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#横山 佳弘 [1)], Sergienko Tima[1)], Brändstöm Urban[1)]
[(1] スウェーデン宇宙物理学研究所

ARTIFICIAL BARIUM CLOUDS MOTION AT THREE DIFFERENT ALTITUDES: RESULTS OF THE BROR EXPERIMENT

#Yoshihiro Yokoyama[1)], Tima Sergienko[1)], Urban Brändstöm[1)]
[(1]Swedish Institute for space physics

The Barium Release Optical Rocket (BROR) mission conducted at Esrange, Sweden, on 23rd March 2023, performed barium releases into the earth's atmosphere at eight different altitudes between 130 and 245 km to investigate small-scale electromagnetic phenomena in the auroral ionosphere. In the initial three releases, which were performed at 132 km, 160 km, and 193 km, the motions of both neutral and ionized barium clouds were clearly and distinctively observed by the ground-based optical camera network for as long as a few tens of minutes. The neutral cloud motion represents the thermospheric convection, and the ionized cloud motion is predominantly controlled by the ExB drift motion. In horizontal plain, all neutral clouds resulting from the initial three releases had a strong westward component in their motion with almost constant velocity, while the ionized clouds behaved quite differently from each other; the first ionized cloud moved southwest with a relatively slow speed, the second cloud moved southeast, and the third first directed southwest but afterward changed its direction to southeast, almost parallel to the path of second ionized cloud. In addition, in the second and third cloud motion, several accelerations and declamations were observed.

Although it is said that no large parallel electric field to the magnetic field line exists at the altitude of the aurora ionosphere, the ionized barium cloud resulting from the second release showed considerable difference in vertical motion from the theoretical estimated value considering the contribution of the ExB drift, which implies that there should be some mechanism that make ionized cloud accelerate in the vertical direction.

In this presentation, we will show the detailed motion of clouds resulting from the initial three releases of BROR in relation to the aurora activity and discuss the plausible mechanism that explains the vertical motions of ionized clouds.