Regional Ocean Climatologies

Regional ocean climatology is a compendium of time-averaged fields of essential oceanographic variables, such as temperature, salinity, oxygen, etc., over the time of several decades or longer in a selected region of the World Ocean. Regional climatologies are most valuable in the ocean regions that are critical for practical applications, such as fisheries, climate change monitoring, etc., with sufficient data coverage to justify the effort of creating high-resolution and high-quality climatological fields of the essential variables.

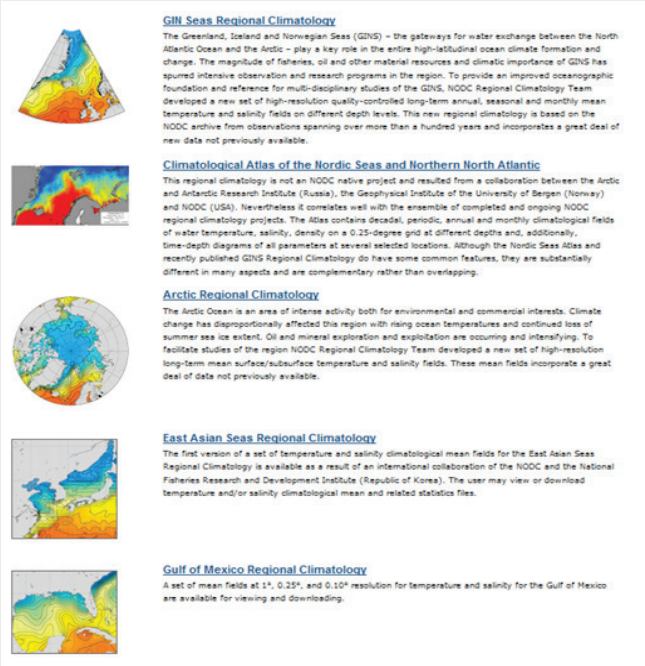
Only in a very few key ocean regions does data availability allow true high-resolution ocean climatologies to be possible, providing a new level of detail and understanding of ocean climate state and long-term variability. Coincidently, such regions are also most important from the long-term climate change perspective. Therefore, NCEI has recently begun a new project of developing high-resolution ocean Regional Climatologies (RC).

To date, four RCs were created and published using the data in the World Ocean Database: The Gulf of Mexico, East-Asian Seas, Arctic Ocean and most recently the Greenland-Iceland-Norwegian Seas (GINS). Additionally, the International Nordic Seas Atlas, which resulted from a US-Norway-Russia cooperative effort led by NCEI, was published by NOAA as the 5th NCEI RC project. The newest NCEI RC project is the Northwest Atlantic (NWA) Regional Climatology, which is now under construction and scheduled for publication in 2015. Figure 1 shows a snapshot of the NCEI Regional Climatology website showing the portal to all five RCs.

The NWA RC is even more advanced, with both mean and six decadal climatological temperature and salinity fields reconstructed in one of the most important U.S. and Canada coastal zones on one-tenth of degree grid, at 87 depth levels from 1955 to 2012.

Melt water in Greenland, one portion of the GINS region. In addition to GINS, NCEI has created regional climatologies for three other regions: the Gulf of Mexico, East Asian Seas and the Arctic Ocean.

Other Regional Climatologies: www.nodc.noaa.gov/OC5/regional_climate/



GIN Seas Regional Climatology

The Greenland, Iceland and Norwegian Seas (GINS) – the gateways for water exchange between the North Atlantic Ocean and the Arctic – play a key role in the entire high-latitudinal ocean climate formation and change. The magnitude of fisheries, oil and other material resources and climatic importance of GINS has spurred intensive observation and research programs in the region. To provide an improved oceanographic foundation and reference for multi-disciplinary studies of the GINS, NODC Regional Climatology Team developed a new set of high-resolution quality-controlled long-term annual, seasonal and monthly mean temperature and salinity fields on different depth levels. This new regional climatology is based on the NODC archive from observations spanning over more than a hundred years and incorporates a great deal of new data not previously available.

Climatological Atlas of the Nordic Seas and Northern North Atlantic

This regional climatology is not an NODC native project and resulted from a collaboration between the Arctic and Antarctic Research Institute (Russia), the Geophysical Institute of the University of Bergen (Norway) and NODC (USA). Nevertheless it correlates well with the ensemble of completed and ongoing NODC regional climatology projects. The Atlas contains decadal, periodic, annual and monthly climatological fields of water temperature, salinity, density on a 0.25-degree grid at different depths and, additionally, time-depth diagrams of all parameters at several selected locations. Although the Nordic Seas Atlas and recently published GINS Regional Climatology do have some common features, they are substantially different in many aspects and are complementary rather than overlapping.

Arctic Regional Climatology

The Arctic Ocean is an area of intense activity both for environmental and commercial interests. Climate change has disproportionally affected this region with rising ocean temperatures and continued loss of summer sea ice extent. Oil and mineral exploration and exploitation are occurring and intensifying. To facilitate studies of the region NODC Regional Climatology Team developed a new set of high-resolution long-term mean surface/subsurface temperature and salinity fields. These mean fields incorporate a great deal of data not previously available.

East Asian Seas Regional Climatology

The first version of a set of temperature and salinity climatological mean fields for the East Asian Seas Regional Climatology is available as a result of an international collaboration of the NODC and the National Fisheries Research and Development Institute (Republic of Korea). The user may view or download temperature and/or salinity climatological mean and related statistics files.

Gulf of Mexico Regional Climatology

A set of mean fields at 1°, 0.25°, and 0.10° resolution for temperature and salinity for the Gulf of Mexico are available for viewing and downloading.

Figure 1. NCEI website snapshot showing the portal to four NCEI regional climatologies

Advantages of Regional Climatologies

The advantages of regional climatologies are many, and a clear demonstration can be done by comparing the low- to high-resolution climatologies in any of the completed regions.

Figure 2 shows three fields of sea surface temperature from the GINS RC.

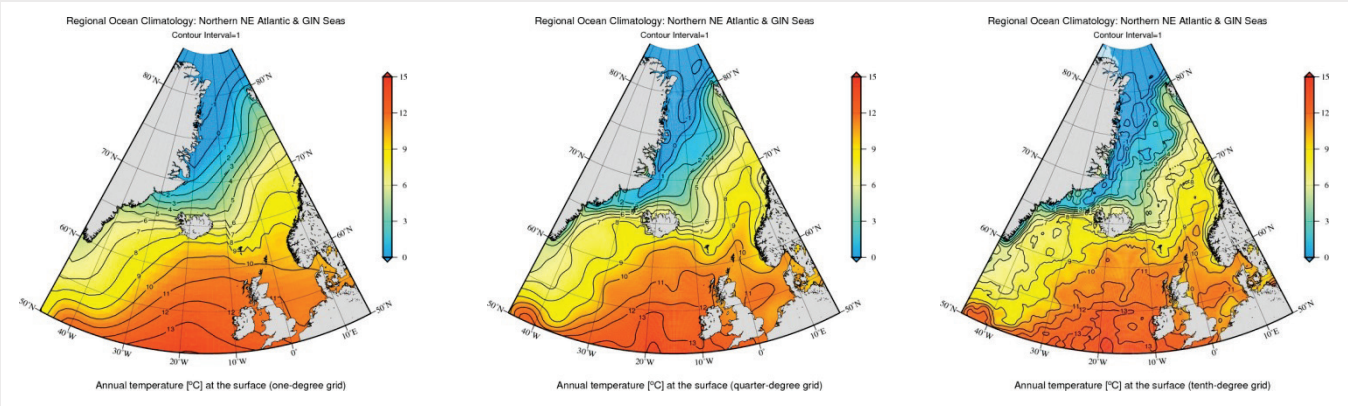


Figure 2. Annually mean surface temperature with three different resolutions: 1°x1° (left), 1/4°x1/4° (middle) and 1/10°x1/10° (right). The GINS RC is available for viewing and data downloading at the GINS RC web site: http://www.nodc.noaa.gov/OC5/regional_climate/gin-seas-climate/

Higher spatial resolutions – here the 1/10°x1/10° resolution – provide major advantages in the areas where such resolutions are feasible and supported by data availability. The quality control on a higher-resolution grid reveals more outliers than an analysis on coarser resolution grids. The structure of the gridded fields is far better sustained, especially in regions with sharp gradients of the essential oceanographic parameters (temperature, salinity, etc.). They are better preserved in the generated climatological fields, which makes high-resolution climatologies more valuable for ocean modeling and other applications.

The most recent NCEI regional climatology project – the Northwest Atlantic Regional Climatology – is a part of the NOAA-wide project Sustaining Marine Ecosystems in a Changing Climate (SMECC) and will be a part of the proposed NOAA Climate Science Strategy plan complying with the first of the three Priority Activities: To conduct climate vulnerability analyses in each region for all Large Marine Ecosystems regions." The first step in assessing climate vulnerability is to gain a better understanding of the state and trend of the ocean climate in key regions.