AeroCom Remote Sensing, Convection & CCN Experiments (or diagnostics?!)
AeroCom Remote Sensing
Aerosol Optical Depth from Models and Satellites (Kinne et al., 2006):

Fine for global annual mean

Poor agreement on component basis
Spatio-temporal sampling differences between model and observations cause ‘errors’. These errors are similar in magnitude to measurement errors & model errors.

**Temporal sampling**

![Temporal sampling chart](chart.png)

**Spatial sampling**

![Spatial sampling chart](chart.png)

Observations occur intermittently: Need to resample model to observations.

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Nick Schutgens – see poster
AeroCom Remote Sensing

AeroCom model evaluation against a large suite of remote sensing observations

MODIS AOT

AERONET AE

MAN AOT

Taylor plots AOT

Regional AOT

Time-series AERONET SSA
Europe: models & AERONET_I (2008)

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Nick Schutgens, Stefan Kinne
Experiment proposal

- Either a separate experiment (2006-2008) or additional output for baseline experiment (nudged, best inventories)
- Deals explicitly with difference in spatio-temporal sampling of models and observations

Observational datasets:
- AERONET +MAN AOT, AE & SSA
- MODIS AOT & AE
- AATSR-ORAC AOT
- MODIS/OMI/CALIOP AOT & SSA
- OMI-OMAERUV AOT & SSA
- POLDER GRASP AOT, AE, SSA
- ?

Requested model data (3-hourly):
- AOT, AE, SSA (2D)
- RH (2D, AOT-weighted)
Global Aerosol Synthesis and Science Project (Leeds, Oxford, Manchester) synthesizes in-situ aerosol aircraft data
AeroCom CCN

Supersaturations used in CCN measurements:

[Bar chart showing supersaturations by campaign with different colors for each campaign.]
AeroCom CCN

GASSP evaluation of AeroCom models:

• GASSP database maturing and paper in preparation (Reddington et al.)
• Currently investigating minimal output requirements (single year vs. hindcast, output frequency)
• Use Community Intercomparison Suite to co-locate models to aircraft data (but many AeroCom models not CF conform)
• Request 3D CCN diagnostics at 0.15%, 0.3%, 0.4%, 0.5%, 1% plus ideally at 0.2%, 0.6%, 0.7%
• Propose to make CCN diagnostic standard in AeroCom
Processes affecting the aerosol vertical distribution:

Convective transport key to aerosol vertical distribution

AeroCom models

HadGEM process sensitivities

Convective transport key to aerosol vertical distribution

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Kipling et al., ACPD, (2015)
Convection is also a key aerosol removal mechanism:
AeroCom Convection

\[ \frac{d \ln(p_{top})}{d \ln(\tau)} \]

MODIS retrieved relationship between cloud top pressure \( (p_{top}) \) and AOD \( (\tau) \)

Evidence for aerosol effects on convection?

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• (Gryspeerdt et al., GRL, 2014)
AeroCom Convection

Strong potential interactions between aerosols and convection:

- So far very limited analysis in AeroCom

Proposals:

- Addition of convective mass fluxes (air + tracers) to AeroCom diagnostics (will benefit many experiments)
- Explore intercomparison of aerosol effects on convection with interested global modelling groups
WRF Chem simulated composite of convective clouds in the Congo basin.
Open source python toolbox to efficiently intercompare data

- Generic tool for analysing, visualising and **colocating** datasets
- Handling of complex gridded and **ungridded** data in many formats
- Simple command line syntax with many options
- Flexible approach through plug-ins, e.g. for new data sources
- Open source software & deployed for community use on JASMIN

CEDA Database

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https://www2.physics.ox.ac.uk/research/climate-processes/projects/cis
Colocation

Colocation method:
1. Specify searchbox
   • Horizontal distance
   • Vertical distance
   • Time separation
2. Specify operation
   • Nearest neighbour (time)
   • Nearest neighbour (space)
   • Average
   • User plug-in

CIS col <native file> <native variable>:<native file>:<colocation method> -o <file>

This file provides the new spatio-temporal sampling
This file provides the data that will be resampled
Nearest neighbour or linear interpolation
Output (netcdf)

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Soon: www.cistools.net