# Simultaneous modeling of microbaroms and microseisms

Mitsuru Matsumura[1], Masaki Kanao[1]
[1]*National Institute of Polar Research*

Oceanic surface gravity waves called as swells with period of several seconds appear anytime and anywhere on the ocean. They continuously radiate atmospheric acoustic waves called as microbaroms, while they also generate seismic surface waves called as microseisms. We can continuously observe both microbaroms and microseisms near the coast, and using these data we could estimate the wave height of oceanic swells. We could also estimate atmospheric temperature and wind, and solid earth density because they affect the propagation velocity of microbaroms and microseisms.

For the estimation we have developed a coupled atmosphere-ocean-solid earth model. If we connect independent parts of atmosphere, ocean and solid earth, we need to impose complicated boundary conditions. Instead we have modeled atmosphere, ocean and solid earth as a unified continuum to exclude the boundary conditions, using CIP-CUP (Constrained Interpolation Profile - Combined and Unified Procedure) scheme. This method makes it possible to precisely compute the advection part and to stably compute the ocean-atmosphere and ocean-solid earth boundaries, which have considerable gap of density and sound speed.

Our model successfully simulates a theoretical microbarom radiation [Arendt and Fritts, 2000]: 1) A microbarom is radiated by two swells propagating in opposite directions. 2) The period of the microbarom is half of the swells'. 3) The amplitude of the radiated pressure perturbation is in proportion to the squared vertical velocity of the swells. We will also compare the features of computed seismic waves with a theory [Longuet-Higgins, 1950], which is very similar to the one for microbaroms.

**References**

Arendt, S. and D.C. Fritts, Acoustic radiation by ocean surface waves, J. Fluid Mech., 415, 1-21, 2000.
Longuet-Higgins, M.S., A theory of the origin of microseisms, Philos. Trans. R. Soc. London, Ser. A., 243(857), 1-35, 1950.