

# Potential civil and scientific applications

## IMS hydroacoustic data offer a wide range of potential uses

*The International Monitoring System uses seismic, hydroacoustic, infrasound and radionuclide technologies to monitor compliance with the Comprehensive Nuclear-Test-Ban Treaty. These technologies, together with the data and the products of the International Data Centre, have potential civil and scientific applications which may benefit States and the scientific community.*

When whales communicate with each other over distances of several hundreds of kilometers, they make use of the efficient propagation of sound through water. Taking advantage of the same effect, the International Monitoring System (IMS) hydroacoustic network covers the world's oceans with six hydrophone and five T-phase stations.

The IMS hydrophone stations are composed of triplets of hydrophones which are floated off the sea floor to the depth of the best sound propagation. T-phase stations, on the other hand, employ seismometers on small islands which detect acoustic waves in the ocean after they are converted

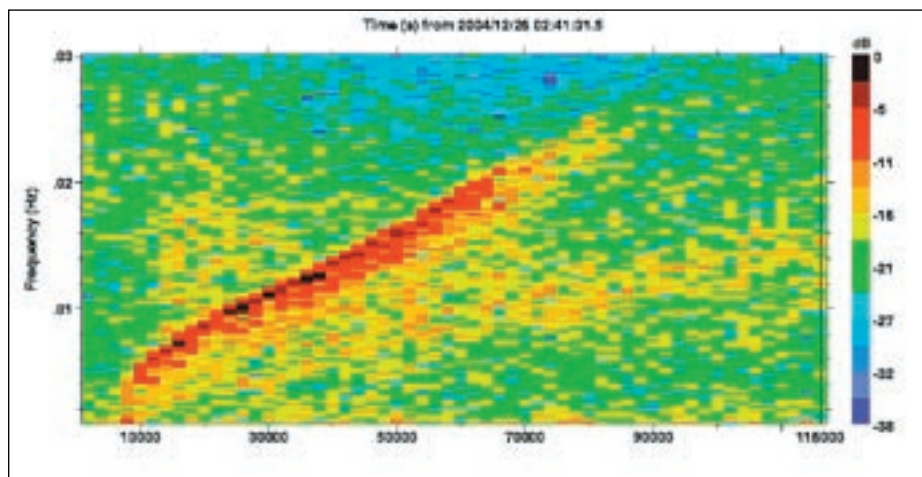


FIGURE 1: SPECTROGRAM OF THE 26 DECEMBER 2004 TSUNAMI RECORDED AT IMS HYDROPHONE STATION HA08 (DIEGO GARCIA, BRITISH INDIAN OCEAN TERRITORY) BETWEEN THREE AND 18 HOURS AFTER THE TSUNAMIGENIC EARTHQUAKE, SHOWING WITH UNPRECEDENTED CLARITY THE HIGHLY DISPERSED NATURE OF THE WAVE

to seismic energy at the islands' shores. Hydrophone stations have a considerably greater monitoring capability than T-phase stations. Although hydrophone stations were designed to detect nuclear explosions in the ocean, they are able to monitor several classes of ocean phenomena, including physical oceanographic processes, natural geophysical events and marine mammals, some of which emit hydroacoustic signals in the 1 to 100 Hz frequency range.

Natural geophysical events such as underwater seismicity and underwater volcanism can also be detected very effectively by hydrophone systems. Civil benefits could arise through integrating these detections into tsunami warning systems (figure 1). At the scientific level, the understanding of the seismicity of mid-ocean ridges and of underwater volcanism could be enhanced. Other signals observed by the IMS hydroacoustic stations appear to come from Antarctic iceberg calving, meteorite impacts on the oceans and submarine landslides. Further work, however, needs to be done to attribute these signals to particular oceanic events.

Similarly, the background noise of the ocean recorded at the IMS hydrophone stations represent data that may be of considerable environmental relevance, with implications on such matters as the contribution to ambient noise by human activities and marine mammal vocalizations. Two significant contributors to ocean ambient noise are shipping and whales, but it is not known quantitatively how one affects the other. Research using IMS recordings of ambient noise could lead to better understanding of these relationships.

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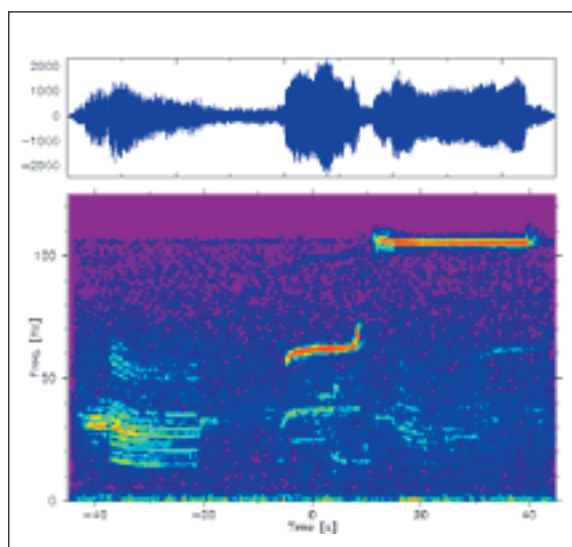


FIGURE 2: WAVE FORM (UPPER FRAME) AND SPECTROGRAM (LOWER FRAME) OF A WHALE CALL RECORDED ON 17 MAY 2005 AT HA08 (DIEGO GARCIA, BRITISH INDIAN OCEAN TERRITORY)

The IMS hydrophones are capable of serving as receivers for ocean acoustic thermometry. Acoustic thermometry is the periodic measurement of travel time of hydroacoustic waves which are affected by the distribution of the ocean temperature. Thus it can be used as a tool for monitoring the large scale temperature structure of the ocean. Potential benefits would include the monitoring of the average and long term temperature changes in the oceans, improved understanding of the oceans' processes and currents, and an increased capability to predict weather phenomena such as El Niño.

## Treaty Status

Signatures .....	175
Ratifications .....	122
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The highly sensitive hydrophones also pick up signals which originate from marine animals. Whales in particular have a very wide range of vocalizations, including some at low frequencies that can be readily detected by IMS stations. The nature of the sounds, their duration, pattern, and frequency content, can be used to identify the whale species (figure 2, page 16). On this basis, it is possible to obtain information on the position and migration patterns of individual whale species. This information could be used to research whale populations and their seasonal migration patterns.

The scarcity of hydroacoustic monitoring facilities and the high quality of the IMS data make it particularly valuable for scientific research. It remains a political decision by the Member States if this data and the International Data Centre's near real-time processing capabilities will be used to supply information related to national disasters and to enhance research in the above mentioned fields. The tragic events of 26 December 2004 which cost the lives of more than three hundred thousand people gave new impetus to the discussion on the potential usage of verification data for civil and scientific purposes (see cover article, page 1 and 17). ■

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24th Session	27 – 30 June 2005
25th Session	14 – 18 November 2005

### Working Group A:

27th Session	6 – 10 June 2005
28th Session	3 – 7 October 2005

### Working Group B:

24th Session	14 Feb. – 4 March 2005
25th Session I	23 May – 3 June 2005
25th Session II	29 August – 9 Sept. 2005

### Advisory Group:

24th Session I	18 – 23 April 2005
24th Session II	17 – 20 May 2005
25th Session	12 – 16 September 2005

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