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Who beats the Earth?

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In recent years, many researchers have reported that Earth's free oscillations a re observed even in seismically quiet days. Fundamental spheroidal modes in the mHz band are continuously and randomly excited at 0.5 nanogalileo level. Our rec ent analyses of spectra of such oscillations both in wavenumber and frequency ev idently have shown that the continuous excitation of free oscillations can be id entified up to at least 20 mHz. Their amplitudes vary annually and are larger in the summer of the northern hemisphere when the infrared flux from the Earth to the space takes the maximum. Fundamental spheroidal modes degree 29 and 37 which are coupled with atmospheric acoustic modes have excess amplitudes about 10% co mpared with the adjacent modes and the excess of the former reaches to about 40% in the summer (e.g. Nishida et al. 2000).

The above features of the oscillations are well explained by the atmospheric exc itation mechanism proposed by us. Turbulence in the lowest atmosphere randomly b eats on the ground and can radiate elastic waves to some extent. Kobayashi (1996) evaluated the fundamental free oscillation amplitudes on the order of a nanoga lileo using a simple scaling law of turbulence. However, the scaling law of the turbulence in the atmosphere or observed pressure fluctuation with an appropriat e coherent length predict larger amplitudes of modes above 10 mHz than the obser ved ones. In addition, pressure spectra on the ocean floors are larger than thos e of atmosphere, and the former spectra resembles spectra of the free oscillatio ns. So some people are inclined to think the oscillations are excited by the oce ans not by the atmosphere (e.g. Watada et al. 2000).

The ocean pressure spectra below 0.03 Hz, however, are thought to be composed of infragravity waves those are in a different branch from Rayleigh wave branch. E ven if the pressure perturbations on the ocean bottom contribute to the excitati on of continuous free oscillations in some part, not all the power in the pressu re spectra can do. Evident explanation of oceanic excitation mechanism has not y et given. On the other hand, Kobayashi (2002) show that the extra amplitudes of the acoustically coupled modes are well explained by sounds excited by atmosphe ric turbulence. In this point, the atmospheric excitation mechanism have an adva ntage. To reconcile the discrepancy in the atmospheric excitation mechanism, we also examine effect of oceans on the background free oscillations. In the presen t state, we prefer the atmospheric excitation mechanism against oceanic one for the cause of the background free oscillations.