

Evaluation of Clouds and Radiation in a High-Resolution Climate Model using CMSAF-Information

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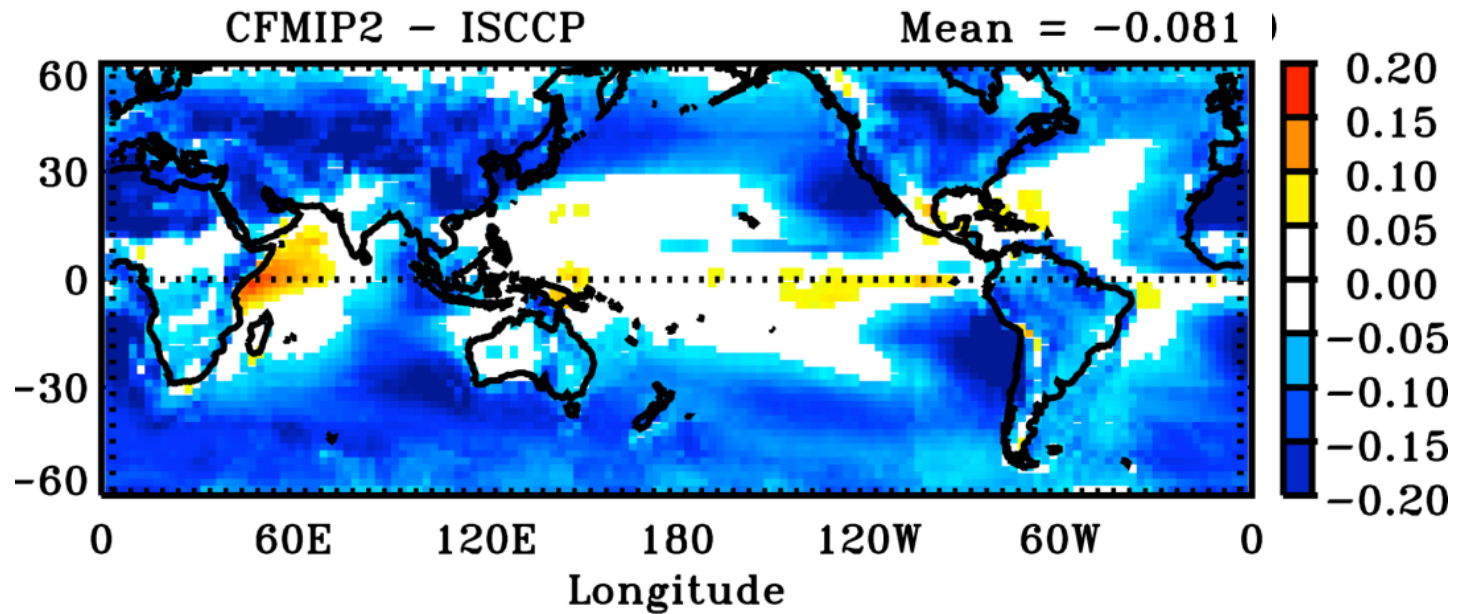
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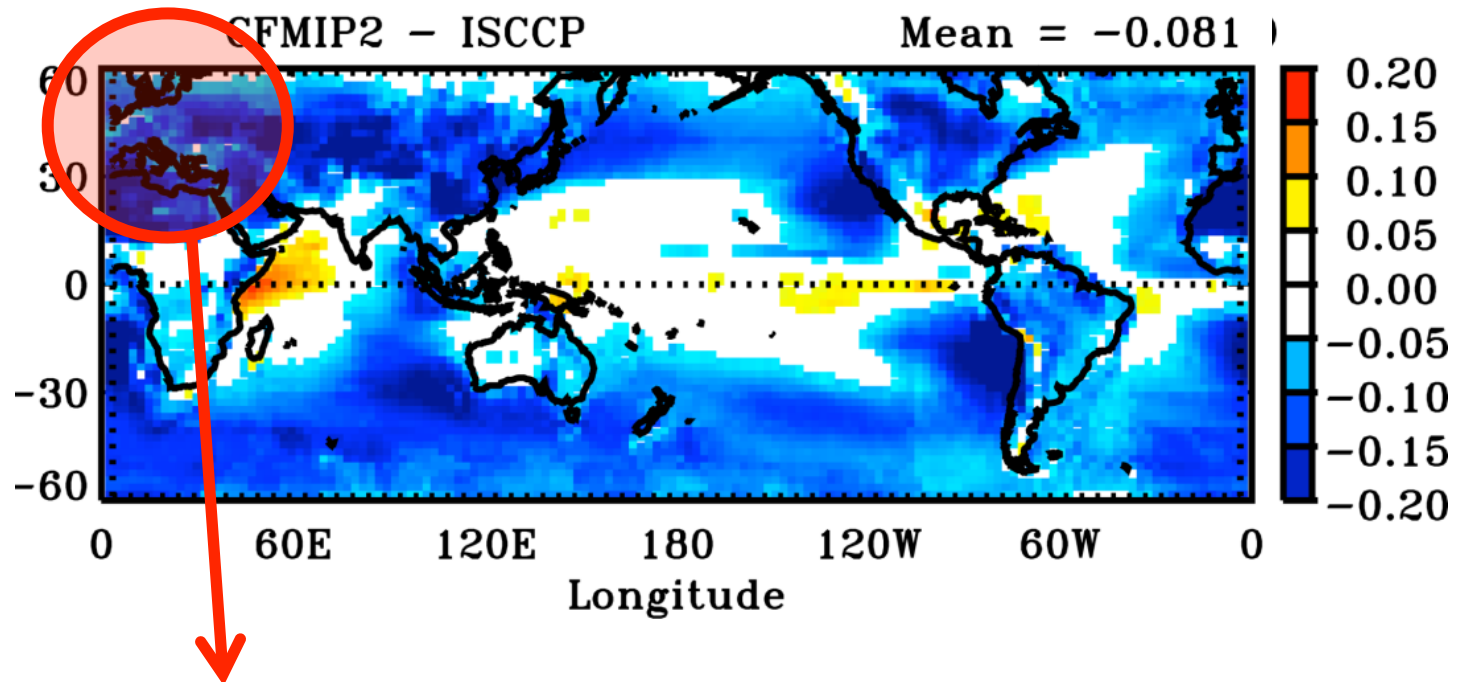
Uncertainty in Climate Models

Bias in global cloud cover against observations (ISCCP)



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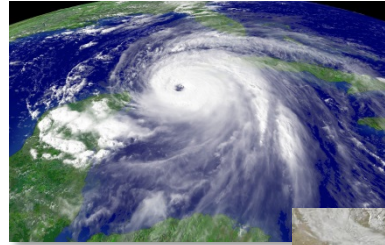
**Severe underestimation of cloudiness
in global models**

Does Higher Resolution Help?

Global Models



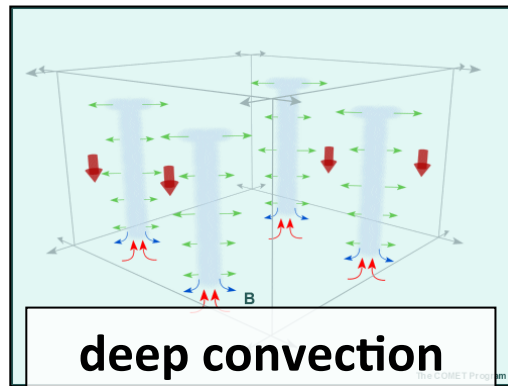
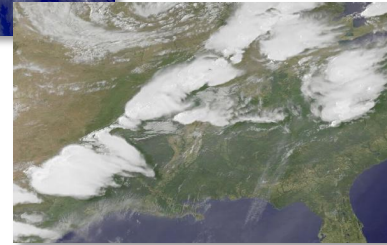
Δ 200 km



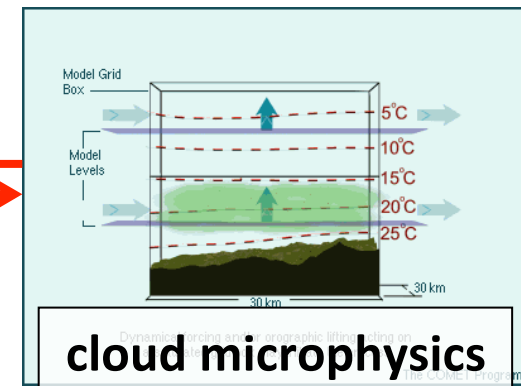
Regional Models



Δ 20 km



dynamical core

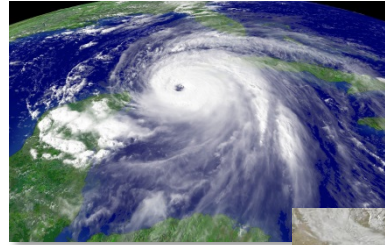


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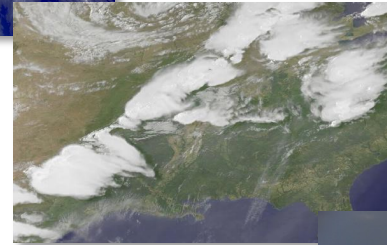
$\Delta 200$ km



Regional Models



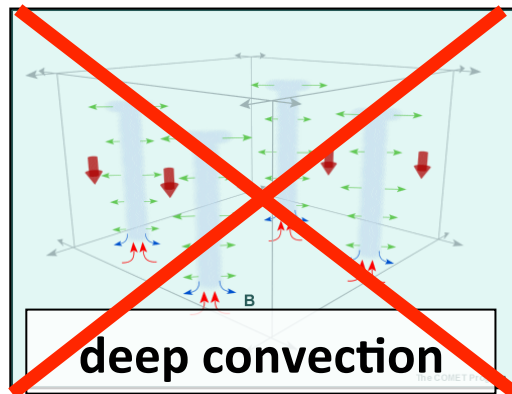
$\Delta 20$ km



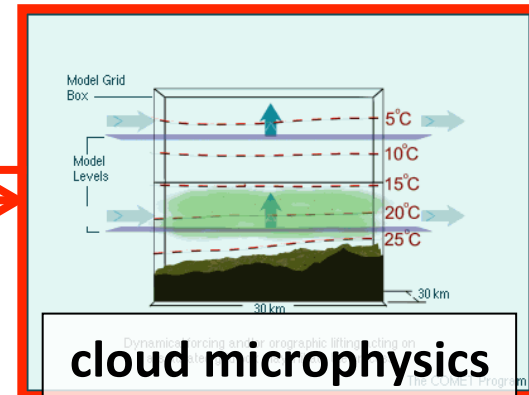
High-Resolution Models



$\Delta 2$ km



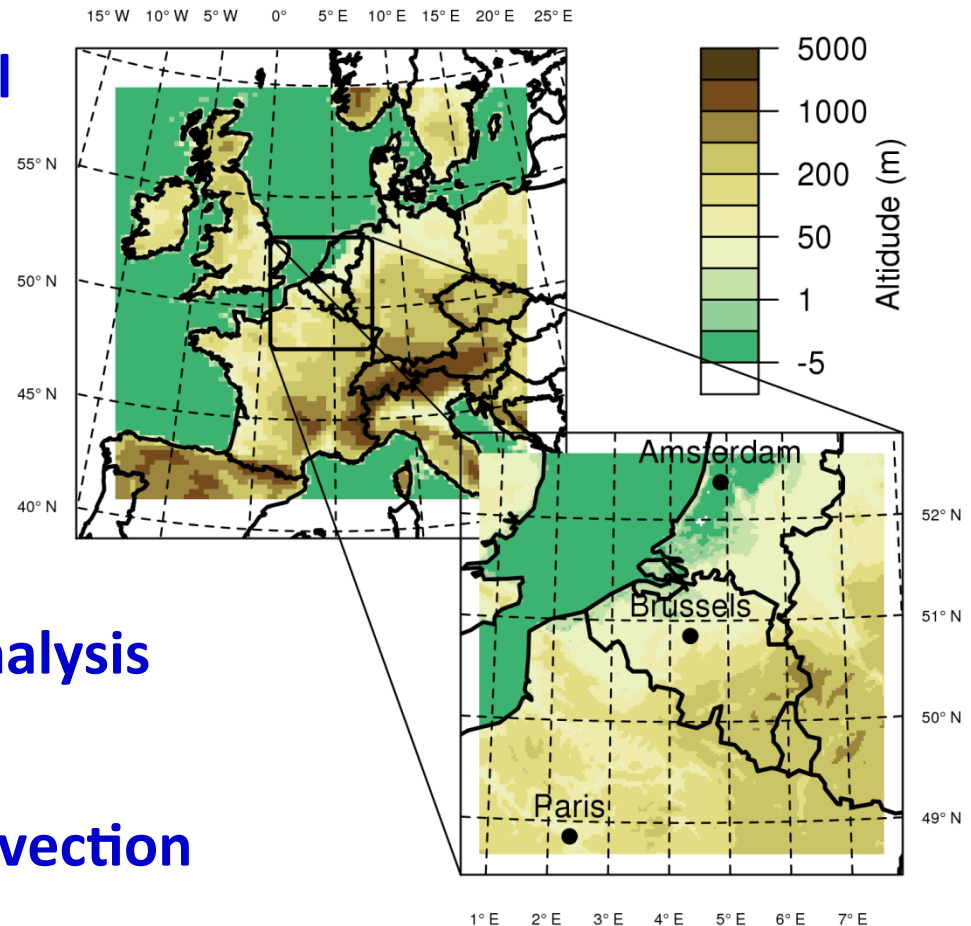
dynamical core



10-year High-Resolution Climate Simulation

- Cosmo – CLM (CCLM) model
- Limited Area (500^2 km^2)
- High Resolution ($\Delta x \sim 3\text{km}$)
- Run for 2000-2010

- Driven by ERA-Interim Reanalysis
- Three nesting levels
- No parameterization of convection



Evaluation – ISCCP approach

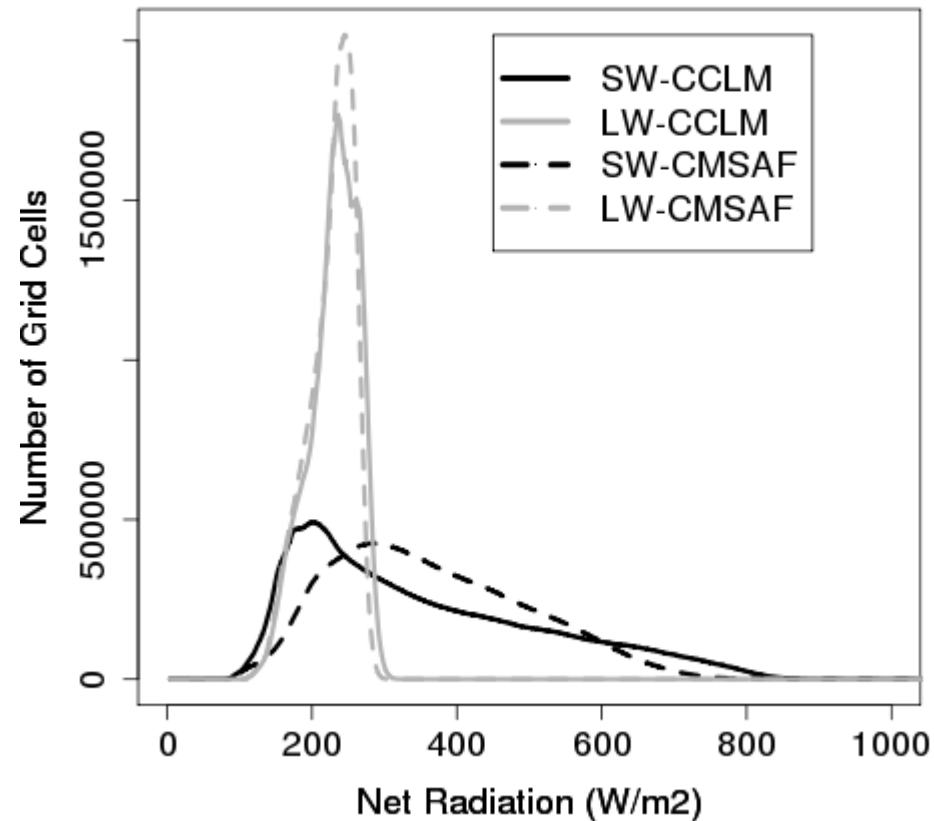
- Focus on Clouds and Radiation
- Using CMSAF data from 2004-2010
- Hourly CMSAF COT, CTP and TOA regridded to CCLM grid

ISCCP classification approach:
9 cloud classes based on COT
and CTP

	Ci	Cs	Cb
440	Ac	As	Nb
680	Cu	Sc	St
	3.6	23	
	COT		

Top-of-the-Atmosphere Radiation

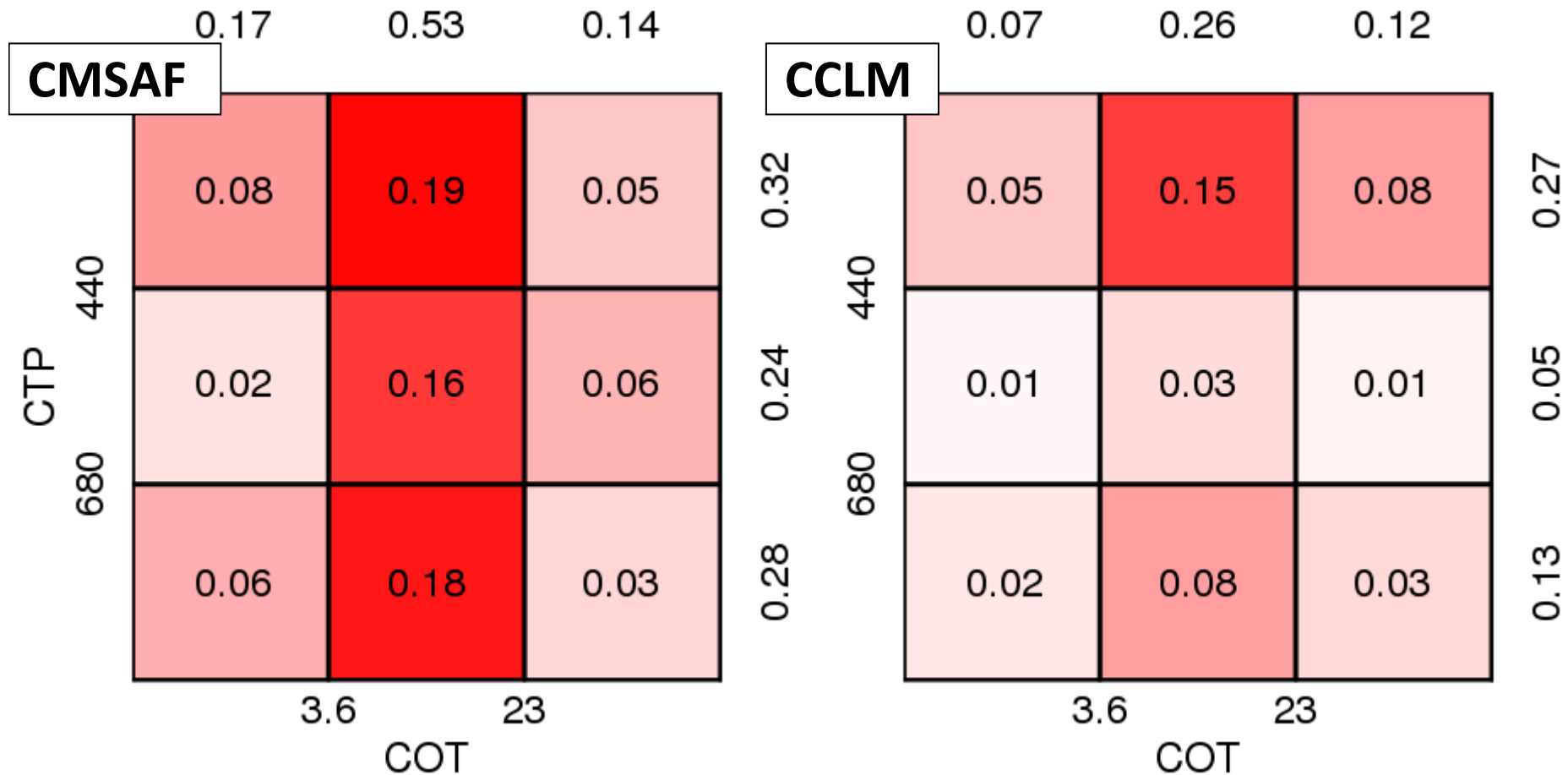
Histograms of summer TOA radiation fields in CCLM and CMSAF (7 years of data)



→ Mean TOA radiation is well captured, but CCLM is too binary in the shortwave

ISCCP Cloud Classes

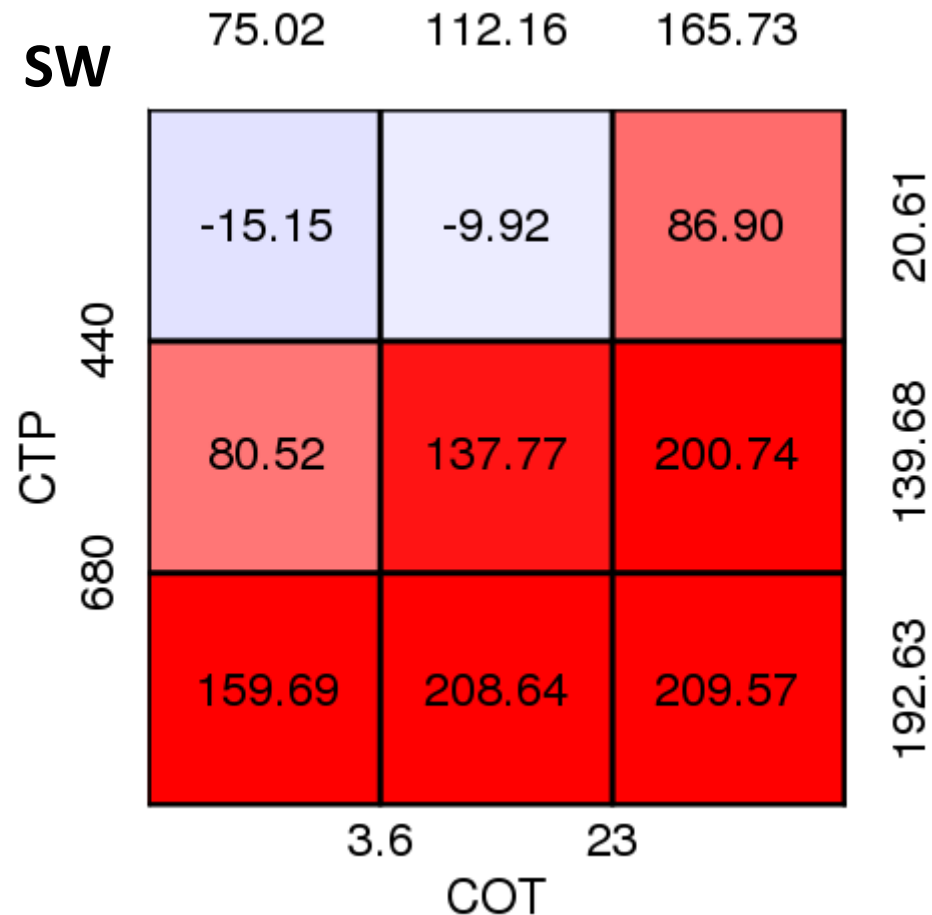
Mean summer cloud fraction in CMSAF and CCLM for all 9 ISCCP cloud classes



→ Huge underestimation of low and mid-level clouds

ISCCP Cloud Classes

Bias in mean summer TOA SW net radiation (W/m^2) by all 9 cloud classes (CCLM-CMSAF)



... lack of clouds compensated by too reflective clouds!

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 - **Biases in cloud cover are compensated by too reflective clouds**
Too much shortwave radiation is backscattered by low and mid-level clouds
Hence the well captured overall TOA cloud properties
- **Long-term and high-resolution satellite data are indispensable to measure progress in climate models!**

Thanks!

