**7th AeroSAT workshop**

September 27 – 28, 2019, BSC, Barcelona, Spain

**Minutes**

**Agenda**

**All presentation slides will become available at** [**https://aero-sat.org/meetings**](https://aero-sat.org/meetings)

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**AEROCOM / AEROSAT 2019**

**AEROSAT minutes**

**SESSION 15 Data and modelling**

*chair:**Pete Colarco / rapporteur: Jacques Descloitres*

A number of comments and questions related to Nick Schutgens’s talk and his conclusion that diversity of AOD retrieved from satellite (derived from the spread of available retrievals at a given location over a 3-year period) can be used as a substitute for AOD uncertainty. The overall strategy for modelers to use satellite products to improve models was discussed, and a general plan to use the existing satellite products as a benchmark for models was established.

Q: Some products are more accurate than others, does that change the observed diversity?

A: No, results won’t change much if fewer satellite products are used to build diversity maps

C: Diversity may substantially vary depending on product availability (e.g. end of a satellite mission)

Q: How is this different from using AOD standard deviation from the product itself as a substitute for uncertainty?

A: Products provide random error estimates, while Nick’s results show that diversity is correlated to uncertainty, including bias

C: Previous studies (e.g., with MISR) show correlation between uncertainty and AOD, as standard deviation increases where mean AOD gets larger (in absolute values). So diversity alone hardly can represent the uncertainty of the AOD distribution.

A: Nick’s study compares relative bias to relative diversity, which should be enough to yield higher uncertainty for higher AOD value.

C: Basic statistical indicators such as standard deviation and mean may not be enough to represent the AOD distribution, as the AOD distribution is not normal.

C: It would be interesting to check whether absolute uncertainty may be predicted

C: Relative uncertainty may also be a concern at low AOD values, as the relative uncertainty may be huge while the absolute uncertainty is small

C: There is a difference between morning and afternoon diversity maps.

A: The difference is mostly due to the similarity between algorithms, not really a morning/afternoon effect

Q: What is the message to the aerosol community? Are these diversity maps what they should use to determine the uncertainty associated to the satellite products, similarly to what is done to derive the uncertainty from the spread of model ensembles?

C: A difference is that we have the AERONET data set as a reference to benchmark against

C: It is expected that, while there is some discrepancy across retrievals, the spread across retrievals is comparable to the uncertainty of individual retrievals.

Q: How can we best use these results to constrain models? Do we just use the diversity maps as shown?

A: We can focus on the regions of the world where diversity is low and retrievals agree with AERONET, and then make sure models get accurate in these regions.

C: For AAOD, AERONET recommends not to use AOD below 0.4, or uncertainty gets too high

A: Modelers are interested in long-term statistics, so we can average over long time periods to average out errors and get small uncertainty values for both AOD and AAOD, even for low AOD values. *However, averaging reduces only random error, not bias*.

C: At low AOD values, noise on AAOD gets very large because of lack of signal

C: Some satellite products are biased at low AOD, some are not, even if the noise gets larger

C: Collocating 7 satellite products must cause much data loss due to colocation criteria, as spatial and temporal coverage is very different across products. Problematic areas or conditions are not retrieved by all products, so we may miss completely some regimes or regions in the collocated data set.

A: No major difference was observed in the results when fewer data sets were collocated, so not much must be missed when collocating all 7 data sets

C: Data loss is acceptable if spatial and temporal sampling is not biased in the subsetting process

C: Product uncertainty may be drastically reduced when synergistically using a collocated product (e.g. for cloud mask)

C: The discrepancy across models is very high while errors of satellite products are much more limited when compared to AERONET. So why can’t models improve using the existing data sets?

A: The models are not that bad, studies have demonstrated good agreement with observations in proper conditions. Also the satellite data sets are sometimes used through assimilation.

C: Assimilation has limitations, as a poor data set will not improve a model

Q: Is it possible to create a benchmark data set from a combination and/or average of existing satellite products, that modelers could use as an objective reference?

A: Nick’s study provides the benchmark: the time series of the ensemble data set, and the regions to look at.

Q: Does the ensemble product have associated error bars coming from the individual products?

A: No, too complicated to propagate uncertainties, as we cannot determine the correlation between uncertainties from 2 retrievals. So the diversity should be used as error bars instead.

C: Data providers must tell whether they endorse Nick’s diversity map as uncertainty estimate for their product. *Larisa has led a separate AeroSat study aimed at merging the best of multiple satellite monthly AOD datasets, using AeroNet as the key arbiter of quality at the regional scale.* Nick and Larisa should try to compare their uncertainty estimates, although data sets are not directly comparable.

C: When comparing models to satellite products, we must keep in mind the intrinsic difference between AOD from model in a 1-deg. grid box and the average AOD from satellite observations within a 1-deg. grid box (e.g. because of high resolution features such as possible cloud-edge contribution resulted in high AOD around clouds)

A: From Nick’s results it looks like the sampling within a 1-degree grid box should be adequate, so this should not be a concern

C: It may be pertinent to use pixel-level uncertainty as a weight when averaging multiple data sets to generate an ensemble product.

**SESSION 16 Satellite and suborbital data**

*chair:**Ralph Kahn / rapporteur: Matthew Christensen*

Introduction

Aerosol quantities *impractical* to obtain from satellites

- Aerosol *spatial variations* on scales shorter than ~500 m (*esp. sources*)

>> Winker: Is anyone working at street light approaches?

(Kahn: Yes. Also moon for additional nighttime aerosol observations. it is difficult, and results are very uneven, but at least something.

LS: https://www.sciencedirect.com/science/article/pii/S1352231019300287 )

- Regional-to-global-scale AOD & aerosol type mapping *at night*

- *Diurnal* variation of *aerosol type* (*can’t do currently from geo*)

- *Diurnal* variation of *vertical distribution* (*can’t do currently from geo*)

- AOD & type over *very bright surfaces at low-AOD* (*high latitudes*)

Aerosol properties *unobtainable* from remote-sensing

- Particle *Hygroscopicity*

*>> except for black carbon!*

- Particle *Chemical Composition*

- Mass Extinction Efficiency (*MEE*)

- Spectral *Light-Absorption* (*at the accuracy needed, e.g., for DARF*)

- The small-size part (<~ 0.1 micron) of the CCN size distribution

Initial Presentations

Lucia Mona and Claudia Di Biagio

ACTRiS – assembles network combining multiple in-situ measurement locations. Offers tools to aggregate data and carry out quality control. Many atmospheric variables: several in-situ, including aerosol, cloud remote sensing, aerosol remote sensing, including the EarliNet lidar network.

EUROCHAMP – advanced simulation chambers to complement remote sensing observations. Can suspend various types of aerosol to simulate atmospheric aging, etc. They have the ability to control for meteorological variables, gas, irradiance, etc., to assess aerosol optical properties both in dry and controlled wet conditions. There are 16 different chambers across Europe showing refractive index over the whole EM spectrum for many regions. Main products are mass extinction and spectral refractive indices.

Seed Questions

What *key quantities*should be or are being measured sub-orbitally to complement aerosol remote-sensing observations, for climate and air quality applications?

Can we close the system?

To do so would require measurements of optics, humidity, composition, and remote sensing. From dry mass to optics, as well as from hydroscopic size back to optics. Key for aerosol-cloud-interaction would be to determine cloud relationship to particle properties (CCN). Also need optical properties as related to mixing state (internal vs. external mixing is difficult) … Aerosol characterization vs. constraining processes. We need both but… FireX had all the chemistry and some of the aerosol optical and physical properties, so there is a lot to be learned from these data.

**Laboratories and *in situ* sampling**

Several merged campaigns could get us closer (e.g. Munich biomass dataset, EMERG campaign, etc.). SAM-CAAM aircraft *in situ* measurement suite includes internal as well as ambient (open-i nephelometer and cloud-coarse-aerosol probe on the wing) aerosol properties. This allows for a closure experiment: measure particle hygroscopicity under controlled conditions (e.g., tandem DMA at two relative humidities), calculate the hydrated particle properties, and compare with the open-I nephelometer. This provides an additional constraint on the uncertainty. Oxford has a large database of reflective indices (majority is from Ash, 34 volcanic ash samples). An ***electrostatic precipitator on a UAV could fly into a volcanic plume*** and get a sample, along with direct imaging of the particles.

Phase – does it matter? phase (solid vs. liquid) aerosols was mentioned, but did not really go anywhere in the discussion. It represents another constraint on particle type. For clouds, the phase (liquid or ice) is critical. *For aerosols, this is usually determined based on particle shape (spherical – liquid vs. non-spherical – solid). However, the optical properties themselves are more important for most current applications.*

**Processes vs. optical property tables?**

Is the purpose to improve satellite retrievals, models? How are you going to use this?

Remote-sensing aerosol retrieval is an underdetermined problem, so particle optical property \*options\* are assumed, and the algorithm determines which match the radiance observations within measurement uncertainty. The more accurate and specific the assumed particle optical property climatology, the better constrained the retrieval. So a capturing set of particle optical properties as priors could greatly improve all satellite remote-sensing retrievals. Having also the mass extinction efficiencies for the range of particle types would greatly improve the assumptions needed to apply optically determined satellite retrieval products as aerosol mass constraints for climate and air quality model.

Aerosol Chemistry gas part (CO and O3) is a convenient tracer. Ozone can be measured, and gives some clues about aging oxidation state. CO is a tracer for wildfire smoke. Idea might be to list aerosol airmass types we want to see measured in chambers? Combine focused flight strategy with chambers studies. Reproduce processes that drive aging.

**New OPAC database**

There is a need to update the OPAC database, providing new measurements of particle physical and optical properties for different types. Measure ambient spectral extinction for different aerosol types coming out of campaigns. Also need updated aerosol refractive index measurements of different aerosol species, UV (e.g., 370 nm) to 40 microns wavelength. Can this be measured for particles up to 50 microns down to ~50 nm. Other tracers? Sulphate, black carbon? The capability is there in the ACTRIS lab facilities. Community is wanting full spectrum and for different humidity too. Requires a new research project or is it already? Partly funded… -> a NEW OPAC WOULD BE FANTASTIC

**Links to models:**

>> contribute mass extinction efficiency which is needed to translate between satellite products and models, but is highly uncertain, even for sulphate aerosols in the AeroCom models (showed slide from 2009 CCSP report).

**New measurements**

Would a polarimeter in orbit provide any additional data? Better constraints on particle size distribution and real refractive index, with higher accuracy under a broader range of observing conditions. Being asked this question for ACCP. However, some things cannot be measured remotely: mass-extinction efficiency Is there a need for instrument development? Polarizing nephelometer for laboratory and/or aircraft.

What *flight-planning strategies*might be used to maximize the contributions made by aircraft to our overall aerosol-climate and air quality goals?

**Collocation with satellite data**

Olga felt that we need to include comprehensive measurements and collocate them with satellite data. This occurs at times in short-lived field campaigns, but it is difficult to coordinate satellite and aircraft over desired aerosol type and surface under relatively cloud-free conditions. *In situ* properties measured systematically for specific aerosol air mass types, associated with specific sources, can actually be transferred to aerosol types identified in remote sensing data. Models can help connect the remotely sensed aerosol air masses with sources.

As such, collocated remote sensing with aircraft is needed for closure experiments and for satellite validation, but *is not required to create a comprehensive database of particle optical, physical, and chemical properties to be associated with remotely sensed aerosol airmass types*. For systematic aircraft measurements, simple, repeatable flight plans would be adequate.

How can *representative aerosol samples*be collected for laboratory analyses?

Mike Garay raised the point whether it will we be possible to sample enough diversity in aerosol conditions? Aircraft samples a very small volume. However, it was argued that systematic, repeated flight measurements to targeted, elevated layers will contribute to a PDF of the aerosol distribution. *You get a representative sample by sampling an aerosol airmass type until the data show a robust PDF of the properties of interest.* How long it takes we don’t know. And it is likely to vary based on airmass type, different properties, and observing conditions. The main thing this offers is that you are building statistics. At the very least, no matter what you get, you will have more statistics than current field campaign measurement programs offer.

**Challenges discussed** (related to measurements)

We are getting more refractive indices, but many different values are obtained, for example, for hematite. Are all correct, or are only some right? This is most likely particle type diversity, depending on the source and aging processes involved. Also, sources are sometimes contaminated, e.g., dust mixed with absorbing pollution particles, so the results can be very misleading if not interpreted correctly. Also, Sahara dust, middle east dust, and China dust are all different, and there are different dust types within these geographic regions as well. Idea might be to start with a few major dust regions and sample each region.

Stefan Kinne noted that the uncertainty in refractive indices as a function of wavelength appeared very large. It is due in part to the variability that is large when chamber measurement samples include aerosols from multiple sources.

Can we obtain optical properties for *non-spherical dust & volcanic ash*particles with aircraft and/or laboratory observations?

Aircraft ambient aerosol measurements (e.g., open-I nephelometer, cloud-and-coarse-particle probe) are promising for some optical properties, but there are significant limitations. New instrument ideas could be helpful. Obtaining a sufficiently large airborne sample for detailed laboratory analysis is difficult, especially for coarse-mode dust and ash particles.

**What approaches might we use to *integrate sub-orbital data* with satellite data?**

Having systematic measurements, from aircraft and/or laboratory, could be used to improve satellite retrieval algorithm assumptions. *This question could bear further discussion*.

**SESSION 17 Aerosol typing**

*chair:**Gerrit de Leeuw / rapporteur: Marta Luffarelli*

Intro – Gerrit de Leeuw

* What aerosol type from satellite sensors?
* How does this relate to *in situ* measurements?
* Language/definitions? AOD, AAOD, FM/CM AOD, Angstrom

Lucia Mona: The REDAT aerosol typing dataset

Antti Lipponen: Information Content Analysis: satellite and ground-based data for more accurate SSA at low AOD

DISCUSSION

Lucia Mona stressed that the modelling community is needed to define aerosol typing.

Ralph Kahn also pointed out how the two communities could integrate their efforts. For instance, in low AOD conditions the information content associated with the satellite observations is reduced. In such situations, models can bring additional information, because in models, aerosol type is determined by the source properties and advection, and does not depend on AOD. It has been stressed that bringing the two communities (modelling and observations) together on this topic does not aim at helping one or the other, but rather to *exploit each other’s strengths and come up with clearer definitions*. It has also been clarified that in this framework aerosol types are characterized by absorbing/non absorbing small/large particles. Additional work will be needed to extract the aerosol composition.

Yves Govaerts suggested that aerosol types should be defined starting from what a satellite can actually measure: single scattering albedo, phase function (asymmetry factor), optical thickness and, if the polarization is measured, the radius and the refractive index. Naming an aerosol type would then be to give a name to particles that fall in a certain subspace delimited by these properties.

One issue, however, is that the amount of aerosol-type information in satellite data varies greatly with retrieval conditions – at low AOD, for example, there is generally much less information.

A lot of discussion focused on what additional variables can be helpful to constrain information on aerosols. Spatial distribution of aerosols retrieved with the same properties can be delivered. Also, Thomas Popp and Ralph Kahn suggested to measure and ***deliver spectral AOD***, which is an intensive property of aerosols can be used for cal/val, and to some degree, for general aerosol-type mapping.

A lot of discussion was raised on whether satellites can independently measure the spectral AOD at different wavelengths. However, such information could help the discrimination between fine and coarse particles (e.g., with MODIS, that is, even with single-view, multi-spectral data). Nevertheless, the definition of fine mode is not clear between modelling and observing community. Adam Povey suggested that any particle small enough to be a spherical droplet can be considered fine mode, but the modelers disagreed, stressing that this definition leaves out the dust fine particles.

To go forward with this study, *the two communities agreed on working together, maybe having a progress meeting before next year meeting*. In the first phase, the focus will be on defining two easily distinguishable types such as dust and biomass burning. Lucia Mona and Kostas Tsigaridis will take the lead.

**SESSION 18 Climate Data records**

*chair:**Kostas Tsigaridis / rapporteur: Linlu Mei*

A way to include *uncertainty in a merged* *aerosol product* is needed.

One potential problem in a merged aerosol product taking uncertainty into account is that different satellite products have different definitions of uncertainty.

If AERONET is used, AERONET is not enough to represent the whole region, one way is to use limited AERONET sites for important regions such as Africa. Some work has been done identifying the representativeness of given AERONET locations for larger areas (e.g., *J. Li et al*., *JGR* 2016, doi: 10.1002/2016JD026308).

To create a high-quality merged product, all existing qualified satellite products should be used. Some products with problematic quality should not be included.

GRASP-PARASOL AOD product has large positive bias for low AOD (partly corrected in the newest version). GRASP performs well over India and east Asia with large AOD, but problem occurs with small AOD conditions such as over ocean, US, EU. Unrealistic high AOD is retrieved over Hudson Bay in winter season; ice detection algorithm should be improved in GRASP. Possible problem of gridding process in GRASP is also mentioned.

For different AOD products from the same instrument but with different retrieval algorithms, do we need to include all products or pick up the best-quality product to create the merged product?

If a merged AOD product includes different individual products (e.g., an updated merged product may include new satellite products), absolute AOD value may differ, but AOD long-term trend /temporal behavior should be similar.

The merged product should be updated with new individual satellite products / new merging algorithm

Merged AOD and fine-mode AOD may be helpful to provide more aerosol size information.

NOAA AVHRR long-term observation should be included in a merged product.

**SESSION 19 Pixel uncertainties**

*chair:**Thomas Popp / rapporteur: Marcin Witek*

**Discussion topics:**

1. Propagation of uncertainties from L2 to L3 product versions
   * When propagating uncertainties from L2 to L3, sampling issues and representativeness of particular regions need to be addressed
   * Spatial correlation of uncertainties is important for modelers, and it can be provided by certain retrievals (CISAR)
2. Quality flags versus AOD uncertainties
   * Is there consistency between prognostic uncertainties and quality flags? Possibly quality flags are more useful (modeler perspective). In the future, prognostic uncertainties should substitute quality flags.
   * Combining official error propagation techniques with other uncertainties can work well (Adam)
   * Having both quality flags and pixel-level uncertainties is useful, partly because there is usually no information that contributes to the predictive uncertainties (Larisa)
   * Quality flags provided by CALIPSO are useful
   * One problem with quality flags is that they are inconsistent between different instruments and products. And unlike an uncertainty estimate, they are not quantitative. It is important to clearly describe quality flags and justify specific choices.
3. Ensemble techniques in AOD uncertainties
   * Ensemble technique has been shown to work well
   * Assumption on particle properties affects AOD retrieval and its uncertainty
   * However, the value of ensemble technique can be diminished in places where no AERONET sites are available for validation (Ralph)
4. Uncertainties in particle properties
   * Unlike AOD, there is no standard to compare against (Ralph). One suggestion is to look at *AOD at different wavelengths*, which might be more beneficial than looking at ANG. Comparing retrieved AODs at different wavelengths can provide additional information about particle properties; if there is disagreement at two wavelengths, reported particle properties should be trusted less. Need to decide which wavelengths to look at, and standardize it if possible, noting that different instruments measure in different wavelength bands.
   * If models optimize their predicted AODs at one wavelength, there is no guarantee that they would agree equally well at another wavelength. (Mia) This indicates the possible value of using AOD at different wavelengths as a constraint on particle type.
   * Retrieval methods often retrieve AOD at one wavelength and assume spectral shape, but some techniques can provide independent retrievals at multiple wavelengths
   * It needs to be defined which parameters (particle properties) are going to be used and how to quantify their uncertainties.
   * Can current AOD uncertainties be split between fine and coarse AOD fractions? One problem with that is that definitions of fine/coarse modes differ from retrieval to retrieval and against AERONET.
   * Modelers and satellite retrieval groups need to work together to decide on common priorities in terms of particle properties.
   * Uncertainties in AODf, AODc, SSA, and other properties are generally more difficult to quantify; better definitions of some of these quantities are required.
5. Radiative transfer calculations as a component of AOD uncertainties
   * There might be a need to revisit uncertainties in radiative transfer codes and incorporate them in AOD retrievals

Other notes:

* SDA algorithm – share in the community (Stefan Kinne as source)

**SESSION 20 New remote sensing techniques**

*chair:**Yves Govaerts / rapporteur: Antti Lipponen*

Presentations by Jaehwa Lee, Linlu Mei

Seeding questions:  
- What are major needs for new techniques?  
- Where can AEROSAT experiments help to improve algorithms?

Discussion:  
- Winker presented the "aerosol" payload options for ACCP  
- Govaerts: Use of AERONET as absolute truth - is it? There are differences in radiative transfer  
(RT) between AERONET and satellite retrievals. There are no dedicated missions just to observe  
aerosols. Are the RT models good enough at the moment to get all out of current satellite  
measurements?  
- Mei: There is a difference between simulations and real observations. Adding constraints may help retrieving difficult quantities (e.g. aerosol over ice).  
- Govaerts: Calibration of satellite instruments is important. Differences in different RT models due to molecular scattering for example will cause difference of about 2% that is usually less than the satellite instrument noise. When instruments become better calibrated accurate RT will be more important.  
- Popp: Differences in RT models come not only from mathematics but also from input data (absorption data, etc.)  
- Govaerts: Some bands are easy but for example 1.6 & 2.2 um are difficult spectral bands in RT  
- Tsigaridis: 3D RT is really difficult. These are used for example in some models.  
- Govaerts: "Earth is flat" approximation used still many times in RT  
- Kahn: In some retrieval algorithms, RT model can be swapped easily when a better one is available. Multi-angle data helps in satellite retrievals in cases of low optical depths. New practical RT codes are welcome. Some of the more advanced RT codes are available but are still impractical.  
- Govaerts: AERONET is only one way to observe aerosols. Especially with low AOD we really  
don't know what is going on.  
- Govaerts: AERONET is not sensitive to the same quantity as satellite instruments so it is difficult  
to compare. For example, surface may cause problems.

- Kahn: Representativeness over larger areas of AERONET point locations is a limitation.  
- Popp: Is there a need for a study to illustrate the problems in RT and radiometric accuracy of  
future instruments. Going away from AERONET is not an option.  
- Sogacheva presented slides showing overestimation of POLDER-GRASP  
- Popp: It is an iterative process to improve the retrieval algorithms - we all learn from comparisons  
- Chimot: Aerosol height is important. Is it useful for modelers to get more accurate aerosol height? Is height or vertical profile the more important quantity?  
- Tsigaridis: In climate models, plume injection height is important. The plume height is useful in  
validation.  
- Popp: In addition to new instruments, we also need to pay attention to old instruments to deliver good climate data records

**SESSION 21 AEROSAT w*rap-up and closing***

Major outcomes of AEROSAT2019

* Proposed collaborative experiments between AEROCOM and AEROSAT: dust (incl. 10 micron), clear sky AOD, aerosol simulator, absorption
* Initialize new collaboration between laboratories and retrieval communities
* need for compiling a “new OPAC”
* Need for systematic 3D aerosol property measurements
* Suggestion to use multi-spectral AOD as an additional, particle-intensive-property related link to models
* Task team to compare in detail optical aerosol specifications in models and retrievals; possibly define a dust inter-comparison experiment first
* A new multi-sensor merged data records were presented and discussed
* Best practices on validating pixel level uncertainties were presented and discussed
* Critical reflection of the accuracy of radiative transfer codes (including auxiliary data on gas absorption)

Suggestions for next year AEROSAT topics:

* cloud masking / fraction

**Thanks to**

Carlos Perez, Alexis Chanthasack, Jeronimo Escribano, Sara Basart and their BSC Atmospheric Composition group colleagues

Chairs (Nick, Lorraine, Omar, Adam, Felix, Rob, Greg, Barry)

Rapporteurs (Ed, Martha, Linlu, Jim, Antti, Zhibo)

**AEROSAT program**

**Friday, September 27, 2019**

***AeroCom / AeroSAT***

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|  | **SESSION 14 AeroCom tasks / AeroSAT goals** |
| **9:00 – 9:45** | *M. Schulz***AeroCom 2019 wrap-up and outlook / link to AeroSAT** |
| **9:45 – 10:00** | *R.Kahn/T.Popp***AEROSAT 2019 introduction / AeroSAT experiments** |
| **10:00 – 10:30** | **poster introductions (part 2)**  **max 1 ppt slides / 1 minute poster introduction** |
|  | *in alphabetical order (of those not present on Monday)* |
| **10:30 – 11:00**coffee-break | |
|  | *chair: Pete Colarco,  rapporteur: Jacques Descloitres* |
|  | **SESSION 15 Data and modelling** |
| **11:00 – 11:05** | *chair***introduction, seed questions** |
| **11:05 – 11:20** | **Seed presentation:** *Matthew Christensen*  **reflections on barriers to using satellite data as model constraints** |
| **11:20 – 11:30** | *Nick Schutgens* short summary of relevant outcome for satellite community from AEROCOM/AEROSAT remote sensing experiment |
| **11:30 – 12:30** | *joint discussion* |
| **12:30 – 14:00**lunch | |

***AeroSAT***

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|  | *chair: Ralph Kahn,  rapporteur: Matthew Christensen* |
|  | **SESSION 16 Satellite and suborbital data** |
| **14:00 – 14:05** | *chair***introduction, seed questions** |
| **14:05 – 14:25** | **Seed presentation:**  *Claudia Di Biagio / Lucia Mona* **Contribution of the laboratory  experimental simulation activity within EUROCHAMP-2020/ACTRIS to the aerosol retrieval from satellite observations, Introducing ACTRIS ground and aircraft measurements** |
| **14:25 – 15:30** | *joint discussion*  -          *New ways to integrate suborbital, lab and satellite / model data* |
| **15:30 – 16:00**coffee-break | |
|  | *chair: Gerrit de Leeuw,  rapporteur: Marta Luffarelli* |
|  | **SESSION 17 Aerosol typing** |
| **16:00 – 16:05** | *chair***introduction, seed questions** |
| **16:05 – 16:20** | **Seed presentation:** *Lucia Mona* **aerosol typing database** |
| **16:20 – 16:30** | *Antti Lipponen* **Information content analysis: Combination of satellite and groundbased observations enables more accurate aerosol SSA retrievals at low aerosol loadings** |
| **16:30 – 17:30** | *joint discussion*  -          *Common definitions*  -          *Interpretive particle composition*  -          *AEROSAT 2018 suggestion: Convert all variables to AOD : absorbingAOD, FineMode-AOD, Dust-AOD, medium-size AOD, non-spherical-AOD, FineMode absorbing AOD, CoarseMode absorbing AOD, spectral AOD, how define size modes?, …* |
| **17:30 – 18:30** | **Poster viewing** |

**Saturday, September 28, 2019 *AeroSAT***

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|  | *chair: Kostas Tsigaridis , rapporteur: Linlu Mei* |
|  | **SESSION 18 Climate Data records** |
| **09:00 – 09:05** | *chair***introduction, seed questions** |
| **09:05 – 09:20** | **Seed presentation:***Adam Povey***A new perspective on satellite data** |
| **09:20 – 09:30** | *Larisa. Sogacheva*Can the merged AOD L3 monthly product (1996-2017) be extended back to 1979 with TOMS AOD? (AEROSAT-induced paper / experiment) |
| **09:30 – 10:30** | *joint discussion*  -          accuracy, usefulness for modelling, how to improve them  - best practices for gridding (daily, monthly) |
| **10:30 – 11:00**coffee-break | |
|  | *chair: Thomas Popp, rapporteur: Marcin Witek* |
|  | **SESSION 19 Pixel uncertainties** |
| **11:00 – 11:05** | *chair***introduction, seed questions** |
| **11:05 – 11:20** | **Seed presentation:** *Jeronimo Escribano, Enza Di Tomaso and Angela Benedetti* **Aerosol data assimilation and uncertainties** |
| **11:20 – 11:30** | *Andy Sayer (presented by Thomas Popp)* **A review and framework for the evaluation of pixel-level uncertainty estimates in satellite aerosol remote sensing** |
| **11:30 – 12:30** | *joint discussion* |
| **12:30 – 14:00**lunch | |
|  | *chair: Yves Govaerts , rapporteur: Antti Lipponen* |
|  | **SESSION 20 New remote sensing techniques** |
| **14:00 – 14:10** | *Jaehwa Lee* **Aerosol plume height climatology derived from synergistic use of UVVIS sensors** |
| **14:10 – 14:20** | *Linlu Mei* A new aerosol optical thickness research product over Cryosphere |
| **14:20 – 14:30** | *Christina Hsu*New “Deep Blue” aerosol products from LEO and GEO satellites |
| **14:30 – 15:30** | *joint discussion*   * What are major needs for new techniques? * Where can AEROSAT experiments help to characterize or improve algorithms? |
| **15:30 – 16:00**coffee-break | |
|  | **SESSION 21 Wrap-up and closing** |
| **16:00 – 16:30** | **Thomas Popp / Ralph Kahn***AEROSAT wrap-up and outlook*  *Any new AEROSAT (or joint AEROCOM/AEROSAT) experiments?* |

**Posters (with AEROSAT relevance)**

**Bowdalo, Dene***GHOST: A framework for the harmonisation of global surface atmospheric observations*

**Descloitres, Jacques***A validation tool for satellite aerosol data sets*

**Khan, Aman Waheed***Real-time forecasting of air pollution using WRF-Chem model over New Delhi*

**Kalashnikova, Olga***Analysis of L3 MISR V23 aerosol products over the ocean, and comparison with MODIS*

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