Discussion on Satellite Model Interactions

AeroSat Workshop 2015

European Space Agency

Frascati

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Philip Stier

Climate Processes Group

Department of Physics

University of Oxford

Uncertainties in satellite data

General:

- 1) Retrieval/measurement/calibration uncertainties
- 2) Sampling uncertainties (spatial and temporal)
- 3) Vertical distribution
- 4) Correct understanding (and application) of errors and error flags
- 5) Understanding of physical properties (type, absorption, ccn)

Specific for aerosol cloud interactions:

- 6) Co-location of aerosol and cloud data in 2D and 3D (links to 2)
- 7) Disentangling effects from meteorological covariability

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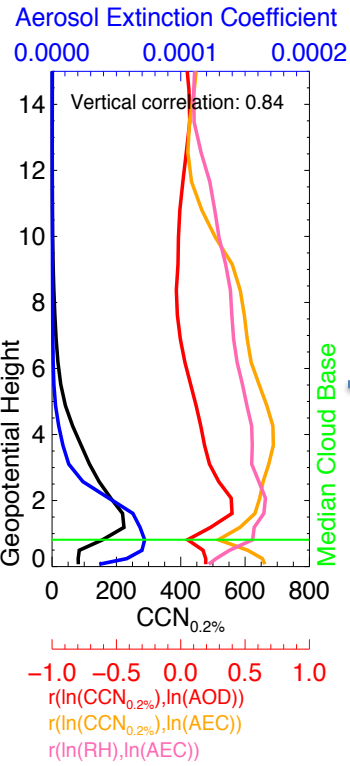
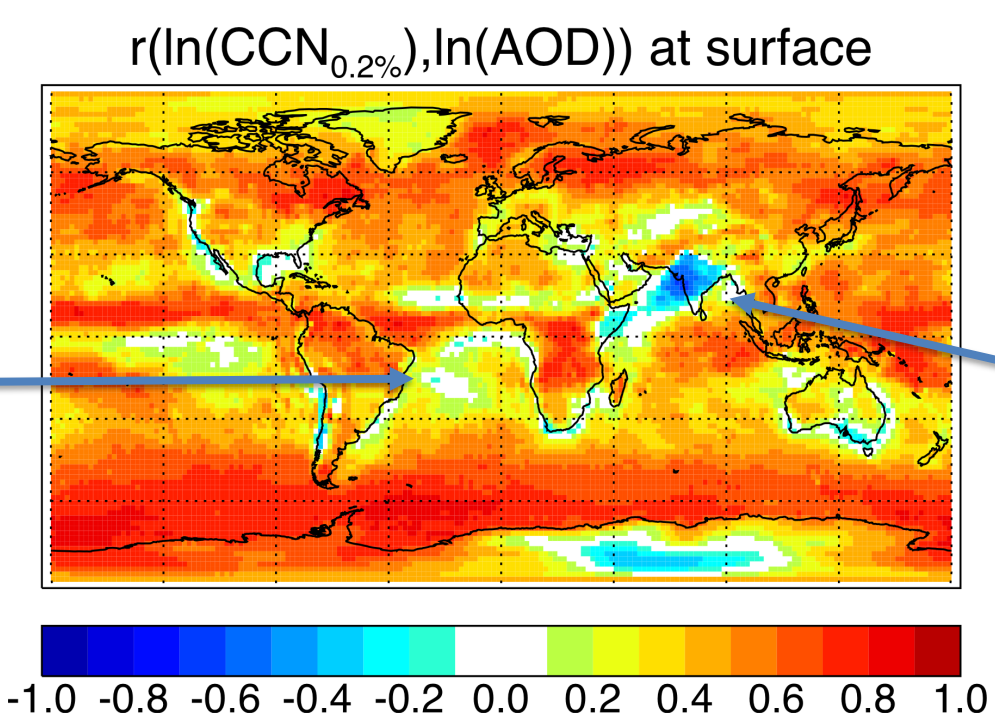
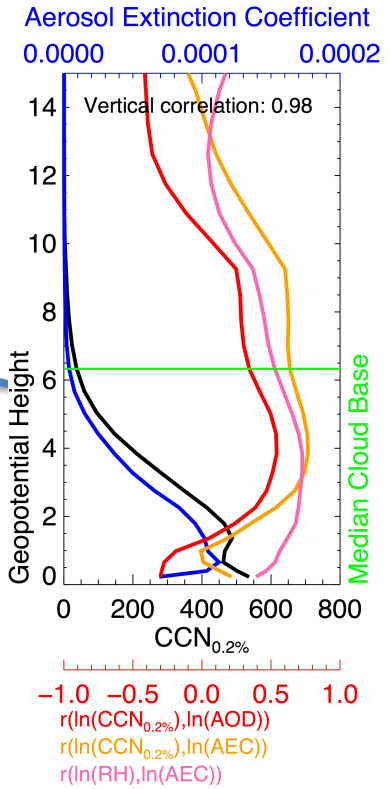
Suitability of AOD as proxy for CCN

Correlation of 6h CCN and AOD from global aerosol model ECHAM-HAM with fully self-consistent calculation:



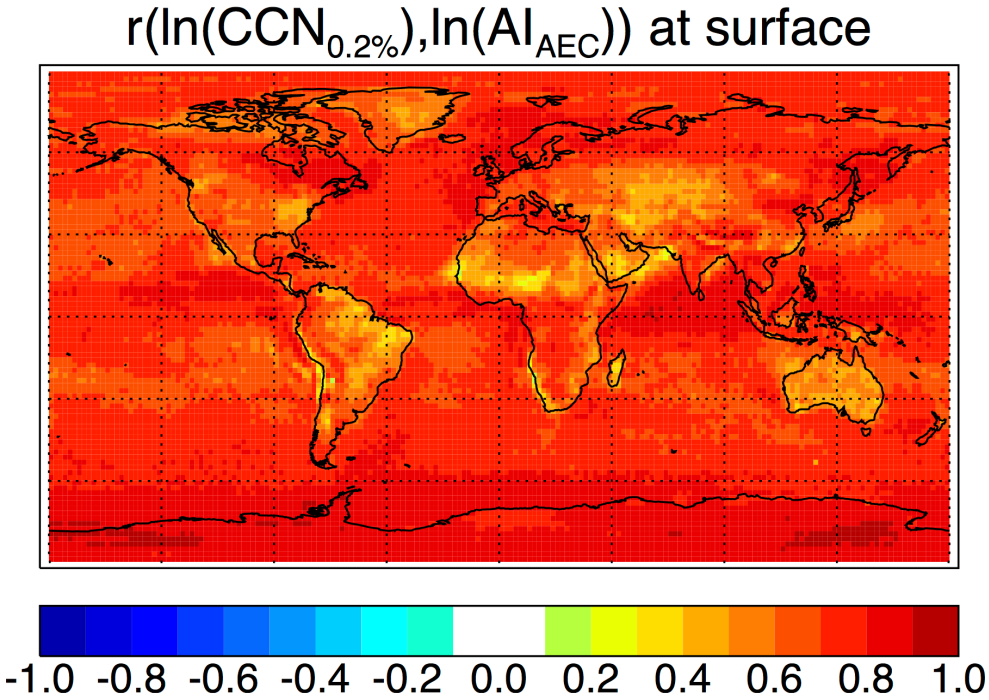




r<0.5 for 55% of the global area

Suitability of AOD as proxy for CCN

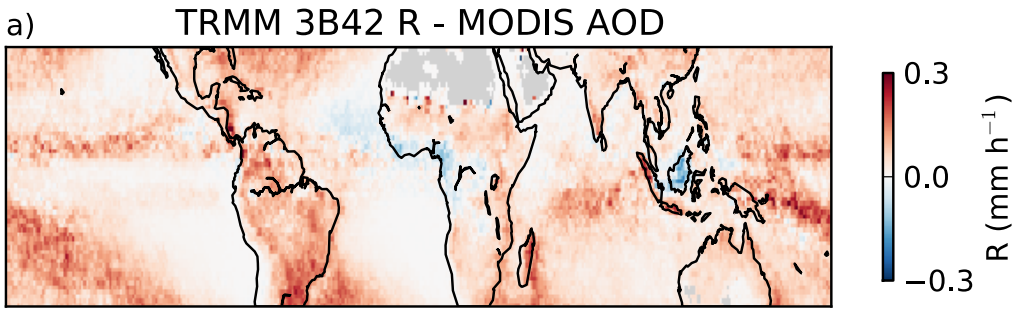
Correlation of 6h CCN and **surface level AOD** from self-consistent global aerosol model ECHAM-HAM:



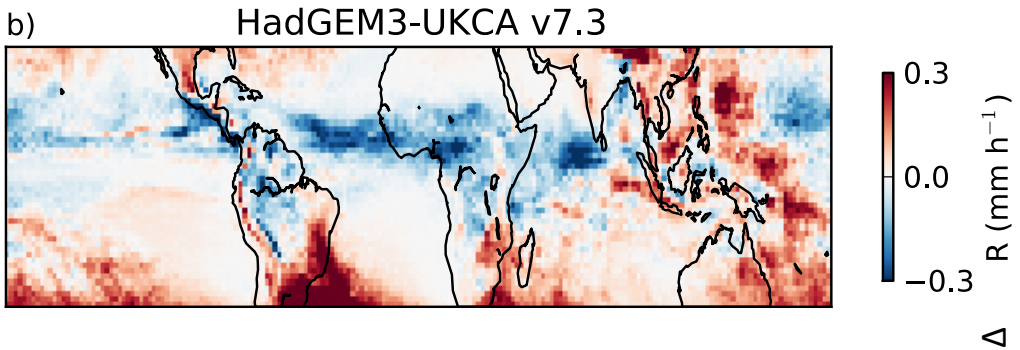
Information about vertical structure (and size) key

Case study: aerosol effects on precipitation?

Difference in **TRMM** rainrate between high and low **MODIS AOD**



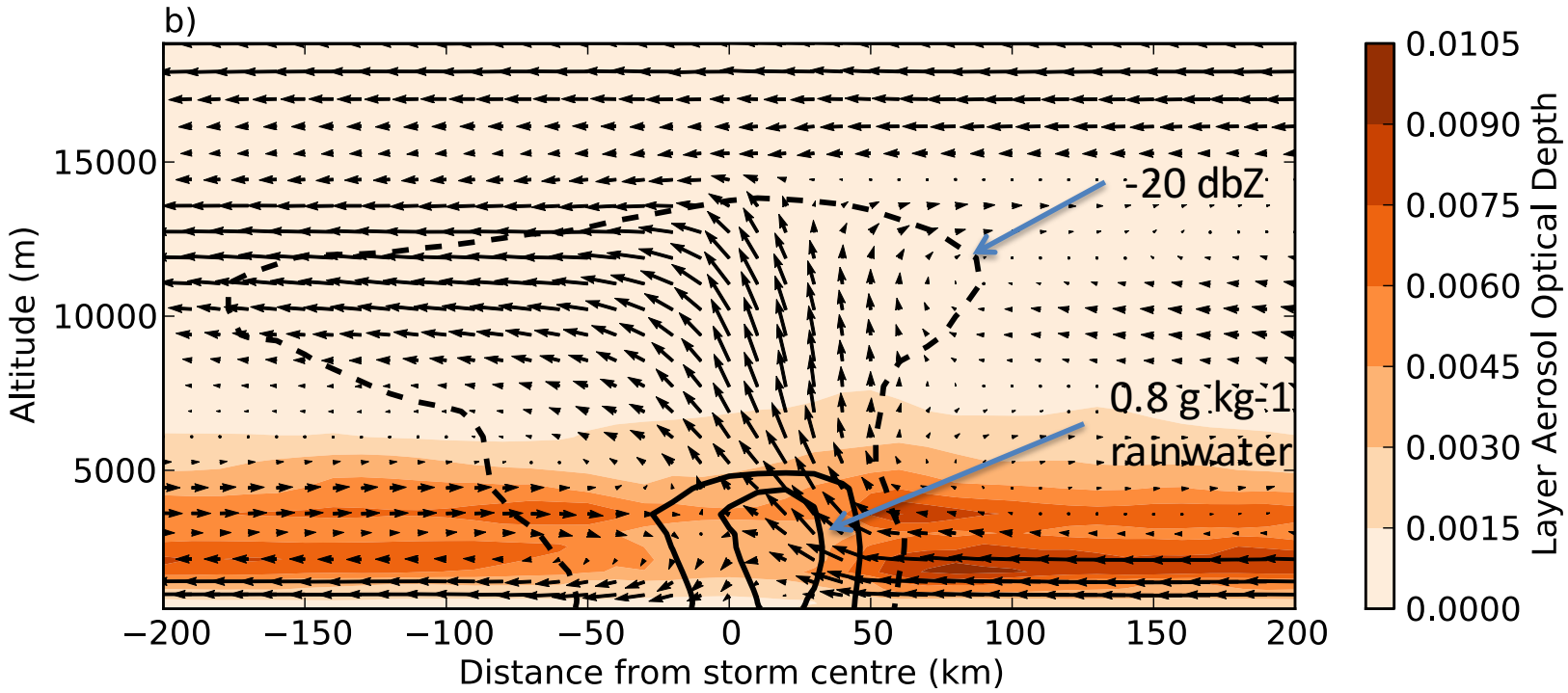
Difference in **HadGEM** GCM rainrate between high and low AOD



Scavenging signature found in GCMs but not in satellite data

Sampling Issues: Non-Coincidence

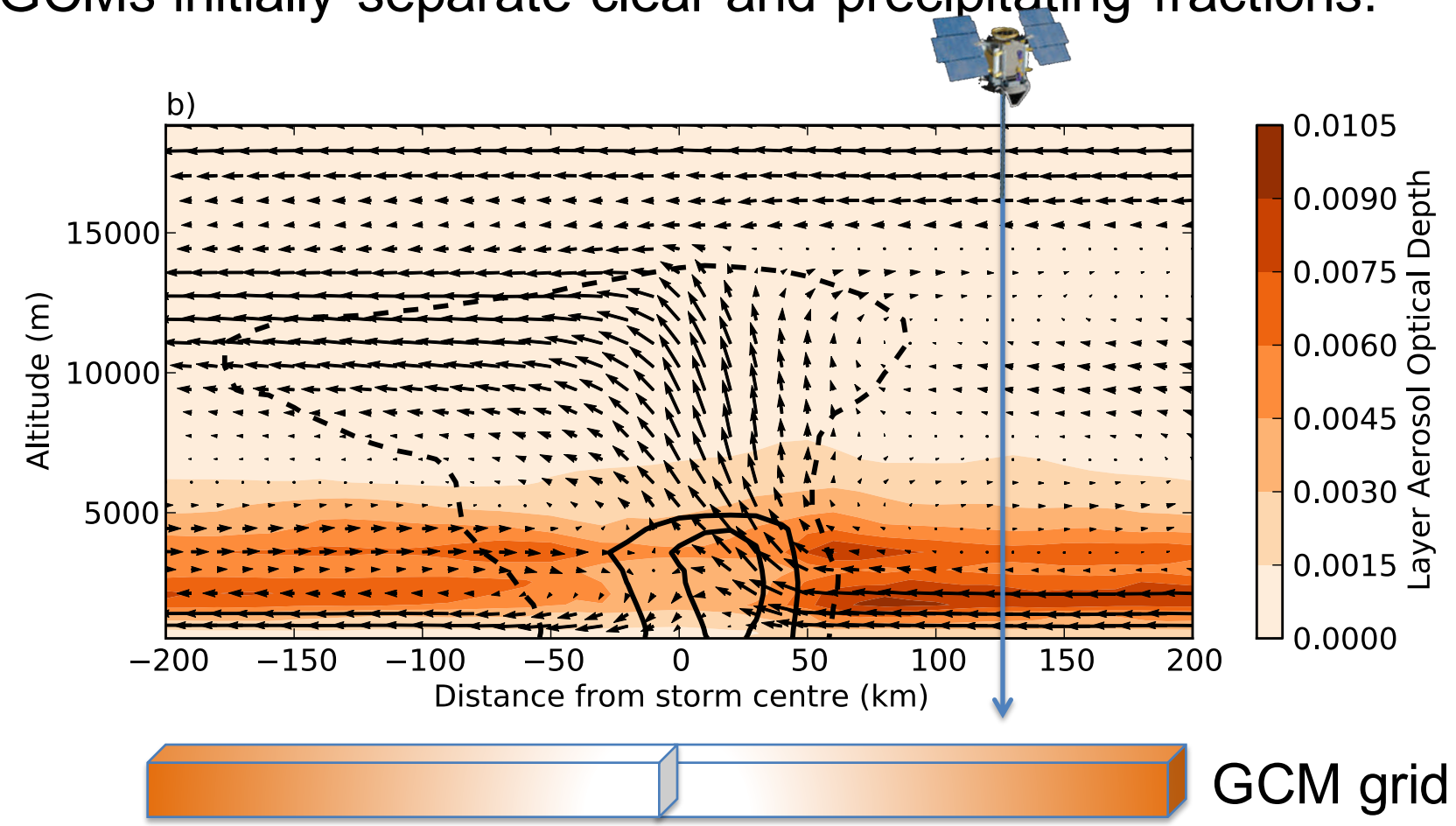
Composite of WRF-Chem simulated convective systems



Issue: AOD scavenging signal concentrated in areas with high cloud fraction – poorly sampled by satellites

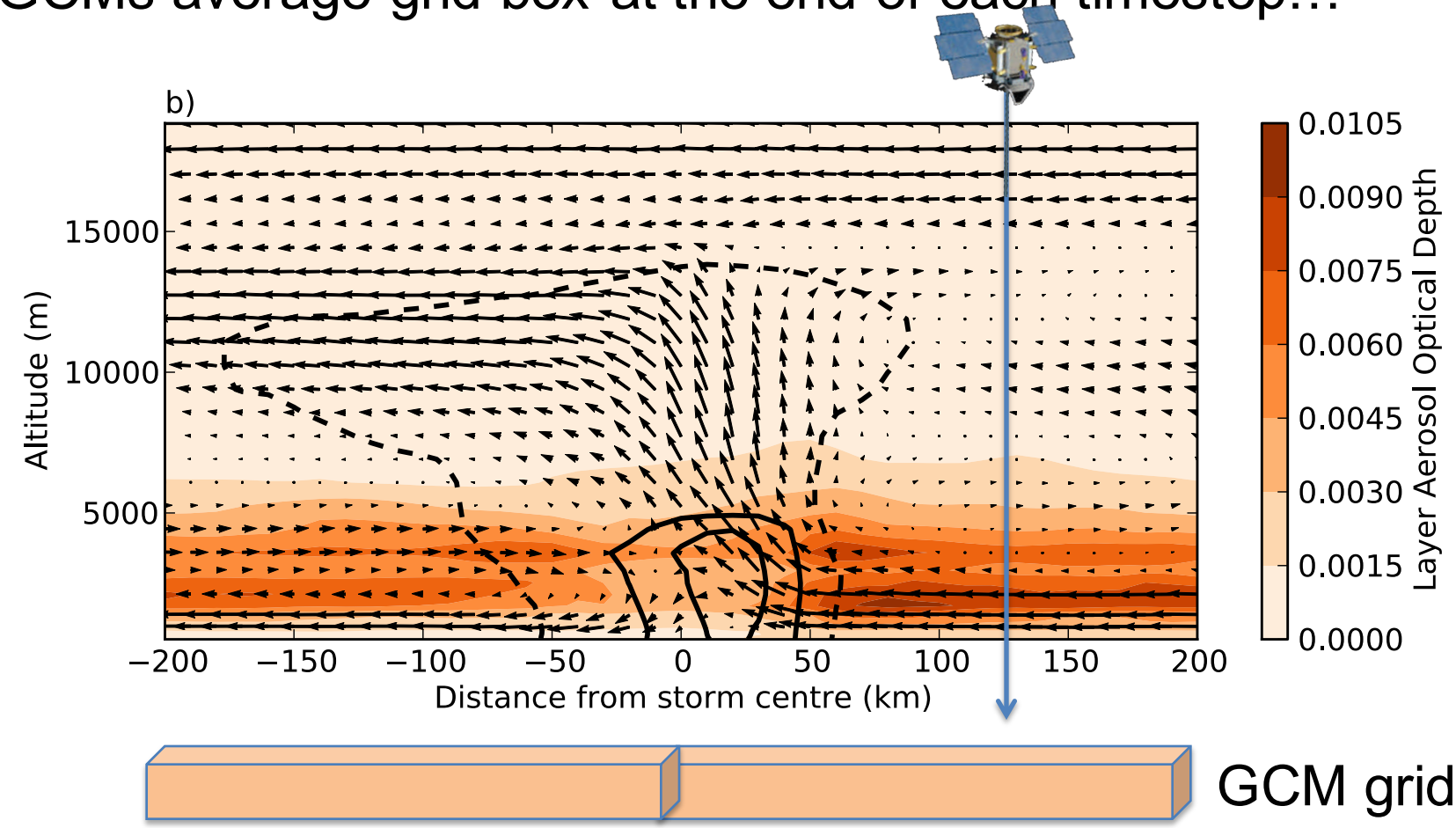
Sampling Issues: Non-Coincidence

GCMs initially separate clear and precipitating fractions:



Sampling Issues: Non-Coincidence

GCMs average grid-box at the end of each timestep…



GCM grid - low bias

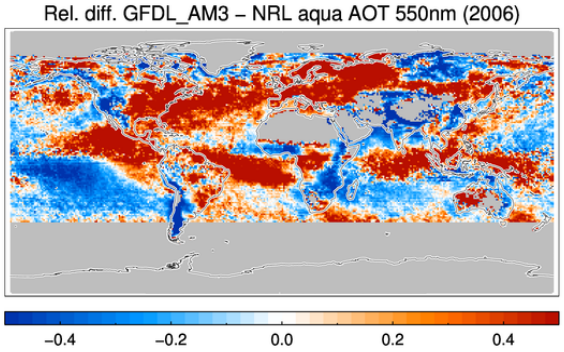
AeroSat Discussion

- Need to understand errors of retrievals
- Need to understand what has not been retrieved (and why) This is key to avoid sampling biases
- Satellite simulators can help to avoid these issues
- Currently the analysis of representativeness (e.g. of AOD/AI for CCN) happens mostly on the user side
- Large domain CRM/LES simulations including aerosols provide new opportunities to test representativeness

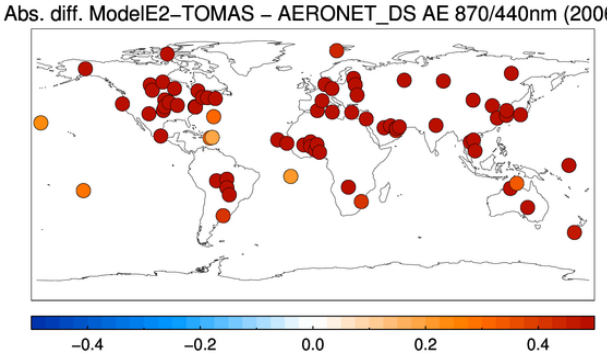
AeroCom Remote Sensing

AeroCom model evaluation against a large suite of remote sensing observations

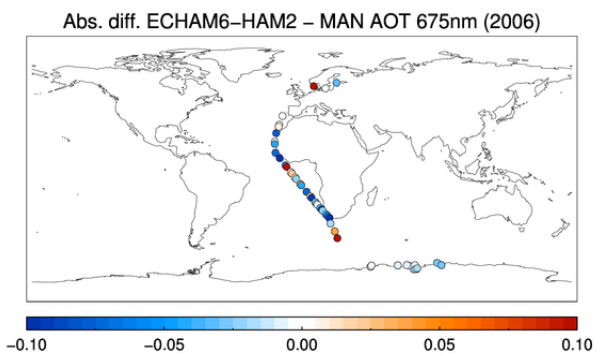
MODIS AOT



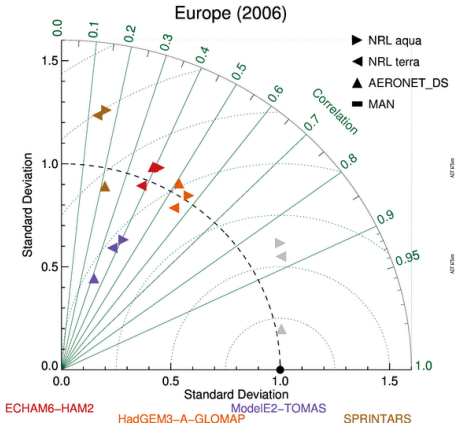
AERONET AE



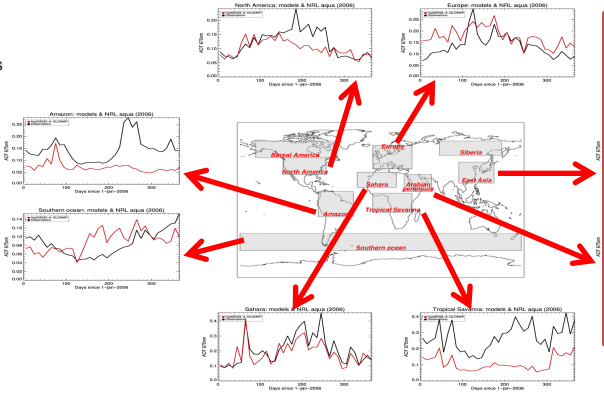
MAN AOT



Taylor plots AOT



Regional AOT



Evaluation of AeroCom 3h model output:

- AOT, AE, SSA (2D)
- RH (2D, AOT-weighted)

Nick Schutgens, Stefan Kinne, Philip Stier

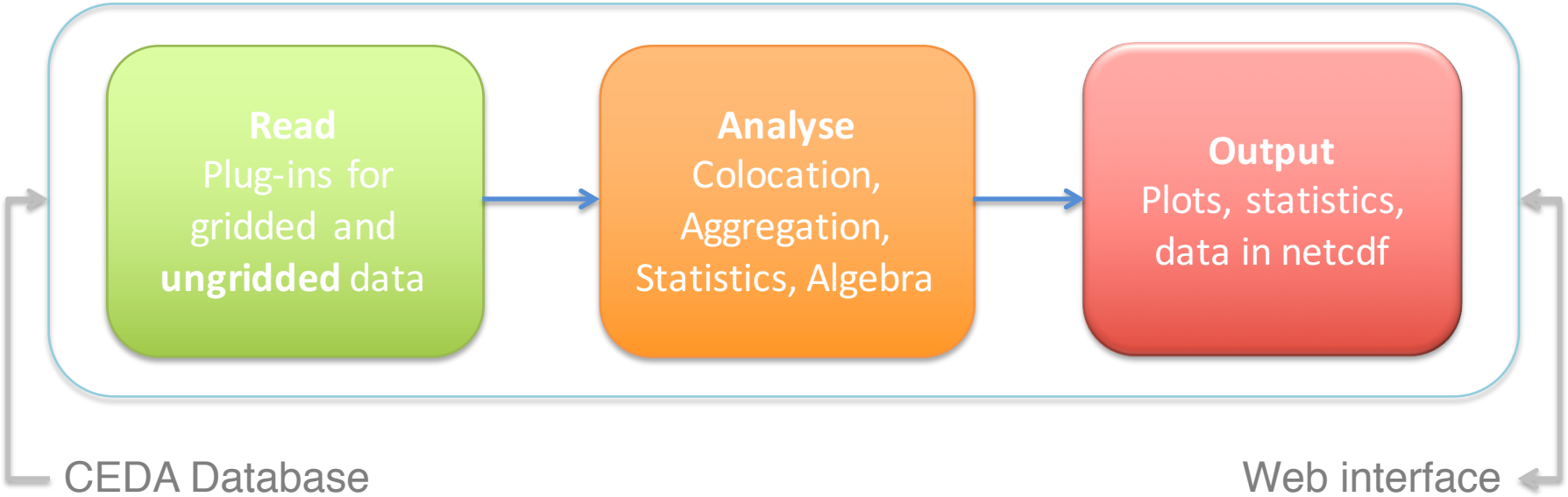
Links to AeroSat?

Community Intercomparison Suite

Community Intercomparison Suite

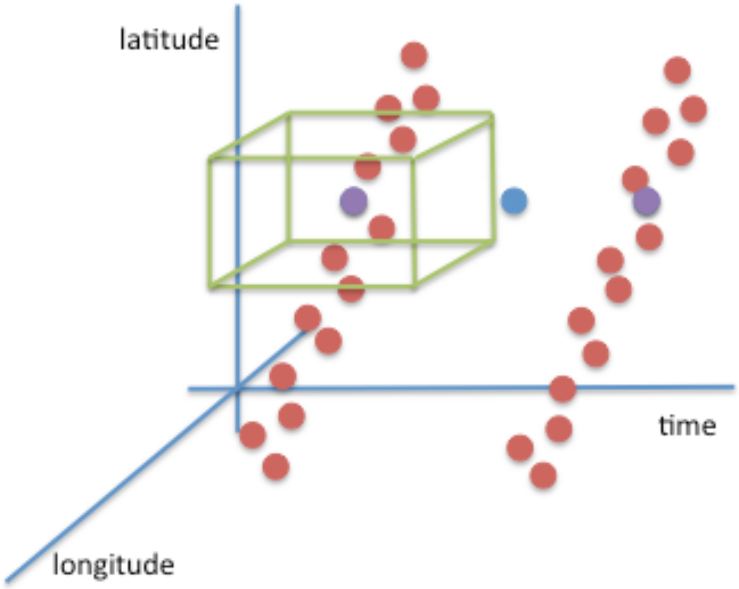
Open source python toolbox to efficiently intercompare data

- 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



Community Intercomparison Suite

Colocation



Colocation method:

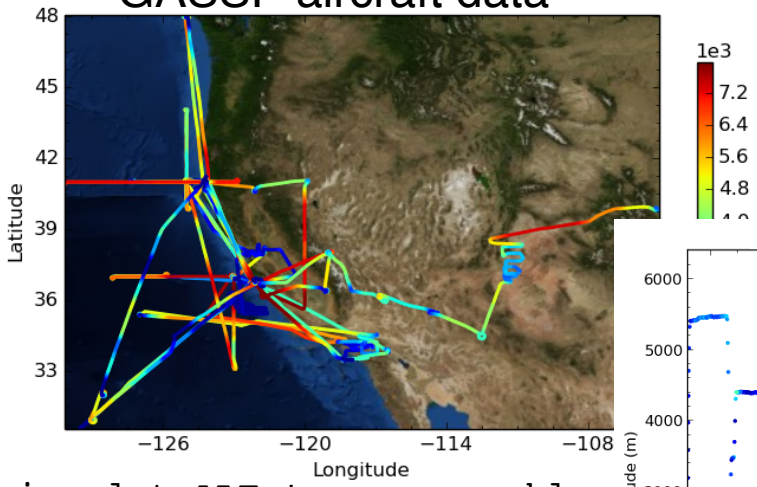
1. Specify searchbox
   - Horizontal distance
   - Vertical distance
   - Time separation
2. Specify operation
   - Nearest neighbour (time)
   - Nearest neighbour (space)
   - Average
   - User plug-in

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

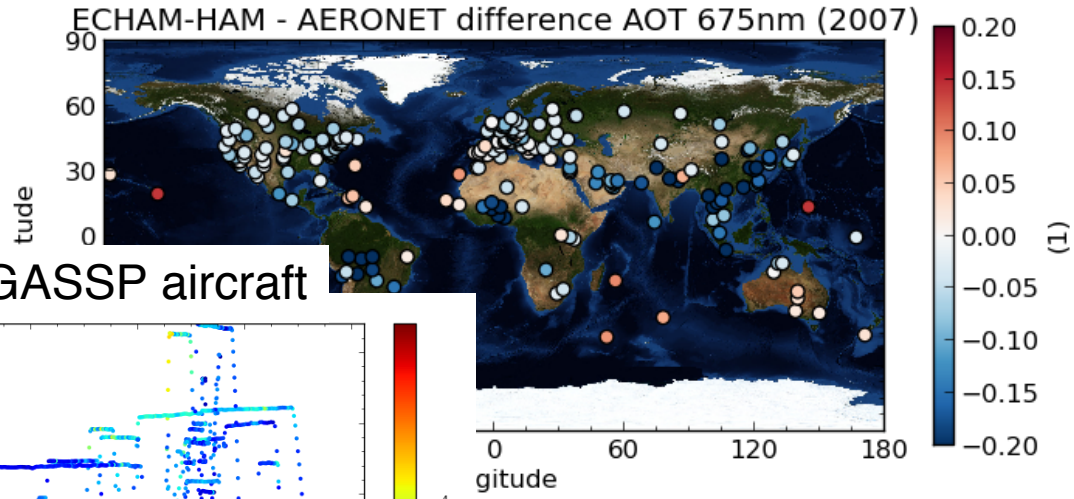
This file provides the new spatio-temporal sampling	This file provides the data that will be resampled	Nearest neighbour or linear interpolation	Output (netcdf)

Community Intercomparison Suite

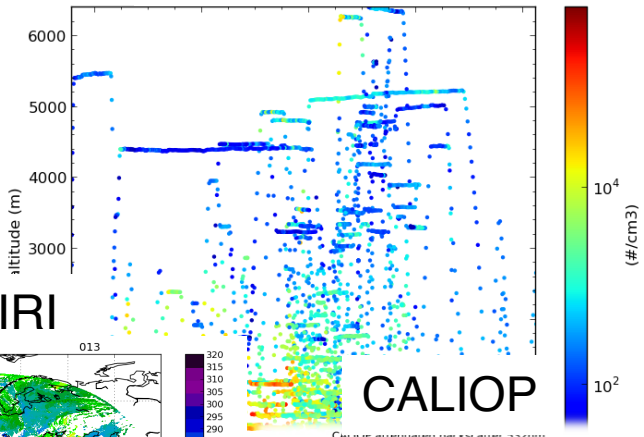
GASSP aircraft data



ECHAM-HAM - AERONET difference AOT 675nm (2007)



GASSP aircraft

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cis plot ALT:*.nc --nasablue
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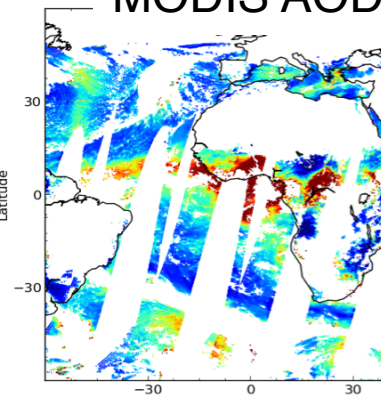
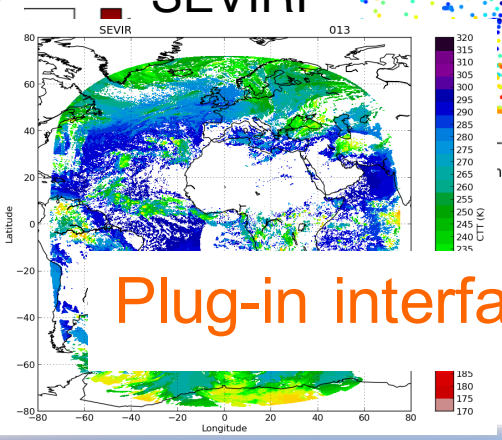
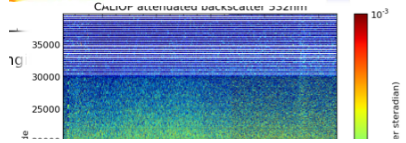
MODIS AOD



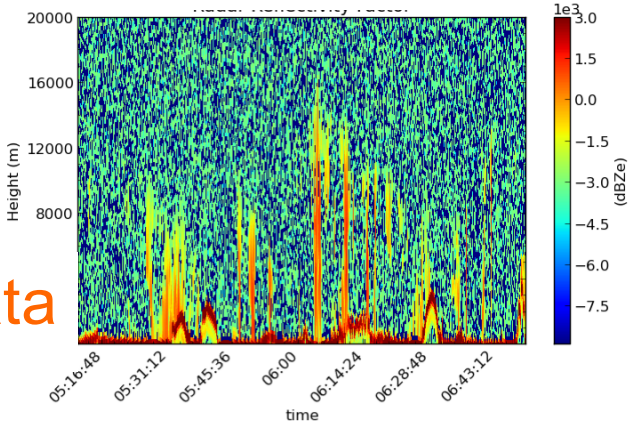
SEVIRI



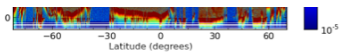
CALIOP



CloudSat



Plug-in interface for new data



www.cistools.net