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Development of the new very broadband compliance ocean bottom station

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In the frame of the EMSEIS Project* the University of Hamburg has developed two broadband compliance ocean bottom stations (BCSs). The objective was to create a station capable of acquire pressure and velocity data on the seafloor in the frequency range where compliance and infragravity waves are studied (30 – 500s).
A triaxial seismometer STS-2, a differential pressure gauge, an absolute pressure sensor, and a MLS Geolon recorder were installed on a Hamburg free-fall ocean bottom station. The whole system works in a broad frequency range (between 0.005 Hz and 25 Hz) with a sampling frequency of 50 Hz. The maximum deployment depth is 6000 meters. The BCSs were created to acquire compliance data during short time deployments (20-100 hours). However, laboratory tests and field experiences indicate that instruments can continuously work during about 30 days.
To secure the correct leveling of the seismic sensor, a two stage active leveling process was designed. In the first stage the mechanical leveling is performed and during the second stage the internal leveling is done and the masses are re-centered.
Two electronic circuits were designed and connected to the recorder and the seismometer to control the complete process. The tasks of the circuits are: 1) determinate the number of cycles during a measurement which depend on the number of leveling signals sent by the recorder, 2) to generate the impulse to initiate the mechanical leveling phase, 3) to send the signal to produce the internal leveling and 4) to sent the signal to lock and unlock the masses to protect the equipment.
To perform the mechanical leveling process the STS2 was mounted in a glass sphere on two gimbaled rings made of aluminum. Additionally, a retractile cube connected to a small motor was built-in the seismometer bottom. With the help of the motor, the cube can be extended to fix the seismometer to the sphere or can be retracted to allow the free pendulum motion of the seismometer in the sphere with an angle of 40°. The free gimbaling of the seismometer allows the leveling of the vertical and azimuth parameters conducted by gravity force, while stability and durability of the configuration are achieved with the extended cube.
The BCSs stations have been successfully deployed several times in the North Atlantic Ocean, specifically in the Logatchev hydrothermal field at the Mid Atlantic Ridge and around the Sao Miguel Island in the Azores.

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