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AeroCom working group **Indirect forcing**

please see the WIKI page

http://wiki.esipfed.org/index.php/Indirect_forcing

for status and updates.



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3. - second indirect effect
4. - different parameterizations
5. - aerosol distribution
6. - direct effect

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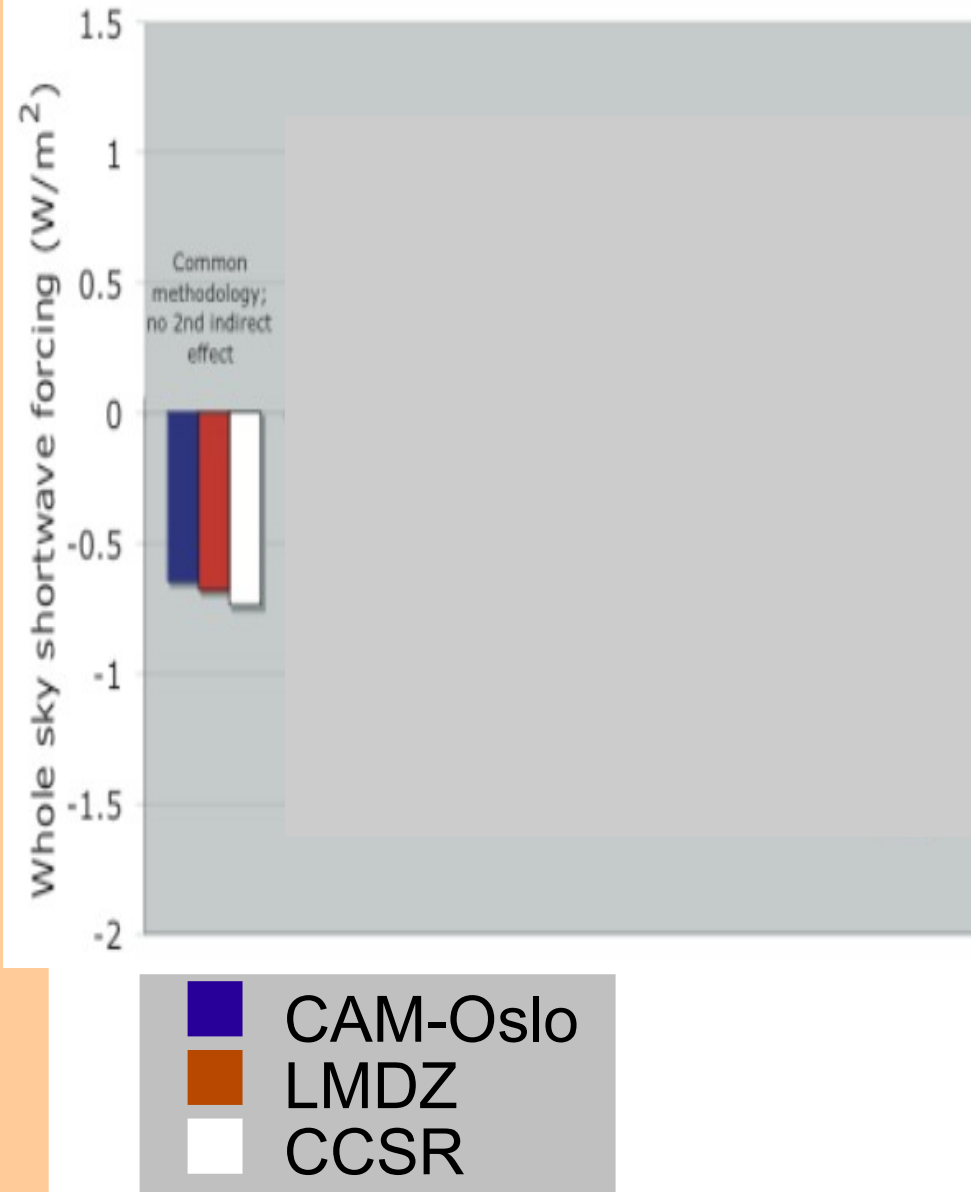
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Uncertainties for aerosol indirect effects

1. - cloud distributions

- link aerosols – droplet concentrat.
- second indirect effect
- different parameterizations
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- direct effect





Modelling uncertainties



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- cloud distributions

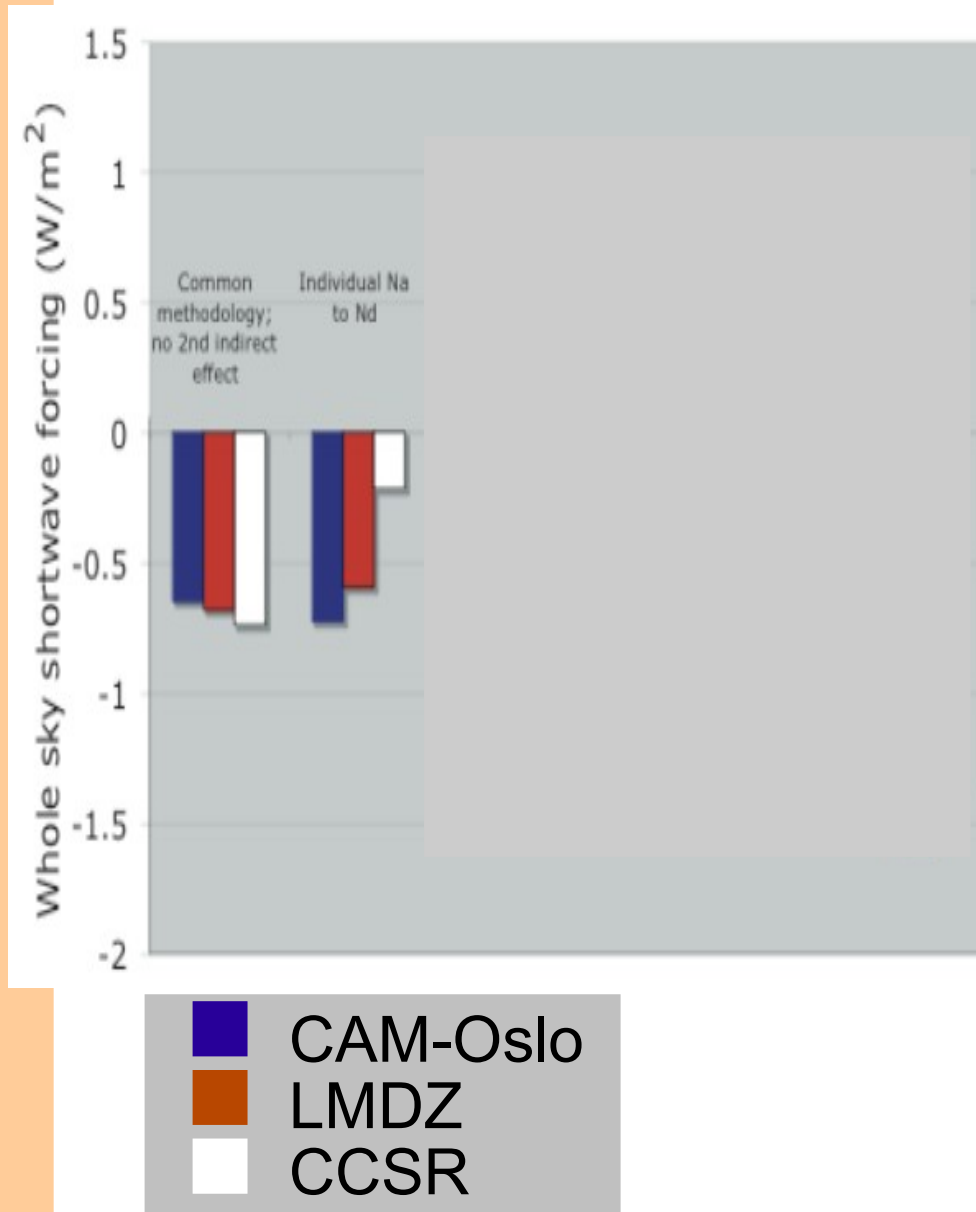
2. - link aerosols – droplet concentrat.

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Modelling uncertainties



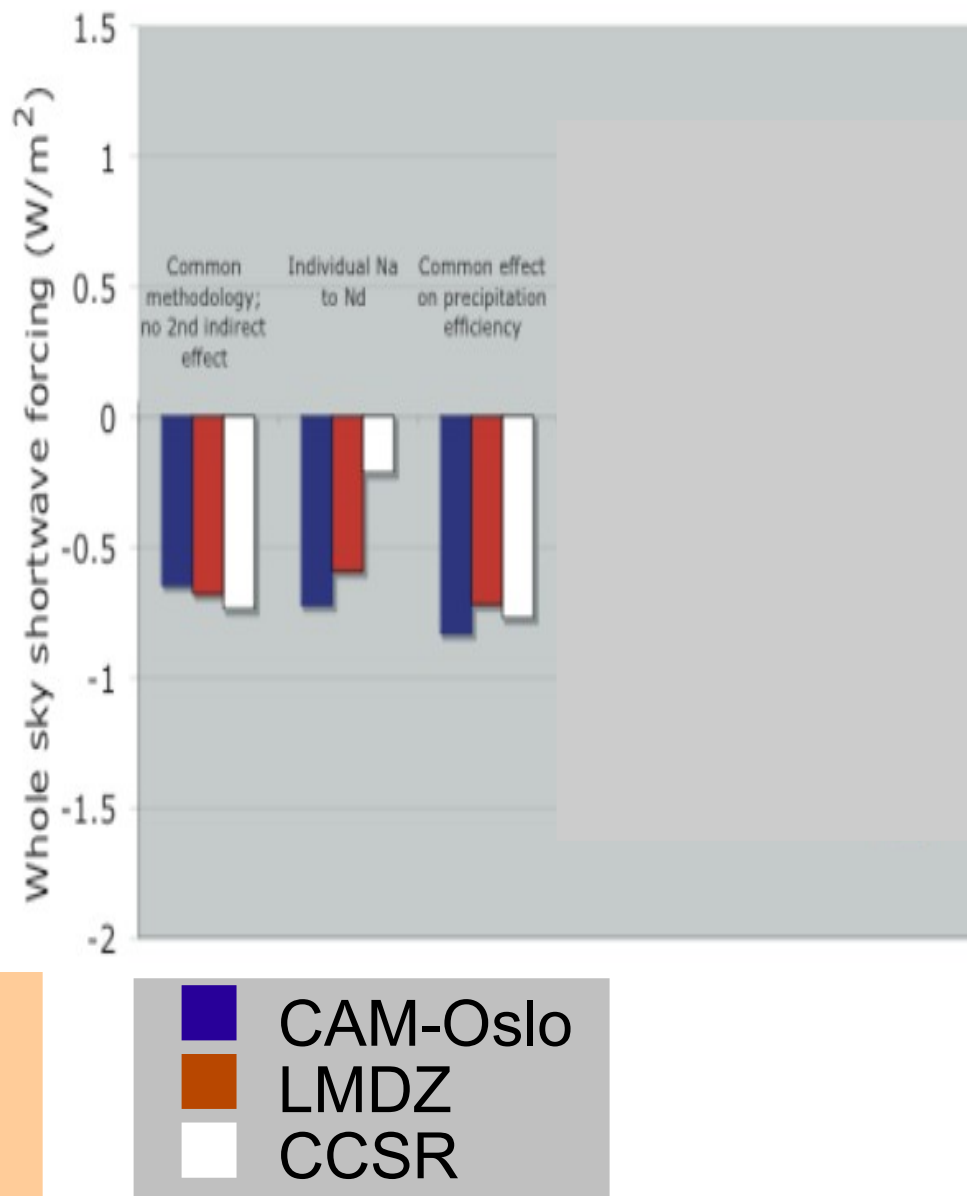
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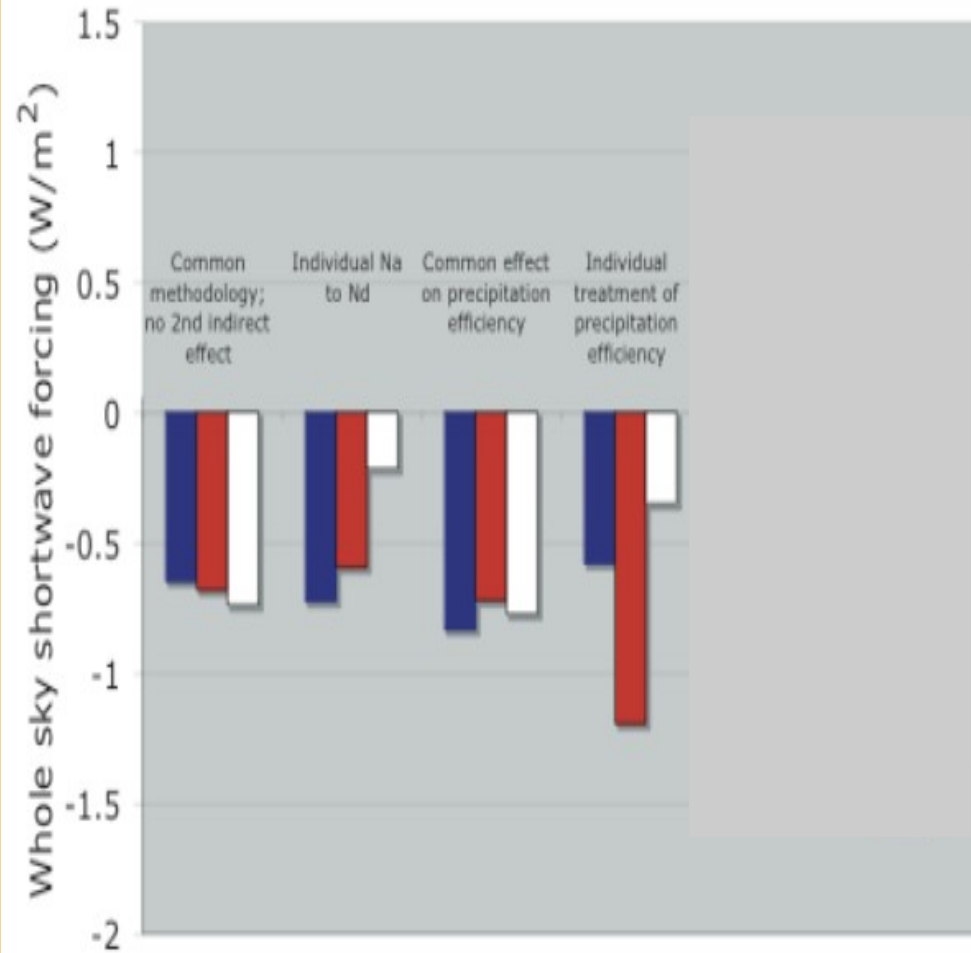
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Uncertainties for aerosol indirect effects

- cloud distributions
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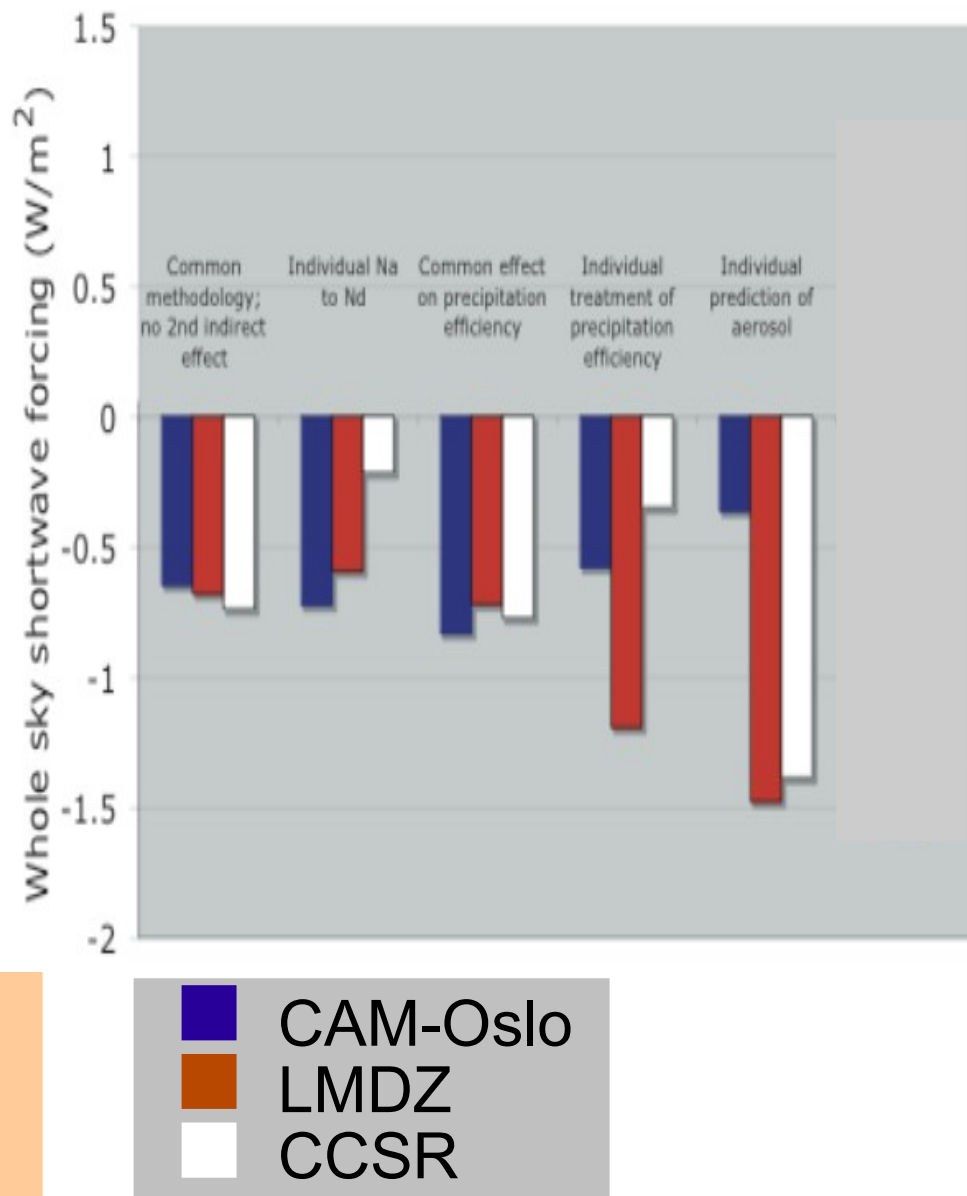
4. - different parameterizations

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Uncertainties for aerosol indirect effects

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- 5.** - aerosol distribution
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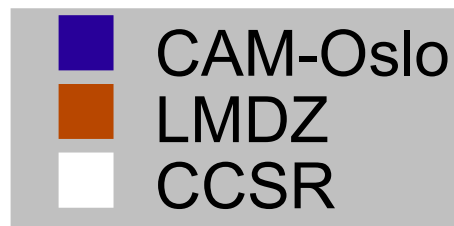
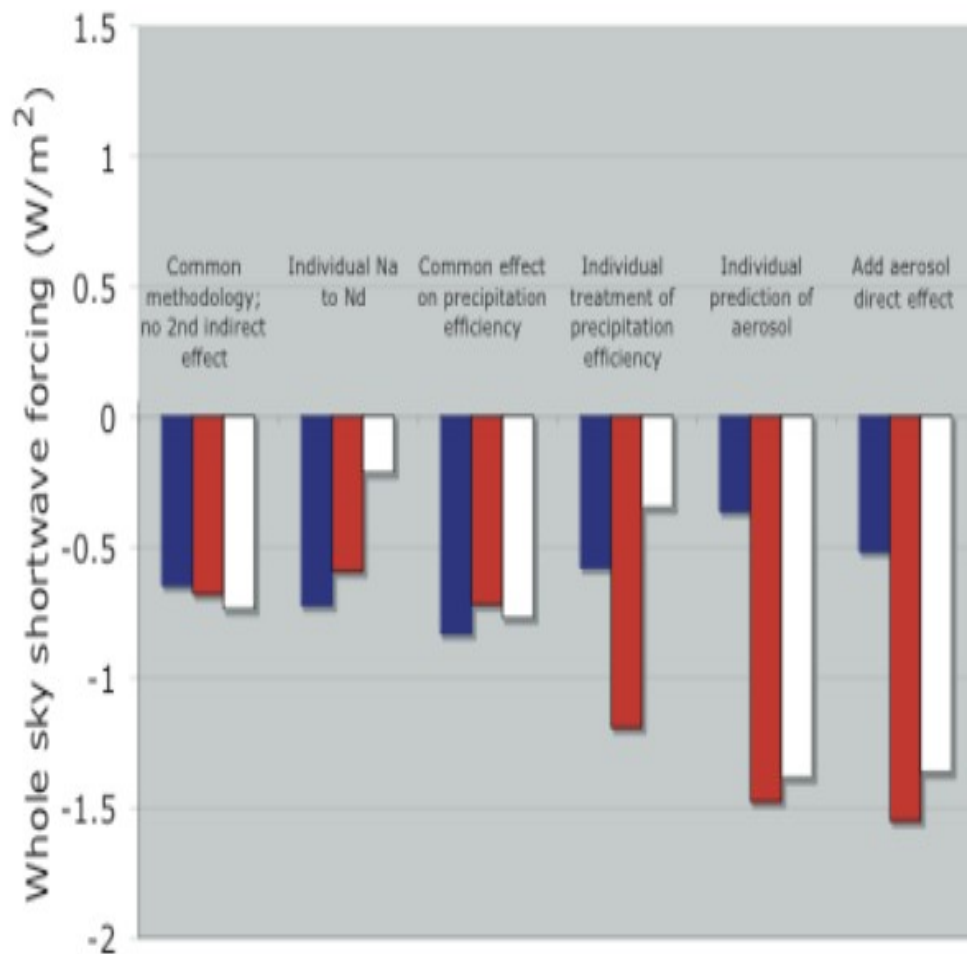
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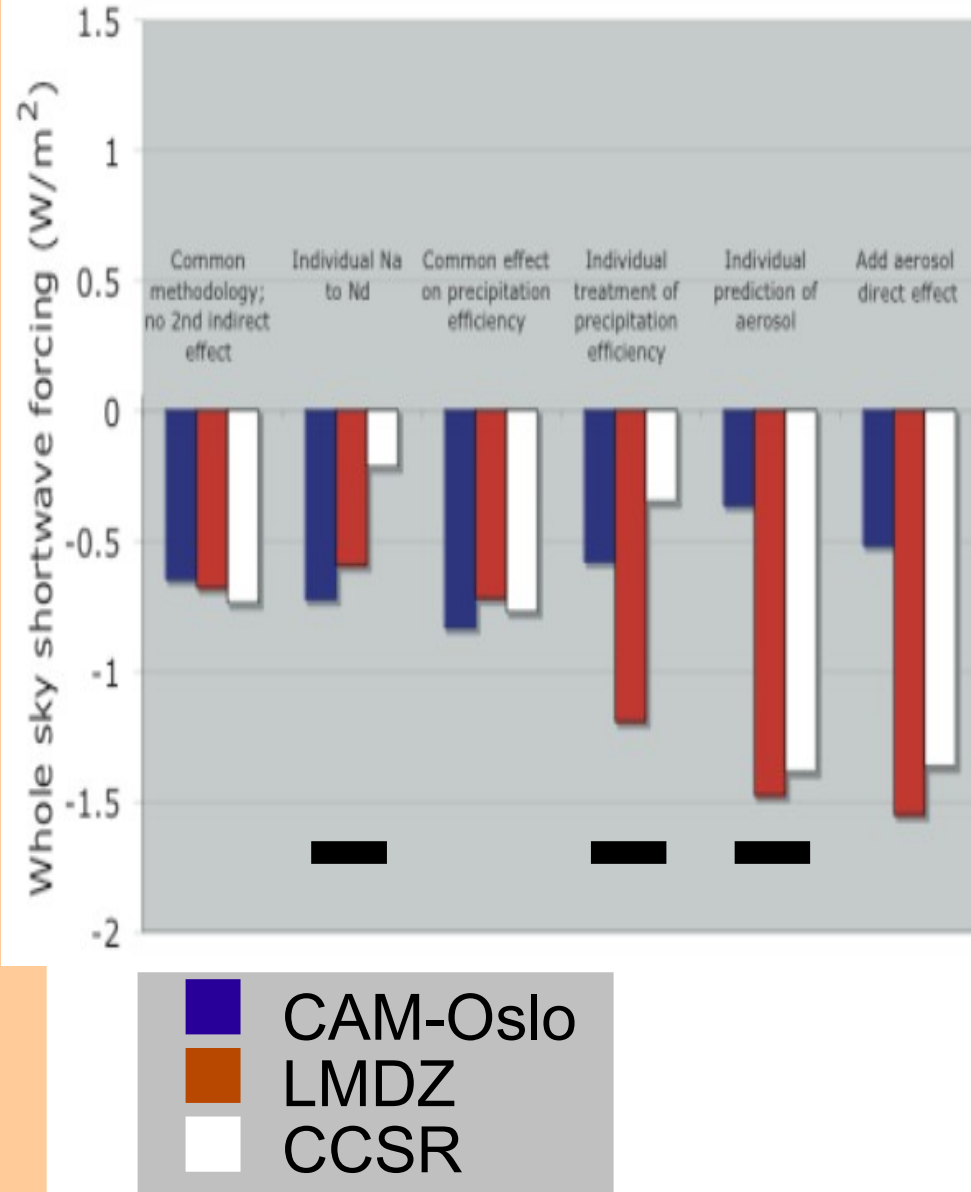
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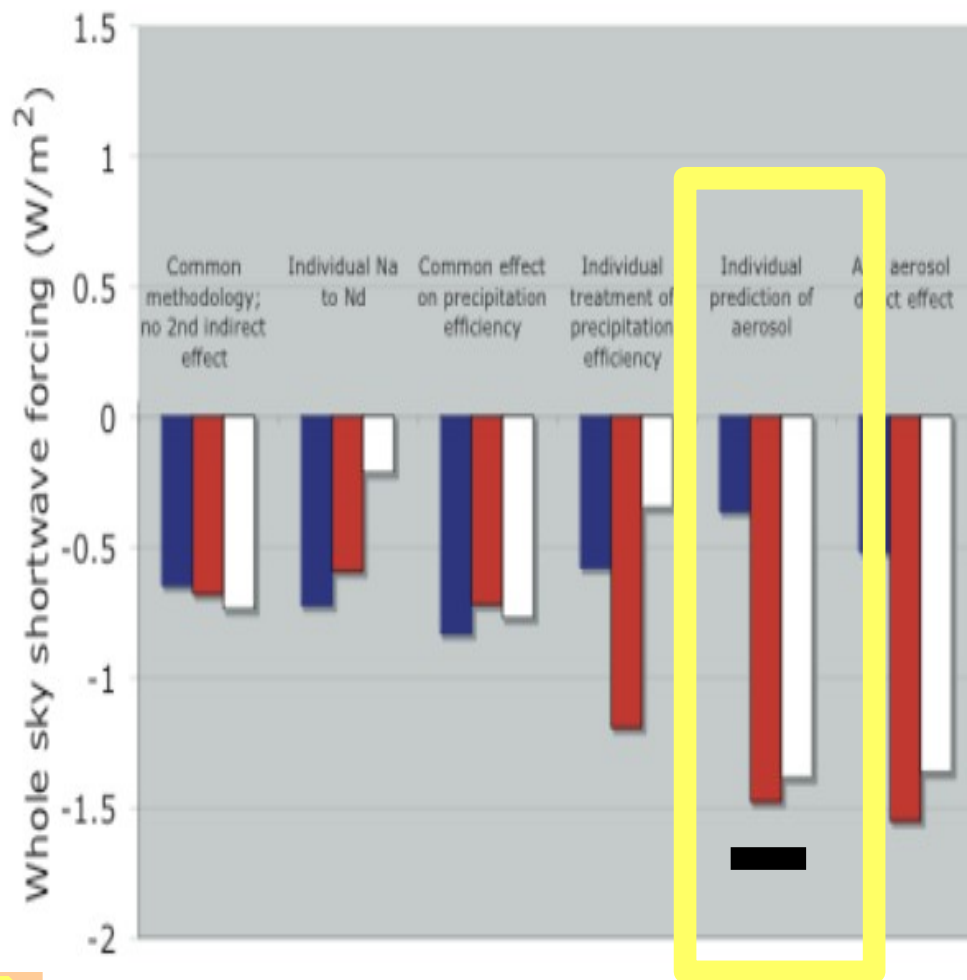
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AEROCOM other



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- cloud distributions

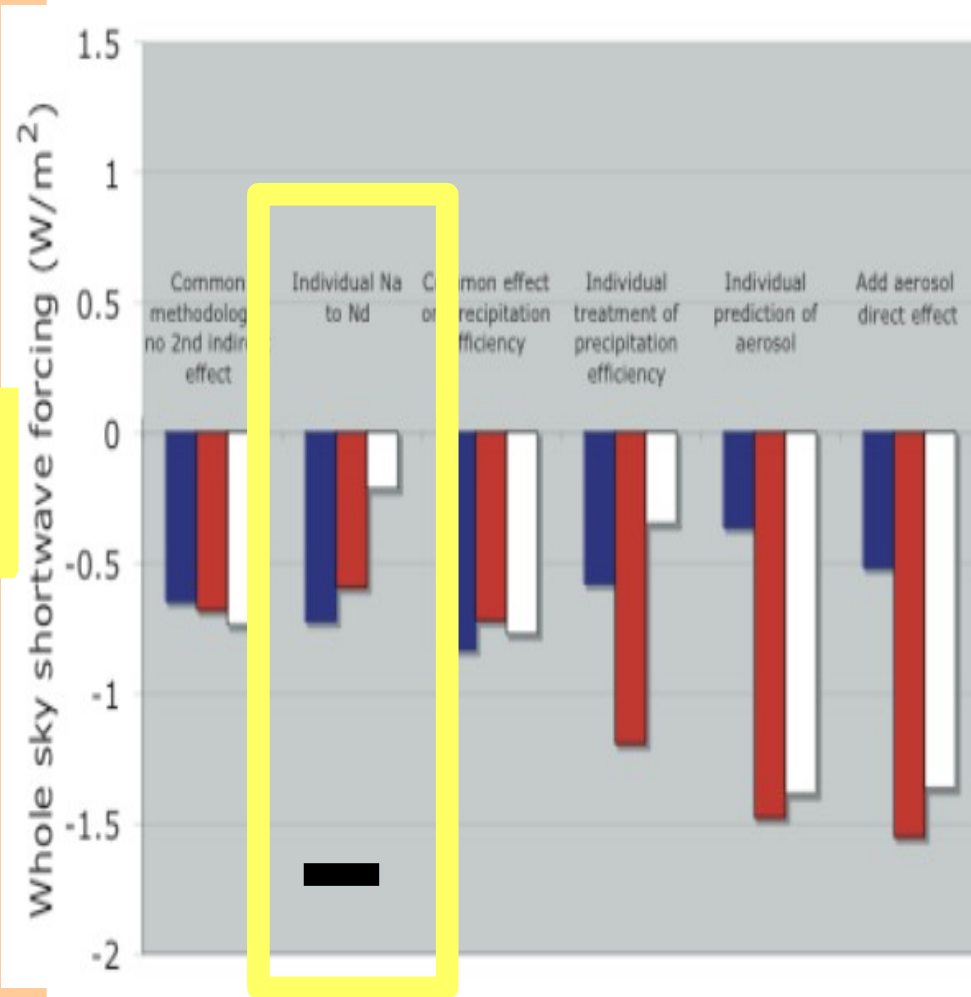
2. - link aerosols – droplet concentrat.

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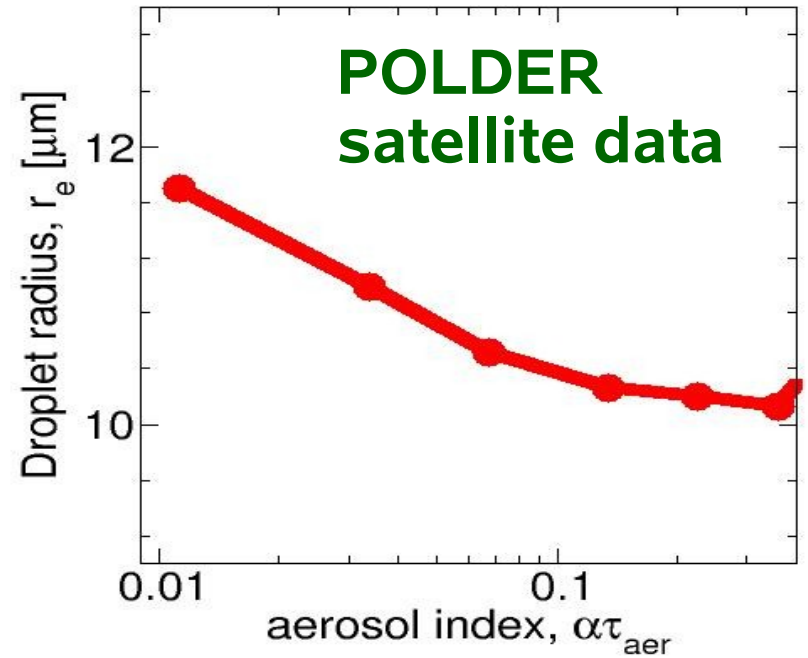
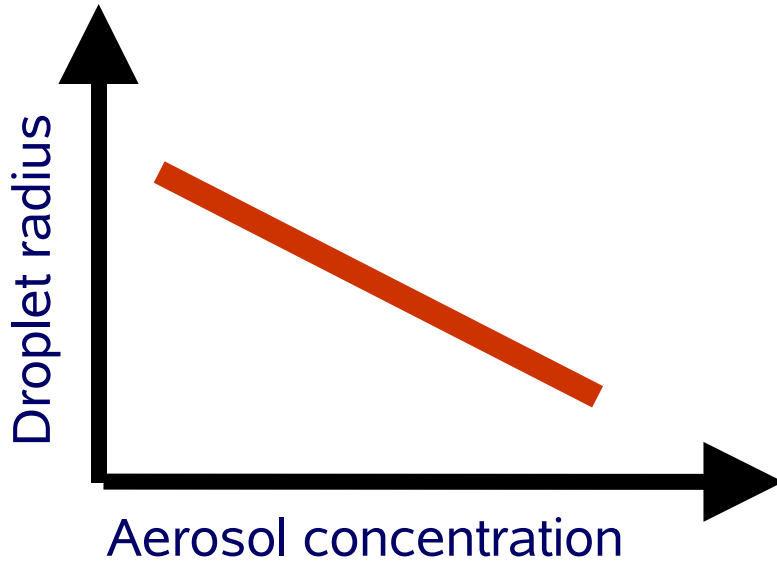
- direct effect



AEROCOM Indirect forcing



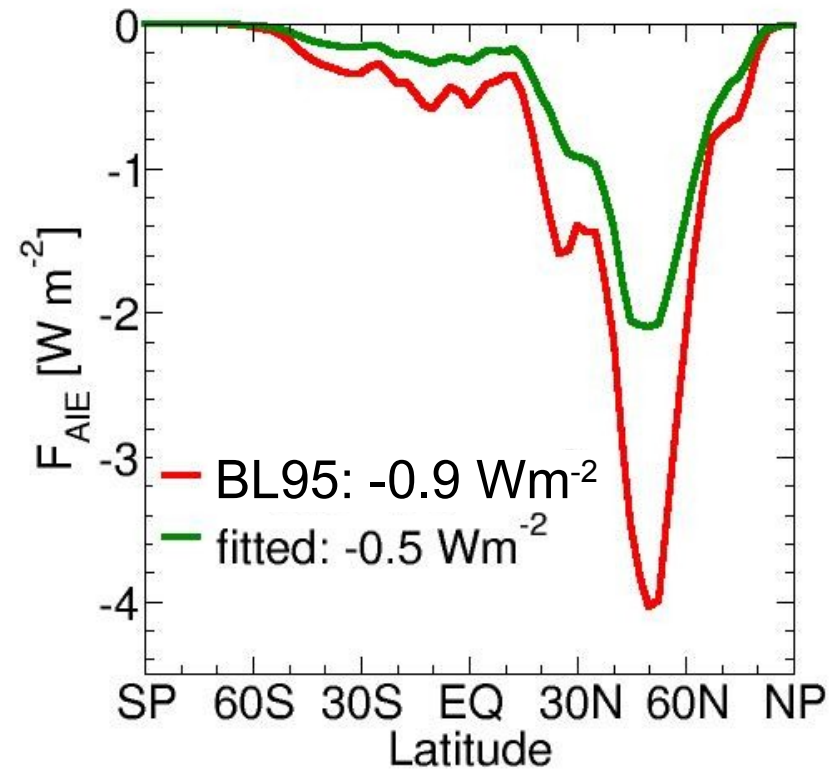
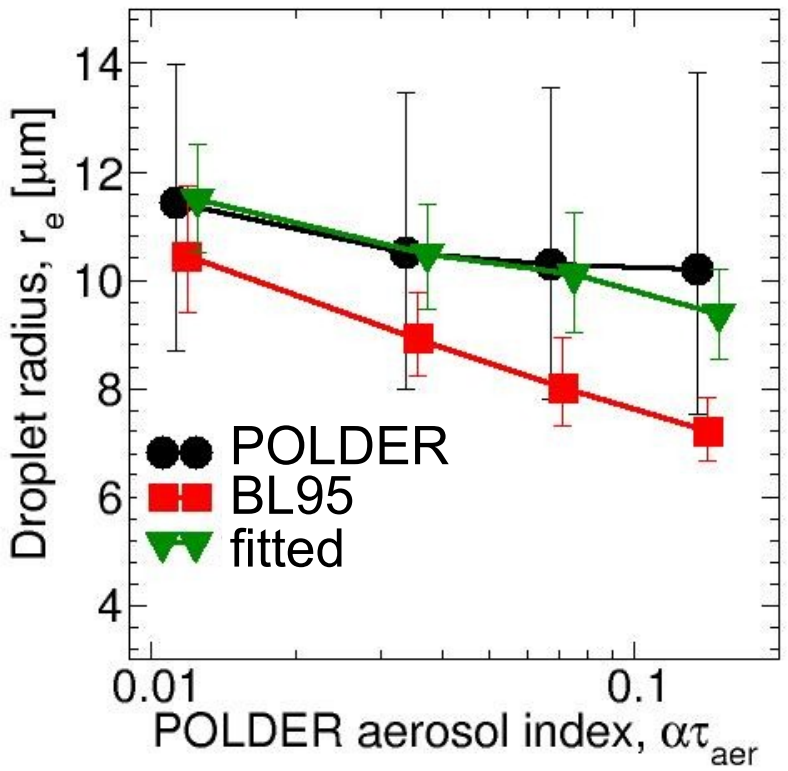
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- robust
- relative changes only
- valid in changing climate

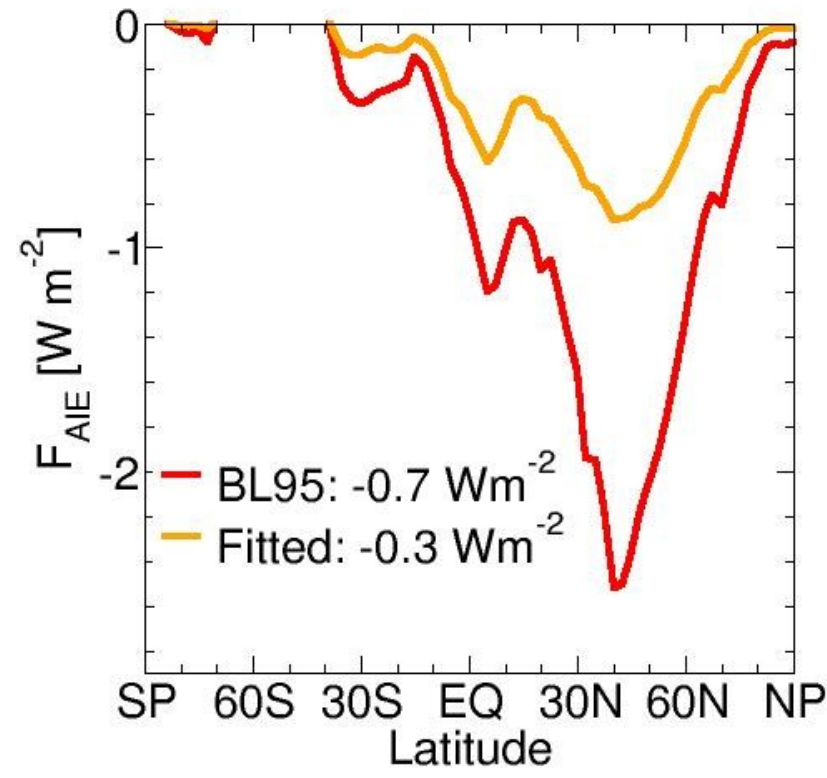
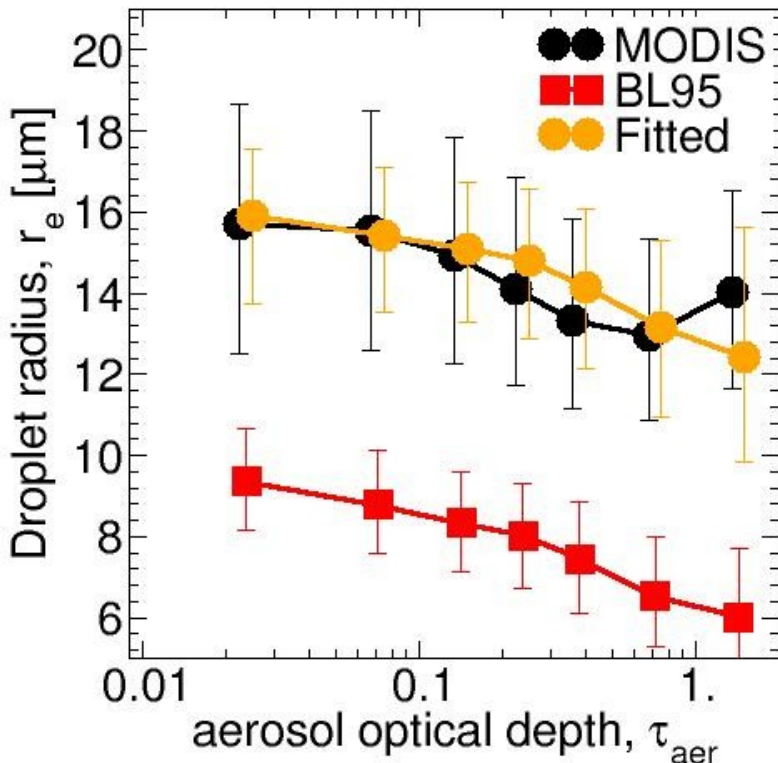


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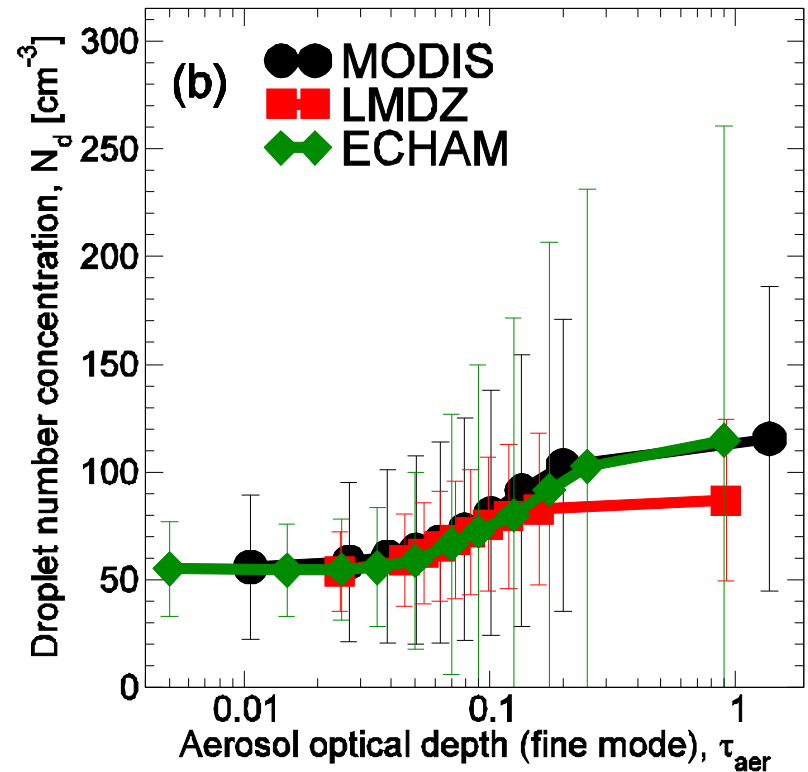
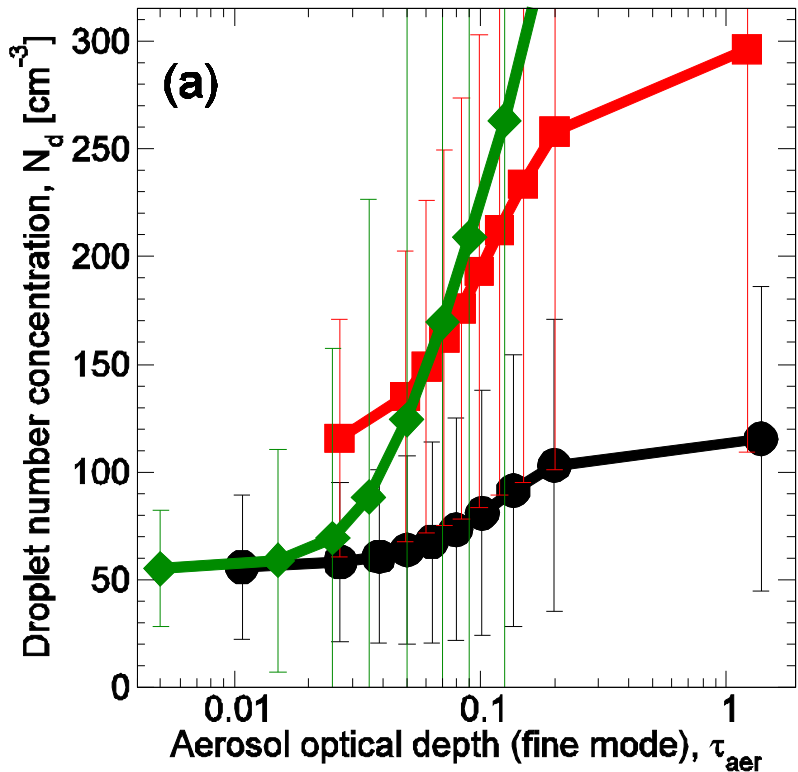


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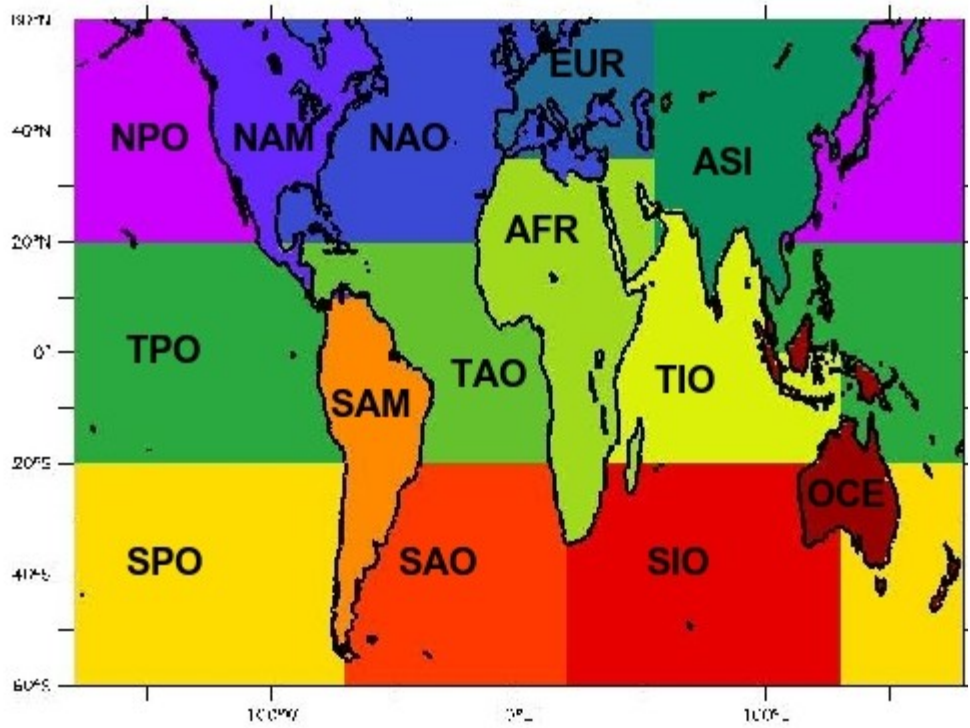


LMDZ	-0.8 Wm ⁻²	-0.5 Wm ⁻²
ECHAM4	-1.5 Wm ⁻²	-0.3 Wm ⁻²



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$$\alpha = \alpha(\tau_a; f, L, N_d)$$



- Analyse separately
- 14 different regions
 - 4 seasons (MAM, JJA, SON, DJF)



Satellite-derived metrics



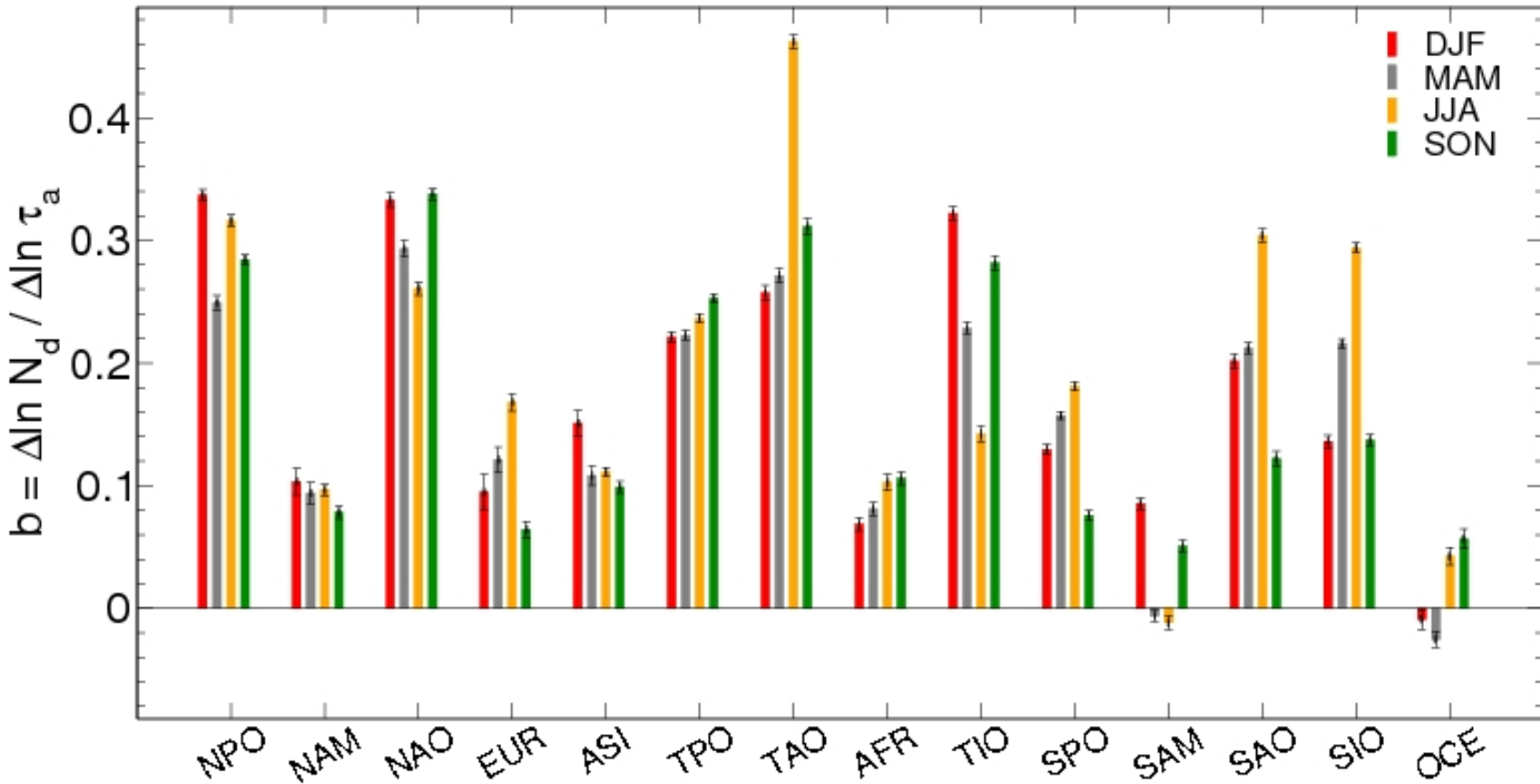
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$$\left[\frac{\partial \alpha}{\partial N_d} \right]_{f, L} \frac{dN_d}{d \ln \tau_a} \text{ Regression from satellite data}$$





Satellite-derived metrics



Emmy Noether-Programm
Deutsche Forschungsgemeinschaft
DFG

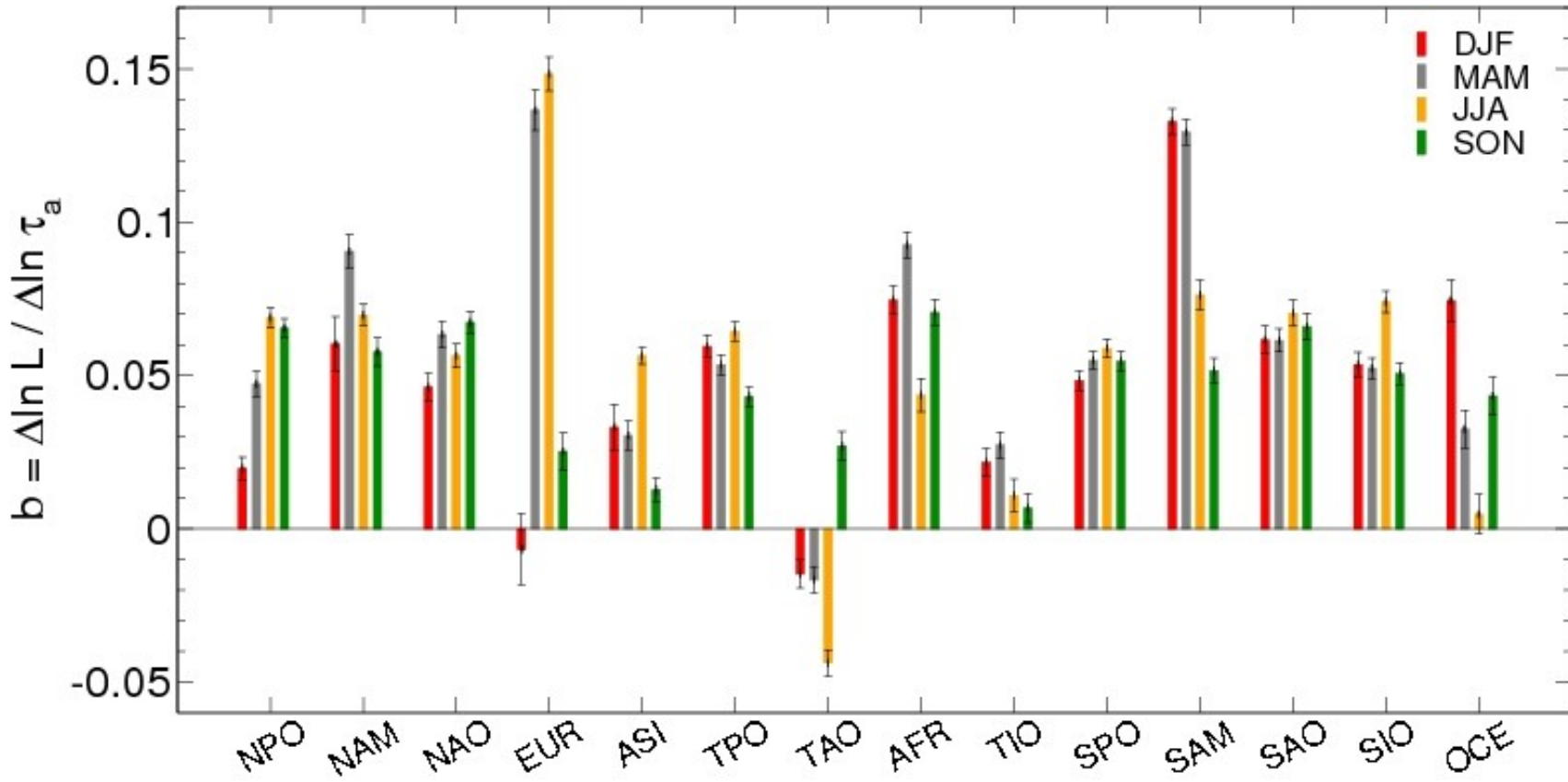
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$$\left[\frac{\partial \alpha}{\partial L} \right]_{f, N_d} \left(\frac{dL}{d \ln \tau_a} \right) + \left[\frac{\partial \alpha}{\partial f} \right]_{L, N_d} \frac{df}{d \ln \tau_a}$$





Satellite-derived metrics



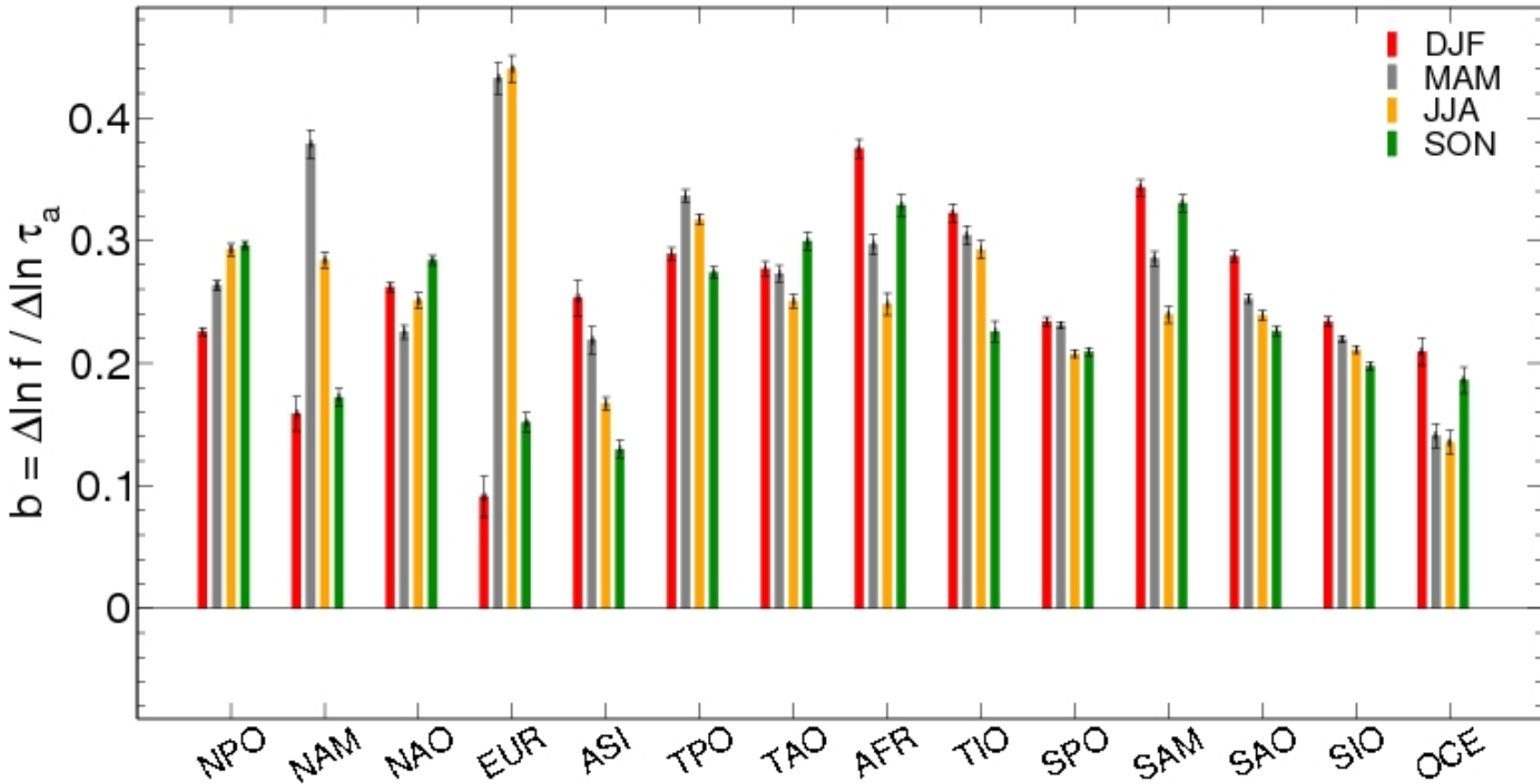
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$$\left[\frac{\partial \alpha}{\partial L} \right]_{f, N_d} \frac{dL}{d \ln \tau_a} + \left[\frac{\partial \alpha}{\partial f} \right]_{L, N_d} \frac{df}{d \ln \tau_a}$$

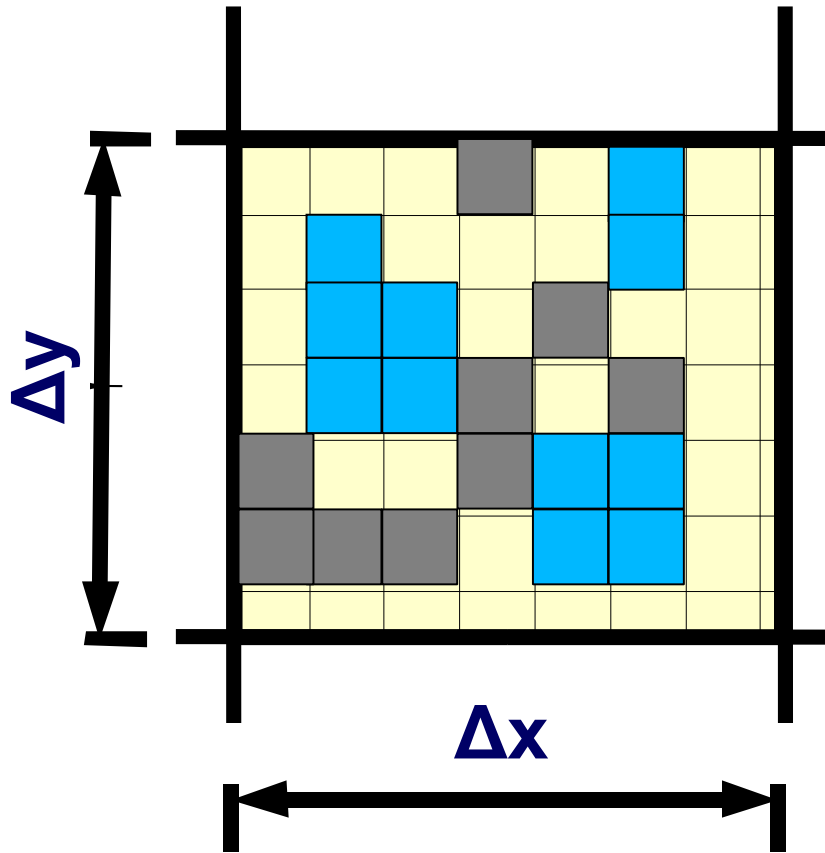







Assumption on interaction clouds-aerosols



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-  Aerosol measurements
-  Cloud measurements
-  No retrieval

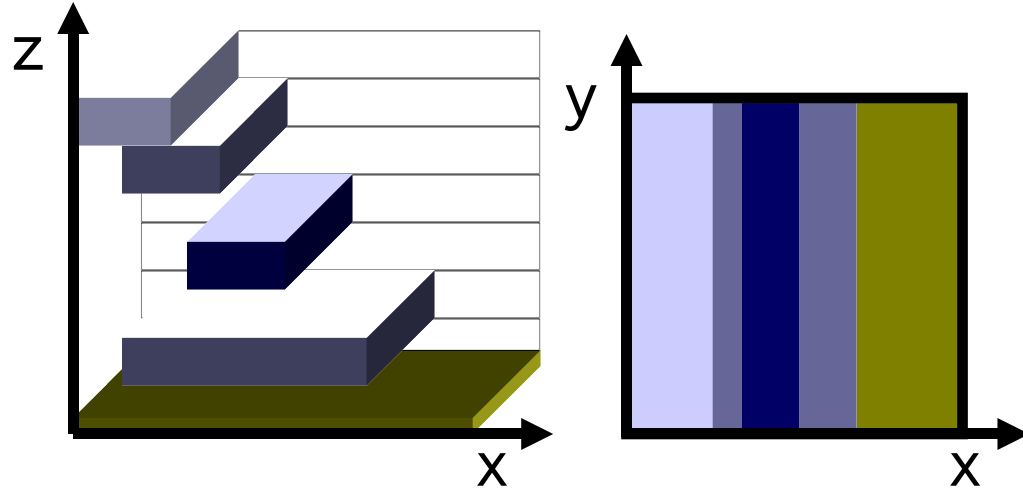
Method adopted:
relate aerosol and cloud quantities within a model gridbox (daily values)

$\Delta x / \Delta y$: model resolution
here: $2.5^\circ \times 3.75^\circ$

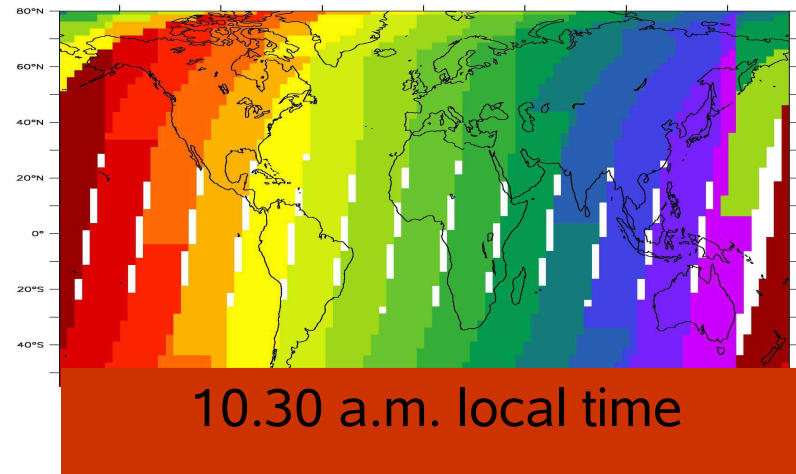


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“Satellite-like” model output



- sample cloud top quantities
- sample overpass time
- use same assumptions





„Satellite-simulator“



Review

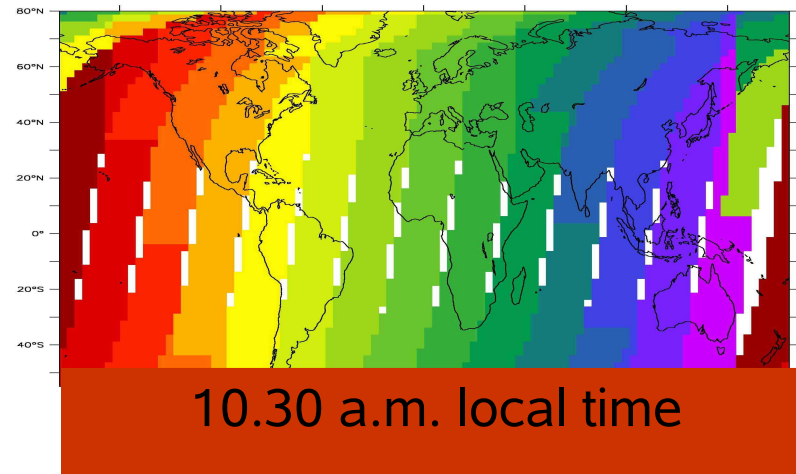
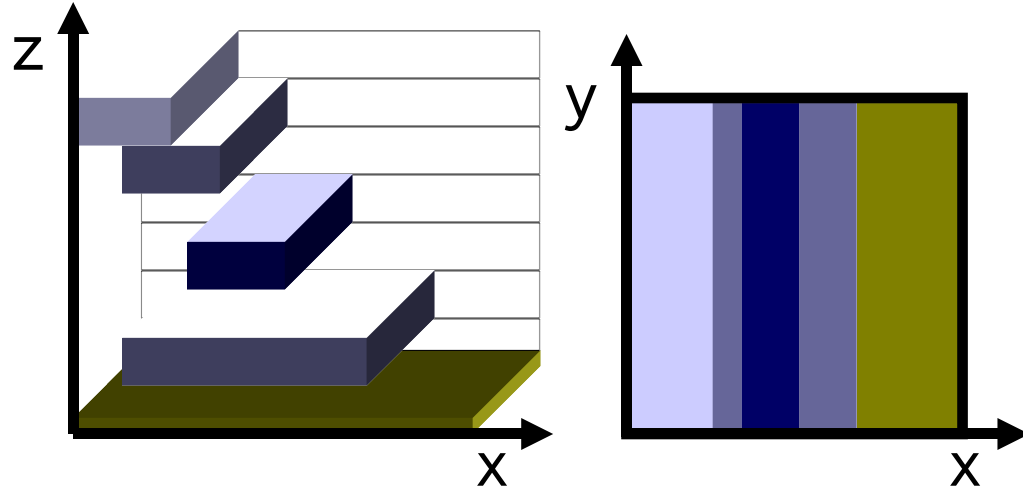
“Satellite-like” model output

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provide „pseudo-code“





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Surabi Menon

- additional use of Calipso/CloudSat-simulator?
 - > CICCIS (CFMIP ISCCP Calipso-Cloudsat Simulator)
- Cloud top temperature/pressure

Thanos Nenes, Jon-Egill Kristjánsson

- interested in participation with GMI





Experiment



Review

Minimum

AOD

Cloud-top droplet effective radius for low-level liquid water clouds

Cloud droplet number concentration for low-level liquid water clouds

Cloud fraction

Fractional coverage by low-level liquid water clouds

Cloud liquid water path for low-level liquid water clouds

Planetary albedo

SW + LW ToA fluxes

SW + LW clear-sky fluxes

Cloud top temperature

Potential temperature @ 700 hPa and surface

Total IWP

Total LWP

Cloud-top ice crystal radius

Cloud-top droplet effective radius for all liquid clouds

Angstrom exponent

Recommended

ISCCP simulator output

CICCS simulator

CCN number concentration at cloud base (or in-cloud CCN concentration)

Aerosol mass concentration at cloud base (or in-cloud aerosol concentration)

daily data with satellite overpass sampling

red: modifications due to recommendations by participants



Experiment



Review

**nudged experiments
starting Oct 2005
output 2006 daily**

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aerosol emissions pd + pi (for the forcing + anthropogenic AOD)

Exp

