Streszczenie w języku angielskim

The main objective of the research, as part of the doctoral dissertation, was to assess the geophysical interaction between the seafloor morphology and regional sea level variability. The research adopted an approach based on modeling hybrid datasets, including time series of sea level anomalies from satellite altimetry, high-resolution bathymetric data from multibeam sonars and digital GEBCO models, free-air gravity anomaly models, mean dynamic topography models, wind speed and direction models and geoid heights and GIA isostatic correction models. This research aimed to determine how seafloor topography – trenches, submarine canyons, seamounts and seafloor corrugations modulate the magnitude, spatial distribution and temporal variability of regional sea level trends over three geographically heterogeneous subregions. In the first step of the study, comparative analyses were carried out, which presented that more irregular and higher sea level trends (from 2.56 to 7.66 mm/year) occur in the areas of seamounts and corrugations (subregion 2), but lower and more stable trend values (from 1.75 to 3.65 mm/yr) are visible in the trench and canyon areas (subregion 1). The integration of multibeam bathymetric datasets and digital GEBCO raster models improved bathymetric density and resolution. In the following steps, regional sea level variability was assessed using linear regression, harmonic analysis, Continuous Wavelet Transform (CWT) and Kalman filtering. The results present a strong positive spatial correlation for regional sea level trends and mean dynamic topography and a moderate negative spatial correlation for regional sea level trends and seafloor depth, which suggests that ocean circulation, gravitational effects, geophysical factors and geographic location have a significant impact on regional sea level variability. In this study, the impact of long-term seasonal cycles, particularly the 18.61-year lunar node cycle ($r > 0.8$), on regional sea level changes was also identified. In the final phase of the research, modified Monte Carlo simulations were carried out, which present divergent SLR accelerations. High acceleration rates (up to 1.7 mm/year^2) were observed in the area of seamounts and subduction zones, while trench areas tended to stabilize or experience local sea level lowering. The results confirm that seafloor morphology significantly modulates regional sea level variability, influencing trends, amplitudes and accelerations through interactions with geophysical and dynamic processes.

This research provides a strong basis for oceanographic modeling, climate impact assessment and coastal and offshore infrastructure planning in areas with complex seafloor topography.

Keywords: satellite altimetry, harmonic analysis, morphology/topography of seafloor, sea level anomaly, GEBCO model