



Numerical Modelling of circulation and internal tides on the Crozet plateau in support of the IMS/CTBTO hydroacoustic installation HA04

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Hydrophone stations of the Comprehensive Nuclear-Test-Ban Organisation (CTBTO) International Monitoring System (IMS), with the exception of one in Australia, comprise two triplets of submerged moored hydrophones, one North and one South of the island from which the respective system is deployed. Triplet distances vary approximately between 50 – 100 km kilometres from the island, with each triplet connected to the receiving shore equipment by fibre-optic submarine data cables. Once deployed, the systems relay underwater acoustic waveforms in the band 1 – 100 Hz in real time to Vienna via a shore based satellite link. The design life of hydroacoustic stations is at least 20 years, without need for any maintenance of the underwater system.

The re-establishment of hydrophone monitoring station HA04 at Crozet (French Southern and Antarctic Territories) in the South-Western Indian Ocean is currently being investigated. The highly dynamic ocean environment at Crozet is governed by strong winds and generally high sea states at the surface, local circulation emanating from the sub-Antarctic front (SAF) and the Agulhas return current (ARC), moderate surface tides and strong internal tides. Deploying the submarine cables and triplets in such an environment requires careful evaluation of all risks and in particular the minimization of the exposure of the deployed system to excessively strong currents. This issue has been addressed by two studies which are briefly introduced here.

In the first study, a linear spectral model was used to study and characterize the barotropic tide-driven currents on the Crozet plateau in three spatial dimensions. The M2 semi-diurnal component was shown to dominate in the area, driving sizeable internal tides. The estimate was quantitatively and spatially refined in the second study, in which a time stepping model was used taking into account the local ocean climatology and stratification, as well as the interplay between the seasonally varying local circulation and the internal tides. The numerical result showed a counter-clockwise circulation around Ile de la Possession and Ile de l'Est (Crozet Islands), with a strong component in the South. Internal waves propagating downslope in the near-bottom layers can be particularly intense South of the two islands, while the regions to the North appear to be more calm. The results from the studies are compared to a set of limited current measurements acquired during a survey campaign in 1998.