An ensemble of trend preserving statistically downscaled projections for key marine variables under three different future scenarios for the region of the Baltic Sea

Authors:

Kristiansen, Trond
Norwegian Institute for Water Research (NIVA)
ORCID 0000-0001-6121-297X

Butenschön, Momme
Ocean Modeling and Data Assimilation Division, Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC)
ORCID 0000-0002-4592-9927

Description:

This dataset is part of an ensemble that provides future projections of key marine variables under climate change for the region of the Baltic Sea, the North Sea, the Bay of Biscay, the Mediterranean Sea, and the Yucatán Peninsula (Fig. 1). The datasets were produced for three different future scenarios (SSP1-2.6, SSP2-4.5 and SSP5-8.5) and five different variables (potential temperature, salinity, dissolved oxygen, pH and chlorophyll) at three different depth levels (5m, 25m and seafloor with the exception of chlorophyll) at monthly frequency for the years 1993 - 2099. The statistical metrics provided are the mean, standard deviation, minimum, maximum, median, 2.5 and 97.5 percentile. The ensemble is computed over 4-7 different CMIP6 model realisations (depending on variable, Table 1), the bias correction and statistical downscaling applied is based on the methodology by Lange, 2019 and was trained on the GLORYS12V1 reanalysis (Drévillon et al. 2021, Perruche et al. 2021) provided by the Copernicus Marine Environment Monitoring Service (CMEMS).

Analogue datasets are provided in separate zenodo entries for the regions of the Mediterranean Sea, the North Sea, the Bay of Biscay and the area around the Yucatàn Peninsula, see “Related identifiers”.

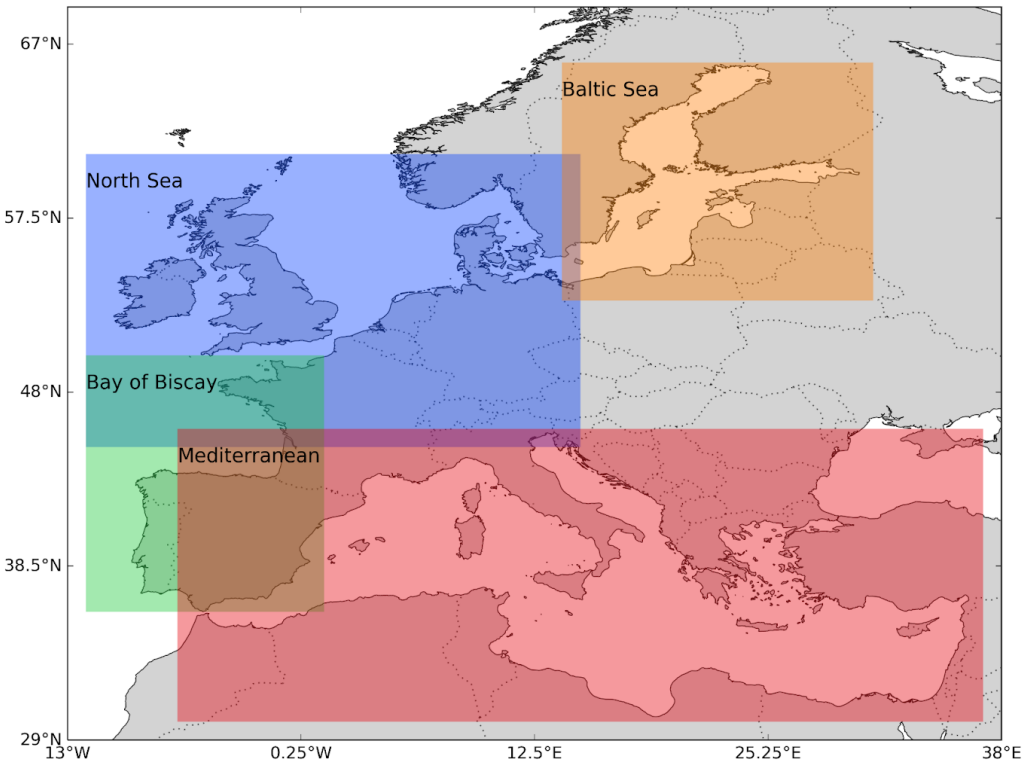

Figure 1: Map showing the 4 FutureMares European regions for statistical downscaling of CMIP6 modelled projections; the Baltic Sea (brown), the North Sea (blue), the Bay of Biscay (green), and the Mediterranean (red).

Model name	id	O_2 SSP1-2.6,SSP2 -4.5, SSP5-8.5			Temperature SSP1-2.6,SSP2 -4.5, SSP5-8.5			Chlorophyll SSP1-2.6,SSP2 -4.5,SSP5-8.5			pH. SSP1-2.6,SSP2 -4.5, SSP5-8.5			Salinity SSP1-2.6,SSP2 -4.5, SSP5-8.5		
IPSL-CM6A-LR (Boucher et al. 2020)	r1i1p1f1	x	x	x	x	x	x				x	x	x	x	x	x
MPI-ESM1-2-LR (Mauritsen et al. 2019)	r1i1p1f1 r2i1p1f1	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x
CanESM5-CanOE (Swart et al. 2019)	r1i1p2f1	x	x	x	x	x	x	x	x	x				x	x	x
UKESM1-0-LL (Sellar et al. 2019)	r1i1p1f2 r2i1p1f2	x	x	x	x	x	x	x	x	x				x	x	x
GFDL-ESM4 (Dunne et al. 2020)	r1i1p1f1				x	x	x							x	x	x
CMCC-ESM2 (Lovato et al. 2022)	r1i1p1f1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
CMCC-CM2-SR5 (Cherchi et al. 2019)	r1i1p1f1				x	x	x							x	x	x
MIROC-ES2L (Hajima et al. 2020)	r1i1p1f2	x	x	x	x	x	x	x	x	x				x	x	x

Table 1: Showing the CMIP6 models and scenarios used for the downscaling of the various variables and scenarios.

References

Boucher, Olivier, Jérôme Servonnat, Anna Lea Albright, Olivier Aumont, Yves Balkanski, Vladislav Bastrikov, Slimane Bekki, et al. 2020. “Presentation and Evaluation of the IPSL-CM6A-LR Climate Model.” *Journal of Advances in Modeling Earth Systems* 12 (7). https://doi.org/10.1029/2019ms002010.

Cherchi, A., Fogli, P.G., Lovato, T., Peano, D., Iovino, D., Gualdi, S., Masina, S., Scoccimarro, E., Materia, S., Bellucci, A., Navarra, A., 2019. “Global Mean Climate and Main Patterns of Variability in the CMCC-CM2 Coupled Model”. *Journal of Advances in Modeling Earth Systems* 11: 185–209. https://doi.org/10.1029/2018MS001369

Dunne, J. P., L. W. Horowitz, A. J. Adcroft, P. Ginoux, I. M. Held, J. G. John, J. P. Krasting, et al. 2020. “The GFDL Earth System Model Version 4.1 (GFDL-ESM 4.1): Overall Coupled Model Description and Simulation Characteristics.” *Journal of Advances in Modeling Earth Systems* 12 (11). https://doi.org/10.1029/2019ms002015.

Hajima, Tomohiro, Michio Watanabe, Akitomo Yamamoto, Hiroaki Tatebe, Maki A. Noguchi, Manabu Abe, Rumi Ohgaito, et al. 2020. “Development of the MIROC-ES2L Earth System Model and the Evaluation of Biogeochemical Processes and Feedbacks.” *Geoscientific Model Development* 13 (5): 2197–2244.

Lovato, T., D. Peano, M. Butenschön, S. Materia, D. Iovino, E. Scoccimarro, P. G. Fogli, et al. 2022. “CMIP6 Simulations with the CMCC Earth System Model (CMCC-ESM2).” *Journal of Advances in Modeling Earth Systems* 14 (3). https://doi.org/10.1029/2021ms002814.

Mauritsen, Thorsten, Jürgen Bader, Tobias Becker, Jörg Behrens, Matthias Bittner, Renate Brokopf, Victor Brovkin, et al. 2019. “Developments in the MPI-M Earth System Model

Version 1.2 (MPI-ESM1.2) and Its Response to Increasing CO2." *Journal of Advances in Modeling Earth Systems* 11 (4): 998–1038.
Sellar, Alistair A., Colin G. Jones, Jane P. Mulcahy, Yongming Tang, Andrew Yool, Andy Wiltshire, Fiona M. O'Connor, et al. 2019. "UKESM1: Description and Evaluation of the U.k. Earth System Model." *Journal of Advances in Modeling Earth Systems* 11 (12): 4513–58.
Swart, Neil C., Jason N. S. Cole, Viatcheslav V. Kharin, Mike Lazare, John F. Scinocca, Nathan P. Gillett, James Anstey, et al. 2019. "The Canadian Earth System Model Version 5 (CanESM5.0.3)." *Geoscientific Model Development* 12 (11): 4823–73.

Acknowledgements

We acknowledge the World Climate Research Programme's Working Group on Coupled Modelling, which is responsible for CMIP. Generated using E.U. Copernicus Marine Service Information; https://doi.org/10.48670/moi-00021, https://doi.org/10.48670/moi-00019.