

Effects of GCM selection for regional climate modelling illustrated by the interactive tool GCMeval

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Norwegian Meteorological Institute

> You can also view a video of this presentation, including a demonstration of the GCMeval tool: <u>https://www.youtube.com/watch?v=_jesUT5wsSY</u>

Motivation

Large number of GCMs. Dynamical downscaling requires selection. Considerations:

- Selection is sometimes subjective or biased
- Sensitivity to choices in selection process
- Representation of present-day climate
- Spread of future outcomes

Our proposal:

- Interactive online tool
- User-selectable weights \rightarrow clarifying sensitivity
- Ranking based on performance for present-day climate
- Scatter plots illustrating spread of full ensemble and selected members



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GCMeval options

Focus regions: 33 IPCC AR5 reference regions

Weights:Focus region (Primary, Secondary),Variable (Temperature, Precipitation),Seasons,Skill scores (Bias, Spatial correlation, Spatial SD ratio, RMSE of annual cycle)

Scenarios: CMIP5 (RCP4.5, RCP8.5), CMIP6 (SSP585)

Time periods: 1981-2010, 2021-2050, 2071-2100

Reference data: ERA-Interim, ERA5, GPCP (precipitation)

Ranking

Based on

- user-selected weights (see previous slide)
- present-day climate (1981-2010)

But: Ranking is sensitive

Interactive tool helps show sensitivity

Including other metrics may give different results

	CMIF5.MIROC5.1211P1	50
	CMIP5.MIROC5.r3i1p1	50
	CMIP5.MPI_ESM_LR.r1i1p1	23
	CMIP5.MPI_ESM_LR.r2i1p1	24
	CMIP5.MPI_ESM_LR.r3i1p1	27
	CMIP5.MPI_ESM_MR.r1i1p1	30
	CMIP5.MRI_CGCM3.r1i1p1	49
	CMIP5.NorESM1_M.r1i1p1	29
	CMIP5.NorESM1_ME.r1i1p1	40
	CMIP6.BCC_CSM2_MR.r1i1p1f1	82
	CMIP6.CAMS_CSM1_0.r1i1p1f1	83
	CMIP6.CAMS_CSM1_0.r2i1p1f1	85
	CMIP6.CanESM5.r1i1p1f1	35
	CMIP6.CanESM5.r2i1p1f1	37
	CMIP6.CESM2_WACCM.r1i1p1f1	2
	CMIP6.CESM2.r1i1p1f1	4
i	CMIP6.CESM2.r2i1p1f1	3
	CMIP6.EC Earth3 Veg.r1i1p1f1	18

Demonstration

https://gcmeval.met.no



"Post-hoc" evaluation of CORDEX GCM selection

Selecting GCMs used in Euro-CORDEX

How well does the current GCM ensemble capture spread of full CMIP5 ensemble?

Selection: North Europe, Central Europe

	r ealisation i nitialisation p hysics
CanESM2	r1i1p1
CNRM-CM5	r1i1p1, (r8i1p1)
EC-EARTH	(r1i1p1), (r3i1p1), r12i1p1
HadGEM2-ES	r1i1p1
IPSL-CM5A-MR	r1i1p1
MIROC5	r1i1p1
MPI-ESM-LR	r1i1p1, r2i1p1
NorESM1-M	r1i1p1



"Post-hoc" evaluation of CORDEX GCM selection

Annual mean climate change in North Europe [NEU:11] Present day (1981-2020) to far future (2071-2100)



"Post-hoc" evaluation of CORDEX GCM selection

Annual mean climate change in Central Europe [CEU:12] Present day (1981-2020) to far future (2071-2100)



CORDEX South America



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But no selected models with precip. increase on west coast.

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Limitations

- Analysis of monthly means, so cannot say anything about daily or sub-daily statistics
- Pre-defined regions (IPCC AR5) may or may not correspond to your region of interest
- Currently using scenarios RCP4.5, RCP8.5 and SSP585
- Not all models (but more added)

Nevertheless, we hope you may find this tool useful, for example for getting an initial overview before downloading model data and making your own detailed analysis.

More information

Use GCMeval online now: <u>https://gcmeval.met.no</u>

Source code available on Github: http://github.com/metno/gcmeval

Peer-reviewed article in Climate Services: https://doi.org/10.1016/j.cliser.2020.100167 (open access)

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GCMeval – An interactive tool for evaluation and selection of climate model ensembles

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Abstract

We present an interactive tool for selection and evaluation of global climate models. The tool is implemented as a web application using the "Shiny" R-package and is available at https://gcmeval.met.no. Through this tool, climate models of the CMIP5 and CMIP6 ensembles can be ranked and compared based on their representation of the present climate, with user-determined weights indicating the importance of different regions, seasons, climate variables, and skill scores. The ranking can be