Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

AAS03-P08 Room:Convention Hall Time:May 23 17:00-18:30

Infrasonic Waves in Antarctica: A New Proxy for Climate and Environmental Monitoring

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The Infrasound is defined as sub-audible sound with frequencies ranging from the cut-off frequency of sound (3.21 mHz) to the lowest frequency of the human audible band (20 Hz). This frequency range presents new opportunities for remote sensing of the atmospheric physical environment (Hedlin et al., 2002). There is an emerging body of published results on infrasound waves generated by diverse sources, such as volcanic eruptions, ocean waves, earthquakes, thunders, sprites and airplane passages (Matoza et al, 2007; Garces et al., 2008). For a remarkable example, the 2011 Tohoku-Oki, Japan earthquake (Mw = 9.0) produced unequivocal infrasound signals associated with the large tsunami (Arai et al., 2011). Free oscillations of the Earth from great earthquakes can also affect even the upper atmosphere. Another striking example is given by infrasounic shock waves generated by a large meteorite fall in Japan (Ishihara et al, 2004).

Characteristic features of infrasonic waves associated with environmental changes are clearly identified in Antarctic stations deployed during the International Polar Year (IPY2007-2008). Loading effects from the Southern Ocean are recorded by infrasound sensors deployed at Syowa Stations (SYO; 69S, 39E), in the Lutzow-Holm Bay, East Antarctica. The oceanic effects on infrasound modulated by the presence of sea-ice are examined relating to atmosphere-ocean-cryosphere system. Measurements of these microbaroms are useful tools for characterizing ocean wave climate and global storm intensity, complementing other geophysical measurements. The infrasound data at SYO, moreover, demonstrate unique signals with harmonic over-tones that may be be influenced by local near-surface processes, such as katabatic winds or the ice dynamics. Infrasound observations in Antarctica, consequently, could present unique new proxies for monitoring environmental change as well as temporal climate variations in the southern polar region.

Keywords: infrasound, Antarctica, microbaroms, environmental monitoring, global network, atmosphere-ocean interaction