Incoming directions of broadband infragravity waves observed at the central part of the Pacific Ocean

*Takashi Tonegawa[1], Kiwamu Nishida[2], Yoshio Fukao[1]

1. Research Institute for Marine Geodynamics, Japan Agency for Marine-Earth Science and Technology, 2. Earthquake Research Institute, The University of Tokyo

Infragravity waves (IGWs) are commonly observed at deep water, and their propagation characteristics have been investigated mainly by array analyses based on seafloor observations using seismometers and pressure gauges. Tonegawa et al (2018) revealed that IGWs at a frequency of 0.005-0.02 Hz observed at an absolute pressure gauge (APG) array with an aperture of 30 km off Aogashima Island, south of the Japanese Islands, are coming from South America in boreal summer and North and South America in boreal winter: the IGWs pass through the Pacific Ocean. To investigate the excitation and its seasonal variation of the IGWs in broadband frequency, arrays of seismometers or/and pressure gauges at the central part in the Pacific Ocean with wider apertures are useful. In this study, we used continuous records of differential pressure gauges (DPG) deployed around Hawaii islands by The Hawaiian PLUME Project to investigate IGW characteristics passing through the Pacific Ocean.

We used 22 DPGs with an array aperture of 600 km and station spacing of ~50 km. The observation periods were (1) from January 2005 to January 2006 and (2) from April 2006 to June 2007. In this study, we used the data from the first observation because the array aperture and station spacing in the first one was suitable for detecting IGWs. For continuous records, we applied a cross-correlation technique with one-bit normalization, and estimated incoming directions of IGWs using the calculated cross-correlation functions (CCFs) at frequency bands of 0.5 –1 mHz, 1–2 mHz, 2–10 mHz, and 10–20 mHz by assuming that IGWs wavefront is planar.

For the CCF, we changed the stacking time length of CCFs to detect IGW propagations. As a result, IGWs could not be retrieved in the 1-day averaged CCFs, but they emerged in the 30-day CCFs in the four frequency bands. Our results on the incoming IGW direction show that long-period IGWs (0.5–1 mHz) are coming from all directions in boreal winter and between east and south in boreal summer, while short-period IGWs (10–20 mHz) are coming between north and east in boreal winter and between east and south in boreal summer. This means that the IGW characteristics between long and short periods in boreal summer are consistent, but in boreal winter are significantly different. To investigate the excitation and seasonal variations of IGWs more details, the calculation of ray paths would be required.

Acknowledgement

The DPG data was acquired by The Hawaiian PLUME Project, and was downloaded by Incorporated Research Institutions for Seismology (IRIS) (https://www.iris.edu/hq/).

Keywords: Infragravity wave, Pacific Ocean, Incoming direction

