

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

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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 Bay of Biscay, the Chilean coast, the Mediterranean Sea, the North 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 3-7 different CMIP6 model realisations (depending on variable, Table 1), the bias correction and statistical downscaling was trained on the GLORYS12V1 reanalysis (Dréville 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, the Chilean coast and the area around the Yucatán Peninsula, see “Related identifiers”.

A description of the downscaling approach and evaluation of the datasets over the European regions is published in [Kristiansen et al. 2024](#).

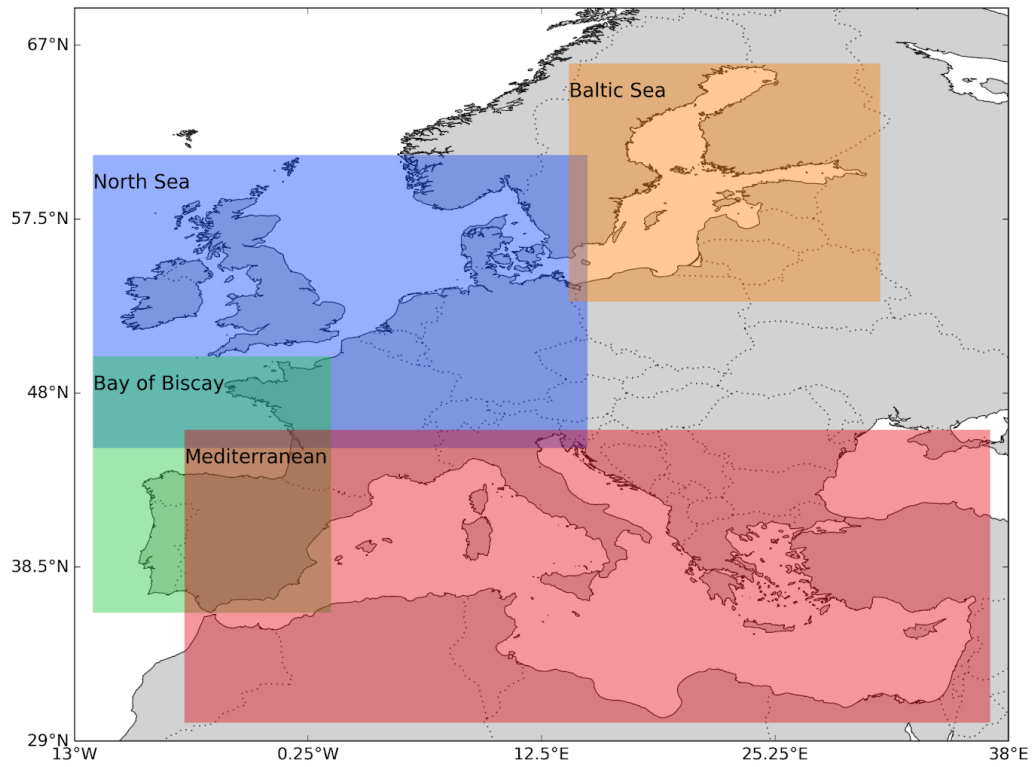


Figure 1: Map showing the 4 FutureMares European regions for statistical downscaling of CMIP6 modelled projections; the Baltic Sea (brown), the North Sea (blue), the Bay of Biscay (green), and the Mediterranean (red).

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
	r3i1p1f1	x	x	x	x	x	x				x	x	x	x	x	x
MPI-ESM1-2-LR (Mauritsen et al. 2019)	r1i1p1f1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	r2i1p1f1	x	x	x	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

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>.
- Kristiansen, T., Butenschön, M., Peck, M.A., 2024. Statistically downscaled CMIP6 ocean variables for European waters. *Sci Rep* 14, 1209. <https://doi.org/10.1038/s41598-024-51160-1>
- 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.

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