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Propagation characteristics of lightning whistlers in the Earth's plasmasphere
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Akebono (EXOS-D) satellite as Japanese scientific spacecraft has observed the Earth's plasmasphere for almost 23 years. Lightning whistler is known as one of typical VLF wave phenomena observed by Akebono. When Akebono traversed in the plasmasphere, a series of lightning whistlers were frequently observed by the analogue wideband receiver (WBA) which covers below 15kHz. Recently, we developed an intelligent algorithm to detect lightning whistler from the WBA data. In the present study, we analyzed two typical events representing clear dispersion characteristics of lightning whistlers along the trajectory of Akebono. Event on 20th March, 1991 was observed at latitude from 56.48 degree N to -5.5 degree S and altitude between 2232 km and 7537 km. Another event on 12th July, 1989 was at latitude 45.35 degree N and -33.38 degree S through altitude 1420 km towards 7911 km. These events show systematic tendency so that can be easily concluded whether the wave packets of whistler originated from lightning strikes in the northern hemisphere or southern hemisphere. Event on 20th March, 1991 that observed at 19.13-19.51 UT has about 564 detected whistlers and their dispersion becomes smaller, which suggests the source of whistlers originate from southern hemisphere. Event on 12th July, 1989 has 542 detected whistlers. There is uncommon phenomenon in the event that is exist two tendency of whistler dispersion, that suggests there are two series of lightning whistlers whose sources were located at both hemispheres coincidently. Finally, we roughly estimated the path lengths of these whistlers from source to the observation points along the Akebono trajectory. In the calculation, we assumed dipole model as geomagnetic field and a simple electron density profile in which electron density is inversely proportional to the cube of geocentric distance. The analysis could make sure that the dispersion characteristics of whistlers agree with the path lengths of wave. That is, it was found that dispersion of whistler D is proportional to square of path length S. It is noted that our current estimation is quite simple but this fact shows the residual between our estimation and observation data is mainly due to electron density profile and dispersion analyses of lightning whistlers is useful technique to reconstruct electron density profile in the Earth's plasmashpere.

キーワード: Akebono, Lightning Whistler, Propagation, Dispersion, Plasmasphere, Electron Density
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