AEROSAT
International Satellite Aerosol Science Network
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AEROCOM & AEROSAT

- AOD inter-comparison (model, remote sensing): large differences: Australia, Sahara…
- Aerosol climatology: compare model median with satellite median of ensembles
- Multi-satellite observations over China: opposing seasonal cycle AOD – PM2.5
- Discussion – burning needs
  - Document assumed optical properties (satellite + model) – look-up-tables or additional dataset layers
  - Are more components needed in models to match satellites – how many?
  - Closure studies using model-simulated radiances in satellite retrieval
  - Terminology is important
  - Assimilation of all datasets – how / what keep for independent validation -> assimilation topic
  - How use satellite aerosol+cloud data for processes in modeling -> ACPC topic
- Other / posters
  - AOD from solar irradiance -> back to 1950 (and 18xx))

Satellite model interaction (1)

- Use of uncertainties in models
  - Qualitative and quantitative aspects to it
  - Observation simulation experiments -> next AEROCOM?
  - Large uncertainties in monthly means due to sampling
  - matching satellite – model on daily / hourly + colocation step needed (Schuttgens)
  - Satellite sampling in 1 degree box can provide histograms
  - Retrieval of cloud / aerosol distinction is probabilistic, qualitative

Satellite model interaction (2)

Use of aerosol types in models

- Dust and fine/coarse mode are most useful for model evaluation; absorption needs improvement
- How quantitative need satellite aerosol type be to be useful? - How can the categorical satellite information be used to constrain models?
- Satellite strength: spatial distribution -> compare patterns
- Satellite quantitative use: not one number, but a probability distribution function
- **Types need to come with explanatory quantitative ranges – one table per retrieval and per model**

- -> working group / satellite – model twins to discuss differences

Satellite model interaction (3)

- How support aerosol-cloud process studies?
  - Need creative ways at the limits of satellite data
  - Working with higher resolution (up to Landsat) for individual cases; aircraft remote sensing + insitu
  - Case studies with known aerosol sources in homogeneous conditions (e.g. ship tracks, volcanoes) -> closure satellite + model + insitu
  - Super pixel case studies with increasing resolution of different satellite instruments (50km – 1km)
  - Better use of better geostationary satellite aerosol products
  - Coordinated aerosol – cloud measurements
  - -> invite cloud people / make focus topic next year?

- Needs for data assimilation
  - More validation data as reference needed
  - How separate systematic and random uncertainties?
  -

- How support CMIP6 / MIPs
  - Critical questions to obs4MIPs (too simplified, dangerous to work with unconsolidated datasets, monthly mean)
  - Which parameters are needed / possible?

Pixel level uncertainties

- Uncertainties on different scales
  - Be aware of limitations in error propagation and in validating propagated uncertainties
- Use of linear regression and alternatives
  - Uncertainties of metrics need to be considered
  - Independent (trend) analysis need to be consistent
  - Obvious analysis create higher confidence than those highly tuned
- -> conclusion: review / synthesis paper on characterizing uncertainties
- Good discussion of some principles

Air quality

- AOD-PM conversion
  - In situ measurements also carry significant uncertainty
  - Satellite PM2.5 retrievals have major uncertainties, major in case of multi-layered aerosol

- How can satellite information be useful for air quality applications?
  - Different applications have different needs: long-term epidemiology studies <-> daily air quality forecasting / detection
  - Improvements: horizontal resolution and coverage (VIIRS)
  - Model-constrained retrieval (speciation, how independent?)
  - Use of geostationary (temporal resolution) and polarimetric (refractive Index) retrievals
  - O2 bands for aerosol layer height
  - Satellite data assimilation to constrain (forecasting) chemistry-transport models (nesting down to finer scales, “gap-filled”, e.g. below clouds) as e.g. demonstrated by Copernicus Atmosphere Service
  - Combined satellite – insitu product
  - Satellites are built to observe regional / global patterns

Aerosol typing

- Connect retrieved properties and interpretive composition
  - Relational database proposed by L. Mona
  - Should be extended to include quantitative definitions of optical properties ranges per aerosol type
  - Need to capture limiting conditions (e.g. low AOD threshold, surface brightness, …)
- Assess retrieved aerosol-type uncertainty
  - Case studies / example co-located datasets from different retrieval principles can follow as next step
  - (possibly starting with dust)
  - Missing laboratory optical properties measurements

Long satellite records

- Historical records
  - …
- consistency
  - …

The end

- 60 - 100+ participants (varying over sessions)
- Comparing discussions at AEROSAT2016 and AEROSAT2015
  - New people from new countries, young people
  - Active contribution from several modelers
- Other suggestions for next year AEROSAT
  - (from 2015) AERONET new version + uncertainties
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