

Free oscillations of the earth observed by HF Doppler sounding

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Any elastic bodies support standing waves known as free oscillation or normal mode. The frequencies of the excited mode of these oscillation is less than 20 mHz since the oscillations are usually low orders of the eigen oscillation. The atmosphere also has resonant oscillations with similar frequencies. Therefore, there are normal modes in the combined system of the solid earth. The upper boundary of the normal modes is considered to be located at the upper ionosphere, as several hundreds km above the ground. This means that a certain ionospheric sounding system can observe this normal modes. In fact, associated with some large impact events, such as the massive earthquakes, volcanic eruptions, the ionospheric disturbances whose frequencies are about several mHz have been observed. Since the earth shows this free oscillation due to various sources of seismic sources but the atmospheric and tidal sources, ionospheric disturbances with a coupled frequencies can be observed in the quiet days for the ionosphere. In this study, therefore, the ionospheric disturbances with frequencies of the coupled oscillation are examined using HFD ionospheric sounding system. The merit of the HFD sounding system used in this study is to obtain the ionospheric disturbances at up to four different altitudes. Selecting geomagnetically quiet days, the spectrum of the ionospheric disturbances in these quiet days are determined. In the presentation, we will report the result of the intensity of the coupled mode oscillation.