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Using downscaling to reproduce the Iberian Upwelling dynamics and to simulate future scenarios

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This work aims at a better understanding of the variability of the Iberian Upwelling Ecosystem, not only in the present regime, but also in a future climate change scenario. The purpose of the present study is to assess whether downscaling is an appropriate methodology for the region and its physical processes.
Numerical simulations with the Regional Ocean Modelling System (ROMS) were setup. We start out with large-scale low-resolution ($\sim$20 km) configurations in the Northeast Atlantic Ocean (from the Azores Islands to the Iberian Peninsula, and from the Canary Islands to mid-Ireland). These runs are meant to obtain boundary conditions for an intermediate, medium-resolution ($\sim$8 km) domain, comprising the Azores Islands to the west, the Madeira Islands to the south and the Gulf of Biscay to the north. This intermediate domain will in turn provide boundary conditions for the final study area, which has a resolution of about 2-3 km and comprises the Gulf of Cadiz, about 270 km off westward and the Galician north coast.
The climatology used for the present is the Comprehensive Ocean-Atmospheric Data Set (COADS) and for the future we have previously validated the Japanese Model for Interdisciplinary Research on Climate (MIROC) used in the IPCC studies as the most suitable and constructed a future climatology. For each climatology, 10-year ROMS simulations were run for each domain and the data were computed through monthly means of temperature, salinity, velocity and its variance, computed for years 4 to 8 of the run. The results are presented for the intermediate domain and the final study area.
We observe that there are major differences in the salinity and temperature distributions between present and a future scenario. The most striking dynamics change is the absence of a poleward current in winter, and the prevailing upwelling conditions all around the year. In winter in the future there are no longer temperature or salinity meridional gradients (seen over the slope in the present) due to the surface low salinity distribution at NW off the Iberian Peninsula, which prevents saltier waters to move northwards. Further investigation with other IPCC models will be done in order to assess the confidence on the obtained results.