

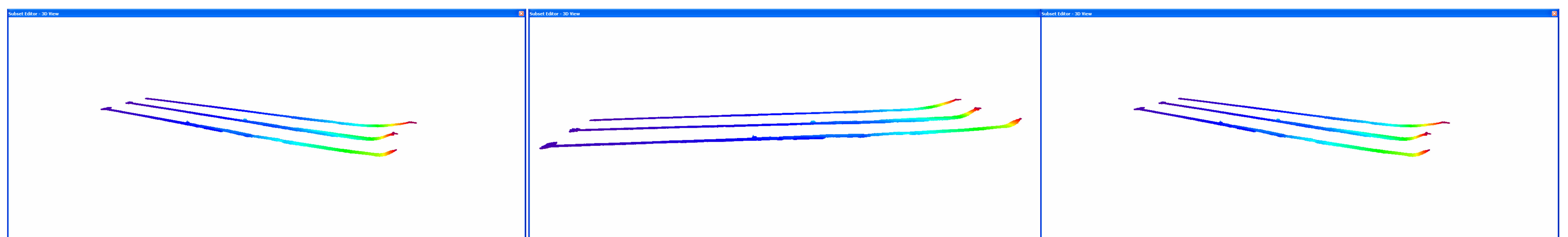
EXPERIENCE OF A HYDROGRAPHIC SURVEY IN THE ANTARCTIC CIRCLE

Chile signed the Convention on the Law of the Sea (UNCLOS) on December 10, 1982, which was ratified on August 25, 1997. In this context, Chile submitted the preliminary report indicative of the outer limits of the Continental Shelf to the United Nations (UN) on December 8, 2009. This report points the areas of claims and the scientific and technical background information to be presented as established by UNCLOS.

Within the study area, the Chilean Navy, through the Hydrographic and Oceanographic Service, was the responsible for the acquisition and processing of bathymetric data of the Bellingshausen Sea in the Chilean Antarctic Territory. Accordingly, five hydrographic surveys have been conducted since 2009 to date and the recent surveys have allowed obtaining oceanic bathymetric data further south of the Antarctic Circle (66° 33' S).

To conduct hydrographic surveys in those frozen waters of Antarctica, the Icebreaker “Oscar Viel” was equipped with an echo sounder for sounding in deep waters and breaking ice. The multibeam system installed on board was the echo sounder Elac Nautik Sea Beam 3020 of 20 kHz, which was designed to reach depths up to 7000 m. Meanwhile, the correction of the ship’s movement was made in real time by POS-MV system.

As one of the objectives of the study was to determine the maximum change in gradient and thus generate the foot of the continental slope from which the maritime boundaries will be drawn, sounding lines were planned. These were located at northwest and had an average length of 350 nautical miles, which varied approximately from 400 to 3000 meters depth at distances of less than 40 nautical miles.



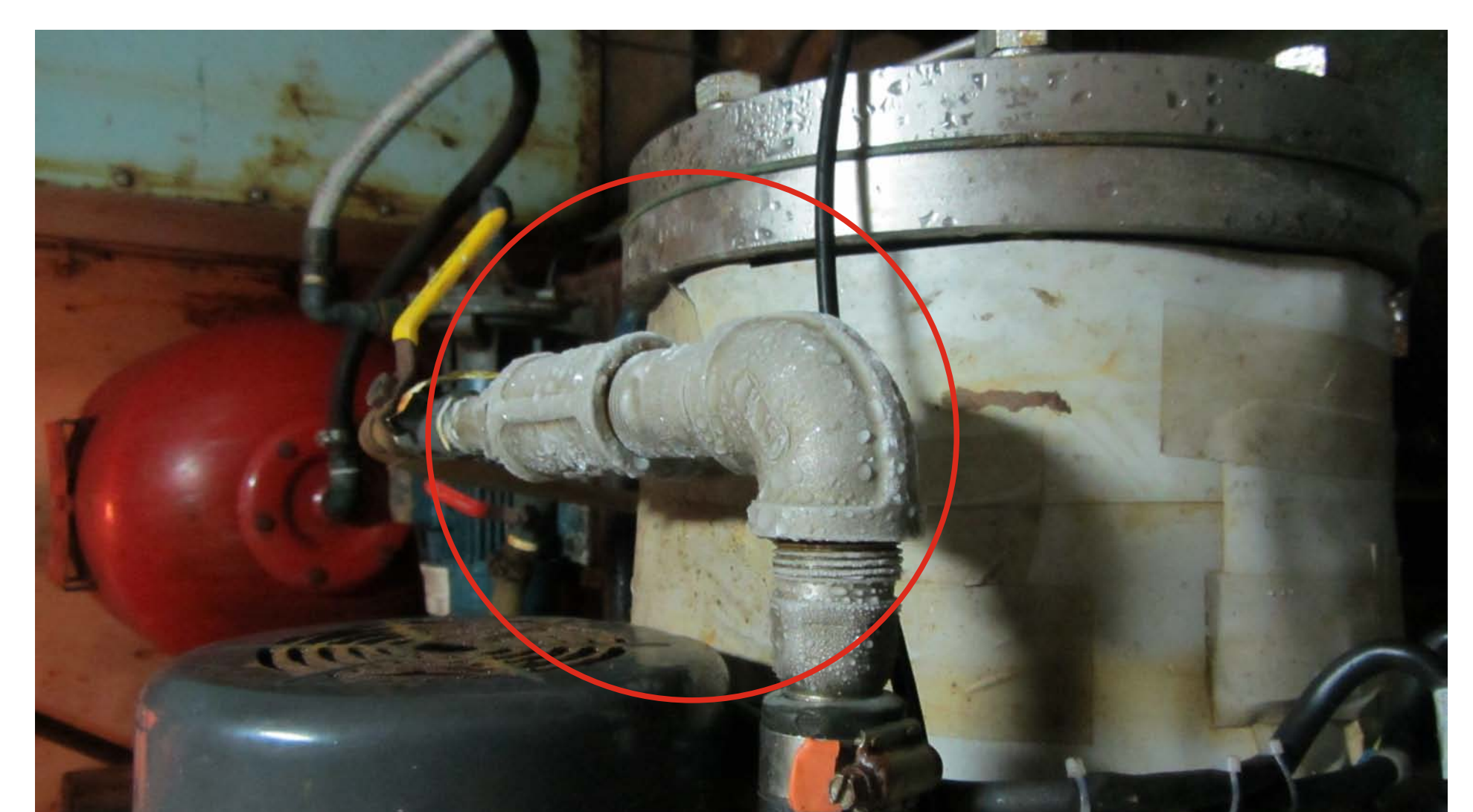
During the hydrographic survey carried out between October and November of 2011, a large amount of ice on the sea surface was found, and while navigating towards south this amount was increasing. This, in conjunction with the low temperature of the water, limited the operation of the echo sounder, which is designed to operate up to temperatures of -2°C. Besides, it restricted the sounding to the north area that had lesser ice concentrations, while in the southern part 9-10 tenths of ice was found for which it was only possible to sound up to 68° 28 '6.2" S. During this survey, 2228 nautical miles of the Antarctic Circle were sounded. Meanwhile, the total sailing distance was 7383 nautical miles.



One of the major components of the multibeam system is the surface sound velocity sensor (SSV), whose aim is to monitor the sound velocity to 6.35 m depth every 2 seconds. This sensor is installed within a pump, which allows

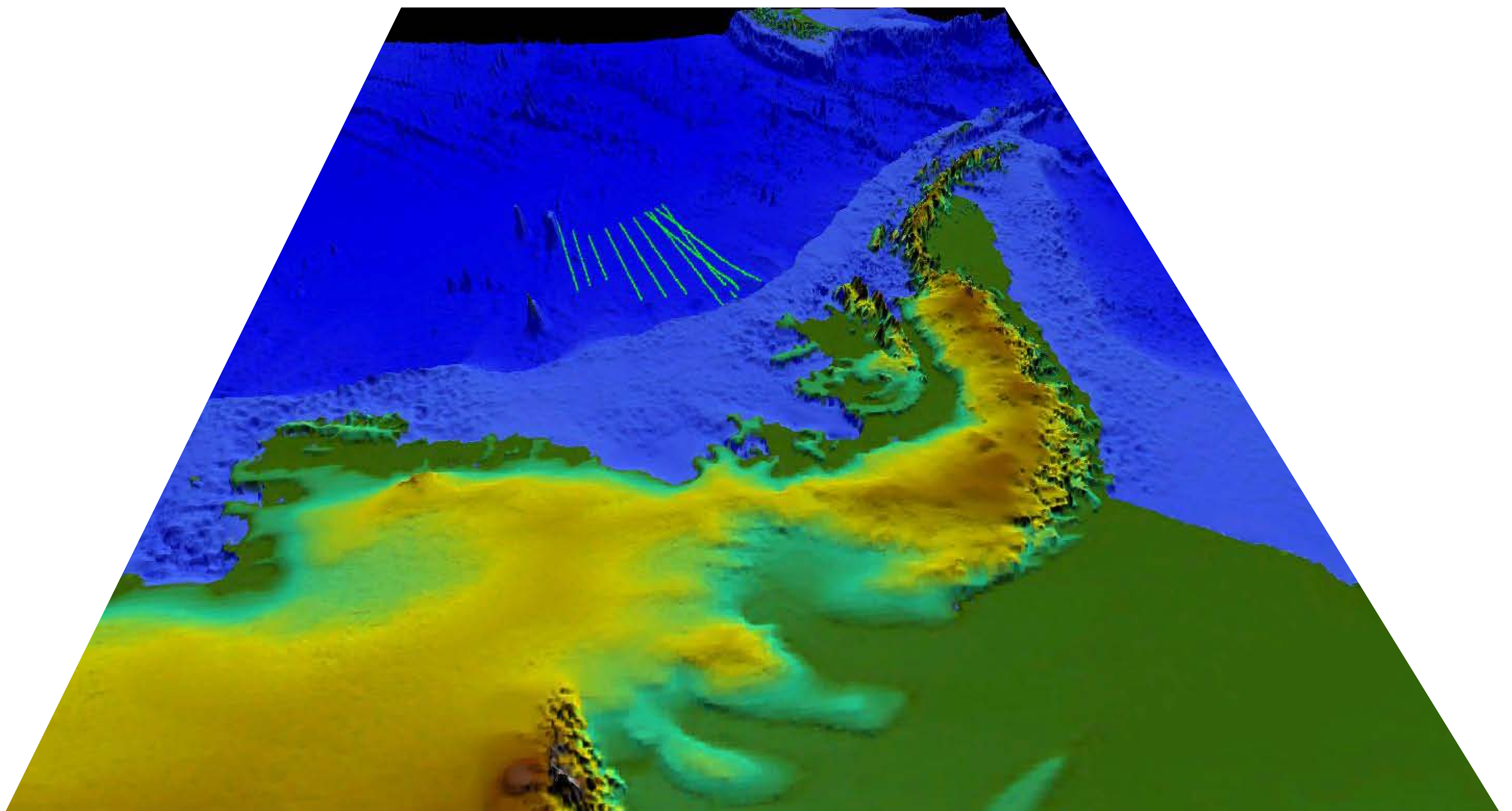


the water to flow constantly; this pump is installed inside the hold of the vessel, mainly to prevent the direct contact of the sensor with the ice that is frequently in work areas. Nevertheless, the adverse weather conditions in

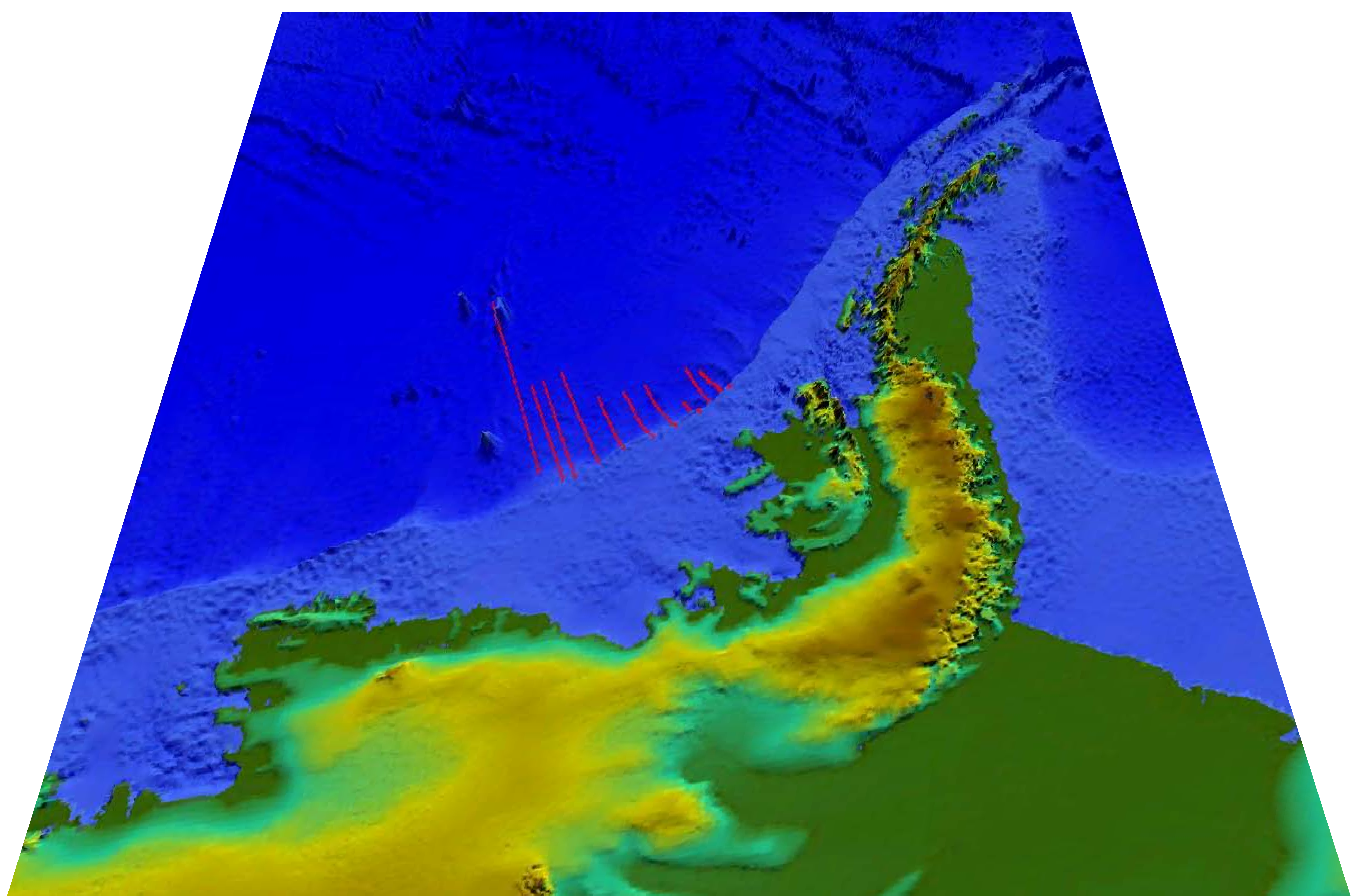


the Bellingshausen Sea conditioned the operation of the SSV due to the low water temperatures, which even caused that parts of the pump reached the freezing point and the intermittent stopping of the sensor. (See photo).

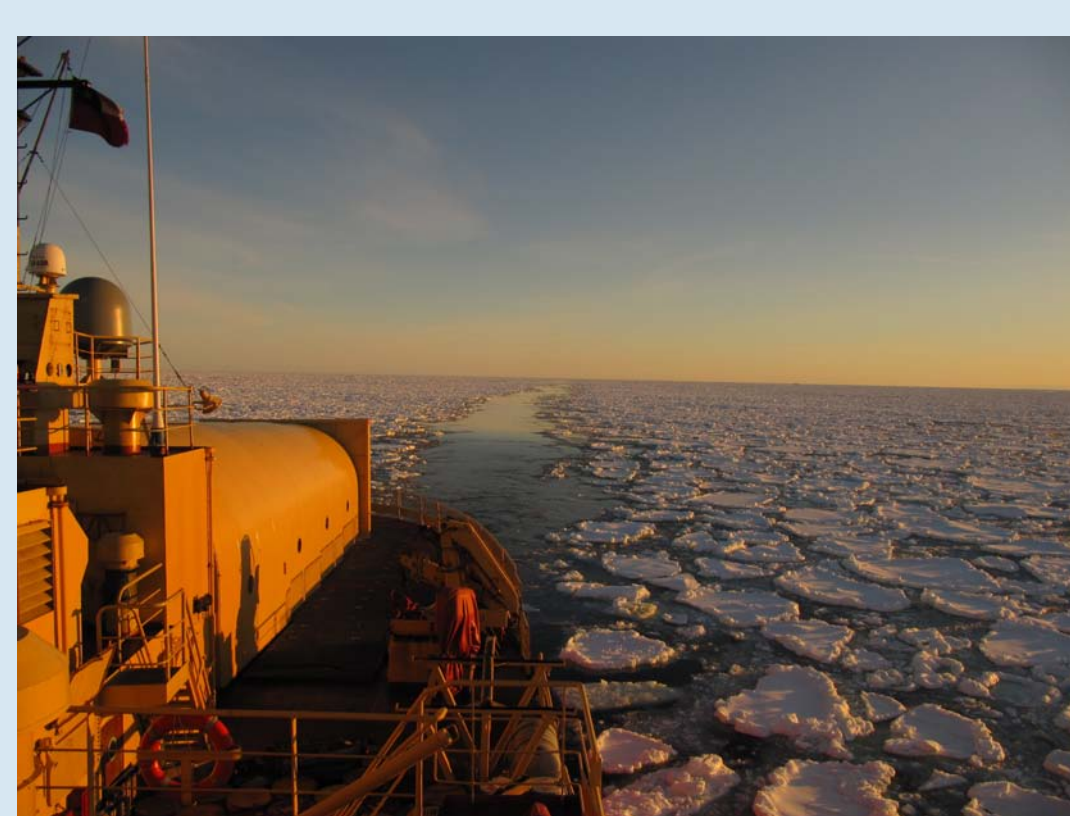
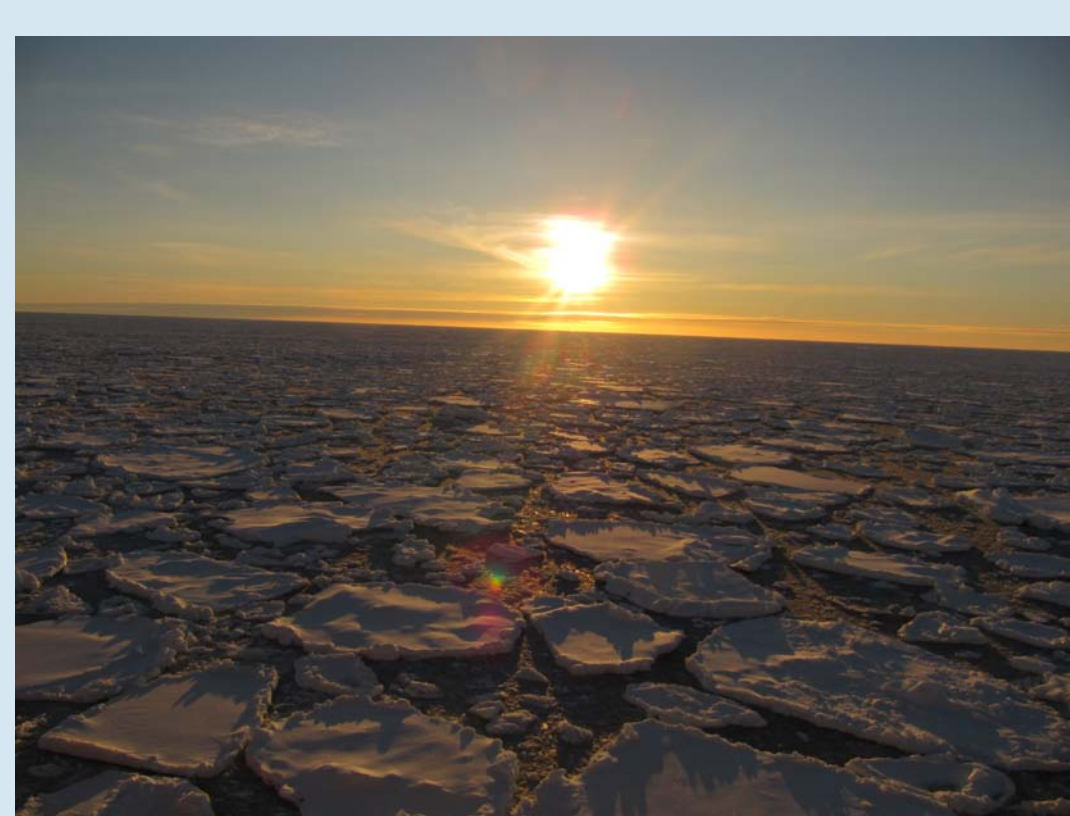
Furthermore, in the hydrographic campaign, conducted during February and March 2012, the weather conditions were more favorable with lesser ice concentrations. It allowed complementing the previous year work and sounding 1920 nautical miles from a total sailing distance of 7356 nautical miles.

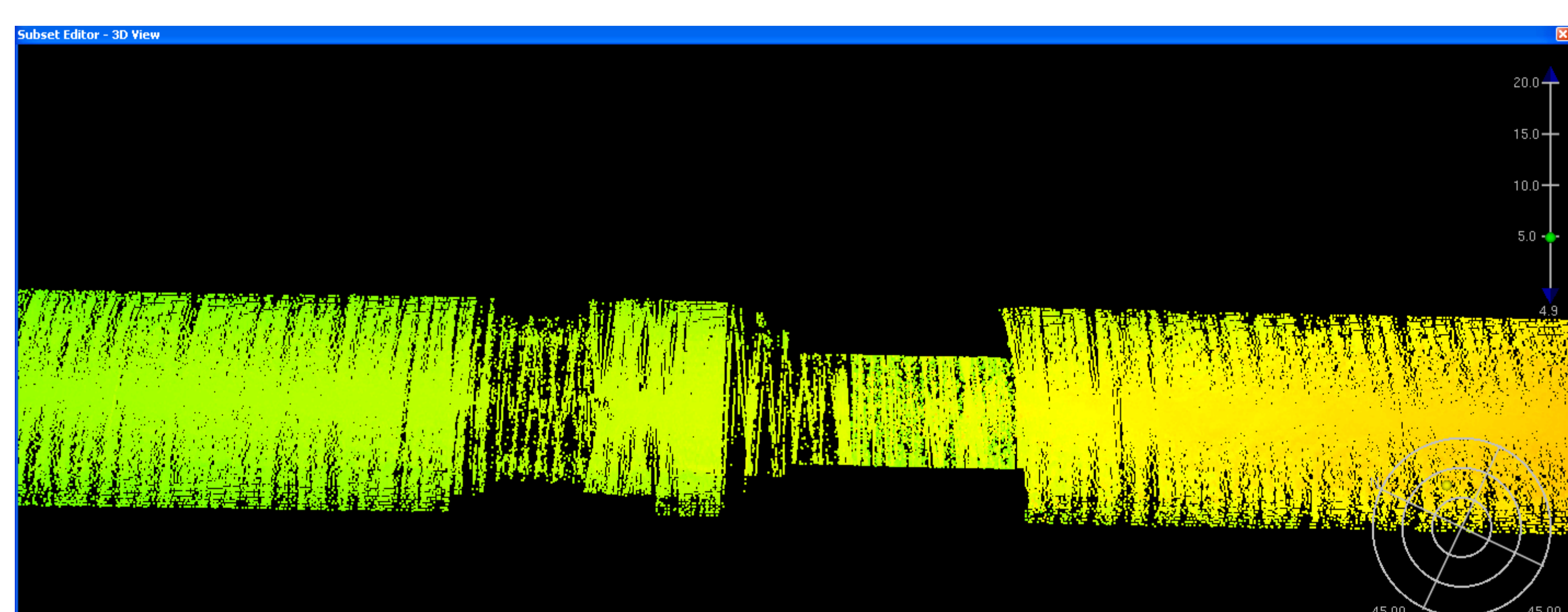
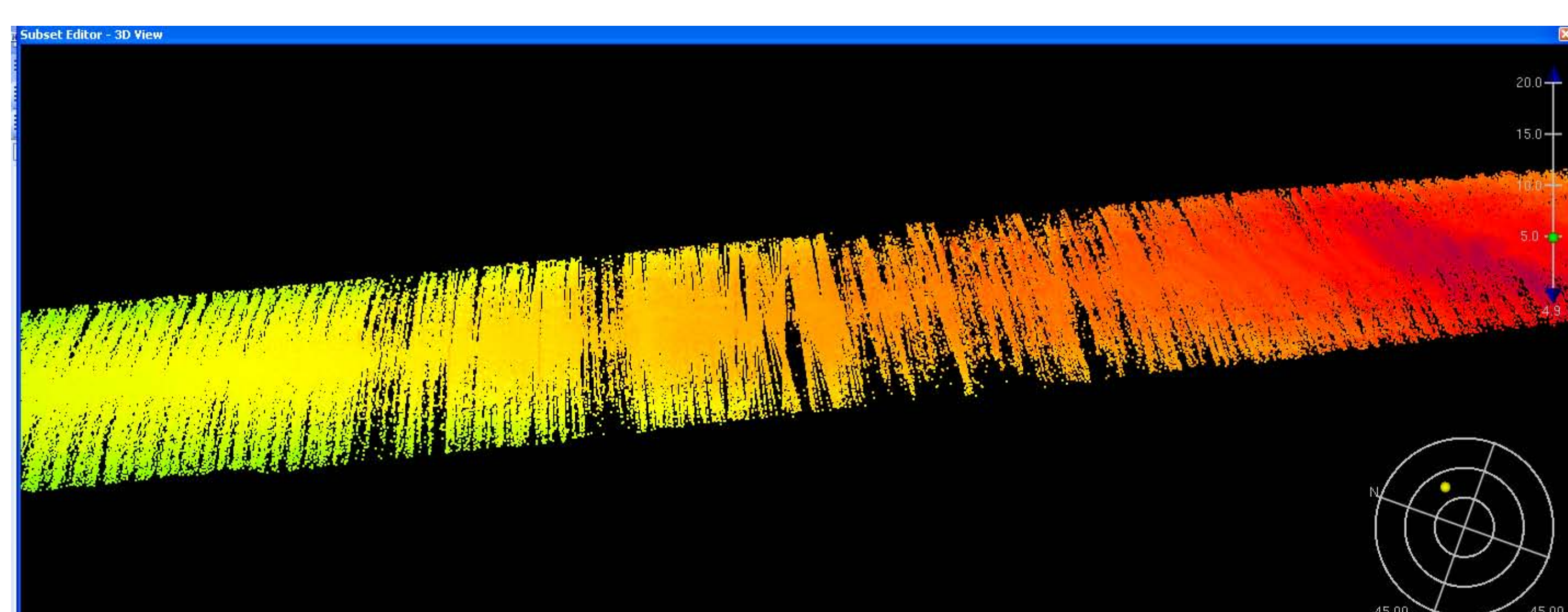


The data were obtained during 53 days in total, with 24-hour work day. The bathymetric data was acquired using the software Hydrostar to monitor the receiving data which later is analyzed and processed with software Caris Hips & Sips that can analyze, clean and display the data on board the ship.

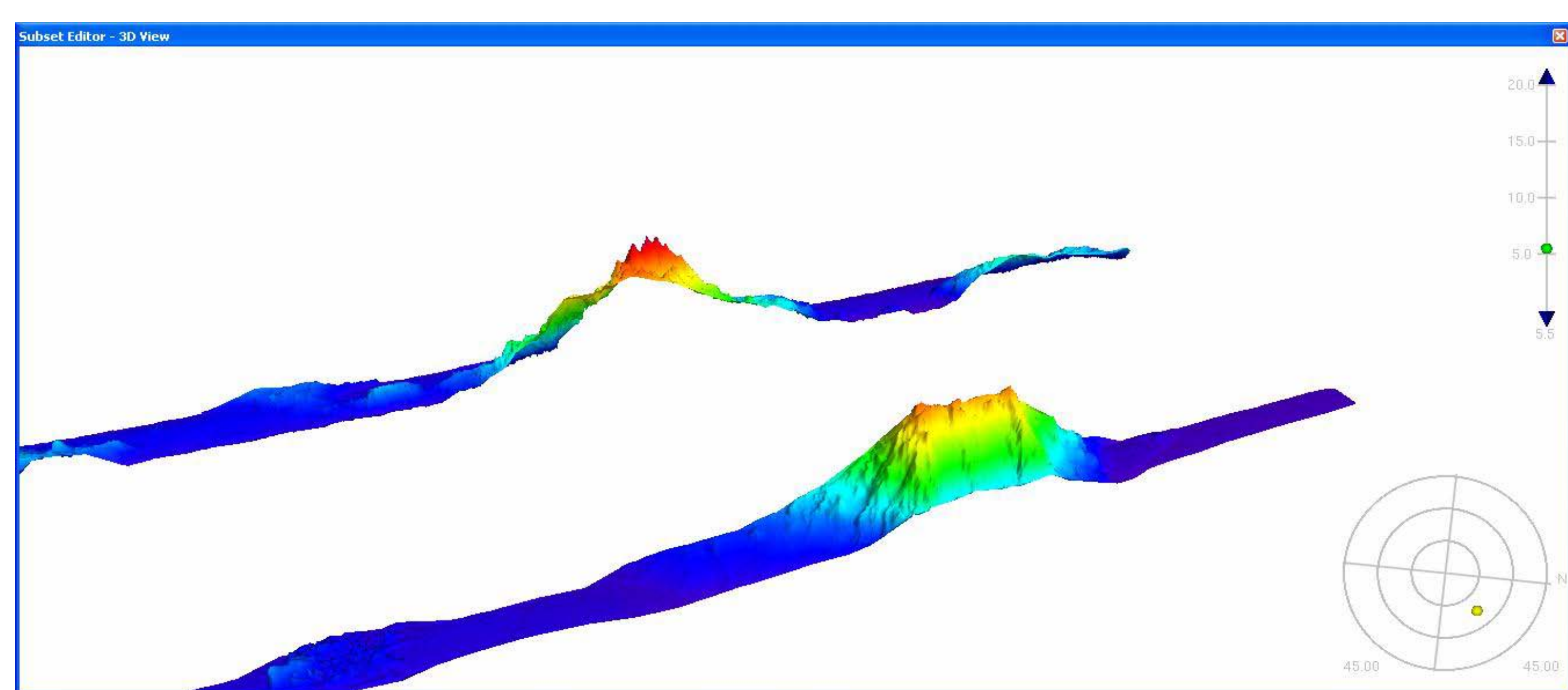


In general, during the soundings a good data quality was displayed, with a continuous record of the ocean floor, observing no significant loss of the data record. It is important to note that a decrease in the quality of the data was produced by the presence of ice belts; but throughout the sounding, seafloor data was observed steadily.

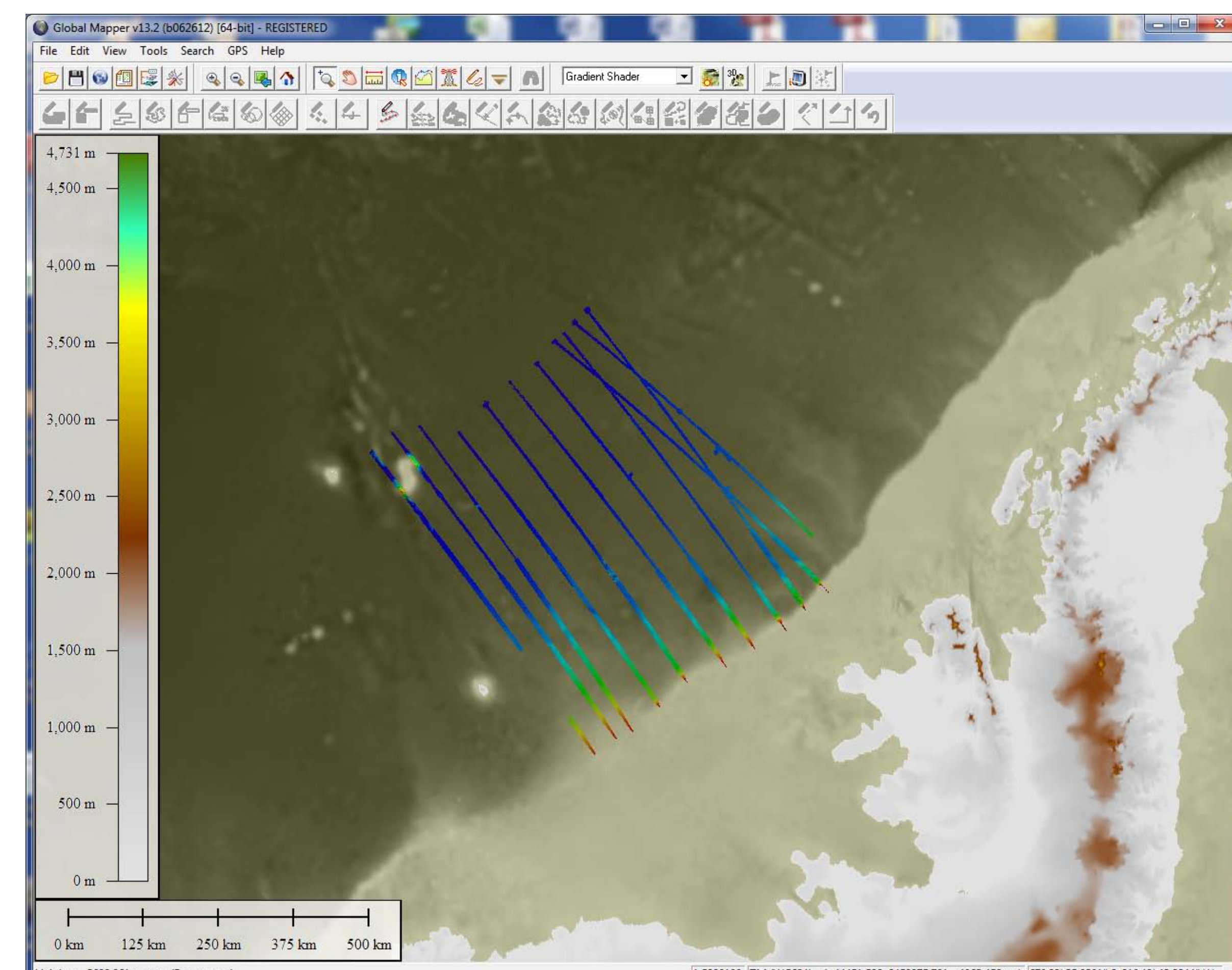
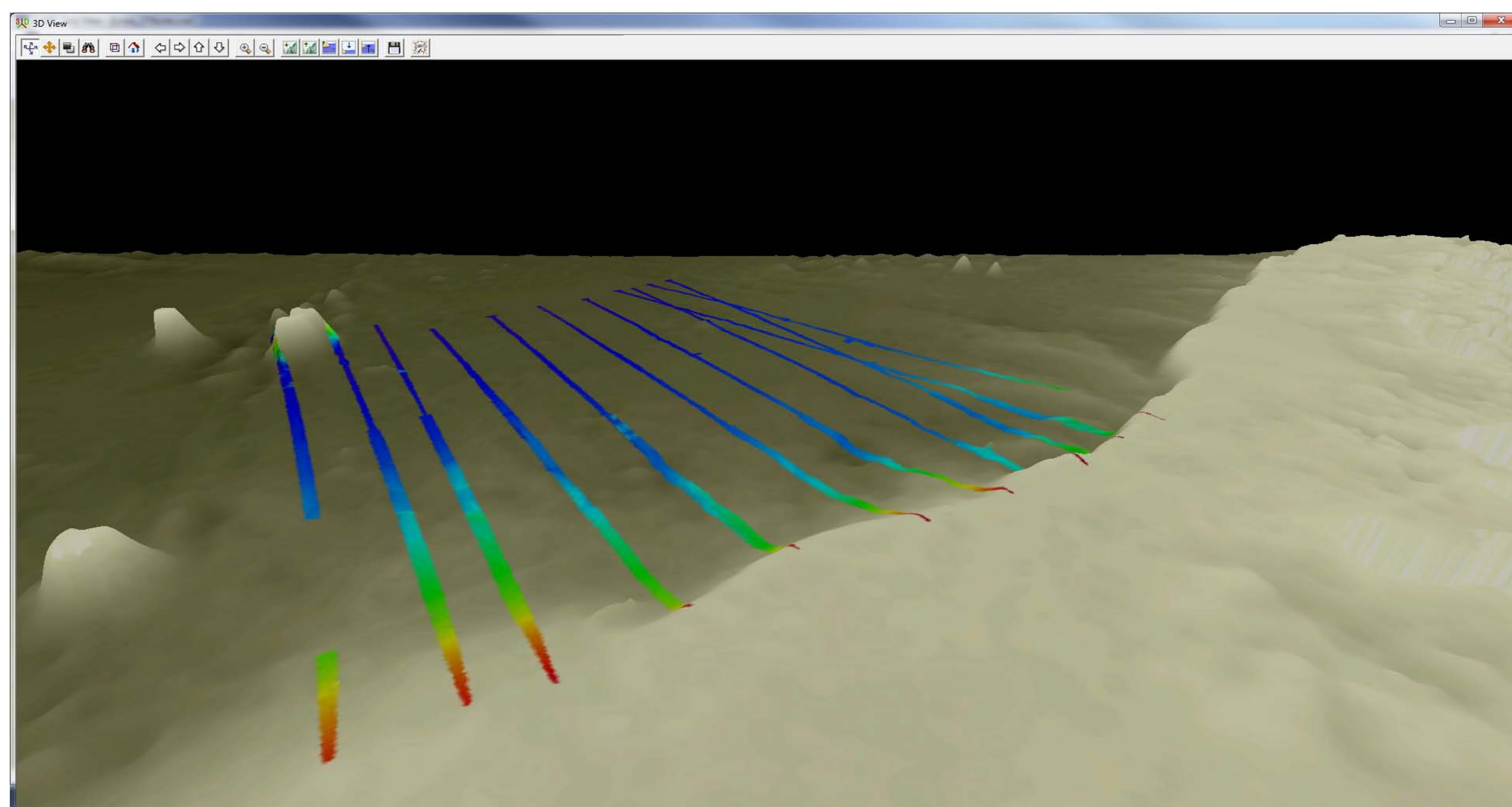
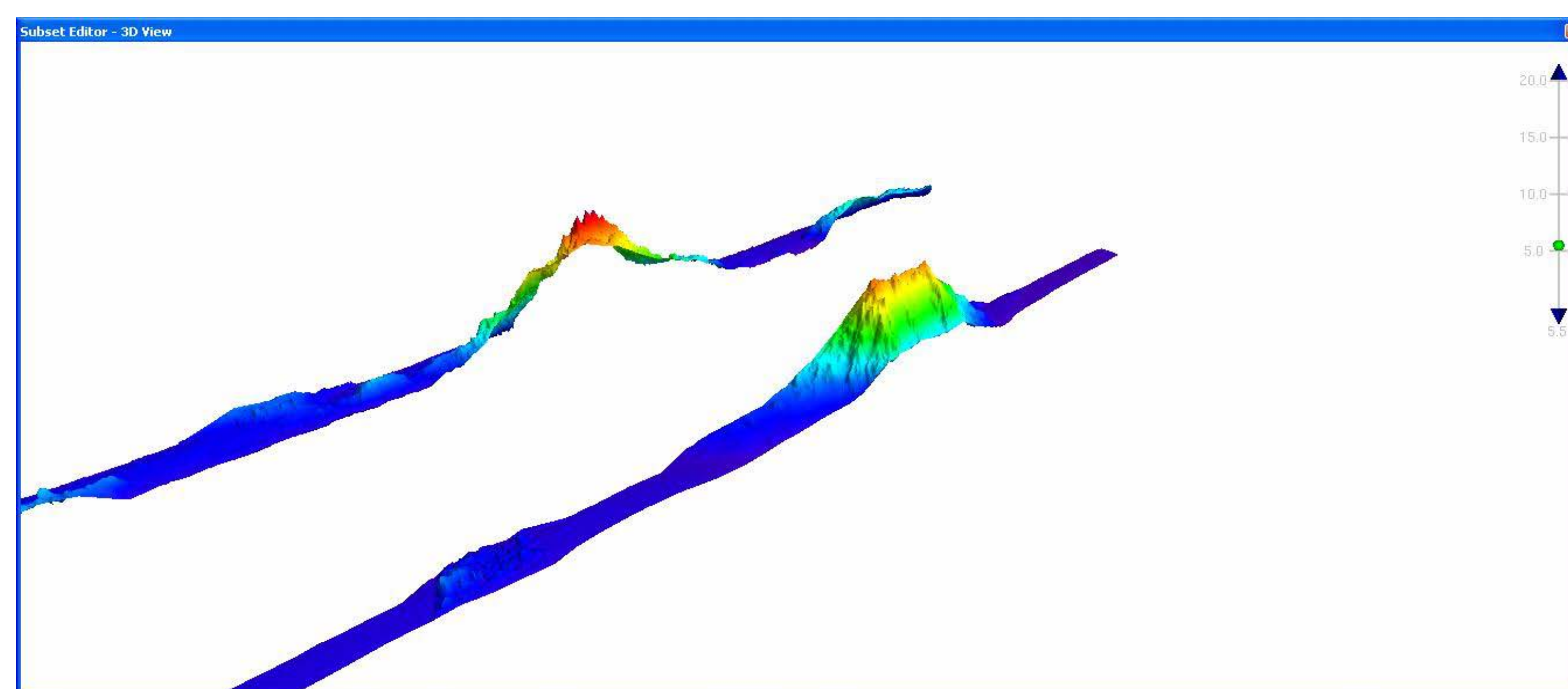
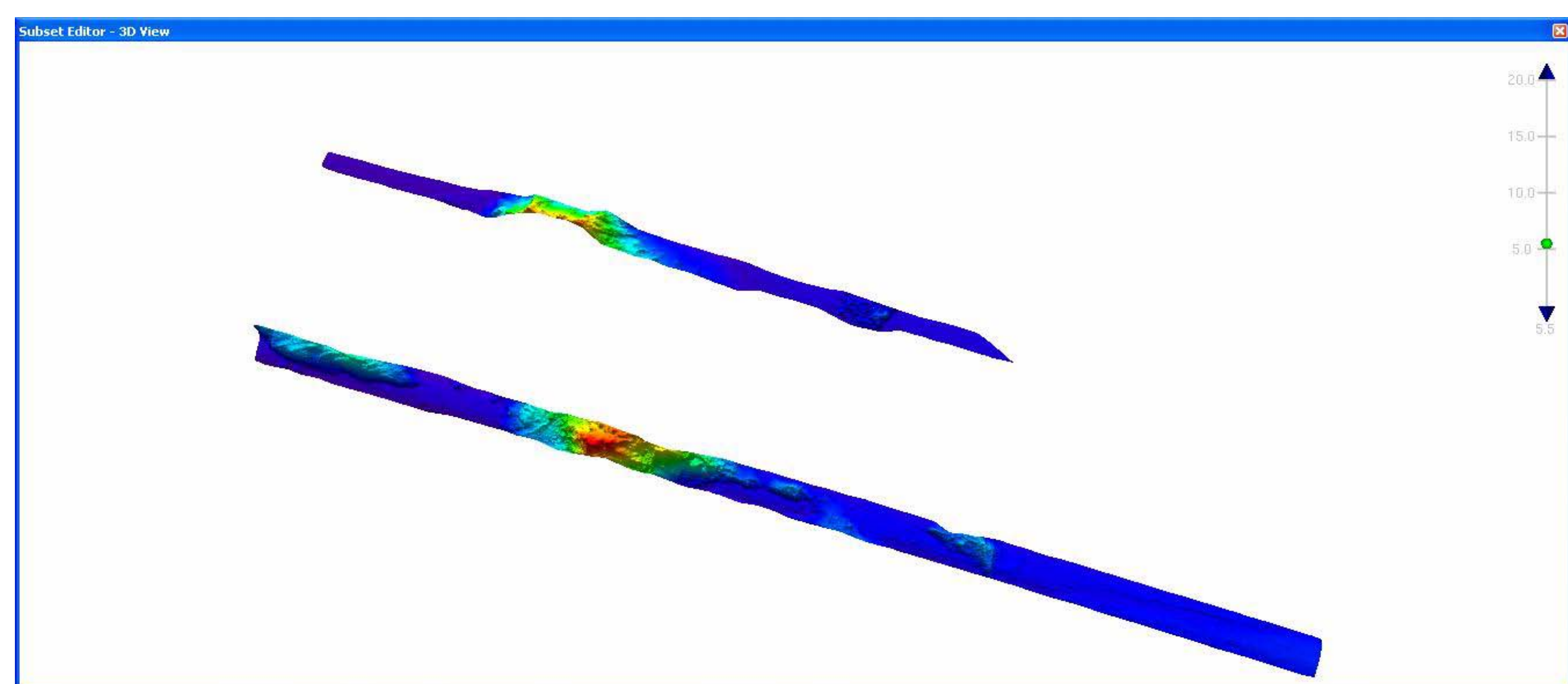




Decrease in the data quality due to the presence of ice belts.



During navigation in the northern part of the planned sounding lines between $65^{\circ} 20' 6'' \text{ S}$ - $90^{\circ} 9' 20'' \text{ W}$, notorious differences in depth were found. These differences were two sides of a large seamount; the size of the east slope of the seamount was 50 km width and through the sounding coverage it measured about 2800 m in height, while the western slope was 58.5 km width and a height of about 3300 m.



Finally, these surveys are a hydrographic milestone, since it was the first time that a Chilean ship carried out oceanic bathymetry works in remote and freezing latitudes, reaching $70^{\circ} 16' 59'' \text{ S}$ - $87^{\circ} 00' 52'' \text{ W}$: in the most southern position.

