CMUG Achievements

Met Office Hadley Centre

SMHI

Sciences de l'environnement Institut Pierre Simon Laplace

DLR

METEO FRANCE Toujours un temps d'avance

Max-Planck-Institut für Meteorologie

ECMWF

plus:

BSC

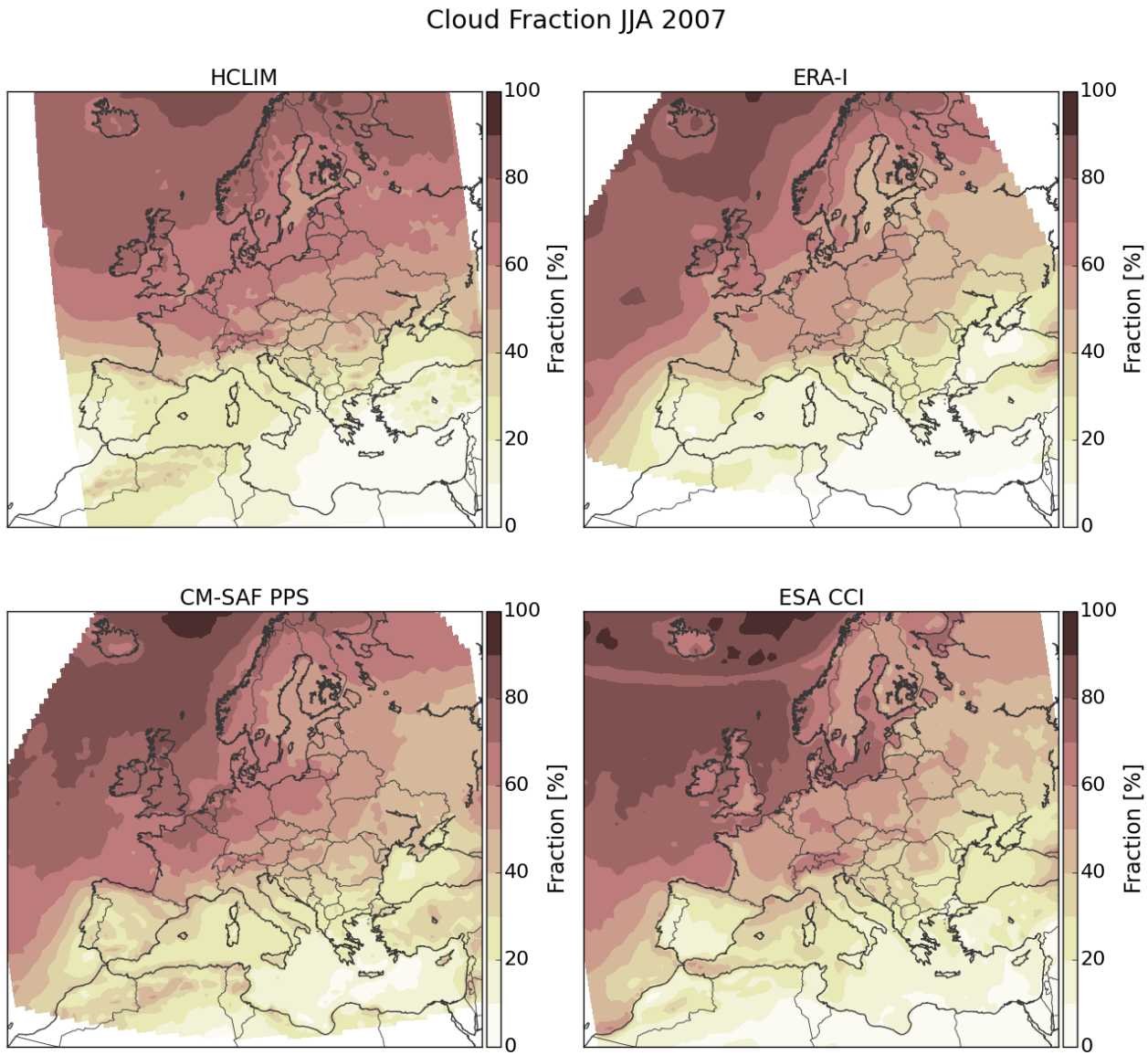
LMU

www.cci-cmug.org

CMUG Programme of work

		SST	SSH	Seaice	OC	Cloud	Ozone	Aerosol	GHG	LC	SM	Fire	Glacier								
WP	Model	Ocean				Atmosphere				Land				Experiment Type	UKMO	ECMWF	MPIM	IPSL	DLR	SMHI	METFR
Task 3 Assessing consistency and quality of CCI products																					
3.1	FOAM	X	X	X	X									Assimilation	15						
O3.1	NEMOVAR, ORA	X	X	X	X									Assimilation and Detection		15					
3.2	ERA-Clim						X							Assimilation		15					
3.3	MACC-II						X	X	X					Assimilation		9					
3.4	JSBACH, TM3								X	X	X	X		Assimilation			24				
O3.4	EC-Earth/CMIP5	X				X	X	X	X		X			Assessment, evaluation						8	
3.5	LMDz, ORCHIDEE								X	X	X	X		Boundary Condition				12			
3.6	MPI-OM, MPI-ESM	X		X	X	X								Assimilation (Polar Regions)			12		6		
3.7	EMAC-MADE					X		X						Comparison					5		
3.8	RCA HARMONIE	X				X					X			Comparison/Eval (CORDEX Africa)						11	
3.9	Arctic HYPE		X							X			X	Assessment						5	
3.10	CNRM-RCM	X	X			X		X			X			Comparison (Med CORDEX)							6
Task 4 Exploiting CCI products in MIP experiments																					
4.1	CNRM-CM, Arpege	X		X				X		X	X	X		Boundary Cond							6
4.2	IPSL-ESM	X		X										Boundary Cond				3			
O4.2	EC-EARTH	X		X										Boundary Condition						6	
Task 5 Adaption of climate evaluation tools for CCI needs																					
5.1	ESMVal	X		X				X		X	X	X		Tech ESMVal CMPI6 + metrics			14		11		
O5.1	ESMValTool	X	X		X		X	X	X		X			ESMValTool + metrics	8		3		6	8	
5.2	CMF	X	X	X	X	X	X	X	X					Web interface CMF		14					
O5.2	Benchmarking	X		X	X	X	X	X	X	X	X	X		ESMValTool + metrics	1		4		3		
Task 1,2,6,7																					
1	Meeting the needs o the climate modelling community														0.6	0.4	0.4	0.4	0.4	0.4	0.3
2	Feedback to ESA and CCI teams														1	0.5	0.5	0.5	0.5	0.5	0.5
6	Coordination and outreach														4	1	1	1	1	1	1
7	Interface with clim service														1	1	0.3	0.2	0	0.2	0.2

Cloud


Cloud Fraction JJA 2007
HCLIM
ERA-I
CM-SAF PPS
ESA CCI
Fraction [%]
100
80
60
40
20
0

Ozone

- Observation uncertainties compare well in structure with estimates obtained using the Desroziers et al (2005) method
- All the products exhibit negligible to very small biases
- All of the assessed O3-CCI datasets lead to improved ozone analyses
- For RR assimilation exercises, with the exception of OMI TCO3, the O3-CCI retrievals seem to better constrain the ozone analyses than retrievals obtained from the same radiances using alternative algorithms
- The assimilation of the GOME-2 NPO3 show a clear improvement in the internal consistency of the data assimilation system in terms of better fit to the AIRS ozone-sensitive IR channels which gives a statistically significant reduction in the RMS of the geopotential forecast errors in the tropics

Ozone: main CMUG results

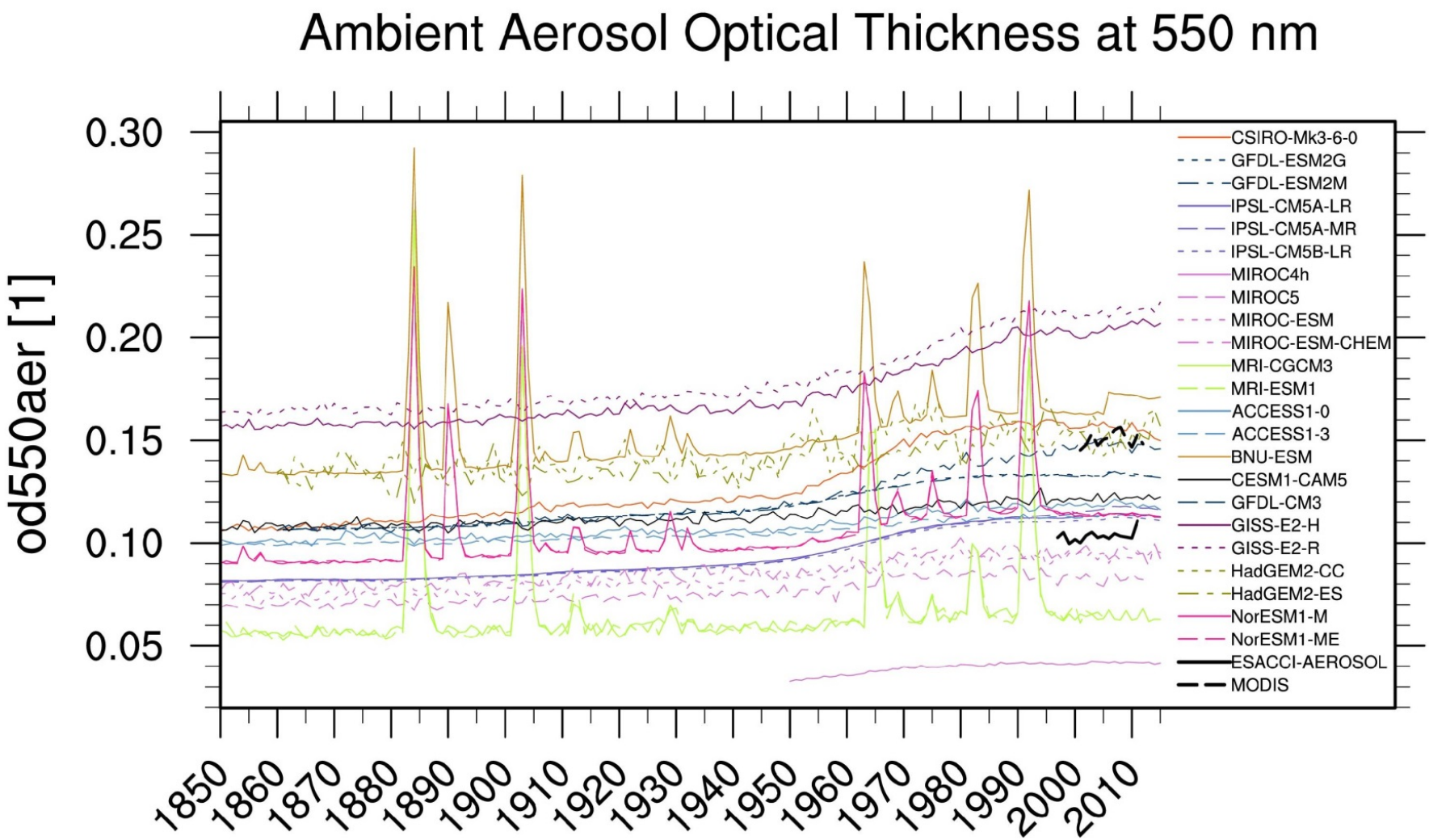
	TCO_3			NPO_3		LPO_3		Recommend-ation
GOME	CCI			CCI		/		**CCI NP**
GOME-2	O_3M SAF	CCI		O3M SAF+	CCI	/		**CCI NP**
SCIA	KNMI	CCI		CCI§		ESA$		**CCI**
OMI	KNMI	NASA	CCI	CCI§		/		**KNMI**
MIPAS	/			/		ESA	CCI	**CCI**

+ Not assessed based on previous runs that led to –ve impact.

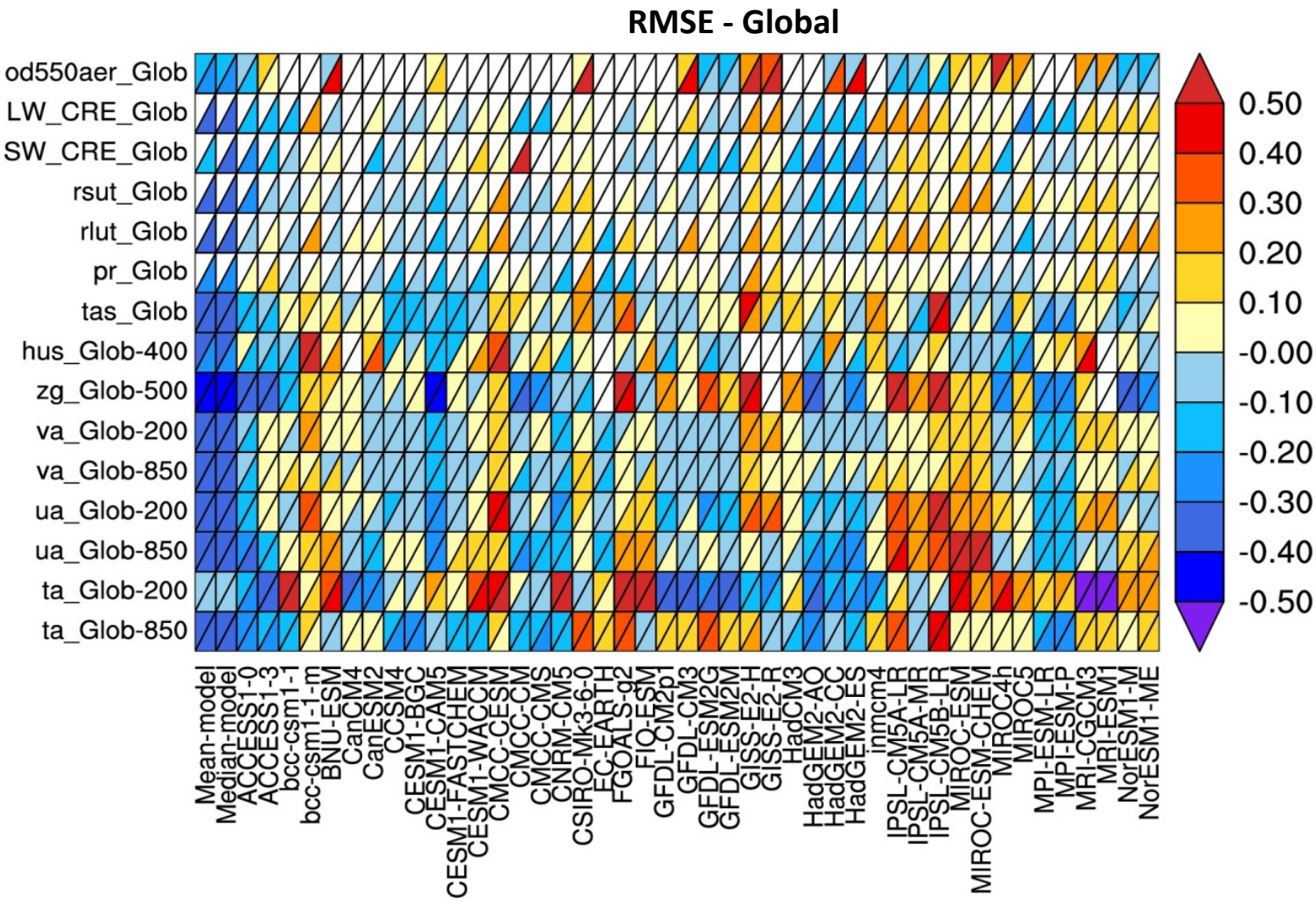
§ Data not yet available.

$ Not assessed based on data assessment results (Dragani, 2012).

Aerosol

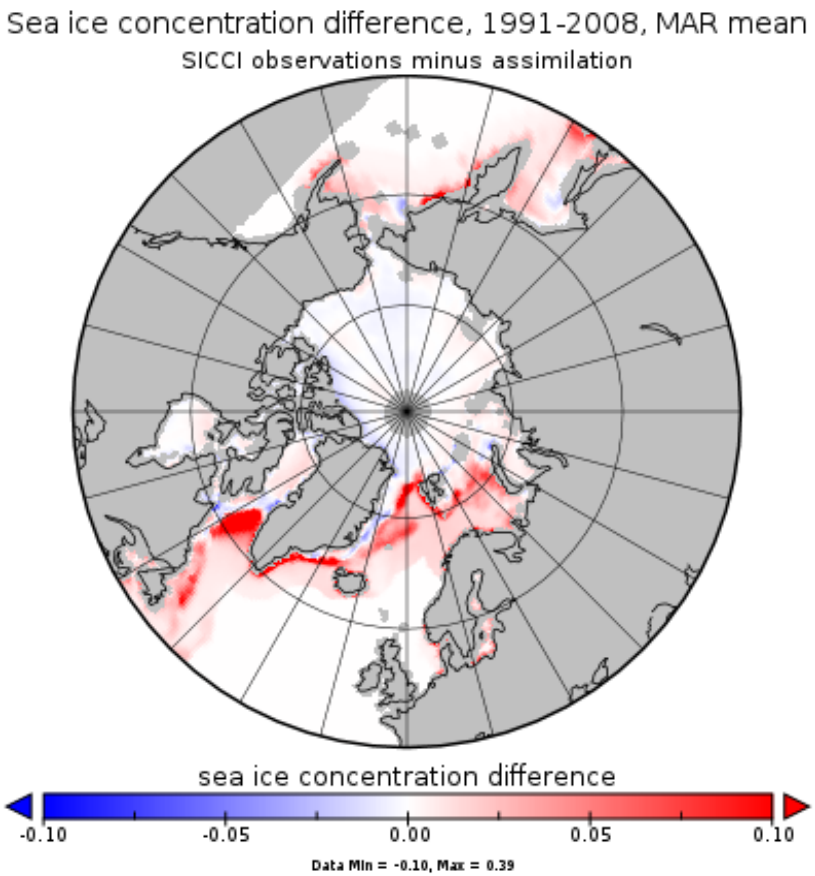

Ambient Aerosol Optical Thickness at 550 nm
od550aer [1]
0.30
0.25
0.20
0.15
0.10
0.05
1850
1860
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
CSIRO-Mk3-6-0
GFDL-ESM2G
GFDL-ESM2M
IPSL-CM5A-LR
IPSL-CM5A-MR
IPSL-CM5B-LR
MIROC4h
MIROC5
MIROC-ESM
MIROC-ESM-CHEM
MRI-CGCM3
MRI-ESM1
ACCESS1-0
ACCESS1-3
BNU-ESM
CESM1-CAM5
GFDL-CM3
GISS-E2-H
GISS-E2-R
HadGEM2-CC
HadGEM2-ES
NorESM1-M
NorESM1-ME
ESACCI-AEROSOL
MODIS

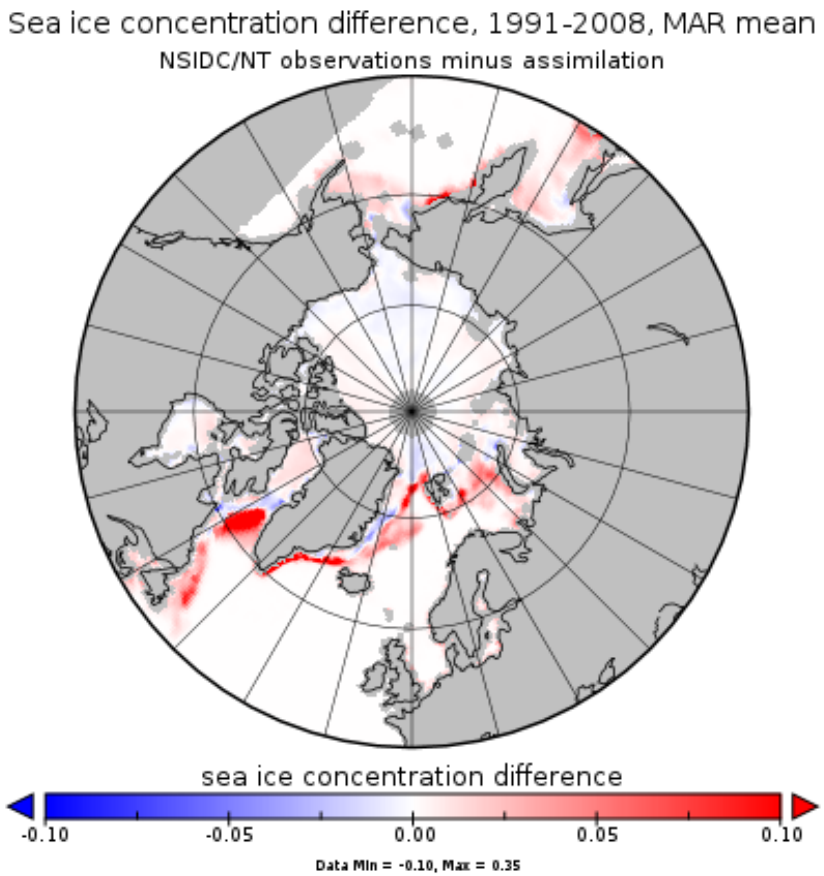
Aerosol



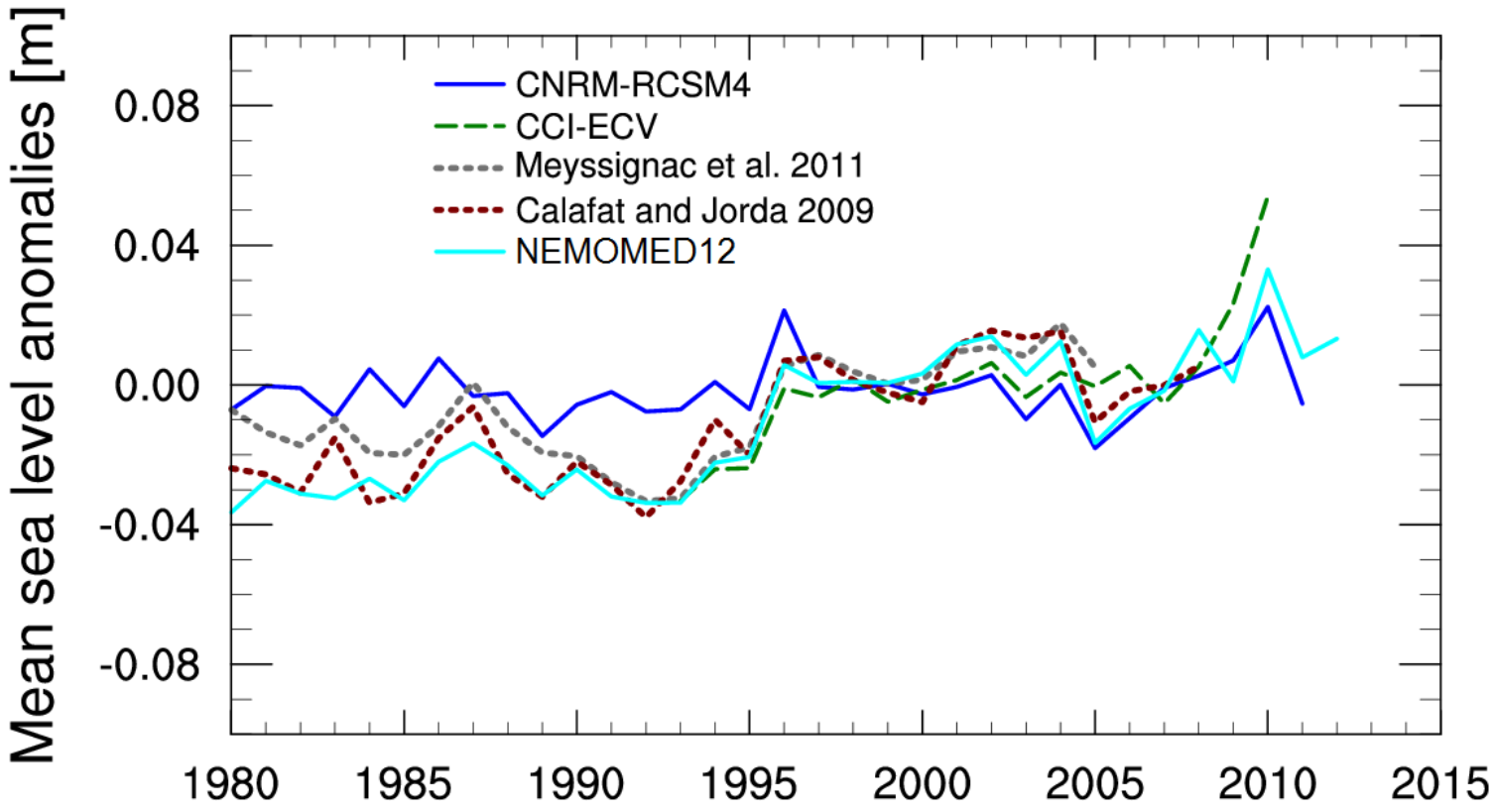
http://www.geosci-model-dev-discuss.net/8/7541/2015/gmdd-8-7541-2015.html

Sea Ice

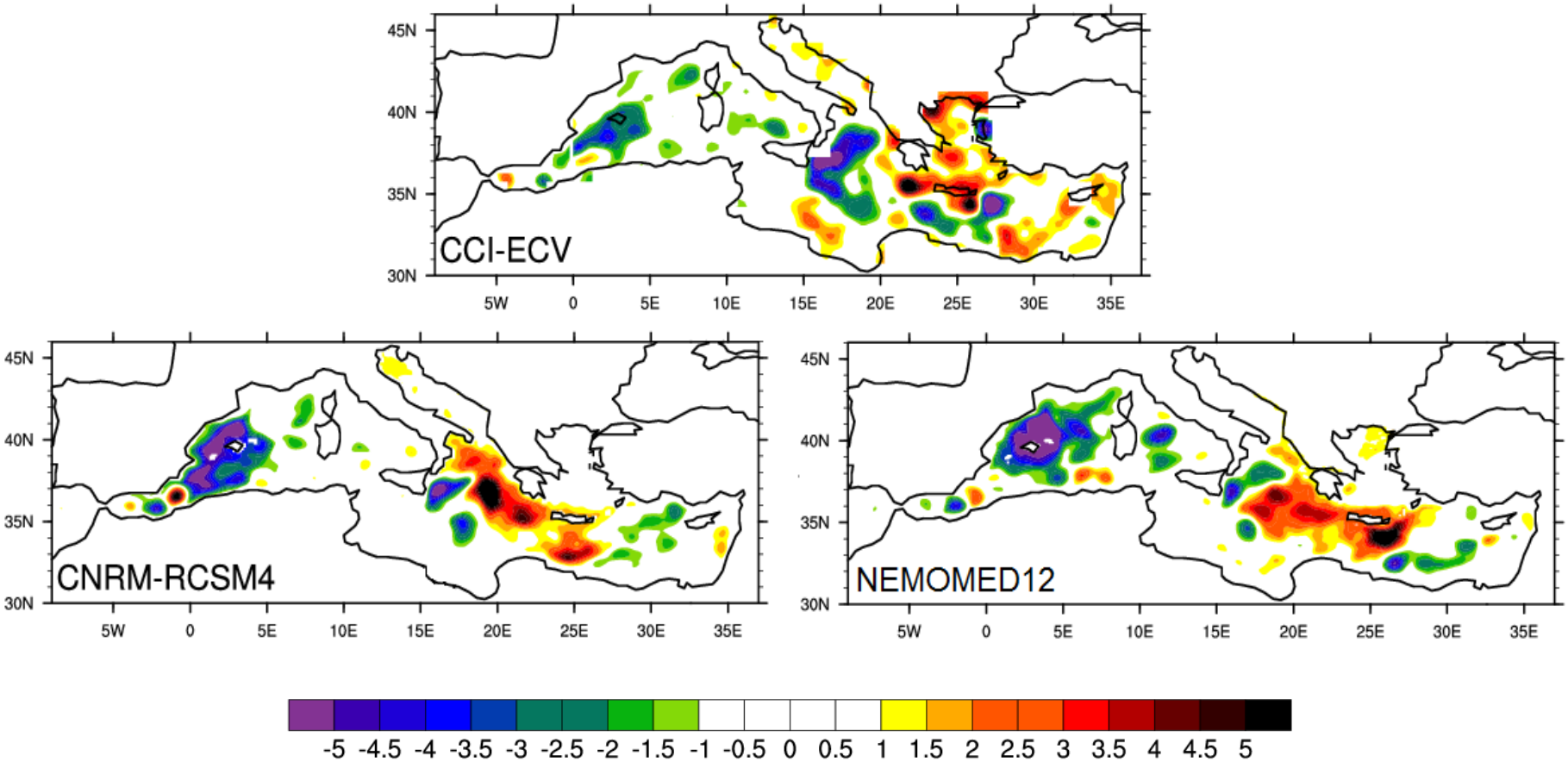

Sea ice concentration difference, 1991-2008, MAR mean
SICCI observations minus assimilation
sea ice concentration difference
-0.10
-0.05
0.00
0.05
0.10
Data Min = -0.10, Max = 0.39


Sea ice concentration difference, 1991-2008, MAR mean
NSIDC/NT observations minus assimilation
sea ice concentration difference
-0.10
-0.05
0.00
0.05
0.10
Data Min = -0.10, Max = 0.35

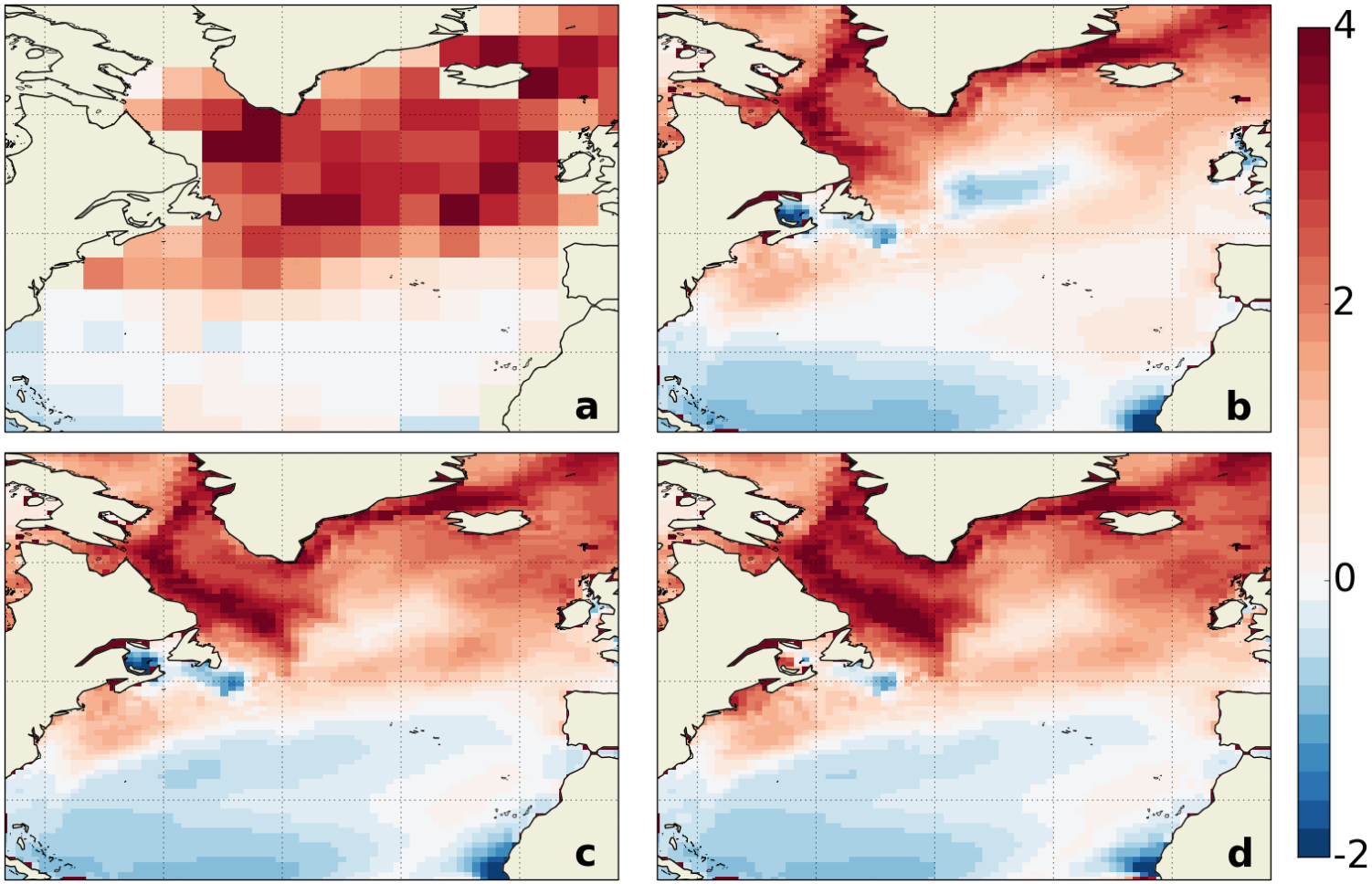
Sea Surface Height



Sea Surface Height



Ocean Colour



Ocean Colour: main CMUG results

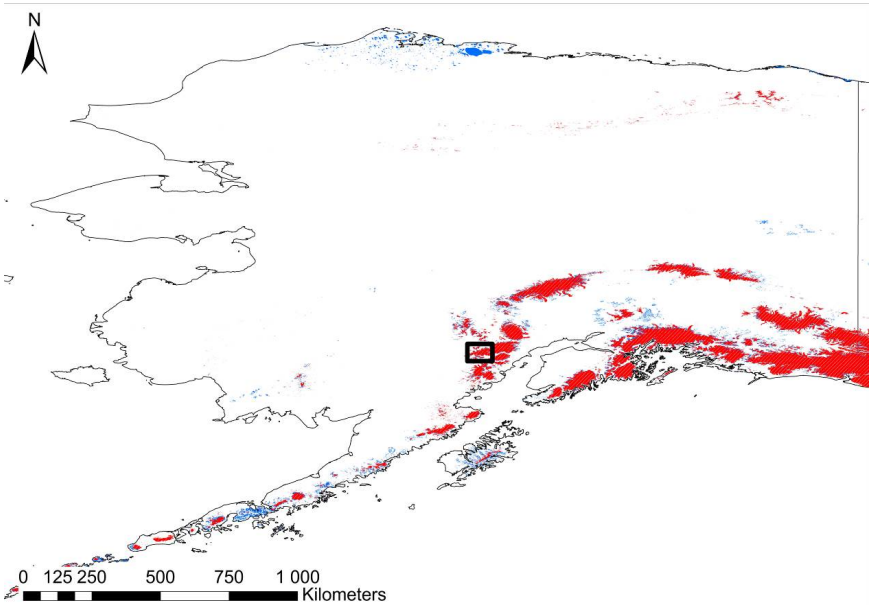
- The data assimilation improves the fit of model chlorophyll to both the assimilated data and independent in situ observations. Improvements are seen throughout the water column, including to deep chlorophyll maxima.

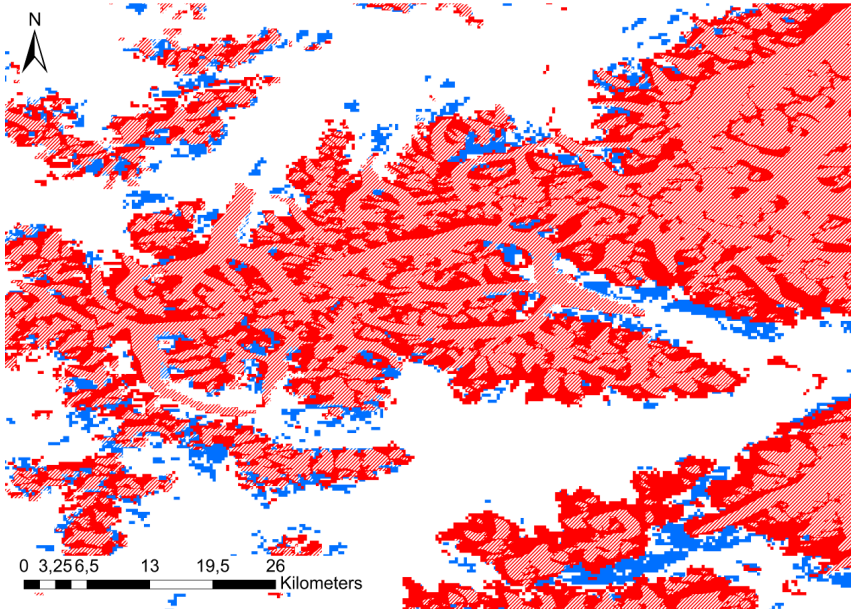
- The impact on the carbon cycle is small overall, but beneficial in areas of high biological activity.

- The reanalyses are able to capture real-world variability on different timescales.

- OC-CCI and GlobColour data give very similar results, and both products are fit for purpose. However, the OC-CCI data show improved coverage and stability, which leads to better results in some areas.

Glaciers



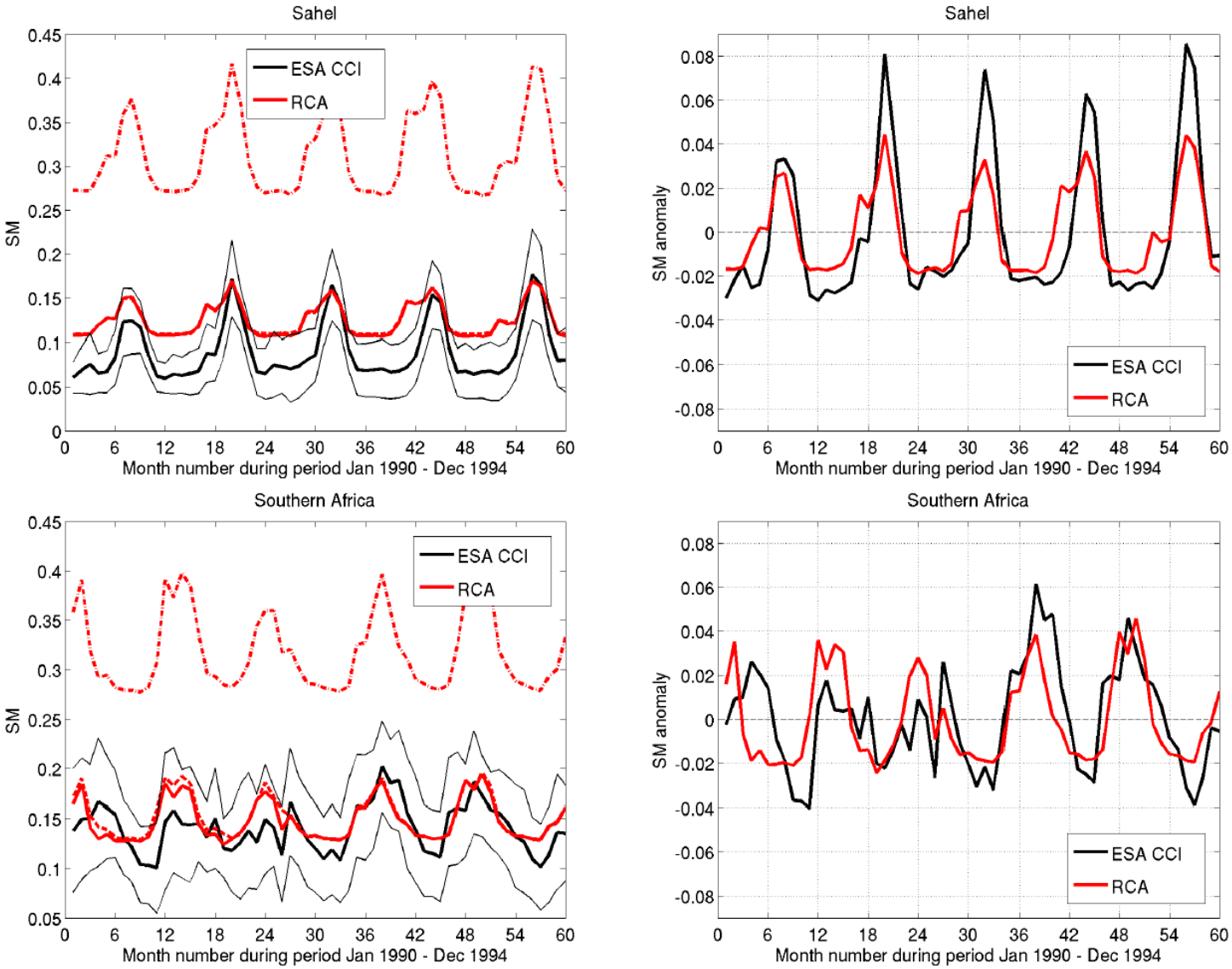


Globcover v.2.2

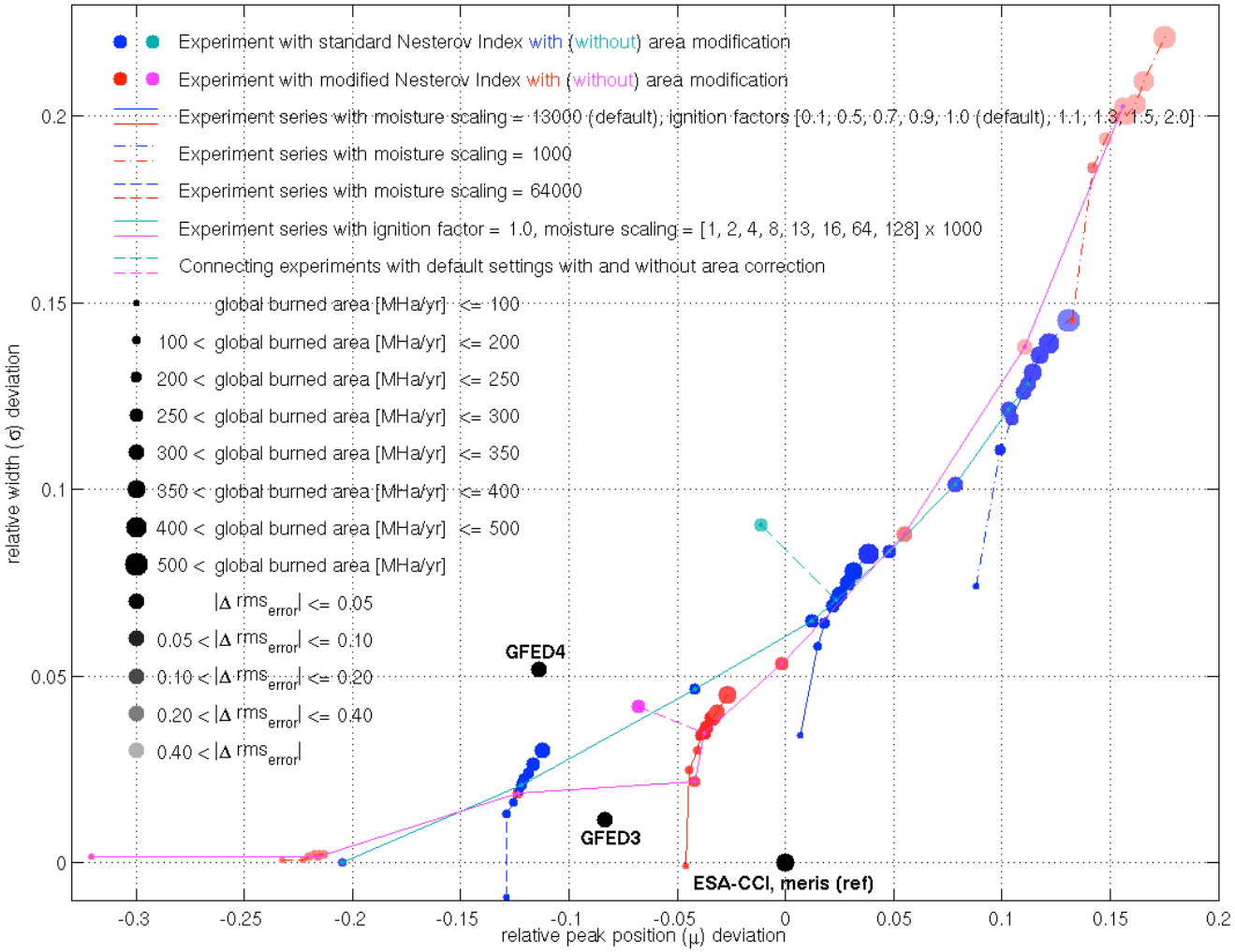
ESA CCI LU 2010 v 1.4

RGI v4.0

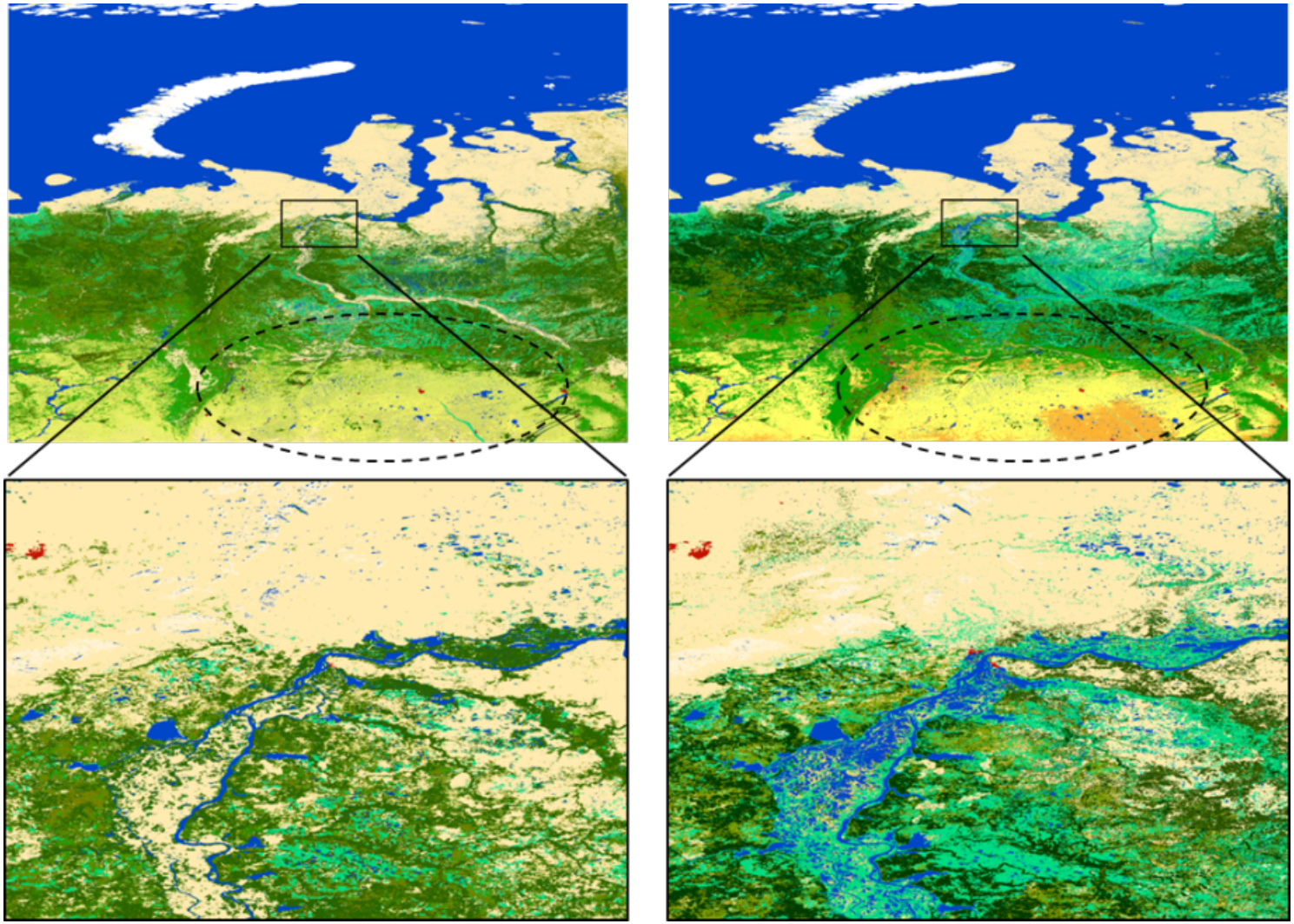
Soil Moisture



Fire


Experiment with standard Nesterov Index with (without) area modification
Experiment with modified Nesterov Index with (without) area modification
Experiment series with moisture scaling = 13000 (default), ignition factors [0.1, 0.5, 0.7, 0.9, 1.0 (default), 1.1, 1.3, 1.5, 2.0]
Experiment series with moisture scaling = 1000
Experiment series with moisture scaling = 64000
Experiment series with ignition factor = 1.0, moisture scaling = [1, 2, 4, 8, 13, 16, 64, 128] x 1000
Connecting experiments with default settings with and without area correction
global burned area [MHa/yr] <= 100
100 < global burned area [MHa/yr] <= 200
200 < global burned area [MHa/yr] <= 250
250 < global burned area [MHa/yr] <= 300
300 < global burned area [MHa/yr] <= 350
350 < global burned area [MHa/yr] <= 400
400 < global burned area [MHa/yr] <= 500
500 < global burned area [MHa/yr]
|Δ rms_error| <= 0.05
0.05 < |Δ rms_error| <= 0.10
0.10 < |Δ rms_error| <= 0.20
0.20 < |Δ rms_error| <= 0.40
0.40 < |Δ rms_error|
GFED4
GFED3
ESA-CCI, meris (ref)
relative width (σ) deviation
relative peak position (μ) deviation
0.2
0.15
0.1
0.05
0
-0.3
-0.25
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
0.15
0.2

Land Cover



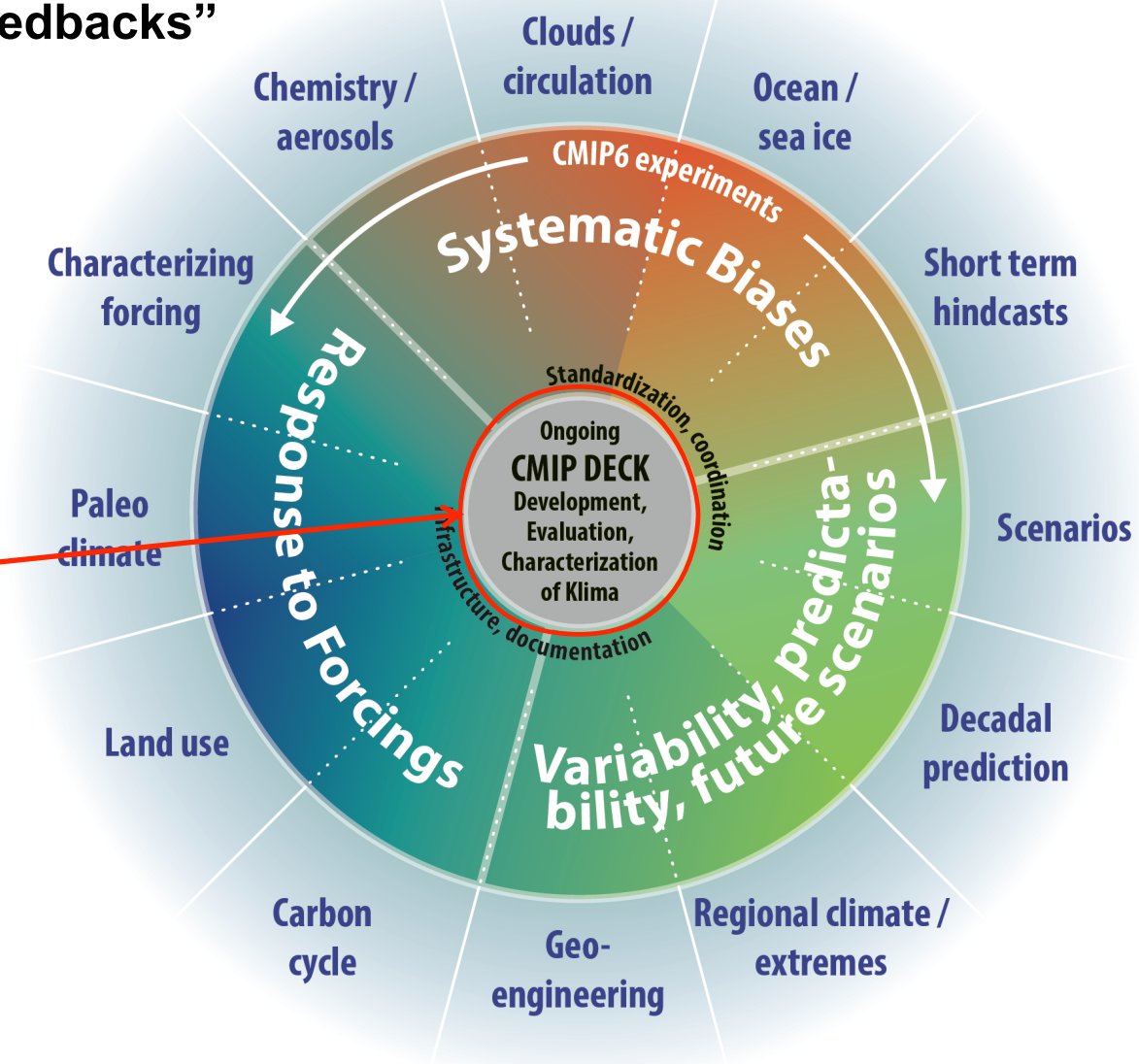
CMUG cross cutting results

- Consistency
- Uncertainty
- Climate processes
- Other (data, masks, algorithms)

WCRP Grand Challenges: (1) Clouds, circulation and climate sensitivity, (2) Changes in cryosphere, (3) Climate extremes, (4) Regional climate information, (5) Regional sea-level rise, and (6) Water availability, plus an additional theme on "biospheric forcings and feedbacks"

Goal

ESMValTool as one of the CMIP documentation functions to routinely assess the performance of CMIP DECK and CMIP6 simulations running alongside the ESGF

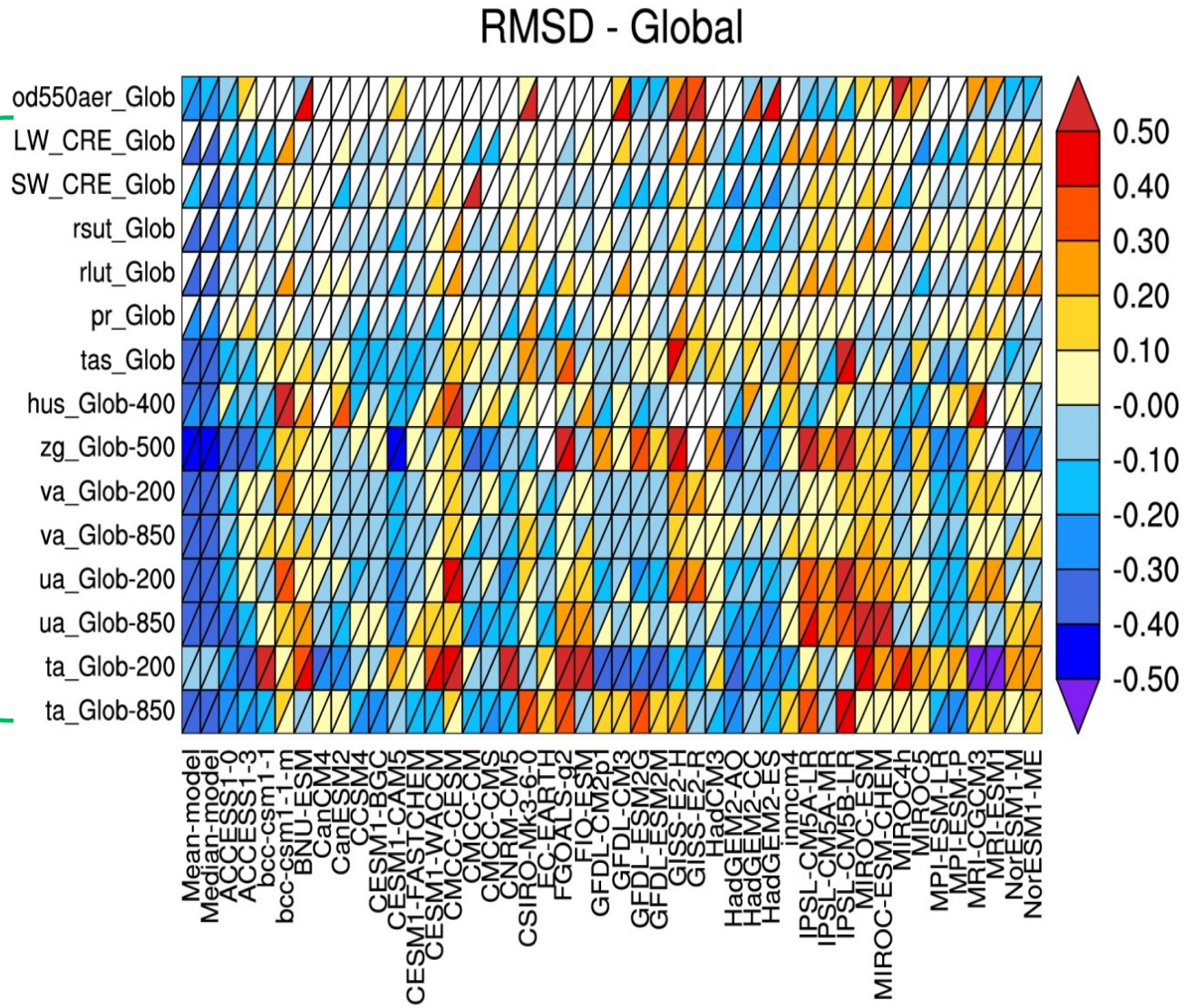


Meehl et al., EOS, 2014

Performance Metrics for Climate Models

CCI Aerosol optical depth

Relative error measures of CMIP5 model performance, based on the global seasonal-cycle climatology (1980–2005) computed from the historical CMIP5 experiments. Figure 9.8 of IPCC AR5 (Flato et al., 2013).



Conclusions

- CMUG Phase 1 results are written up
- CMUG Phase 2 results arriving now
- Good dialogue between CMUG CRG and Science Leads
- Good interactions between CMUG and external actors
- Think integration!

CMUG Integration 6

Early / mid-April 2016

LMU, Munich, Germany

Paper on ESMVal tool

Eyring, V., Righi, M., Evaldsson, M., Lauer, A., Wenzel, S., Jones, C., Anav, A., Andrews, O., Cionni, I., Davin, E. L., Deser, C., Ehbrecht, C., Friedlingstein, P., Gleckler, P., Gottschaldt, K.-D., Hagemann, S., Juckes, M., Kindermann, S., Krasting, J., Kunert, D., Levine, R., Loew, A., Mäkelä, J., Martin, G., Mason, E., Phillips, A., Read, S., Rio, C., Roehrig, R., Senftleben, D., Sterl, A., van Ulft, L. H., Walton, J., Wang, S., and Williams, K. D.: **ESMValTool (v1.0) – a community diagnostic and performance metrics tool for routine evaluation of Earth System Models in CMIP, Geosci. Model Dev. Discuss.**, 8, 7541-7661, doi: 10.5194/gmdd-8-7541-2015, 2015.

http://www.geosci-model-dev-discuss.net/8/7541/2015/gmdd-8-7541-2015.html