AEROSAT
International Satellite Aerosol Science Network
Third Meeting,
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New retrieval examples

- MAIAC and OMI SSA agree better than each with AERONET

- IASI aerosol retrievals still large variability -> ensemble

- Neural network for retrieval trained with model simulations

- Discussion

    - Compare dust source **detection** from different retrievals vs. Chiwawa database

    - Retrievals need to take into account information content

    - Combine complementary retrieval information UV – VIS – TIR

    - 10 micron different information

        - Hyperspectral: dust optical depth, height, …

        - radiometer channels: dust detection

    - **Model output 10 micron and 550 nm from dust (depends much on size distribution) -> compare to satellite (also effective radius output**

- **AERONET new version coming out 2016 -> invite talk at AEROSAT2016 + discussion**

- AEROCOM AOD inter-comparison

  - Include comparison with satellite datasets

  - –> contact Nick Schutgens if you have dataset to offer

- RFMIP will compare mass extinction efficiency

  - -> also compare to retrieval assumptions

  - AEROCOM WIKI description of what models do to produce optical properties (old)

  - -> needs update

- Satellite simulators

  - people talk of different concepts (radiance / level1, inversion products / level2)

  - Backscatter profile simulator in progress in COSP

  - To justify: simulator needs list of potential issues with associated biases

  - Main task: conditional sampler using same assumptions

  - How different is a "Simulator" from just a „Sampler"?

- Use of satellite data in MIPs

  - Not possible for pre-industrial and for future

  - Observations only for present climate

  - Where observations are available they should be used (consensus); past and future should be informed by present to the degree possible

- AERONET inversion limitations – **as distinct from** the direct-sun spectral AOD values

  - AOD>0.4 works only if plumes are above station, a relatively rare occurrence in most places

  - only one imag. refr. index for all size modes

  - -> invite AERONET team next AEROSAT to present / discuss AERONET version 3

- ↗ User need: Aerosol precursors

  - ↗ (from spectrometers) Explore CONSISTENcy with AOD!

  - ↗ Combine for aerosol typing

- ↗ User need: easy use of satellite products: consistent products for use in interaction cycles

- ↗ User need: CCN proxy - vertical profile of aerosol index is a possibility to be evaluated

  - ↗ Require highest sensitivity to boundary layer

  - ↗ Clear nomenclature: aerosol index AI=AOD*Angström, aerosol absorption index AAI
    Maybe call AI something like fine AOD Index FAI?

  - ↗ combining CALIPSO and MODIS? (This has already been done in some cases)

  - ↗ Combine AI with effective layer height as possible response to need for AI profile

- ↗ Uncertainty

  - ↗ Multi-retrieval diversity is not uncertainty

  - ↗ Metadata to support conducting bias correction by users (Meteorology, flags, input used)

Aerosol type from satellite

- V1 inventory of approaches made and analysed

- Hierarchical structure / not invest too much into detail

- 2 steps: optical properties, interpretation / matching

- Both are useful

- Different usage: model validation, data assimilation, policy support / public communication

Combined use of satellite data

- Mean / median satellite product in MAPPS

- Combined aerosol and cloud products in one analysis
    - Transition zone near clouds?

- Satellite simulator / emulator in AEROCOM
    - Emulate model / satellite output with similar sampling

- Data assimilation as one method to combine different retrievals

- Can we use TRMM-like method (precipitation) for aerosols

Pixel level uncertainties

- Pixel-level predicted uncertainties need to be statistically validated

- Validation and uncertainty propagation are different complementary tasks

- Use of uncertainty:
  - Uncorrelated errors reduce with averaging
  - Correlations not known well in retrievals
  - Deviations between uncertainty / validation mostly due to clouds

- A monthly average is obligatory with associated uncertainty but can difficult / meaningless
  - -> pdf of AOD during month
  - Overcome sampling errors by aggregation done by modelers (satellite simulator)
  - Sat-model comparison is different from use for science

- Now is an opportunity for twinning satellite / model to develop estimation and use of uncertainties in both communities

Long-term satellite-based time series

> MODIS – VIIRS time series 2000 - ?

> METEOSAT broadband time series since 1982 (changing response function)

> Reanalysis (incl. data assimilation) to integrate satellite / model into time series

> Datasets to validate AOD in 1980s (dimming, solar observatories, MFR, …)

> Workshop on early satellite time series, validation data, modeling expertise for 1980s?

The end

- 70 – 45 participants

- "Mean" is the no-word of this AEROSAT

- Comparing discussions at AEROSAT2014 and AEROSAT2015
  - Evolution of thinking
  - Examples of tests, demonstrations, …

- Other suggestions for next year AEROSAT
  - "new OPAC"
  - PM2.5, PM10

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