

Seafloor and Sea Surface Modelling in the East Coast Region of North America

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Abstract : Seafloor topography is a fundamental issue in geological, geophysical, and oceanographic studies. Single-beam or multibeam sonars attached to the hulls of ships are used to emit a hydroacoustic signal from transducers and reproduce the topography of the seabed. This solution provides relevant accuracy and spatial resolution. Bathymetric data from ships surveys provides National Centers for Environmental Information - National Oceanic and Atmospheric Administration. Unfortunately, most of the seabed is still unidentified, as there are still many gaps to be explored between ship survey tracks. Moreover, such measurements are very expensive and time-consuming. The solution is raster bathymetric models shared by The General Bathymetric Chart of the Oceans. The offered products are a compilation of different sets of data - raw or processed. Indirect data for the development of bathymetric models are also measurements of gravity anomalies. Some forms of seafloor relief (e.g. seamounts) increase the force of the Earth's pull, leading to changes in the sea surface. Based on satellite altimetry data, Sea Surface Height and marine gravity anomalies can be estimated, and based on the anomalies, it's possible to infer the structure of the seabed. The main goal of the work is to create regional bathymetric models and models of the sea surface in the area of the east coast of North America - a region of seamounts and undulating seafloor. The research includes an analysis of the methods and techniques used, an evaluation of the interpolation algorithms used, model thickening, and the creation of grid models. Obtained data are raster bathymetric models in NetCDF format, survey data from multibeam soundings in MB-System format, and satellite altimetry data from Copernicus Marine Environment Monitoring Service. The methodology includes data extraction, processing, mapping, and spatial analysis. Visualization of the obtained results was carried out with Geographic Information System tools. The result is an extension of the state of the knowledge of the quality and usefulness of the data used for seabed and sea surface modeling and knowledge of the accuracy of the generated models. Sea level is averaged over time and space (excluding waves, tides, etc.). Its changes, along with knowledge of the topography of the ocean floor - inform us indirectly about the volume of the entire water ocean. The true shape of the ocean surface is further varied by such phenomena as tides, differences in atmospheric pressure, wind systems, thermal expansion of water, or phases of ocean circulation. Depending on the location of the point, the higher the depth, the lower the trend of sea level change. Studies show that combining data sets, from different sources, with different accuracies can affect the quality of sea surface and seafloor topography models.

Keywords : seafloor, sea surface height, bathymetry, satellite altimetry

Conference Title : ICCMEE 2023 : International Conference on Coastal, Marine Ecology and Environment

Conference Location : Paris, France

Conference Dates : August 24-25, 2023