RV SONNE Cruise SO244-II

Antofagasta – Antofagasta

27.11.15 – 13.12.15

1. Weekly Report

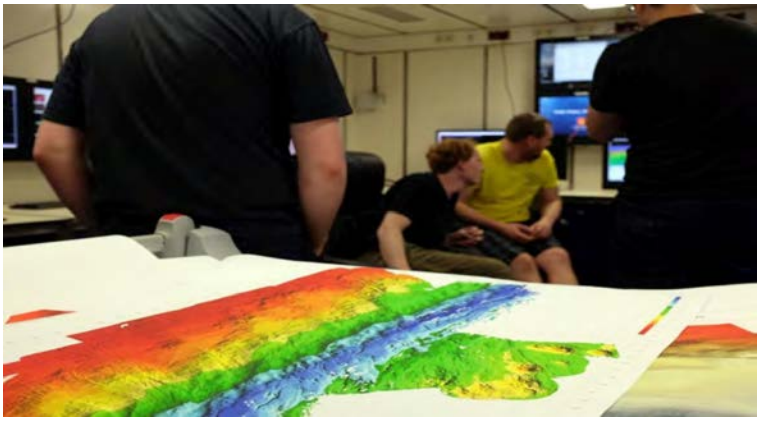
We left the port of Antofagasta and its beautiful setting against the coastal cordillera on Friday, November 27 at 9:30 a.m. The previous days in port were used to prepare and assemble our scientific gear. A total of 24 scientists from Chile, Germany and Great Britain will sail on SONNE to install the seafloor geodetic array GeoSEA. GeoSEA (**G**eodetic **E**arthquake **O**bservatory on the **SEA**floor) will be deployed in water depth between 2000 m and 6000 m on the continental margin and the oceanic plate offshore Chile to measure seafloor deformation at a sub-centimeter scale. The measured seafloor parameters contain crucial information on the strain build-up prior and during an earthquake and hence are important to improve our understanding of earthquake physics and hazard mitigation in the area. The network contains 23

RV SONNE leaves the port of Antofagasta.

transponder benchmarks, which are installed on steel tripods on the seafloor where they autonomously measure the deformation pattern.

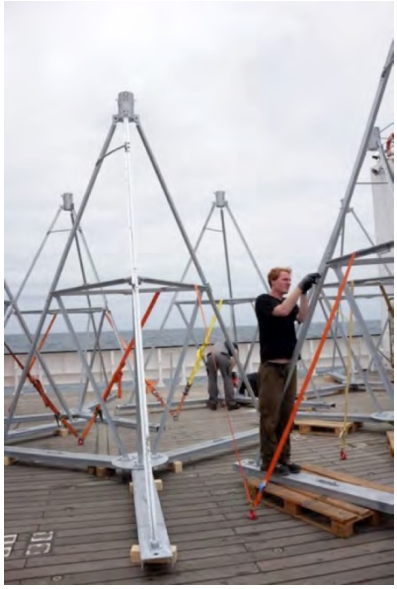
The 20-hour transit to our first working area was used to define locations for the network based on AUV data acquired during Leg I of SO244. The scientific crew of Leg I mapped four areas on the continental slope as well as an additional area on the outer rise seaward of the trench at 2 m resolution. From these maps we identified three areas, which are ideal for the installation of three GeoSEA sub-arrays to survey their diverse tectonics.

Our first working area is located at water depth ranging from 2500 m to 2800 m and thus is the most shallow of the target areas. It is characterized by four fault zones trending in a N-S direction parallel to the trench showing indications for active deformation.



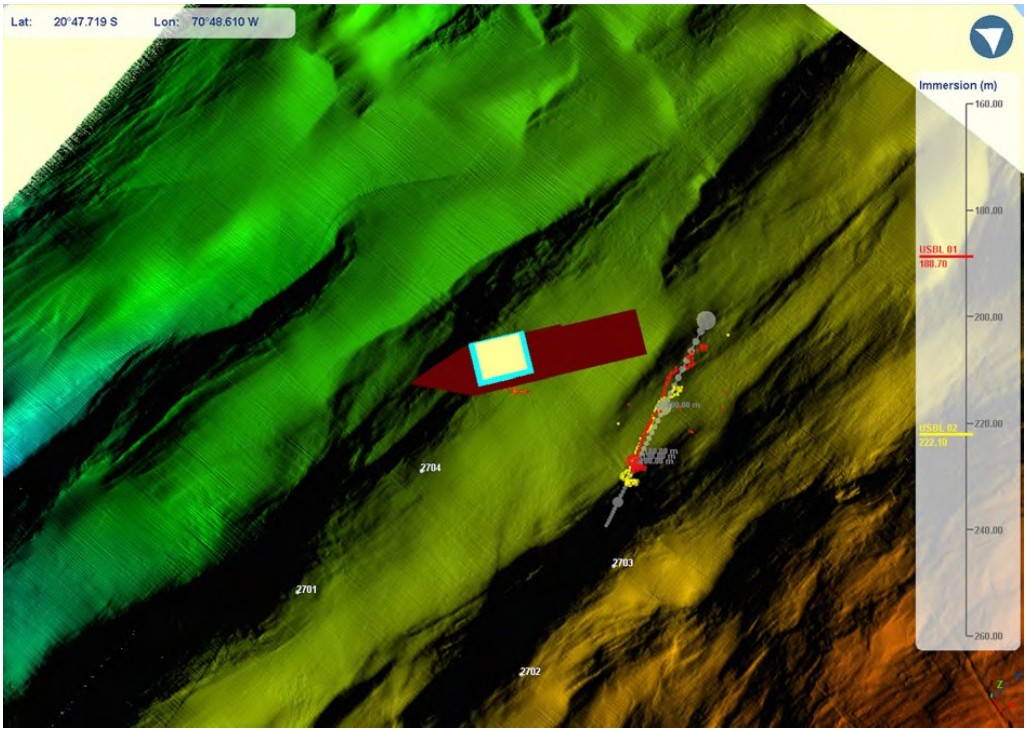
Analysis of bathymetric maps to define the network configuration.

On Nov. 28 at 6:00 we started with the preparation of the first deployment of GeoSEA station A101. The steel tripod is approximately 4 m high and was assembled on the large working deck of RV SONNE. Deployment was conducted using the deep-sea cable to which the tripod as well as two floats and a train wheel (as weight) were attached to stabilize the cable tension. In addition, two USBL Posidonia transponders were attached to the cable to indicate touch down on the seafloor.



GeoSEA Tripod on the aft working deck (Height app. 4 m without transponder beacon).

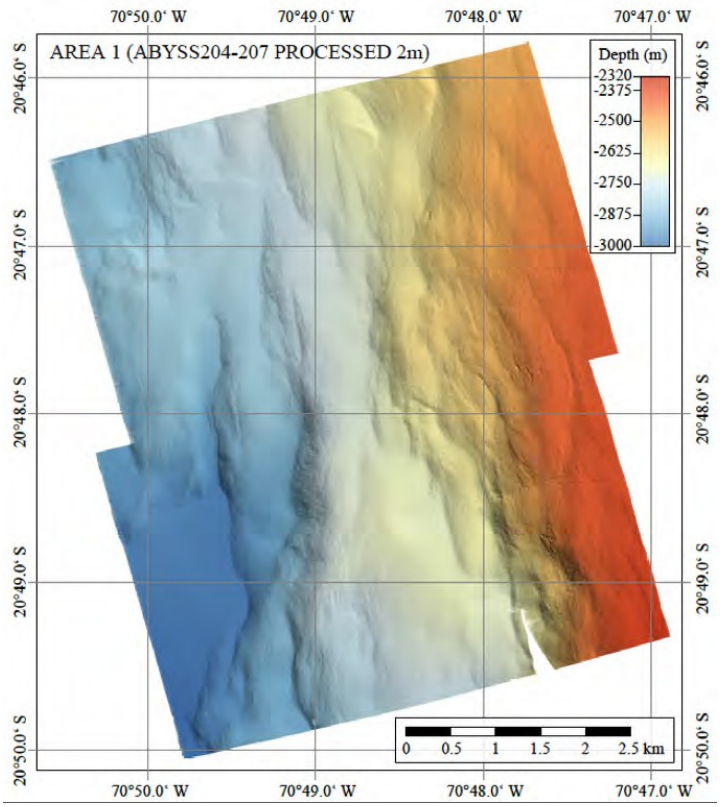
The deployment went smoothly until 200 water depth, when the winch was put on halt to deploy a dunker modem over the starboard side of RV SONNE. While on hold, suddenly the distance between the two USBL transponders rose significantly, indicating that the tripod was in a free fall mode towards the seafloor at 2500 m water depth.



USBL-Tracker monitoring the distance between two Posidonia transponders (red and yellow) to survey the seafloor deployment – and the yanking off of the tripod. White dots on the seafloor AUV map indicate planned positions of the GeoSEA network.

Due to the quick response of the deck's crew and scientific crew the hook of the heavy weight releaser could be released and the instrument as well as the floats were rescued.

With the additional modem on the starboard side we could monitor the fall and touch down of the tripod on the seafloor. As the barycenter of the tripod is located at its base, the instrument landed upside down and could be pinged immediately. It landed approximately 12 m away from its planned position and can be included in the network as a full-scale node.



AUV map of the first working area on the middle continental slope offshore northern Chile (2 m resolution). A total of 8 GeoSEA transponders will be deployed in a network on the seafloor.

Heave of the deep-sea cable brought the train wheel back on the deck: The eyelet where the cable had been attached was broken. The weight was modified to compensate for this.

On November 28 at 16:00 station A102 was deployed and installed on the seafloor. Both beacons respond and communicate with each other.

On November 29 we continued to deploy stations A103, A104, and A105 at water depths ranging from 2620 m to 2865 m. All five stations respond properly. Based on the acoustic travel times between the instruments we calculate the distance between the nodes and monitor the tectonic deformation between the stations in the following years.

In the meantime the deck's crew and scientific crew have reached some routine in deploying these new instruments and hence we look forward to our remaining time on board. Our special thanks go to the crew and officers of RV SONNE who make difficult deployments like ours possible in the first place.

The weather up to now has bee very good and everybody on board is doing fine and enjoys the Pacific swell.

Kind greetings to everybody back home,

Heidrun Kopp

At sea, 20°47'S / 70°49'W