

International workshop. Cetacean echolocation and outer space neutrinos: ethology and physics for an interdisciplinary approach to underwater bioacoustics and astrophysical particles detection



Contribution ID: 19

Type: **Invited Lecture**

Underwater acoustics in Antarctica

Saturday, 19 October 2013 14:30 (50 minutes)

The Southern Ocean is one of the most diverse soundscapes of earth. The dynamics of the cryosphere i.e. sea ice, glaciers and icebergs create unique acoustic conditions. During polar winter the snow covered sea ice shields the ocean from atmospheric influences, suppresses the creation of waves and resembles an almost perfect acoustic absorber, thus creating one of the quietest environments of all oceans. On the other hand, large table icebergs calved from the enormous ice sheet of the Antarctic continent are the largest moving objects on earth and can accumulate kinetic energy in the terajoule range when driven by circumpolar currents. This energy is eventually released when these giants collide with the continental or ice shelves - events that create some of the loudest sounds in the sea which can be detected thousands of kilometers away. However, these are singular events which occur only few times per year. Typically the acoustic environment is dominated by the vocalizations of marine mammals. Most remarkable, the chorus of blue whales represents the spectral peak of the acoustic spectrum, audible almost during every single minute of the year despite the remaining population of blue whales in the Southern Ocean is just 2300 animals –compared to about 350.000 in the pre whaling area 100 years ago. The second largest source of acoustic energy are Antarctic Minke whales - the main target of today's scientific whaling. The relation between these animals and a sound of formerly unknown origin was just recently identified in 2013. Long term acoustic monitoring of this ecosystem thus can yield easy indicators for the population development of these animals.

In 2005 we set up the autonomous PALAOA observatory on the Eckström ice shelf, an acoustic array deployed through bore holes into the ocean under a 100m thick ice sheet. In 2009 we started to add long term deep water acoustic recorders to most of the oceanographic moorings that are deployed throughout the Weddell Sea, creating a basin wide acoustic array with 20 nodes at the moment. An international project will extend this to a circum- Antarctic installation during the next years, aiming to infer the complete spatio-temporal distribution of the Antarctic great whales. While the long term recorders are typically recovered every three years and their data are analyzed offline, the PALAOA data is streamed live via satellite to the lab and the public internet. This allows to direct field parties immediately to the seaside when interesting acoustic events are detected. Additional sensors provide related information that helps to interpret the acoustics. An AIS receiver monitors all ship traffic in the area to analyze human impacts. A CTD probe delivers oceanographic data. Meteorology and webcams make local weather and ice conditions accessible. Relating the acoustics to the medium and large scale ice situation is possible through high resolution ASAR images, provided by several satellites. All this data is collected in a database at the Alfred Wegener Institute and published in the PANGAEA data center. Live audio stream and historical data are available via www.awi.de/palaoa

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Session Classification: Information technology & infrastructures for acoustic data acquisition, archival and analysis