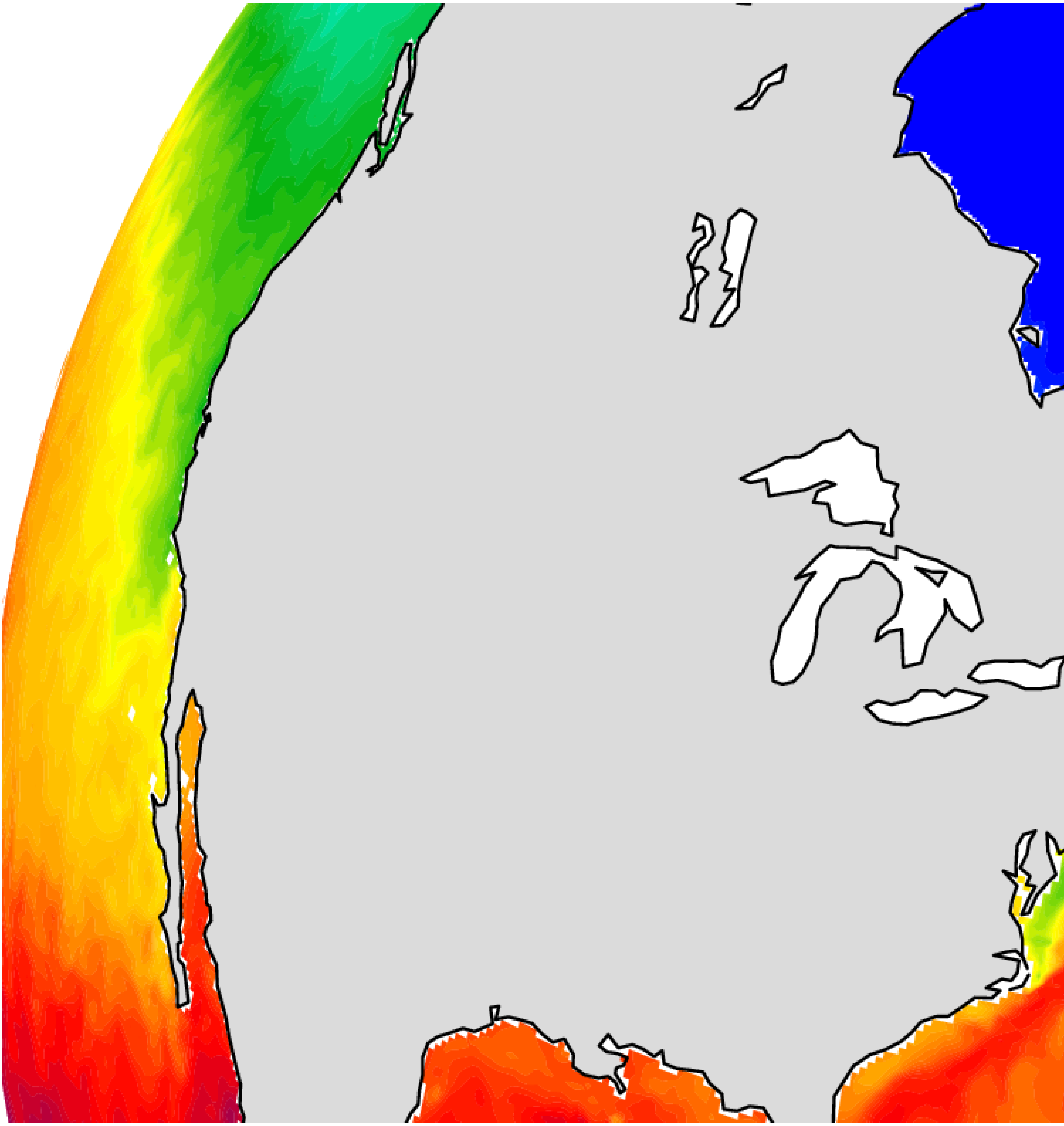
Ocean forecasting



The World Oceans cover more than 70% of the Earths surface and are estimated to contain 1.3 trillion of cubic km of sea water. With their immense capacity to store and transport heat, but also maintain a complex biogeochemical cycle, the Oceans constitute a vital component in the Earth System.

Summary

The World Oceans are not still bodies of water. On the contrary, they are characterized by strong currents, both close to the sea surface but also at larger depths, which overturn in different locations of the globe, thus resembling a closed loop of water masses that are constantly in motion. This closed loop is what is commonly referred to as the "global ocean conveyor belt", or, the Meridional Overturning Circulation. There is a strong interest in understanding the ocean circulation because of its important implications on Earth's climate from seasonal to multi annual timescales. The ocean transports and stores vast amount of heat, which affects climate patterns all over the globe. For example, the weather and climate in north-western Europe is well known to be affected by the overturning circulation in the Atlantic Ocean. In the context of the ongoing climate change, the ocean, because of its enormous heat capacity, stores most of the added heat induced by the anthropogenic activities. By taking up most of this heat, the ocean has the ability to significantly delay the surface climate change. The heat transported and stored by the ocean has also the potential to affect sea ice in the polar regions, which can then trigger several other feedbacks in the climate system. The ocean also plays vital role in natural climate variability. Changes in the ocean circulation in the tropical Pacific, for example, are paramount for the dominant mode of coupled ocean-atmosphere variabilty in the tropics, the El Niño Southern Oscillation (ENSO), which has marked consequences for the global climate.

The goals of activities from the group members at BSC-ES is to advance our understanding about the role of the ocean in the context of climate prediction, by using state-of-the-art global climate models that include fully dynamical 3D ocean model. By intializing these models with the best available datasets, obtained either from satellites or from reanalysis, and producing simulations of the Earth's climate, we are able to address questions that are until today still open: How the changes in the ocean affect climate and climate predictability? Can we increase our skill in climate forecasts by improving the respresentation of the ocean? How ocean-atmosphere interactions affect climate phenomena, such as the North Atlantic Oscillation (NAO - leading mode of internal atmospheric variability in the Euro-Atlantic sector) and ENSO? How the ocean circulation interacts with sea-ice? How can we use oceans forecasts in fisheries? Can we improve the systematic model biases, and will such improvements enhance the predictability in key regions of the world?

Within the framework of several national, European and international projects, where BSC is involved, we address questions which are interesting for the scientific community but also for the society. For example, we investigate how we can improve climate predictability in the Tropical Atlantic (PREFACE, DRETNA). By using models with very high spatial resolution, which can resolve small scale processes, we can represent climate phenomena with higher accuracy than ever before, and can investigate pressing questions about regional climate change (PRIMAVERA).

Objectives

- Assess the role of **oceanic resolution** in climate predictability
- Improve **ocean initialization**, in order to reduce model drift and improve climate forecasts
- Produce and provide **high quality ocean initial conditions**