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# Observation and simulation of AGW in Space

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Examples are presented of satellite observations and imaging of AGW and related phenomena in space travelling ionospheric disturbances (TID). The structure of AGW perturbations was reconstructed by satellite radio tomography (RT) based on the signals of Global Navigation Satellite Systems (GNSS). The experiments use different GNSS, both low-orbiting (Russian Tsikada and American Transit) and high-orbiting (GPS, GLONASS, Galileo, Beidou). The examples of RT imaging of TIDs and AGWs from anthropogenic sources such as ground explosions, rocket launching, heating the ionosphere by high-power radio waves are presented. In the latter case, the corresponding AGWs and TIDs were generated in response to the modulation in the power of the heating wave.

The natural AGW-like wave disturbances are frequently observed in the atmosphere and ionosphere in the form of variations in density and electron concentration. These phenomena are caused by the influence of the near-space environment, atmosphere, and surface phenomena including long-period vibrations of the Earth's surface, earthquakes, explosions, temperature heating, seisches, tsunami waves, etc. Examples of experimental RT reconstructions of wave disturbances associated with the earthquakes and tsunami waves are presented, and RT images of TIDs caused by the variations in the corpuscular ionization are demonstrated.

The results of numerical modeling of AGW generation by some surface and volume sources are discussed. The milli-Hertz AGWs generated by these sources induce perturbations with a typical scale of a few hundred of kilometers at the heights of the middle atmosphere and ionosphere. The numerical modeling is based on the solution of equations of geophysical hydrodynamics. The results of the numerical simulations agree with the observations.

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