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CS4 Climate services for marine fisheries

Based on model simulations, both existing and to be performed within the project, Blue-Action will assess the feasibility of climate services for applications in marine fisheries. Case Study 4 will examine the predictability of the distribution, abundance and/or phenology (timing) of marine species from various trophic levels, including economically important fish species. This deliverable makes existing model simulations performed at MPI-M and University of Bergen available to the colleagues of the case study 4 at DTU Aqua.

In previous projects funded by the European Commission, such as FP7 projects THOR and NACLIM, both the predictive skill of physical quantities and the relationship between physical quantities and abundance and distribution of marine species from various trophic levels has been demonstrated for the northern North Atlantic Ocean. Within Blue-Action, we combine the two approaches by using physical output from decadal prediction experiments (both retrospective and actual forecasts) together with understanding of the physical-biological relationships. As initial step, temperature and salinity monthly output from existing suites of initialised decadal climate prediction ensemble experiments with the MPI-ESM earth system model over the period 1960 to 2015, namely FP7 project SPECS and German BMBF projects MiKlip, has been provided to WP5 partners.

Data Source Nr 1

Provider: University of Bergen in Blue-Action WP4.
Data set: CMIP6 DCPP data archived via ESGF https://esgf-node.llnl.gov/projects/esgf-llnl/
Contact: Noel Keenylside noel.keenlyside@gfi.uib.no
Which data have been used: An ensemble of decadal hindcasts was provided by the University of Bergen in WP4 to CS4 in WP5 in autumn 2019. These data represent fresh results produced in Blue-Action and as part of the CMIP6 Decadal Prediction Projection. The data consists of 10 year forecasts initialised annually from 1960 to 2018 inclusive, with twenty ensemble members for each initialisation. Outputs of monthly averaged temperature and salinity were provided on the 3D native model grid (i.e. depth resolved). This data has been coupled into the system described above to examine the predictability of fish distributions, and provides a valuable contrast to the other data sources. The resulting predictability of biological responses is currently being assessed.

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Data source Nr. 2

Provider: MPI-M in Blue-Action WP4.
Contact: Daniela Matei <daniela.matei@mpimet.mpg.de>
Which data have been used: Case Study 4 has received the data from partners in WP4 - specifically in the form of a decadal hindcast ensemble from the MPI-ESM-LR earth system model developed as part of the German BMBF MiKlip and FP7 SPECS projects. Data has been received on the native model grids, as depth-resolved monthly averages. Preliminary work performed by CS4 has focused on extracting the appropriate quantities, applying bias corrections as needed and interfacing these physical forecasts to the relevant biological forecast models. Preliminary assessments of the ensuing predictability of relevant biological quantities, including the spatial distribution of Atlantic Bluefin Tuna (*Thunnus thynnus*) have been performed, and show promising biological predictability. Once the CMIP6 simulations have been completed, these will also be interfaced into the relevant climate services and the associated predictive skill reassessed.

Data source Nr.3

At the Blue-Action Annual Meeting on 27-29 November 2018, during the break-out session, Case Study 4 also benefited from interactions with representatives from the National Center for Atmospheric Research (NCAR), partner of Blue-Action from the United States. The Community Earth System Model (CESM) Decadal Prediction Large Ensemble (DPLE) project consists of an ensemble of decadal hindcasts each with 40 ensemble members. This work has been presented previously at two Blue-Action annual meetings and now with the help of NCAR the relevant data has been obtained by Case Study 4. This data will provide a valuable complement to the MPI-ESM-LR data set, due to both the large size of the ensemble (allowing for production of probabilistic forecasts), the up-to-date nature of the data (allowing for the use of decadal predictions starting in 2017), and the addition of a second modelling framework to the decadal climate services (allowing for quantification of model structural uncertainty).
Provider: National Center for Atmospheric Research (NCAR), partner in Blue-Action.
Data set: http://www.cesm.ucar.edu/projects/community-projects/DPLE/
Contact: Steve Yeager yeager@ucar.edu

Which data have been used: Decadal forecasts for 64 initialisation dates (Nov 1 1954 to Nov 1 2017), each with 40 ensemble members and 10 years in length form the basis of this data set. Data has been downloaded on the native CESM model grid (nominally 1 degree in the ocean and atmosphere) for the globe – this will be restricted to the region of interest upon further processing. Monthly-averaged ocean temperature and salinity (both surface and sub-surface properties) are the two main variables that have been downloaded.

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