Athanasios Aerosol data assimilation as a tool to detect model errors

- 14:15 Discussions (integration of model and data, best practices)

UTC: 15:00-16:00

AeroCom / AeroSAT

EU:5:00–6:00pm/NY11:00am–noon/CA:8:00–9:00am/JP:12:00pm–1:00am/CN:11:00pm–midn.

Session O8 oral session

trends

Moderator: Andy Sayer // Rapporteur: tbd

1 15:00 Quaas, Johannes

Aerosol trends since 2000 and aerosol ERF

2 15:15 Mielonen, Tero

Comp. aerosol type time series in a climate model and a satellite retrieval

- 15:30 Discussions (trends, Covid, natural events)

15 min break

- **Dust Retrieval Improved by combining measurements**

e.g., VIS + TIR, IIR +Lidar

- **Several Efforts Underway**

to collect particle microphysical & chemical properties

in situ data are especially important here

- **accelerated anthropogenic climate forcing** since ~2000

- **aerosol type changes** are usually not included in retrievals, trends
... an AOD bias?

- increased attention on **stratospheric aerosol trends** is encouraged, due to:
increased **PyroCB** frequency
increasing Indian monsoon injections
volcanic contributions

Day5

Friday, October 15, 2020

UTC: 11:00-13:00

AeroSAT

EU:1:00–3:00pm/NY:7:00–9:00am/CA:4:00–6:00am/JP:8:00pm–10:00pm/CN:7:00–9:00pm

Session **O9 oral session** Aerosat/Geo Moderator: Larisa Sogacheva // Rapporteur: Adam Povey

1 11:00 Robbins, Daniel Improving Differentiation of Cloud and Extreme Smoke Plumes in Himawari-8 Scenes

2 11:15 Espinosa, Reed A synergistic multipixel retrieval of aerosol properties from geostat. satellite obs.

3 11:30 Mei, Linlu Above cloud aerosol properties retrieved from the XBAER algorithm

4 11:45 Winker, Dave Upcoming CALIOP Data Product Release

12:00 Discussions (added info from active, geo and passive combined sensors) + **15 min break**

- **synergy** offers added value

GEO + active sensor: better **NN training**

GEO angular sensing: **aerosol properties**

2 GEO: **cross-calibration**, testing azimuthal symmetry assumption, stereo plume heights

passive + active: **vertical structure / typing**

satellite + model: constrain **aerosol type for low AOD**

Session **O10 oral session** AerosatAQ Moderator: Ralph Kahn

1 14:00 Martin, Randell Overview/ status of satellite based AQ

2 14:15 Garrigues, Sebastian Assimilation of multiple satellite aerosol optical depth (AOD) near real time (NRT) products in the Copernicus Atmospheric Monitoring Service (CAMS) data assimilation system

14:30 Discussions (Air Quality is the hot top for aerosol in the future, as radiative forcing has maxed)

- Air Quality **future aerosol hot topic**

- **Multiple challenges**

near-surface

space-time coverage

high spatial resolution / urban areas

speciation, ambient and dry aerosol

coastal areas, rugged terrain

- growing confidence, evidence short-term changes

- data assimilation of multiple NRT satellite AOD



AeroSat Web Site

<https://aero-sat.org>

- **Mission Statement**
- **Introduction to AeroSat (brief pre-recorded video)**
- **Past Meeting Agendas w/slides & edited notes from discussion sessions**
- **Upcoming meeting information**
- **Publications**
- **Related web links**