南極域で観測されるインフラサウンド波による電離圏擾乱の可能性
－ 東日本巨大地震によるケーススタディとアナロジー －

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Ionospheric disturbance assoicated with infrasound observed in the Antactica
- Case study and analogy of the 2011 Tohoku earthquake

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After the 1964 Alaska earthquake, acoutstic wave excited by the earthquake was observed with micorobarography [Bolt, 1964]. Simultenusly, traveling disturbacne from ground to upper ionosphere was found in ionosonde data [Leonard & Barnes, 1965]. The results suggest that the acoustic wave was excited by the ground motion, propageted to upper atomosphere and disturbed ionosphere. Theoritical studies showed low frequency acoustic wave, infrasound, can propagate upper atomosphere [e.g. Watada, 2009]. Total electron content (TEC) are derived from dual frequency of GPS radio signal. Since dense GPS arrays which are good monitoring tool for the ionosphere have been developed all over the wold, traveling ionospheric disturbances asociated with earthqakes were often observed in GPS-TEC [e.g. Heki and Ping, 2005; Otsuka et al., 2006]. A megathrust-type earthquake, the M 9.0 Tohoku earthquake (Tohoku EQ) occurred on 11 March 2011 in the western Pacific Ocean. After the Tohoku EQ, many types of ionospheric disturbances such as acoustic resonance and gravity wave were observed. Furthermore, large plasma depletion named “tsunamigenic ionospheric hole” was observed. Since similar plasma deletions were also found in the 2010 M8.8 Chile and the 2004 M9.1 Sumatra earthquakes and other earthquakes. Since the depletion was not found after the 1999 Chi-Chi EQ which was inland EQ, the deplition is expected to be related to initial tsunami generation. Eight minutes after the Tohoku EQ, a faster CID was observed at ~3.0 km/s only in the west-southwest, while a slower concentric CID was observed at 1.2 km/s or slower from the tsunami source area in the Tohoku EQ. Taking the propagation speed and oscillation cycle into account, the faster CID was associated with a Rayleigh wave but the slower CID was associated with an acoustic or gravity wave. The north-south asymmetry of the CID associated with the Rayleigh wave suggests that the Rayleigh wave did not act as a point source of the acoustic wave because a point source propagating in all directions produces CID in all directions. Therefore, a superimposed wave front of acoustic waves excited by the Rayleigh wave produced the north-south asymmetry of the faster CID due to the magnetic inclination effect. From aspect of the earthquake study, it is possibly to be observed ionospheric desturbances excited by infrasound excited by ground/sea suface acitites in Antactica region such as icequakes and ocean waves.

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