

Wind Europe Technology Workshop 2024 - Climate change session

Quantitative approach for climate model selection and application in WRA & EYA

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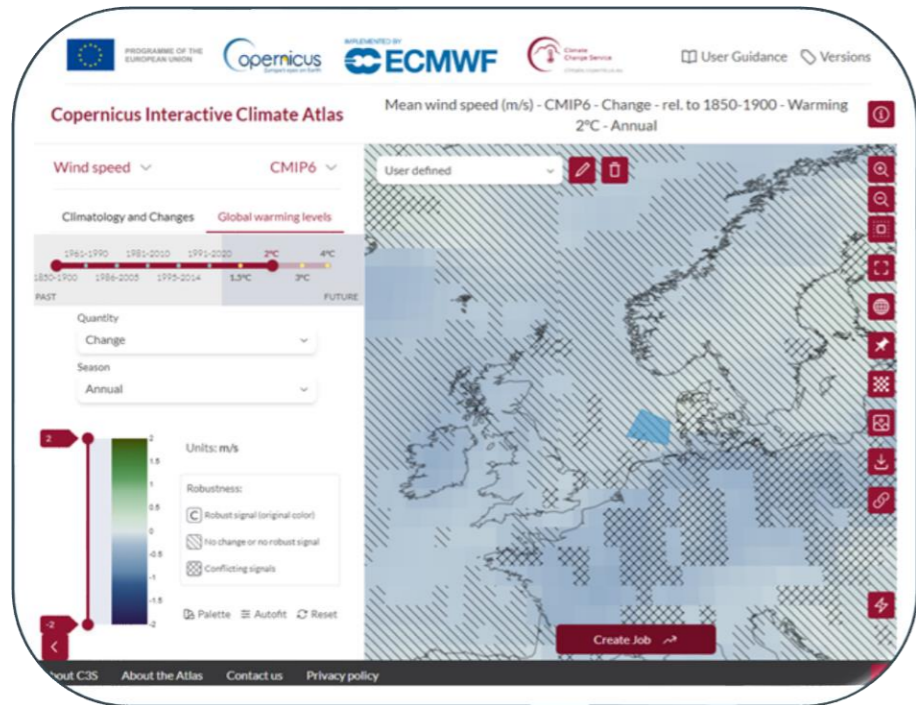
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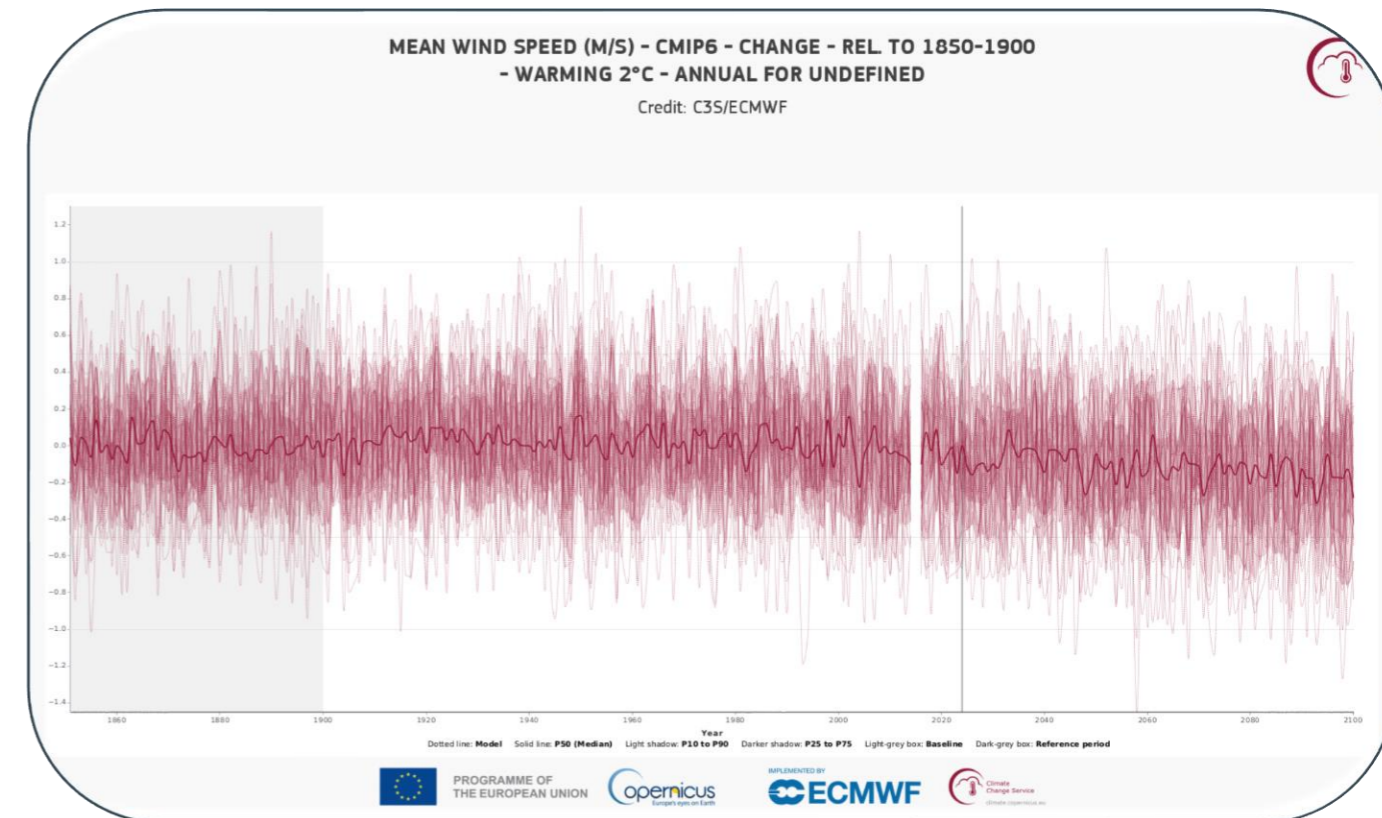


Introduction – Methodology – Results – Conclusions – Future Work



The effect of climate change on **wind speed** is often **unclear**.

Weak signal-to-noise ratio for all models



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Large number of models

+ Weak signal-to-noise ratio

= Risk of mistaking natural variability for climate change signal

Problem #1:

Which models should I choose at *my* site, based on what, and what for?

Problem #2:

Assess the change in **frequency and strength of extremes**



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3 Regions:

North Sea

USA East Coast

Taiwan

3 scenarios:

SSP2-4.5

SSP3-7.0

SSP5-8.5



A new CDS soon to be launched - expect some disruptions and watch this page for latest. Thank you.

Overview Download data Documentation

This catalogue entry provides daily and monthly global climate projections data from a large number of experiments, models and time periods computed in the framework of the sixth phase of the Coupled Model Intercomparison Project (CMIP6).

CMIP6 data underpins the Intergovernmental Panel on Climate Change 6th Assessment Report. The use of these data is mostly aimed at:

- addressing outstanding scientific questions that arose as part of the IPCC reporting process;
- improving the understanding of the climate system;
- providing estimates of future climate change and related uncertainties;
- providing input data for the adaptation to the climate change;
- examining climate predictability and exploring the ability of models to predict climate on decadal time scales;
- evaluating how realistic the different models are in simulating the recent past.

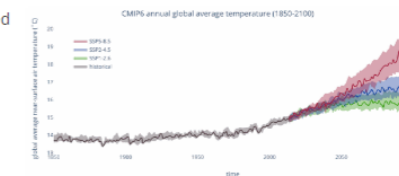
The term "experiments" refers to the three main categories of CMIP6 simulations:

- Historical experiments which cover the period where modern climate observations exist. These experiments show how the GCMs performs for the past climate and can be used as a reference period for comparison with scenario runs for the future. The period covered is typically 1850-2014.
- Climate projection experiments following the combined pathways of Shared Socioeconomic Pathway (SSP) and Representative Concentration Pathway (RCP). The SSP scenarios provide different pathways of the future climate forcing. The period covered is typically 2015-2100.

This catalogue entry provides both two- and three-dimensional data, along with an option to apply spatial and/or temporal subsetting to data requests. This is a new feature of the global climate projection dataset, which relies on compute processes run simultaneously in the ESGF nodes, where the data are originally located.

The data are produced by the participating institutes of the CMIP6 project.

DATA DESCRIPTION	
Data type	Gridded
Projection	Regular latitude-longitude grid, ocean grid
Horizontal coverage	Global
Horizontal resolution	Varies between models
Vertical coverage	Single levels, pressure levels (1 - 1000 hPa)
Temporal coverage	From 1850 to 2014 for historical experiments



Help

Get help

Licence

CMIP6 - Data Access - Terms of

Publication date

2021-03-23

References

Citation

Acknowledgement

DOI: 10.24381/cds.c866074c

Related data

CMIP5 daily data on pressure le

CMIP5 daily data on single level


CMIP5 monthly data on pressu

CMIP5 monthly data on single l

CMIP6 predictions underpinnin



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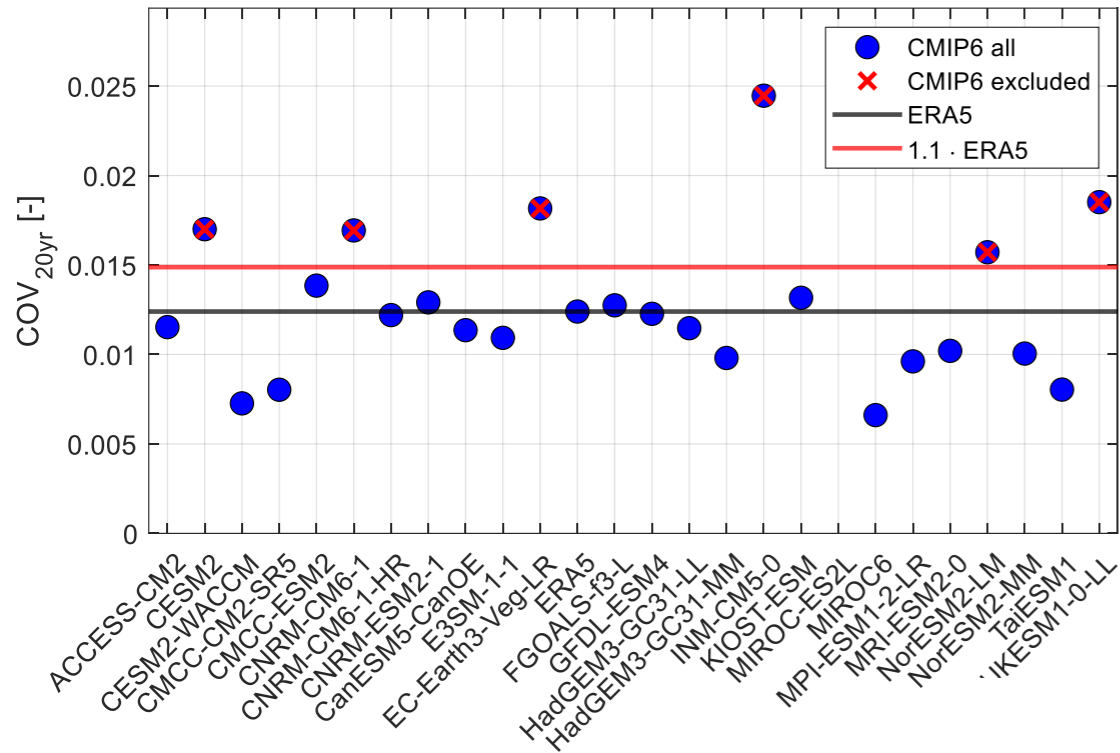
- Download all CMIP6 monthly- and daily data at the site, for all SSPs.
 - Compare the following metrics with ERA5:
 - a) Interannual variability (coefficient of variation)
 - b) Rolling average wind speed anomaly (sign and magnitude value of correlation coefficient)
 - c) Daily and monthly mean distributions (earth mover's distance)
 - Discard the models which show large discrepancies with ERA5
 - Sensitivity analysis
- 



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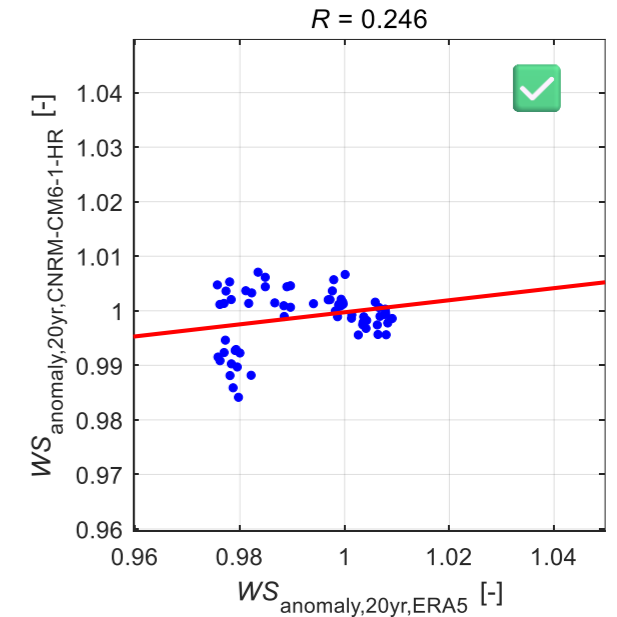
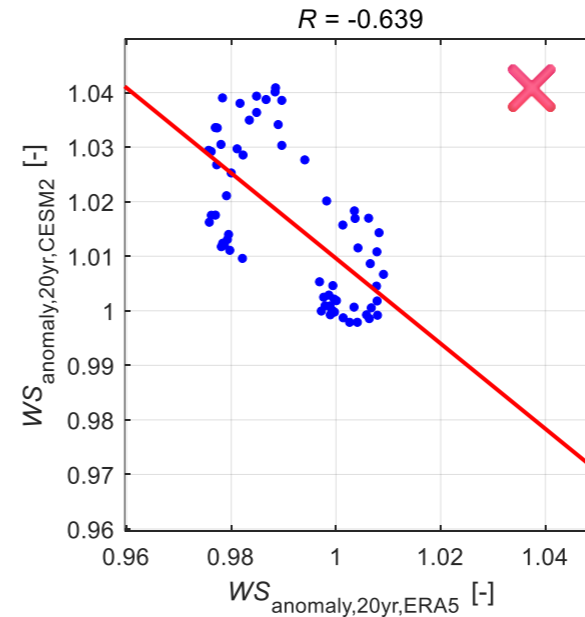
a) Interannual variability (coeff. of variation):

$$\text{COV}_{20\text{yr}} \leq 1.1 \text{ COV}_{\text{ERA5},20\text{yr}}$$



b) 20-year rolling average anomalies:

Exclude models strongly out of phase with ERA5



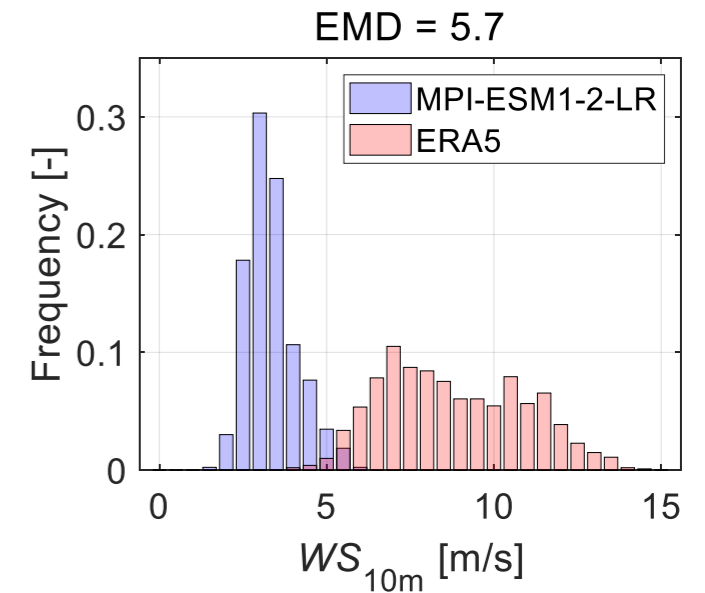
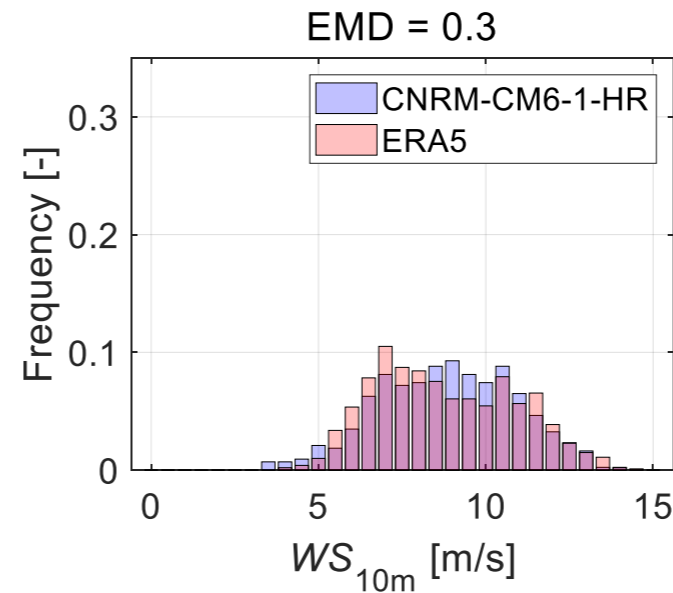
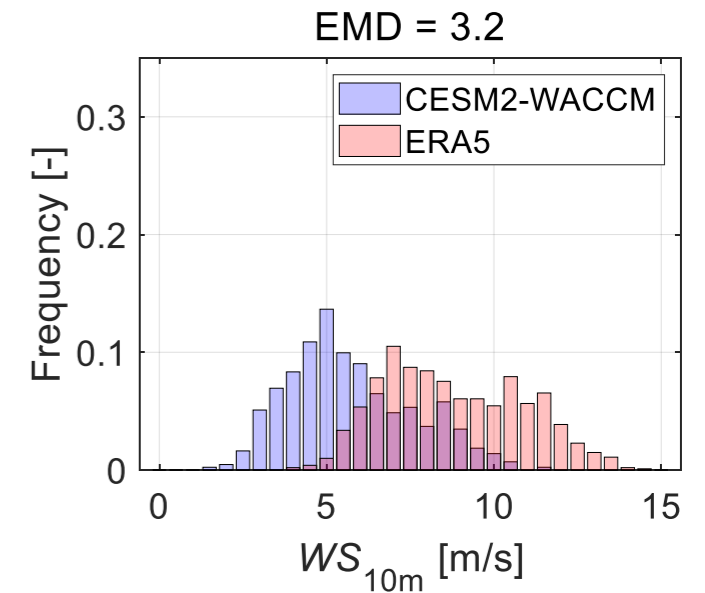
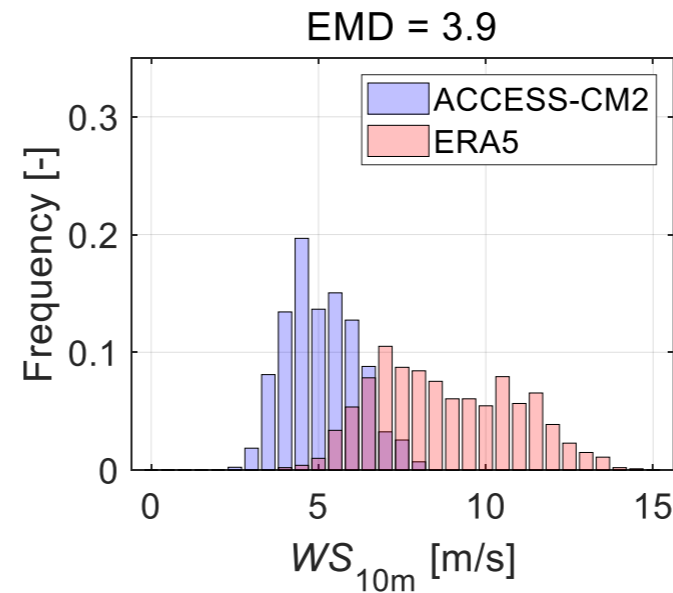
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c) Earth mover's distance (EMD) on monthly datasets.

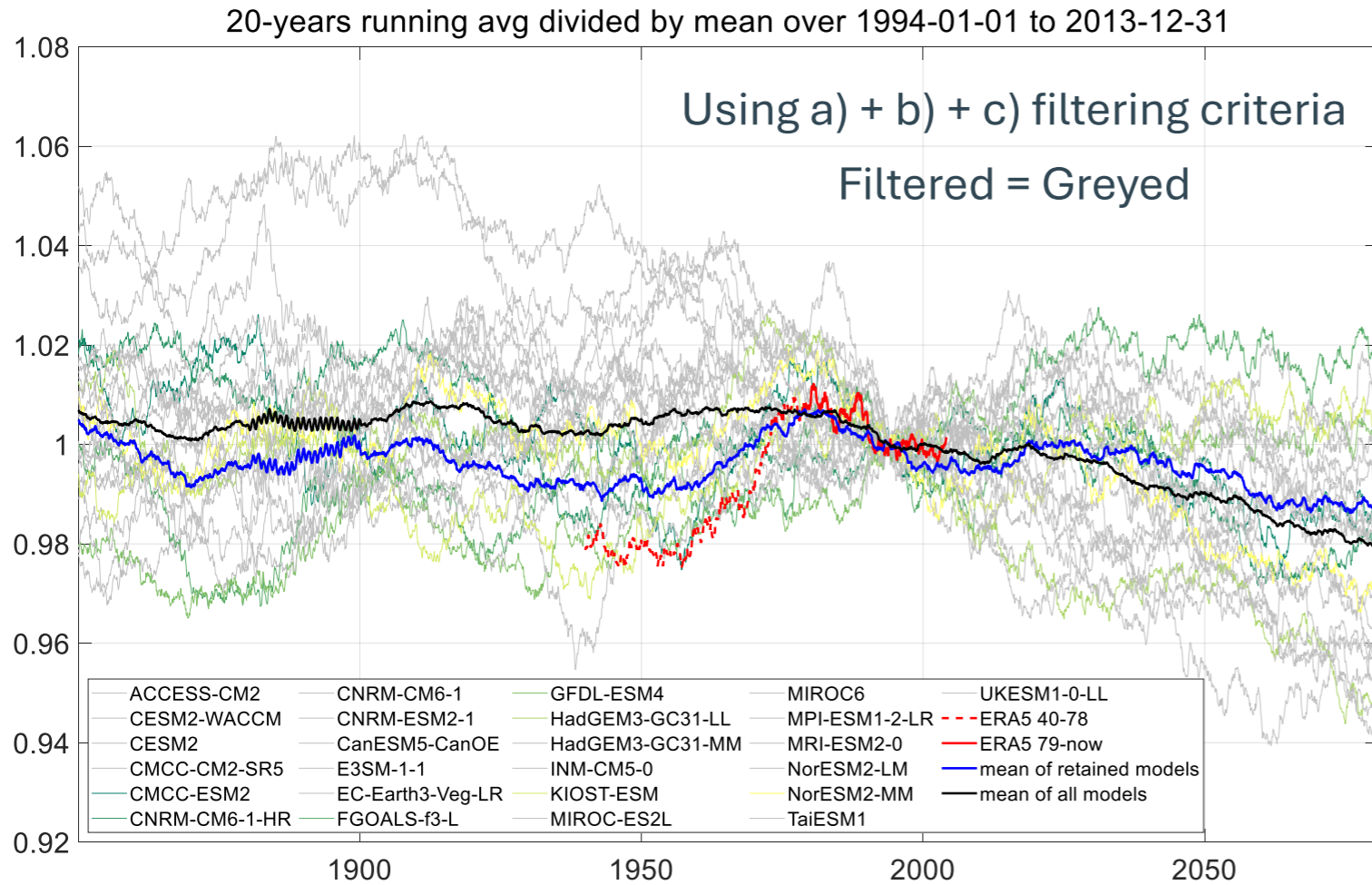
Example for Taiwan Strait.

EMD criterion is fine-tuned for each region.

We apply EMD to monthly means and yearly average anomalies.

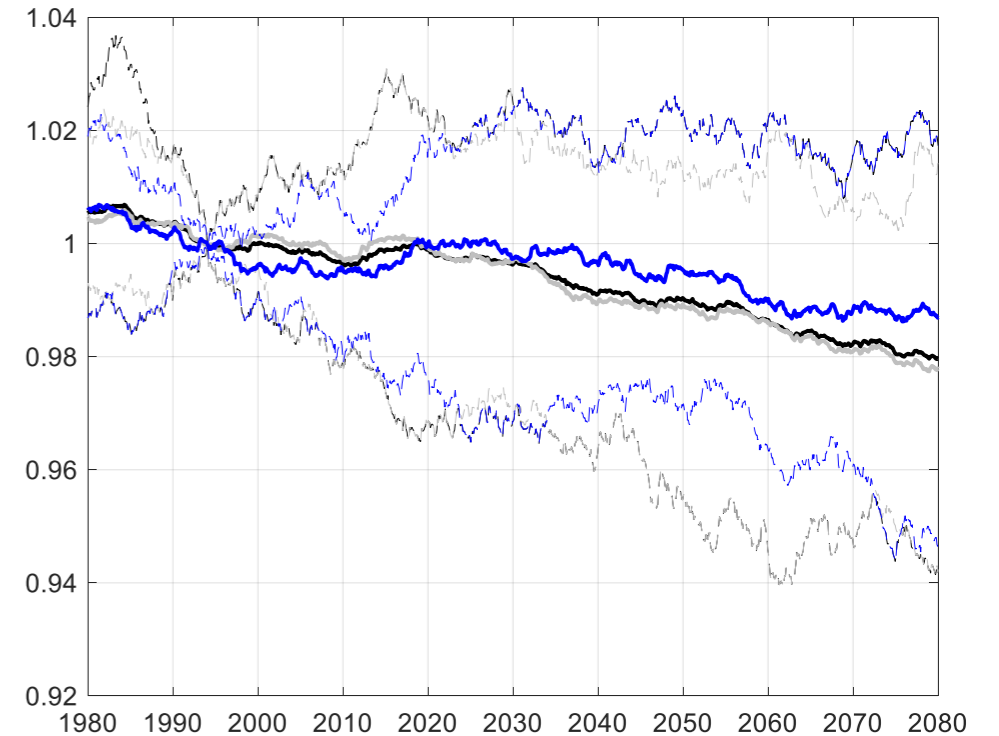


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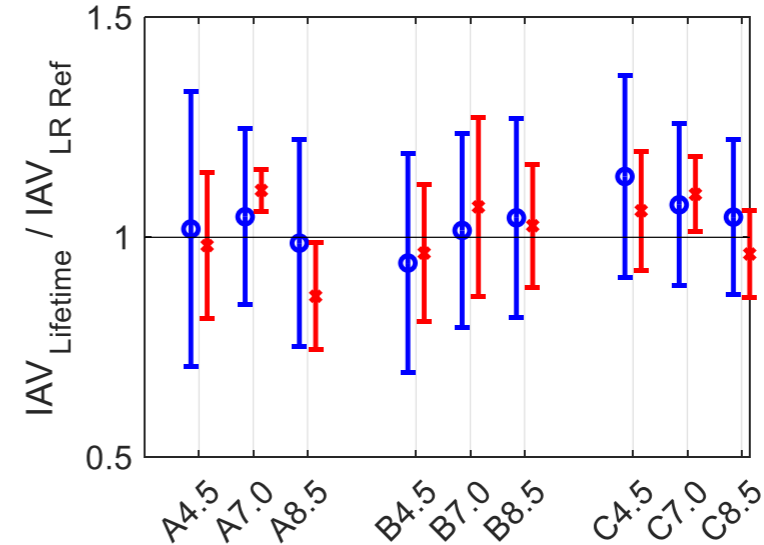
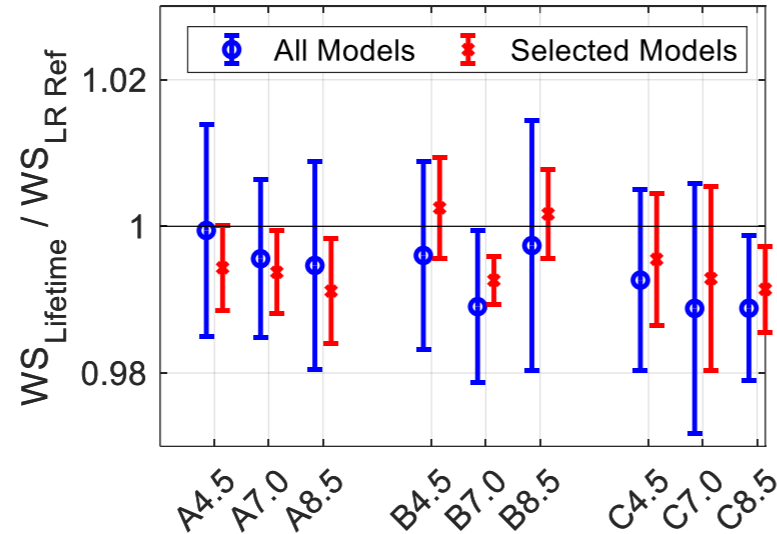
Narrower intervals for modelled future trends

For regions where the signal-to-noise ratio is weak, discarding models may change the result of the analysis.



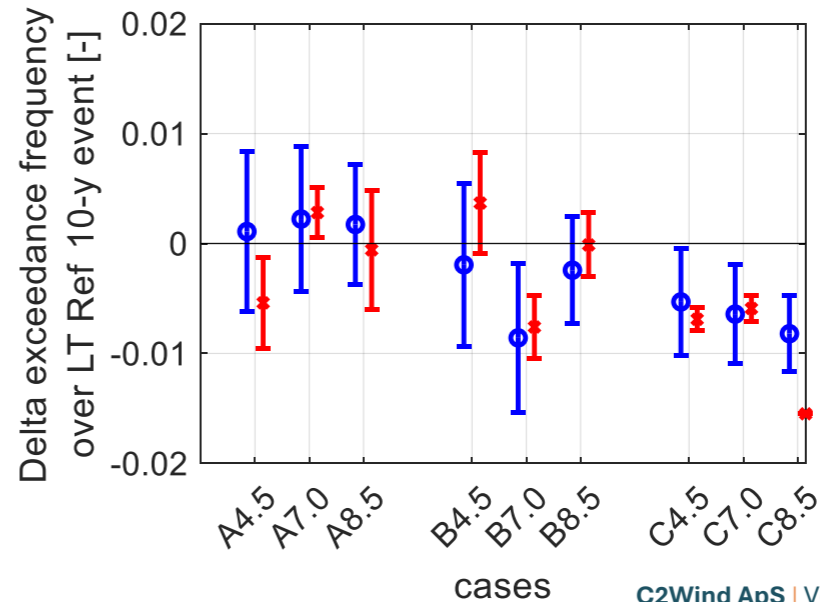
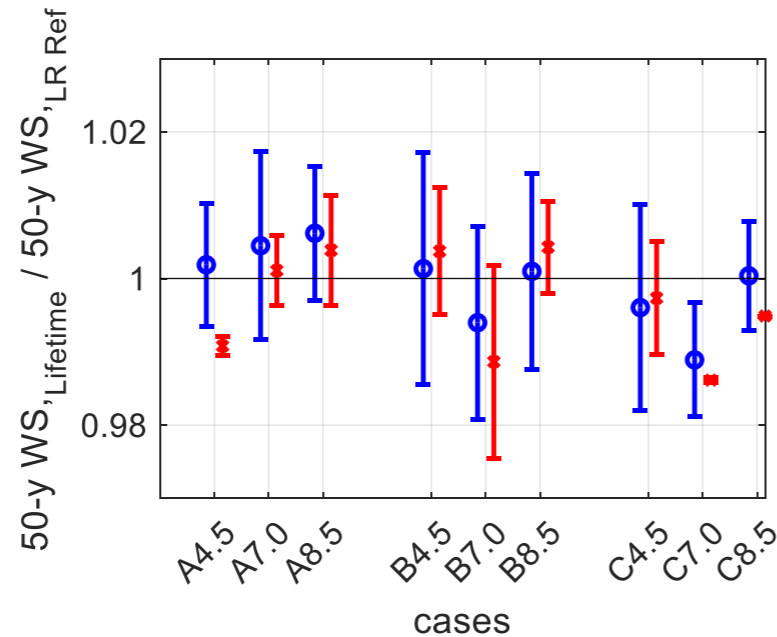
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Mean wind speed:
tends to decrease



IAV:
tends to increase

Severity of extreme events:
SSP- and region-specific trends



Frequency of extreme events:
SSP- and region-specific trends,
tends to decrease



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- CMIP5 and CMIP6 data should readily be used in WRA and EYA.
 - Documented well enough and easy to use
- Some models have too large *historical* interannual variability.
 - Filtering them out of the analysis reduces uncertainty related to future variability
- Model selection can be made by comparing with ERA5 (or any trusted and validated long-term reference) and using simple metrics.
- These data can be used for qualitatively assessing future frequency and strength of extremes (at least better than just referring to literature).
- Sensitivity analysis is always required (including choice of SSPs).



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For some regions, the effect of climate change may **already be visible in the reanalysis**. Future work should include a quantification of the **Time of Emergence (ToE)** of climate change signal.

