GC2024-SG068

Technology for surface waves processing recorded using seismic streamers to study the upper part of the Pechora Sea shelf section

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In water areas, to ensure the safety of drilling and construction of bottom infrastructure facilities, a complex of geological and geophysical studies is carried out, aimed at studying the upper part of the section and identifying hazardous geological processes. At the same time, as part of seismic work, only reflected waves are usually processed. This project provided a unique opportunity to perform specialized processing of not only reflected waves, but also surface waves, in order to study the upper part of the section in detail. As a result, it became possible to evaluate the convergence of the results obtained and to develop methodological recommendations for conducting engineering geophysical studies in water areas using surface waves, which is important for areas with high gas saturation in the upper part of the section. The project used 2020 MOV-OGT data obtained using towed systems as part of 3D seismic surveys in the Pechora Sea. The presence of intense surface waves can be explained by the short distance (less than a quarter of a wavelength) between the towed streamer and the seabed. In order to process the materials within an acceptable time frame, the original data array (145 km2), containing more than 1 million traces, was thinned out 10 times, so that, based on the results of MASW, the output was a set of 1D models located along a relatively regular network with an approximate step 250x250 meters. The resulting models were interpolated into a 3D velocity cube Vs of shear waves. The depth of the speed cube was 80 meters. Comparisons of horizontal sections based on MOV-CDP and MASW data showed high correlation and correctness of constructions within the MASW method. From a geological point of view, it was possible to identify such dangerous phenomena as paleoincisions and paler channels, to show a steady decrease in Vs velocities in these zones, and also to identify other zones of increased and decreased Vs velocities. The detection of these objects in the results of MASW processing indicates the high resolution of the method, and the contrast of velocities and the ability to determine the depth of the object provide great potential for subsequent geological interpretation. As a result of the work done, it was possible to develop an optimal methodology for processing data within the framework of the MASW method recorded by towed streamers; show the correctness of the results obtained and the possibility of their use when interpreting data; develop methodological recommendations for processing surface waves recorded in the water area, useful for the implementation of other projects. It should be noted that during the implementation of the project, it became obvious that it was necessary to use neural network technologies when working with 3D MOV-CDP data in order to increase the information content of processing by using the entire data array. The introduction of these technologies into the surface wave processing process is currently the main goal of our research, since then it is possible to obtain detailed Vs velocity cubes from all CDP data recorded by seabed seismic equipment.