AeroCom-Aerosat Board for keeping discussions, comments, question and answers
DAY 2 / 13 October 2020
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Use the agenda to insert comments, Q&As in a chronological order
Let us develop this document jointly, in a stuctured way - can serve as useful minutes taker tool
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Plenary Session 4 - other modeling results (90 min) *6 talks 12 minutes + 3 minutes discussion*
Moderator: Stefan Kinne // Rapporteur: Nicolas Bellouin
- Yves Balkanski: Aerosol absorption: how dust absorption causes Sahel precipitation
- Claire Ryder: Aircraft observations of Coarse Dust: Radiative Significance and Model Evaluation
- Ross Herbert Understanding the Asian summer monsoon response to a future dipole in aerosol emissions across India and China using an intermediate-complexity GCM
- Christoph Bruehl: Model simulations of the Pinatubo volcanic eruption: direct and indirect effects on stratospheric chemistry and dynamics
- Kai Zhang Intercomparison of aerosol microphysics parameterizations in the MAM aerosol box model
- David Neubauer: Soot aging by ozone/sulfuric acid enhances future warming and reduces shortwave aerosol cooling by changing cloud formation
15 minutes break

Yves Balkanski: Aerosol absorption: how dust absorption causes Sahel precipitation
Michael: It would be nice to document the "forcing efficiency" of the dust /per DOD, dust emission in the model version you are using.
Yves: Absolutely, even better would be to compare it with measurements...

Paul Ginoux: If dust is increasing precip in Sahel.How do you explain that dust did not reduced the Sahel drought from 1970 to 1990?
Yves: The explanation is that they are other factors at play: SSTs are a big one (the litterature is large to show that), but also the interactions between vegetation and dust are entering into that question, and I know you will not contradict me on this one

- Michael: Isnt that a chicken and egg problem?
- Yves; Yes
- Paul G: Dust increased by factor 4 such that it could be tested
- Yves: I do not understand your factor of 4. The dust fields are realistic here and have been compared to constraints of Kok et al, and Rydley et aL.
- Michael: Agreed. ...at least its a feeback acting against more dust&drought
- Laura Wilcox: But if other drivers had reduced the moisture flux into the Sahel during the drought period, perhaps the mechanism breaks down then? Anthropogenic aerosol is thought to have reduced moisture flux from the Indian Ocean.
- Yves; I agree with Laura, there are also studies showing the role of GHG increases on the SST gradient over the Atlantic.

Paul G.: With Jeffrey Strong and Gabe Vecchi we test the effect of absroption and scattering dust on Tropical Cyclone. The impact was a U curve with strongly scattering and absorption had an effect. I hvae also a paper on dust feedbacks over Sahel with Stuart Evans showing that dust should be scattering rather than abs to match obs!
Paul G: Are you using a fully coupled GCM?
Yves; Yes IPSLCM6 with NEMO at 1° resolution same setup than a historical simulation but with interactive aerosols

- Paul G: Very interesting work and interesting that at GFDL we get the opposite: to match obs precip we have to increase scattering (I am using your 2.7% hematite refrative index of Balkanski et al., 2006). Now with JOnas Gliss' work on AeroCOm3 it seems that GFDL is overestimating absorption because of high sulafte load which is internally mixed with BC. So, maybe we need to decrease dust abs because SO4+BC is too absorbing!
- Yves: Do you account for large particles Paul, Claire showed that you could be missing out 60% of the absorption by not representing well large particles.

Jane Mulcahy: very nice talk Yves. So clearly there is much debate on how absorbing the dust is. have you looked at the impact of these different assumptions on the precipitation, that is: compared your 3% hematite to your other % contributions? Also what are your thoughts on how globally applicable these absorption assumptions are. Currently most models use Saharan values everywhere. thanks!
Yves: Yes Jane, it is even better done by Ron Miller who is our mentor on these questions. Have you read his chapter in The dust book (Miller et al. 2014)? It reads very well and exactly addresses this topic.
Thanks Yves, yes I know the book and have a copy on my desk in the office...:-) I guess my question really was getting at if there is any new consensus on what we should be using in our climate models. UKESM and HadGEM models still using your 2007 data which is less absorbing I think than what you have here - we get minimal forcing from dust, due to compensations of LW and SW dust effects. think it would be quite informative to compare simulations with different absorption rather than just vs. no dust.
Yves: It is important to understand that I am interested in Sahel dust that is more absorbing than dust from other deserts. What this study brings you is the added absorption when you account for large and very large
particles, so this matters particularly for near-source regions.

Ron Miller: great talk, Yves. I like your explanation in terms of moist static energy. Your JJAS rainfall anomaly peaks between 6-10 N; is dust RF also positive at these latitudes?
Yves: Yes it is, if you download the presenaion this is shown in slide 10. We can discuss that offline if you are interested.

Ron: thanks, Yves.
Bjørn: Great analysis! Do you have fSST simulations too? Would be very interesting to separate the fast/rapid adjustment term from the SST related dynamics, even if the latter is likely very weak for this perturbation. (Also, this ls super relevant for what we'll be discussing in the next section, on absorption in CMIP6 and its implications.)
Yves: Looking forward to that discussions. I think we have saved the daily SSTs.
Thanos: Great talk! I assume the model is fully coupled with dust radiative effect affecting meteorology. Is the dust radiative effect a combination of direct + semi-direct + indirect on your experiments? Or only direct + semi-direct? I think, indirect would not matter much if you didn't consider dust ageing (great thanks for clearing this out for me Yves!).

- Yves: Fully coupled model with NEMO. The forced model that we have run for 30 years show a much stronger effect and cannot be trusted. Only direc + semi-direct, I am not comfortable for the indirect effect of dust, you are a better person to treat the indirect. Yes dust ageing could matter, I agree. Glad you liked the talk!

Philip: nice work Yves. Conceptually this is probably consistent with our idealised work in https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019GL083479 . We have also expanded on this analysis in another submitted paper, showing that the transition zone is exactly somewhere in the sahel latitudes.
Yves: Sorry I have not yet read your work in GRL 2019, I put it on my list. Please send me the submitted one once accepted, I am also very interested. THank you for your nice comment on the talk. Y
Claire: Nice talk Yves. Is it published yet? Or do you have more detailed information on what you did with the size distribution and RI setup? I would like to try and digest the dust setup more slowly!
Yves; Thank you Claire and yours TOO! Manuscript is written, we aim at at very high impact journal so chances are small but we will try to convince all reviewers. Yes I can give you much more information on how this is done.
I will extract the relevant part from the manuscript or if you can keep it for your eyes only I can forward you the whole thing.

- Claire: Thanks Yves, I will get in touch with you by email.

Claire Ryder: Aircraft observations of Coarse Dust: Radiative Significance and Model Evaluation
betsy: in the three size distributions for the 3 compaigns/locations that were presented - were they column averages? how much did they change in the vertical?

- Claire: I think I answered your Q in the session - but if not, see Ryder et al., 2013a, GRL - https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/grl.50482 supplement figure S2.

Michael: Are we fooling ourself by using lognormal distributions in the models for the super coarse modes? The coarse particle tail is probably removed more fast. => do we need another type of distribution for the giant particles?

- Claire: Yes, perhaps. My feeling is that it would be more tricky to accurately represent transport/deposition processes for the coarse/super-coarse with modes

Mian: We did include larger particles (up to r=50 um) but the problems is that they cannot stay in the atmosphere. So the problem is how to retain them.

- Claire: I think this is the key. We need to understand how the coarse particles remain airborne in order to improve models - need to work on identifying individual transport processes which are important
- Paul G.: Working on this issue with GOCART (JGR, 2003), I implemented the Michael Prather moment scheme to study the effect of numerical diffusion by settling scheme and it matters a lot, well before the non-sphericity. With Prather'scheme, GOCART could reproduce the volume size distribtuion retrieved from AERONET by Oleg Dubovik. Conclusion: we should be careful with our settling "upwind" linear schemes which are quite diffusive.
- Mian@Paul: Do you still have that code? I think Dongchul tried using the code you sent him last year but that made little difference. Kok's recent paper says 3-D ellipsoid shape is better than spheriods.
  - Paul G: Dongchul implemented the "implicit" version of upwind settling scheme, which is linear and diffusive but stable any time step and particle size. I gave to you and Dongchul the original GOCART fortran code calling the Prather's moments scheme.
  - Paul G: There is a very new and interesting paper from Greece showing that dust is vertically aligned and not randomly oriented. So this may have an impact indeed.
  - Ron Miller: Hi Paul; the vertically aligned particles would probably fall out faster; I think the Greece group is arguing that electric fields that orient the particles also suspend them and reduce their fall speed. Of course this requires modelers to introduce electric fields into their models :)
    - Paul G: Thanks Ron. Indeed their work points to consider the electric field in dust modeling!
    - Yves: If you had 3 recommendations for modellers what would they be?
      - Claire: firstly to include coarse particles - many models don't even go beyond 10um diameter. Second - compare to dust obs making sure to include a comparison to vertically resolved data, and preferably vertically-resolved AND size-resolved, where the obs properly measure the coarse particles.
      - Michael: supporting also the idea of better size diagnostics..
      - Claire - yes definitely
  - Andy Sayer: Paul - Nick Schutgens posted a link to an EOS article about that work in Hongbin Yu's discussion yesterday. Would definitely be interested in exploring Claire's in situ size distributions, and preferential orientations, etc, on satellite retrievals. I looked a bit more after though and didn't yet find a tool that can simulate oriented particles (in the same way Mie routines work for spheres and T-matrix etc for randomly oriented spheroids). That seems to me the main missing element right now and am hoping I am just unaware and someone knows it is already filled somewhere. Have reached out to someone who might. EDIT: they replied and suggest we might need Monte Carlo simulations, although there is a problem as current codes require block diagonal phase matrices, and that doesn't hold for non-random orientations.
  - Claire: This is really interesting to look at. Jamie Banks did some work with orientated dust particles (IR though), looks like T-Matrix was used - https://acp.copernicus.org/articles/18/9681/2018/acp-18-9681-2018.pdf - though interestingly these authors used horizontally aligned dust, based on likely fall

orientations - which (electric field omitting) would be with the largest face perpendicular to the fall direction. This would also give the dust a smaller settling velocity, and more so for the larger particles.

Nick: a few years ago a study suggested that convective updrafts could keep

Dongchul: It would be useful for modelers if you have numbers for > 10um.

- Claire: All the aircraft data I showed is available for model comparisons - just ask me and I can send a copy of the data. I'm also working on including it on CEDA (UK Centre for Environmental Data Analysis)
  - Sorry I meant in summary. I think you showed for >5um and >20um.
  - Claire: Ah yes, the fraction above certain sizes. I probably have a figure somewhere - I can send to you if you're interested.
  - Absolutely yes. email (dongchul.kim@nasa.gov) or link works too.
  - Great - I will dig out and send to you.

Ross Herbert Understanding the Asian summer monsoon response to a future dipole in aerosol emissions across India and China using an intermediate-complexity GCM

Mian Chin: If there is no aerosol (ctrl exp), how does clouds form?

- Laura Wilcox @Mian: Various parameterisations for clouds: https://gmd.copernicus.org/articles/8/1157/2015/gmd-8-1157-2015.pdf

Paul G: Very nice experiment setup. It is interesting to see that scattering case is contrasting precip over the Tibeta Plateau as observed: the Karakoram is seeing an increase as opposed to Himalayas (Kapnick et al., **Snowfall** less sensitive to warming in **Karakoram** than in Himalayas due to a unique seasonal cycle, Nature, 2014).

- Ross: there are certainly some things missing in the model that could explain the differences - a big thing would be the lack of dust over the TP i would think! But what it does show us is hat there can be some interesting large-scale dynamical responses that divert the flow

Yves: Have you looked at obs of precipitation trends over these regions and see if they look like what the low complexity model produces?

- Ross: in some respects it matches obs, but for us i think it may be also useful to compare to other global models - we have a good represneation of the monsoon circulation that other more complex GCMs don't - it would eb good to compare to these. These are quite big perturbations that would in reality take decades to occur, however, the drying of the monsoon, and the southward shift of the LLJ is consistent iwth obs (but not the past decade...)

Paul G: Also dust from Thar has been decreasing recently which means than scattering from pollutants is increasing.

- Ross: it would be great to include the dust in these experiments - it is clearly important for the elevated heat pump and therefore preconditioning of the monsoon

Wenying Su: In the last 15 years, the precip over India has increased, and AOD increased based on satellite obs. Seems contradict to your conclusion?

- Ross: yes, so there is more happening than perhaps our simple model shows! and also that it is likely not just local aerosol changes that impact the monsoon. a recent paper by hunag et al 2020 (https://doi.org/10.1175/JCLI-D-19-0833.1) shows that there are many factors that could be impacting the changes over indian monsoon precip - though they point towards the IPO being an important contributor to the recent changes

Cynthia Randles: Very nice talk, thanks. I did something similar in my thesis way back in 2007 and had similar findings, glad they still hold.

- Bjørn: Cynthia, are those results avaiable somewhere? Would be very interesting to see.
- Yes. Published in JGR ~2006 or 2007 I think ... used the GFDL model of the time, with fixed aerosol (over both India and China) and fixed SST, and adjusted SSA
- Found it. Thanks!
- Thanks Cynthia!

Mian Chin: We do have an ACAM UTLS AeroCom experiments in place and we can coordinate the efforts together @ Ross Herbert

Michael: Shouldnt one include GHG increases in these experiments?

- Ross: yes, and this would be a very nice extension of the expeirments - however, should i then include changes to aerosols in other regions? it could get very complex quickly, but i agree it would bea useful first thing to do...

Mian @Michael: Yes, good idea. That would mean a new AC experiment...

Mian: I think we can extend the UTLS/ACAM experiments to add GHG or change SST

Mian @Ross: Would you be interested in doing the UTLS/ACAM experiments? We do ask modelers to separate East Asian and South Asian sources, plus tagging global anthropogenic and volcanic sources

- Ross: I am now on a different project, but please contact by email and we can discuss it further ross.herbert@physics.ox.ac.uk
- ROss: it would certainlty be interesting with this kind of model though
- Mian@Ross: Ok, lets discuss offline...

Any thoughts on the impact on non-local aerosol emission changes? Given large aerosol emission decreases in other regions, especially in the NH, would this not impact the ITCZ, which would impact India/China precip?

- Laura Wilcox: We have been looking at this a lot in our group, including in ESMs. The importance of the non-local emissions seems rather model dependent in terms of both the magnitude of the response, and the mechanism driving the response. Watch this space for a few papers coming soon, or drop us a line!
- Ross: i think the experiments alone would be difficult to give a good enough answer to that - whwther these impacts wouldact to buffer or enhance other large-scale shifts in the itcz / jets would be interesting to look at

Bjørn: Thanks Ross, very nice talk!

- Thanks!

Xiaohua Pan: Interesting talk. I am wondering how to adjust the doze of absorbing and scattering aerosols put in these experiments. I am thinking that the results will depend on the relative amounts of those two elements.

- Ross: yes definitely, we based our experiments on the AOD seen today, but even that is a too-high perturbation, but for looking for the overall driving processes these kind of loadings are useful. It would be good to repeat the experiments with lower / higher loadings to test further..

Christoph Bruehl: Model simulations of the Pinatubo volcanic eruption: direct and indirect effects on stratospheric chemistry and dynamics
Kostas: are you injecting that much ash in the stratosphere together with SO2? Wasn't there a plume separation that kept most of ash further down?
Christoph: In the simulations we injected the ash with the same spatial distribution as SO2, at least for the small particles. A separation might occur later due to sedimentation and radiative heating. There are studies of my coauthor Osipov with a different model and different assumptions.
Valentina: Related to Kosta's question, do you get a separation because of different settling velocity? Or is all ash and sulfate mixed at that point?
Ash is coated with sulfate. In the early phase a fraction of accumulation mode ash grows to the coarse mode and sedimentates quickly. This effect is sensitive to particle density and shape and will be studied.
Valentina: beside the peak in AOD, the shape of the tail in the AOD vs time graph doesn't change if you have ash or not. Does it mean that ash is relevant only on short time scales?
The tail is dominated by sulfate. Ash causes an earlier formation of sulfate and an earlier removal. Heterogeneous reactions on it can cause a removal of sulfur in the early phase. Small ash particles contribute to AOD for more than a year.

Kai Zhang Intercomparison of aerosol microphysics parameterizations in the MAM aerosol box model
Mian Chin: Can this box model be plugged into any models?
Kai: The model utilizes the data structure in E3SM/CESM, so right now it takes some effort to implement it in any models. However, under the EAGLES project we are refactoring the MAM module, so that it will be less dependent on the host model and easier to be implemented in other models.
Michael: Nice effort and talk. Can we use it as a basis for an AeroCom aerosol module?
Kai: Thanks, Michael. We'd be happy to see it happen! The model will be shared publicly, so hopefully other modelers can try it as well.
Michael: Whats the timeline on your side Kai?
Kai: We plan to release the code (current version) publicly by the end of this year, along with some test cases/results we have been using and the documentations (they are being updated continuously though).

- Nicolas: Is that an actual plan Michael?
- Michael: well its a dream, but yes its also a plan....Maybe it would be good to assemble all open source aerosol code and box models, and dicuss how they can be developed / used and then also be "coupled" to actual 3d models.

Philip: Kai, nice stuff. I guess this is similar to the M7 box model that you will remember? I think this could be very useful for community use at some point - but what we are really missing is a community reference model (bin with multiple size distributions or particle tracking).
Kai: Yes, very similar in terms of processes considered and complexity represented. I agree with you, and it seems that there are some models available (as indicated by Tero below). But we do need some community effort to establish some baseline test cases and evaluate the results together.
Tero: Then there's also our SALSA box model. So, good opportunities for comparisons.
Kai: Thanks for the information. Yes, it's great to have opportunities for such comparisons.
Kostas: All: my presentation later fits well with what you mention here about portability, generalization, etc.
Kai: Great to know! Thanks.
David Neubauer: Nice work Kai! The single-column mode (SCM) allows also to better test microphysical parameterizations. Wouldn't it also be an option to compare SCM experiments of different models?

David Neubauer: Soot aging by ozone/sulfuric acid enhances future warming and reduces shortwave aerosol cooling by changing cloud formation
Bjørn: Thanks David, very interesting. We just published a related model study, on the global impacts of BC as an INP. McGraw et al. 2020 GRL, here: https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2020GL089056.

- It's different enough from your setup and topic that it's a bit difficult to see if our results are consistent; would be interesting to look into the details
- David Neubauer: Thanks Bjorn, it would be interesting to see if the results are consistent, I will look into your study.

Philip: investing stuff. O3 ageing of BC has been discussed by a range of others (Molina's group etc.). But I remember the timescale to be much slower than our microphysical ageing, hence I never bothered. What has changed?

- David Neubauer: What's new is that the experiments were run for several hours i.e. the same aerosol particles could age in the chamber for several hours at atmospherically relevant ozone concentrations. In my understanding previous experiments used shorter aging times but higher O3 concentrations but O3 concentration and aging time cannot be exchanged. The experimental details are described here:https://doi.org/10.5194/acp-19-15545-2019

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EU:3:45–5:15pm/NY:9:45–11:15am/CA:6:45–8:15am/JP:10:45pm–0:15am/CN:9:45–11:15pm

Restarting 5 minutes later
Plenary Session 5 - new activities and link to ESMs/CMIP6 [90 min] *7 talks 10 minutes / 3 minutes discussion*
Moderator: Duncan Watson-Parris // Rapporteur: Ben Johnson
- Andrew Gettelman Natural Laboratories for Aerosol Cloud Interactions- Simulating Aerosol Cloud Precipitation and Climate interactions (ACPC)
- Kostas Tsigaridis US aerosol coding initiative
- Fangqun Yu Use of machine learning to improve global models on aerosol-cloud interactions without compromising their computing efficiency
- Pierre Nabat Evaluation of aerosol absorption in CMIP6 simulations
- Bjørn Samset Aerosol absorption in CMIP6 and its implications for projected precipitations
- David Winker An update on the NASA_Cloud_Convection_precipitation study
- Ilona Riipinen EU FORCES project
- Harri Kokkola Properties contributing to aerosol forcing
Plenary-Introduction: 1 slide introductions from breakouts

Andrew Gettelman Natural Laboratories for Aerosol Cloud Interactions- Simulating Aerosol Cloud Precipitation and Climate interactions (ACPC)
Nicolas: Track studies are often criticised for focusing on specific cloud types or meteorological conditions, and for not accounting for the temporal evolution of the response. Is it possible to get around those limitations?

- Andrew: Good point. Looking across studies should help: from individual tracks and in situ data up to entire cooridor studies. We note regimes in the database, so we can sort by that as well.
- Ed: Just to add on the temporal part (nice talk Andrew!) - we had a look at that recently (for shiptracks), as you might expect (and following the results from Franziska Glassmeier, Fabian Hoffmann et al), there is quite a big change in the properties with time https://acp.copernicus.org/preprints/acp-2020-1030/
    - Nicolas: Interesting paper Ed, thank you. I was not aware of it.
        - Ed: It was only online last week, so that is understandable! Any comments/suggestions welcome
- Andrew: Yes, thanks for the reference. Added to the database....
    - Ed: Thanks Andrew - not quite sure how to fill in a single number in the database for these results

Tero: Where should we send tips on probably interesting papers on these natural laboratories/events?

- Andrew: Please send tips to me (andrew@ucar.edu) and/or Matt (matthew.christensen@physics.ox.ac.uk). We can add you to the list and you can add them right to the database document.
- Tero: Thanks! Are you also interested in aerosol events which could be suitable for ACI-analysis but they haven't been done yet?

Andy Sayer: while not anthropogenic, Santiago Gasso (at GSFC, not Barcelona Supercomputer Center - same names, different people) has compiled "volcano tracks" in clouds from outgassing which could provide good case studies. We also had a paper looking at retrievals around volcanoes, though the data versions are somewhat outdated now: https://acp.copernicus.org/articles/14/10601/2014/ Note for volcanoes there are some concerns that orographic effects alias in so maybe some source near ground level is better to look at. I would mention the ship tracks stuff we did at Oxford some years ago but am sure Matt already has that (plus the related work by others) listed already and I know other groups went further than we did.

- Andrew: thanks Andy. We have the Ebmeier et al 2014 paper in the database of studies.

Michael: very nice initiative ! .. and talk Johannes: Second that. Many thanks, Andrew (and Matt). That's really useful. I am amazed that you already have a meta-analysis done!

- Andrew: Thanks. Wea re getting there! Thanks for all the help. The draft is coming along as well, and we will be asking for more help this fall.

Mian @Andrew: Will you be willing to share the database you compiled?

- Andrew: Yes, we intend to publish the database as well with the review paper, either as a supplement or under a separate DOI.

Wenying Su, @Andrew, very interesting initiative! What satellite obs. are included in the database, are MODIS and CERES observations of interest to this study?

- Andrew: the satellite information comes in through different studies. We are not building a database of data itself most likely, but a database of different studies, and a database of different locations, times and emissions magnitudes. Many of the papers use satellite data.
- Ralph: I will try to get around to sending to Andrew and Matt this week -- we have MISR particle property retrievals for the Holuhraun (Iceland) and Grimsvotn volcano plumes, just published in JGR. (Ref.: Flower & Kahn, JGR 2020, doi:10.1029/2019JD031625). We have also submitted our paper on Kilauea particle properties. We see particle growth, with indications of activation, in some cases.
- Andrew: Thanks Ralph, I had seen your email earlier. I added this to the list of studies. But I think this is just aerosol properties, not cloud properties?
- Ralph: Yes. Just aerosol properties, but quite detailed mapping of the plume with 1 km horizontal resolution. We see systematic particle evolution -- both size and SSA as the plume approaches meteorological cloud in several cases. Given the MISR wavelengths (longest is 867 nm), we do not have sensitivity to the microphysical properties of cloud droplets or particles larger than ~ 3 microns. We could look at the Terra/MODIS cloud products to complement the MISR results; that was beyond the scope of the JGR paper.

Steve Smith: We're going to be integrating large point sources into CEDS over the next year. There are likely instances in the past where specific sources have shut down for some period of time. That would result in a "natural" experiment. Looking forward, there might be cases were this is known in advance, which could offer the opportunity to deploy instruments.

Kostas Tsigaridis US aerosol coding initiative
Mian Chin: There are many scale-dependent processes that are hard to unify even within one model, let alone for multiple models.

Nicolas Bellouin: Another "Cons", or at least a difficulty with these "plug and play" models, is the versioning. It has to be very tight and very quickly and completely documented. I know of many community models that diverged over time to the point of eventually becoming different models.
Yves: It is very hard to figure out if this initiative is a serious attempt towards the goals you put forward or whether it will fail miserably. It will very certainly be a US only effort since the funding are not exchangeable between US, Asia, and Europe.

- Andrew: Some of the US modeling groups are developing a common interface for physical and chemical parameterizations, which I believe this initiative will be using (NCAR is part of this plan), that is open source and should facilitate interoperability. If that interface (Common Community Physics Package, CCPP) becomes widespread, this effort will be easier.

Michael: So what are the next steps? Who and how can AeroCom modellers participate?

- Kostas: Next steps are funding and a whitepaper. AeroCom modelers can volunteer by expressing interest and participating in the future discussions, and then we take it from there.
- Maybe AeroCom can start a non-funded initiative...+1

Philip: It is a good idea (and has been explored already, e.g. in Germany, not always delivering more cohesion.... In my view this can work well at the right level (interface to the key physics routines). Efforts to link at a too high level are likely to create headaches. The ECHAM-HAM community had to undergo some of this when we defined clear interfaces between ECHAM and HAM, life was much easier afterwards...

- Michael: yes - but- How to pick low hanging fruits?
- Kostas: one can start from the easy stuff (e.g. calculate size distribution, effective density, etc.) and then build on top. There is no need to do everything at once, and doing only the easy stuff first will not scare models away.

Ramiro: Its interesting but there is a lot of possible perspectives for this. So a lot of discussion is needed. Maybe with metaprogramming...
Matthias Schwarz: Probably a smaller and easier step forward would be to develop consistent unit testing for aerosol/cloud modules rather than plugging in code from one model into the other. Do you have an opinion about that?

- Kostas: Unit testing is going to be a major component of this, I agree it will help tremendously.

Duncan: It seems that developing a box model framework (essentially an offline interface) would be a useful first step and provide valuable intermediate results

- Michael: as discussed above, yes, thats probably most straightforward
- Kostas: Yes, abstracting your code out in a box model is a good way to start.

Tom Zhao: How cloud computing contribute to this effort? Test bed ideal can be borrowed?

- Kostas: I do not understand why cloud computing can be relevant here. This is not a computational project, rather a programming one.

Toshi: A similar discussion was initiated between MIROC and the MRI groups in Japan. We are working towards a gradual collaboration in model development.

- Kostas: Good to know! Maybe join forces and experience? You should be contacting Natalie Mahowald if interested.

Wenying Su: @Kostas, thank you and all co-authors for putting together this coding initiative. Are there any test cases that will be used in testing the code and how you define measure of success?

- Kostas: too early for this.

betsy: super cool. you are going from the front end instead of the backend like this NOAA initiative: https://www.gfdl.noaa.gov/MDTF-diagnostics/ . but seems like front/back together would be even more valuable.
Andrew: From the discussion, perhaps the other groups (i.e. MIROC and MRI, ECHAM/ICON-HAM) that are working to make more portable aerosol models could work with this cross US group to figure out how to proceed. I agree that a box model framework for testing might be the most useful way forward to intercompare models. I've been part of efforts that have done this (e.g. for Cloud microphysics) and it's been very useful for comparing models and testing codes. But that would only require common high level interfaces, so maybe not so difficult. Should also incoroporate Kai's talk: they already have a box aerosol model .
Sabine Undorf: Such efforts, especially the technical details necessary to make one module work with another host module, could maybe also be framed as making the models more transparent in a philosophy of science way (Kevin C. Elliott and others) with the 'cross-models' being a bit freer of the inherited modelling choices and hence values (cp. Eric Winsberg Ch13 in Climate Modelling: Philosophical and Conceptual Issues, 2018) - of course full of new ones but they can be documented better. Nothing AeroCom per se will care about I guess, but some funding agencies might. Bit of an offside comment...
Kai: Some agencies indeed care about model/code transparency, verification, and modernization. The improvement we made for the MAM aerosol box model wouldn't happen without the support from DOE (https://climatemodeling.science.energy.gov/projects/cmdv-sm-global-climate-model-software-modernization-surge, proposal: https://climatemodeling.science.energy.gov/sites/default/files/attachments/ACMESM_PublicProposal.pdf).
Christoph B: With EMAC we have a modular approach with core layers and interface layers to different meteorological base models, not only ECHAM but also for example the Canadian model or regional models. The tedious part is to write the interfaces for data exchange. Contact patrick.joeckel@dlr.de. There are also partners in the US.

Fangqun Yu Use of machine learning to improve global models on aerosol-cloud interactions without compromising their computing efficiency

- Antti Lipponen: We have developed a machine learning based correction model for cloud droplet formation. We also used Random Forests. We found that correcting the output of an approximative model output resulted in more accurate result than by training the model to predict the number concentration directly. Could be interesting approach for your work as well. Paper here: https://gmd.copernicus.org/articles/6/2087/2013/ (if any questions, will be happy to answer, antti.lipponen@fmi.fi)
  - Fangqun: Thank you for the comment. We will look into this.
- Michael: very nice work: --- what are actually the model parameter inputs to the ML PNC computation?

- Fangqun: It can vary. For ML PNC implemented in GISS-ModelE2.1, there are 18 parameters (predictors): mass concentrations of sulfate, nitrate, ammonium, secondary organic aerosol (SOA), black carbon (BC), primary organic carbon (POC), sea salt, and dust in particles smaller than 2.5 μm, concentrations of SO2, NH3, NOx, O3, OH, isoprene, and monoterpenes, temperature (*T*), relative humidity (RH), and pressure.
- We can use different set of parameters (based on what are available and our understanding what are important) and retrain the machine to get a different ML algorithm. For example, in slide #9 of my talk, we reduce the # of parameters from 18 to 9 in order to compare with airborne measurements.

- Mian: So each model have to train individually. Do the parameters change with environmental conditions and aerosol types?
  - Fangqun: Yes, for each output parameter we want to get. The output parameters (PNC, CCN, extinction coef., etc.) change with input parameters which change with environmental conditions and aerosol types (compositions).
- Susanne: Thanks that was interesting. This brings OMA forcing down to MATRIX values. Looking forward to our discussion soon.+1
  - Fangqun: Thanks. I can explain in more detail when we meet and discuss.
- Kai: very nice talk. Did you apply any physical constraints in the ML training processes?
  - Fangqun: Thanks. Not sure what you mean with regard to physical constrains here. I think that the physical constrains are implied in the data (model outputs) used for training as the GEOS-Chem-APM contains full chemistry and size-resolved particle microphysics. In term of ML analysis, testing, and optimization, you can find more info in Nair and Yu, ACP, 2020 (https://acp.copernicus.org/preprints/acp-2020-509/).
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Pierre Nabat Evaluation of aerosol absorption in CMIP6 simulations

Laura Wilcox: What made you decide to look at the historical runs over the AMIP experiment?

Pierre: Thanks for the suggestion, indeed I could do the same with AMIP simulations, I thought more models had produced the abs550aer variable but I need to check this point.

- I wonder if AMIP might give you some constraint for the comparison with observations, since you may have less diversity in aerosol transport. It might not make much difference, of course. Perhaps it is worth a look for the models that have AAOD available for both experiments, just to get a sense of how much difference the choice of experiment could make.
- Pierre : good idea thanks !

Andy Sayer: when comparing model and AERONET SSA I think we need to be very careful when showing maps like this (sorry I forget the slide number; it was early on) - there is a lot of variation in seasonality (both between and within seasons, e.g. Tom Eck's paper showing a variation around 0.1 within the biomass burning season at Mongu: https://doi.org/10.1002/jgrd.50500), plus AERONET has some sampling limitations (high AOD, near dawn/dusk for almucantar scan, needs cloud-free sky and spatially homogeneous plume). So plotting the means (I assume these were averages of all data or something?) might not mean the same thing. I would at least output on a seasonal rather than annual basis. (I know models generally don't give daily or finer output to allow for more precise colocation.)

- Tero: I agee with Andy's comments. Monthly comparison would be better than annual. Also variability would be a good addition
- Pierre: I forget to mention it, all the plots were for summer (as mentioned in slide 3)
  - Andy Sayer: sounds good! Sorry I missed the comment in slide 3. That helps. I agree with the sampling discussion later on here too though. I know we can't output models at all time steps but I do get concerned about sampling differences.
  - Pierre: You are right, I need to pay much attention when comparing the model to AERONET data, that is why I tried to keep only stations with enough data (at least 3 years for each month, and for each month 8 days of measurements), in order to limit the influence of particular years on the mean. +1
  - Tero: Thanks! I missed that 3rd slide as well :) What about the amount of AERONET data within a day? I've noticed that the new daily AERONET products include also days with only one observations so it might be good to check that.
  - Pierre: Yes I could check also the amount of data within a day, I got the impression that the minimal number of days within a month made a first selection.
  - Tero: Yes, the amount of days within a month is more important and has a bigger effect. I just mentioned this to let you know if you hadn't noticed already. It probably doesn't affect your conclusions or results but it could help you get rid off uncertain observations.
  - Pierre : Thanks !

Ramiro: It might be that INCA from CMIP6 has less absorption that in AeroCom Phase III, because of a new implementation of BC absorption for the recent AeroCom simulations. We could also provide abs550aer for the model with 4 dust modes!

Pierre: ok thanks for this information, I would be happy to have abs550aer for other IPSL simulations if available.

Nick: to what extent do model evaluation results for AERONEt and GRASP agree. I think I saw several differences?

Pierre: yes there are several differences, notably over Sahara and Eastern Asia. It is more consistent for the transport of biomass burning aerosols over SE Atlantic.

Greg: How do you handle AERONET AOD(440) < 0.4? Also, are you using coincident AODs, or all AODs for AERONET?

- Thank-you for attempting to answer, Pierre. (Nice talk btw). My question was really about AOD measurements which happen very frequently vs AODs that are coincident with the absorption retrievals, which only happen when SZA > 50 and have many other restrictions. Also, the Level 2 retrievals require AOD(440) > 0.4, so some trickery is necessary for good comparisons.
- Pierre: I understand the difficulty to have a fair comparison between models and AERONET, I tried to keep as far as possible level 2 data, but in some regions I took also level1.5 to avoid empty regions.

- Gotcha. It is important to be careful with L1.5, especially in V2. L1.5 is not screened for SZA, for instance, which can result in retrievals with a very small range of scattering angles. Stefan wrote up the best approach for capturing quality L1.5 in the Appendix of Bond 2013. Basically, SDs are available in the L2 dataset at all AOD. So only used L1.5 absorption products when a corresponding L2 SD exists. This assures all L2 quality standards except the AOD(440) > 0.4 requirement. In Version 3, there is a new L1.5 parameter called if_lev2_except_for_AOD_threshold. Only use L1.5 retrievals where this parameter is true.+1
- Pierre: Thanks for this information, I will look at this new parameter, I have used version 3 for AERONET.

Yves: I am uncomfortable with SSA derived from Aeronet since they also choose a model to mimick the aerosol size distribution. I believe that SSA derived during campaigns and understanding the values of SSA is important.
Tom Eck: Yves, the AERONET retrievals do not choose a size distribution model. The size distribution is retrieved from the measured AOD spectra and angular sky radiances with no a prior assumptions, except forced to zero at the ends. Also the AERONET L2 quality retrievals fit the measured angular scattered radiance measurements very well (better the 5%) with the combination of retrieved size distribution and real refractive index. The major source of uncertainty in the SSA from AERONET retrievals is the uncertainty in sky radiance calibration, this is the main reason for the SSA uncertainty of 0.03 at AOD(440)=0.4, but this uncertainty decreases as AOD increases (and vice versa; see Sinyuk et a. 2020 AMT).

- Greg: Field missions have SSA issues, too. Dried, aerosols, measured on filters, inlet cutoffs, etc. Aeronet doesn't really mimick a SD, I would argue. Rather, it uses the scattering field to infer it. The SD retrieval uses less assumptions than some in situ SDs, some of which require a refractive index assumption.
- Andy Sayer: I agree with Greg here, there's a constraint on size distribution smoothness but not form. For me a more crucial assumption is that refractive index is independent of particle size. However, when you have e.g. a strong dust storm or smoke event it is likely that one mode is strongly optically dominant, which alleviates that somewhat (e.g. for smoke the fine mode fraction is often >0.9). Also worth noting the particle shape assumptions (spheroid aspect ratio shape based lab measurements at blue/red wavelengths, might not represent the scattering field as well at other wavelengths).
- Claire: I believe AERONET forces the PSD to zero at the max size. This is probably not an issue for most smaller absorbing species, but could be important for dust.
  - Andy Sayer: you are right, it is forced to 0 at both edges.
  - Greg: Yes. I don't believe that AERONET has sensitivity for radii greater than 15 um anyways, since the max wavelength is usually 1 um. The old retrievals (prior to forcing to zero) used to frequently have "tails" at both ends, especially for dust.

Pierre: I am not specialist enough in AERONET data to answer this question, but I try to be careful in the comparison with models.
Nick: how do you deal with different sampling of observations?. For AAOD, sampling is even more important than for AOD.+1+1
Pierre: this is not taken into account for the moment, I tried to minimize the impact of sampling by keeping as far as possible long time series in AERONET stations.
can you distinguish between AAODf and AAODf ? (stefan Kinne)
Pierre: I am afraid this information (AAODf / AAODc) is not available in CMIP6 data, but I could try to look at fine mode in AOD to start with.
Paul G: Do you plan to contact the modelers? I may have some comments on your interpretation of GFDL biases.
Pierre: Yes as mentioned in the perspectives, I would like to have some feedback from the modelers.
Alcide Zhao: There are several models as outliers comparing to others, for example, the CanESM5 which has more emissions than others and larger AAOD accordingly. do we understand this for other models as well.
Pierre: I agree, several models are outliers depending on the region and the season. For CanESM5, I think that it could be also a problem of aerosol properties. I will try to contact modelers to have more information on aerosols in their model.
+1

Bjørn Samset Aerosol absorption in CMIP6 and its implications for projected precipitations
Yves: Note that atmospheric absorption does not necessarily inhibit precipitation, it is TRUE over oceans not over Sahel and desert surfaces (Miller et al., 2014, my talk, many others)
Mian @Bjorn: Yves showed that dust absorption increases precip (+1 Yves)
Yves to Mian The explanation is in one of my slides (the one on MSE). I also can send you a paper that details that much more.
Mian@Yves: thanks

- Bjørn: @Yves, can you send it to me too? Also, would it be interesting to see what the CMIP6 sample does over Africa? Absorption exacerbates precip there in the models, so we could make the opposite argument over Sahel using the same method. (Note, this simple method isn't really giving us very deep insights, it mainly warns about blind usage of CMIP6...)

Mian@Yves: you should lower your hand after done asking question
Alcide Zhao: does the relationship between AAOD and atmospheric absorption stand for all aerosols species?

- BJørn: Yes, so long as it has absorption. It does for all species that we've investigated explicitly, and I think we understand the underlying mechanisms well enough to say that as long as something dumps energy into the atmospheric column via absorption then it will - globally - inhibit precip. @BJørn, thanks !

Robert Wood: How is anthropogenic vs natural AAOD assessed?

- Bjørn: In my case I just subtracted the 1850-1900 value, so it's really just the change over the scenario periods. Which will include the natural feedbacks, but likely isn't dominated by them.

Philip: Provocatively, as Bjorn can take it, why do we worry about the global mean precipitation change? Ah here it comes...

- Bjørn: We don't, but we can certainly assume that whatever we see on global scale will be amplified regionally. Notably over regions where the fast precip relation holds AND there are high emissions - such as over India and China.

David Winker An update on the NASA_Cloud_Convection_precipitation study

Andrew: Note: ACCP is hosting a Modeling Workshop Next month, if Dave doesn't mention this, I can.
More information and registration forms can be found at: http://www.cgd.ucar.edu/events/2020/ACCP/
This workshop will bring together experts in simulations and satellite observations of clouds, aerosols and chemistry to discuss (1) past, present and future of cloud and aerosol observations, (2) the future of cloud and aerosol models, and (3) state of the art methods for model-data fusion.
We welcome all interested in the future of cloud and aerosol science, especially modeling clouds and aerosols.
All aerocom and aerosat participants are most invited to attend, and your input will be valuable.
Ramiro: Is this workshop online?

- Andrew: Yes, of course. It's next month...

Dave, can you please comment on the synergy btw ACCP radiation measurement and the current Earth radiation measurements?
We have formed an ACCP radiation working group which is beginning to think about these issues. This needs more work but we are defining ACCP radiation measurement requirements to allow us to relate ACCP radiation measurements (likely at cloud scale over a small swath) to the long term record from CERES and Libera (coming).

Ilona Riipinen EU FORCES project
Yves: Nice groups of scientists, it will be very interesting to follow the progresses in this project. I am in favour of the links you decribed between AEROCOM and FORCES.
Ilona @ Yves: Thank you! We will discuss concrete plans for linking FORCeS and AeroCom in the FORCeS annual meeting in two weeks. I also hope we can make a common meeting happen in some format in the future.
Ilona: I will post the link to our website here too: https://forces-project.eu/
Zak: Agreed, linking the two projects together with a coordinated meeting at some point sounds like a great idea!
betsy: hi ilona! - meeting in stockholm sounds like a great idea too!

Harri Kokkola Properties contributing to aerosol forcing
Harri: Please note that this is still something we are applying funding for and will require that to be able to pursue in full force
Michael: In a way this uses a box model , right? Could this be combined with an "AeroCom" or any other box model???

- Harri: Yes, it uses a box model, but optimally this would include all the parameterizations used in different models and those could also be interchangeable

Dan: How do you account for "memory" offline. I see how this can be applied offline using a box-model to represent droplet formation if the GCM CDNC is diagnostic (e.g. HadGEM-UKCA), but it is not so clear to me how this would work for say ECHAM-HAM which has prognostic CDNC. Any thoughts?

- Harri: I have tested this with CDNC and the offline tools gives very similar results as online ECHAM-HAM calculated CDNC. Of course, we need as high time resolution as possible.
- Dan: Thanks Harri, I'd be interested to chat about this in more detail sometime when you have time (I'll drop you an e-mail)
- Harri: I will be glad to discuss this further

Kostas: For GISS-OMA, all-sky AOD is very high for known reasons. The ideal comparison should be clear-sky across models, but I understand that not all models provide that. I'll touch on that during my Thursday's talk.

- Harri: We don't need model calculated AOD since the tool provides that value. If the models provide cloud fraction, we can calculate both clear-sky and all-sky AOD

Kai: Very useful tool/analysis! So I guess the tool can well handle output from modal aerosol models?

- Harri: Yes, at the moment, we can process modal and sectional model data. Maybe other size distribution representations also if they could be e.g. sectionalized.

Ramiro: Nice approach!
Zak: Very interesting tool! Offline processing of prognostic aerosol mixing ratios / properties into extinction/absorption/backscatter etc. is something we're keen to implement around the ECMWF/CAMS IFS model to make multi-wavelength 3D optical diagnostics available without online calculation of all possible diagnostics. It sounds like your tool is possibly doing exactly the same kind of thing although from a different angle.
Mian: How do you evaluate?

- Harri: We don't need to evaluate. We get out what we put in and based on that we can get the AOD and CDNC variability due to different model properties

Plenary-Introduction: 1 slide introductions from breakouts

10 minutes break
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EU:5:30–7pm/NY:11:30am–1pm/CA:8:30–10am/JP:00:30am–02am/CN:11:30pm–1am

BREAKOUTS will start 35 minutes late

BREAKOUT DISCUSSIONS follow here
Breakout 1: AeroCom experiment status
Moderator: Philip Stier, Rapporteur: Ross Herbert

new link for the discussion! the one on the technical pdf is incorrect

https://nasaenterprise.webex.com/nasaenterprise/j.php?MTID=me721ebac70f533c586b1d866775d3c93

Betsy Andrews - AP3 evaluation with optical property obs
Andy Sayer: To what extent are the model and AERONET data colocated here? I realise it is probably not hourly, but is it eg daily or monthly or longer-term means? Systematic differences could also arise from sampling differences. (Answered in session by Jonas: monthly composites with some sampling restrictions.)
Mian: How can modeled size being too large and too small at the same time?
betsy: spectral issues as you raised... but also there's a lot of moving pieces with size distributions and definitions of coarse/fine that might play a role. the schuster 2006 paper in jgr (or grl?) show the wiggle room in AE depending on the actual size distribution.
Andy Sayer: maybe it would be better to calculate "monthly mean AE" as "AE from monthly mean spectral AODs" rather than "mean of AEs within a month" for AERONET/satellite. Since AE and its error characteristics don't go linearly and are a function of AOD. I did this for a satellite-vs-satellite comparison over water and the difference between the two methods of calculation was something like 0.2. I am not 100% certain how this calculation is done within the model output.
betsy: i think for aeronet at least we also were comparing different flavors of apples - aeronet AE was across the aeronet wavelength range while the model AE was for two wavelength pair (jonas - correct me if i'm remembering wrong!)
Jonas: Andy, this is a very good point, thank you. We indeed computed monthly means of AE from the daily level 2 product. I did some sensitivity studies of AERONET 2-channel AE (computed from ~440 and ~870 AOD) and the difference to the multiwavelength AE were rather small, but I have to dig a little back in time to quantify that bias. I will check the monthly average AE from monthly mean AODs at 2-channels.

- Andy Sayer: oh yes good point. I wonder how much difference that makes (whether systematic or it averages out). FYI the satellite products are mostly (all?) two wavelength calculations too (i.e. calculated from single scattering properties of the optical model at a pair of wavelengths).
- i think jonas was going to check that out - seems like this evaluation effort brought up a lot more work to be done!
- Jonas: we discuss these things to some extent in the paper, and from the satellite AEs we only use AATSR (which is rather uncertain in terms of bias, which we discuss). I believe discussing bias in total AE is difficult, especially without looking in different size regimes. This is why we looked at the binned AE biases in different AE ranges.
- Andy: I find this all very interesting and important stuff and it can be maddening that we can't have all the things sampled in the way we would ideally want :)
- :) devil is in the details always!
- Greg: Two vs three wavelengths is probably more important for satellite vs models. Error in AOD at each wavelength can result in large AE uncertainty. Models are computations, so there is less of an issue. Nonetheless, the wavelength range is important b/c of curvature.
- Ralph: Right Greg. This is the motivation for my point here. Maybe better to compare AOD at specific wavelengths rather than the *slope* of AOD based on constraints at not-always-the-same wavelength pairs. The spectral AODs are what is actually measured.
- Greg: I missed Betsy's talk, but folks are generally interested in AE as a rough indicator of size. We can't get that from AOD alone.
- Ralph: Right. but at the level of detail being discussed here, AE really does not adequately reflect particle size either.
- Greg: Agreed. That's why I wrote the 2006 paper.
    - Andy Sayer: Greg, perhaps a way forward is to encourage satellite teams to report the quadratic coefficients for the multispectral fit rather than just AE?
    - Ralph: Better yet, report AOD at specific wavelengths at which it is measured. Then similarities and possible issues can be considered when making comparisons. This is what I suggested at the AeroSat meeting in Barcelona last year, and Larisa followed up and will be talking on Thursday.
        - Andy Sayer: yep, this is done already for MODIS, VIIRS (and as you're aware MISR) and some others. I guess the difficulty is getting people to look at them. ;) Maybe these discussions and Larisa's effort will help here. I think we also need to push more multispectral validation vs. AERONET.
        - Greg: Years ago, the MODIS folks did not have confidence that they could accurately capture the curvature. Are you measuring curvature, or just quantifying the noise that is at each wavelength? At any rate, folks decided to create a fine mode fraction of AOD product, which I imagine is rather similar.
            - Andy Sayer: Greg, yes MODIS Dark Target (and sometimes Deep Blue) still has this issue over land. But the water algorithms are more robust. Not sure about some others. And yes MODIS Dark Target don't recommend use of fine fraction over land (theirs is a fine "model" fraction, not fine "mode" fraction). Deep Blue and MISR don't have explicit fine mode fraction over land either. I am a bit outdated on current status of European products. OMI has a "type" mask (dust, smoke, sulphate). Himawari 8 AHI has fine mode fraction reported.
            - Ralph: We actually do report a fine-mode AOD for MISR, but it depends on the definition of fine mode. The idea that there are just two modes with a minimum between is a fine generalization, but it does not hold up in detail in many cases.
                - Andy: Ralph, I agree about generalisation. I guess my preference would be to define as "AOD of particles <1 micron diameter" or something? Do you happen to know the name of the MISR field with that? I had been looking and asked Marcin. EDIT: Just found it. Small_Mode_Aerosol_Optical_Depth_Raw . Will make a note as I thought it was missing. Apologies!

- But you then need to have confidence in the part of the AOD retrieval that is < 1 micron. Which gets us back to the original issue. These days I just use the Research Algorithm for MISR, so better to ask Marcin about the new Version 23 product fields. (I can look them up, of course, but not just now.)
    - Yep but with common definition we can at least look at the comparison as a target. Agree it's thorny.
- Greg: Well, I don't know that more products will help us. The fine mode AOD products, for example, are using the spectral dependence of AOD to make their inferences. AE does the same thing. If we add more products, folks will find difficutlies with them as well.
    - Andy: I am not sure I fully agree. Some retrievals have state vectors of ["AOD at 550 nm","fine mode fraction of AOD at 550 nm"], for example. So those ones are directly retrieving the two and it is multispectral/AE which are derived. (Although it is a bit of a shell game because in theory changing the state vector formulation should not change the retrieval result if it is self consistently formulated though an optical model.)
    - Yes, but do we really need FMF and a quadratic fit to spectral AOD? Are we gettgin new info, or just a different packaging of the same thing?
        - Andy: oh, I understand what you mean now. I misinterpreted before. Yep agree it is just different packaging. Guess it depends on what packaging(s) people want most.
        - Yes. And making sure that people know how we arrive at the products. That can be difficult, as folks like to take the retrievals and run.+1
    - Maybe we should have a discussion in the Social Room later -- I need to listen a bit to the Breakout Session just now.
- Andy Sayer: I believe plenary 9 and breakout 8 (both on Thu) will discuss satellite multispectral AOD (talk by Larisa) and related questions, if you're around then, all.

Mian: We can take step by step - starting from dry aerosol AE for individual species, then H2O fraction of extinction, also wavelength dep., then compare AE with size...
betsy - i like this idea!!
Greg: Sorry I missed this. :(The Schuster 2006 paper was JGR.
Wenying: many evaluation studies have printed out that the models underestimate the AOD, this is also in good agreement with the TOA SW flux evaluation. The question is how these findings can be implemented in the model?
Wenying: similarly, surface albedo in the model also needs to be modified using observation as a guide.

remark from Nick: re AE is aeroocm going to come up with column aervage particle size - can then relate to AE and observations

Steven Smith - emissions mip
Michael: Maybe we should try to understand more of the sulphur cycle problems, as raised by Gliss et al ACPD 2020, eg by adding relevant diagnostics - NorESM would be interested to participate also
Philip: first order effect is emission size - and it shown that its important - planning on playing with emission sizes?

- Steve: BC / OC probably most important

Jane: also looked at this in UKESM and see similar things - also gathered data on deposition of SO2 and evaluating

Paul Zieger - aerosol hygro
Mian: Models have parameters of hygroscopic growth of SIZES, not scattering. How do you recommend the f(RH) for sizes for different components? Also, how about RH> 95%?

- Paul Z: We also compared the g(RH) values from the models with literature (see Table 3 in the Burgos paper).

Michael: Models should just provide 40% scattering... not 0%
Michael: Maybe we should inquire how we can change hygroscopic growth functions in the models?
Philip...Many models have not consistent treatment..Looking into activation and hygroscopic growth at the same time?
Wenying... also TOA fluxes are underestimated. How can we implement what we know on the AOD bias?
Kai: Hi Paul, do you have any recommendation on the hygroscopicity of organic aerosols (POA and SOA)?
Paul Z: Hi Kai, we have some good data at least for f(RH) for organic dominated aerosol, which also includes parameterizations of f(RH) as a function of organic mass fraction (Quinn et al, Zhang and my Hyytiälä work). For Hyytiälä, we used g_organic(90%)=1.05 for more polluted sites g_organic(90%)=1.2. As mentioned in the discussion, we could look at the relationships in terms of chemical mass fractions.

For me the eye-opener was the comparison of sea salt dominated aerosol. As uch I would recommend to compare "pure components" to literature findings.
Kai: Thank for the information. It's great to know. And starting from the single composition analysis/calculation is a great idea to evaluate the wateruptake schemes (somewhat simple but with a lot of assumptions).

RUNNNING THROUGH ALL EXPERIMENTS
Mian.. multi models .CO50day decay tracer, Rn-Pb210 tracer, total deposition

- .. clearly model process determines the diversity observed - would like to implement transport tracer and removal tracer to give good ediagnostic tool - at least for wet removal

Jonas...

Dongchul...more models -

- Michael: Can we also add more size diagnostics, maybe revise what we want from the models across experiments wrt size
-

Paul Kim: good participation for first phase, still waiting for longer runs but understand reason behind delays

gunnar: want to include more cmip6 results - also planning on using similar method as harri to understand the model diversity .. very happy to include more models - contact Gunnar

Xiaohua: observations in Arctic and Russia would be appreciated , 2008

- Ralph: plume heights for Siberian fires become available from MISR
- betsy: do you want surface aerosol data? if that would be helpful betsy.andrews@noaa.gov
-

Mian.@ Wenying.. can you provide the surface albedo to the models?

Michael @ Wenying@Jonas@Betsy ... would be nice to see which components/regions are responsible for negative model bias in TOA, AOD and surface scattering?
@Michael, that's model dependent.

duncan/philip: BC MPPE should also be done by more models (they stress that it's quite manageable)
Greg: Apparently y'all can't hear me. The BC sensitivity study allowed BC IRI values to go way too low. BC IRI /= 0.2. (for the Watson-Paris talk)

Hongbin ... most important thing : dust size distributions and vertical distribution - not enough information from models, refer to Yves's suggestion for models implementing the same sizes , focus on large dust storms?

Mian... what shall we do after this AeroCom? - maybe a telecon is needed to discuss next steps for all experiments

Breakout 2: Modelling and methods I
Moderator: Stefan Kinne, Rapporteur: Laura Wilcox
https://nasaenterprise.webex.com/nasaenterprise/j.php?MTID=m70ef7246fe7f5708b02f16633b562c62

Ramiro Checa-Garcia: Modelling of mineral dust in CRESCENDO-ESM
Sophie: do you think that the dust aerosol AOD / mean altitude / full profile from satellite in the Infrared (retrieval is done at about 10µm, with conversion to 550nm - but this involves an additional uncertainty) would be useful for your comparisons?
Yves: can be useful, but haven't found a way to make good use of it.
Claire: Interesting results Ramiro, I look forward to seeing/reading more.

ChiuTung Cheng: Size-resolving aerosol microphysics scheme
Ramiro: Would it be interesting also to compare with MISR for AOD and AE?

Jeff McQueen: NOAA's global aerosol modelling progress
Thanos: Are you planning to include into your assimilation system other observations than VIIRS AOD? e.g. AAOD or SSA, AE or AODf and AODc.

Mariusz Pagowski: NOAAs data assimilation ensemble system
Thanos: Your data assimilation acronym (JEDI) is very cool :-)
Thanos: How is VIIRS AOD observational error is calculated? Is it based on the VIIRS retrieval algorithm or some kind of comparison between VIIRS and AERONET?
Stefan: Are you participating in the assimilation group led by NRL?

Breakout 3: Modelling and methods II
Moderator: Duncan Watson-Parris, Rapporteur: Ben Johnson
https://nasaenterprise.webex.com/nasaenterprise/j.php?MTID=m66b5b6a82b5ebd0ed1265fc1811155e7

Huisheng Bian: Investigation of impact of Amazon fire on forest productivity using an Earth System Model

Natalia Chubarova: Urban aerosol and its radiative effects in Moscow Megacity according to the ground- based and satellite (MODIS/MAIAC) measurements, and COSMO-ART modelling

Tobias Lord: Investigation of the relative importance of meteorological and aerosol-related parameters in determining cloud microphysical properties using Machine Learning methods
Duncan: How do your results over the SE Atlantic compare to the work of J Fuchs et al. who I seem to remember used a similar technique?

- Tobias: I'm not familiar with this article actually. I'll have a quick look and get back!

- Great! (https://acp.copernicus.org/articles/18/16537/2018/)

Frida: They emphasise sub-regional variability, but the overall result that microphysical properties can be predicted from meteorological parameters, with secondary influence from aerosol, is similar I think.

- Tobias: Yes I agree. I would say that they use a very similiar method. Their model seems to perform slightly better than we one we developed here aswell. Although they also provide more meteorological information to their models so this might explain this.

Qirui Zhong: Understanding the uncertainties in the modeling of biomass burning aerosols

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