A two-step amplification mechanism of infrasound waves in the ocean-atmosphere system

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It is widely recognized that atmospheric acoustic waves (infrasound waves) are generated by seismic waves, propagating upward up to the upper atmosphere. The amplitude of seismically excited acoustic waves in the thermosphere is about 10^4 –10^5 times larger than the amplitude of seismic waves on the ground [Shinagawa et al., 2013; Maruyama and Shinagawa, 2014]. In the ocean, compressibility of water becomes important for seismic waves with a period of 10 seconds or less, and acoustic waves are generated by sudden motion at the sea bottom, propagating upward up to the sea surface. Resonance of the acoustic wave in the vertical direction can occur depending on the period of the acoustic wave, and can result in large oscillations at the sea surface. Previous theoretical studies suggest that the amplitude of sea surface oscillation at resonant frequencies could reach about 100 times larger than the sea bottom oscillation [Williams and Guo, 1991; Izumiya et al., 1996]. The large amplitude oscillation driven by resonant acoustic waves generate atmospheric acoustic waves, which propagate upward into the upper atmosphere, resulting in the amplitude of acoustic waves of about 10^6 –10^7 times larger than the sea bottom oscillation. Therefore, oscillations of micrometer amplitudes at the sea bottom become meter-order oscillations in the thermosphere, and may generate significant variations in the ionosphere. In this talk, I will discuss and present possible effects of the resonant amplification of acoustic waves in the ocean on the upper atmosphere.

References

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