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沿海地区一次多单体雷暴电荷结构时空演变

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Spatial and temporal evolution of a multi-cell thunderstorm charge structure in coastal areas

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摘要

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摘要 利用闪电放电辐射源三维时空分布测量,分析了山东低海拔地区一次多单体雷暴过程的电荷结构演变以及与回波强度的关系.结果表明对流云区电荷结构是典型的上正下负电偶极结构,且随着雷暴发展正负电荷层强度增大,高度抬升.负电荷区处在40 dBz以上的强回波区域中,正电荷层处在约40 dBz区域中.层状云区也有类似结构,只是强度弱,高度低.观测到的四层电荷结构是出现在对流区消散阶段,此时,由于云体不同部位的不同消散程度,电荷结构发生断裂,云体前部正负电荷区下沉,云体中部正负电荷区高度变化不大,但负电荷区域变薄,呈现出四层电荷结构.从本例结果说明,雷暴优势起电机通常能形成电偶极或三极性结构,多极结构可能不是起电形成.本文还分析了一次负地闪传输过程,和宏观电荷结构很好吻合,说明利用三维定位系统观测,可以较好地描述雷暴宏观电荷结构.

关键词 电荷结构, 回波范围, 正电荷区, 负电荷区

Abstract: The spatial and temporal variations of charge structure and the relationship with intensity of radar echo of a thunderstorm in lower altitudes, Shandong of China, have been analyzed with the radiation sources of lightning discharge three-dimensional mapping system. The results indicate the charge structure was typical dipolar in the convective areas. The intensity of positive charge region was increased and the height of location was lifted with the development of thunderstorm. The negative charge region is in the area where the intensity of radar echo was more than 40 dBz and the positive charge region was in the 40 dBz radar echo area approximately. The charge structure was also inferred dipolar with low charge height and weak charge intensity in stratiform areas. In the dissipation stage of thunderstorm, the charge structure was ruptured for the different dissipation level of different part in cloud. The positive and negative charge regions sank in the front of the cloud, and the height of the positive and negative charge region changed little in the middle part of the cloud, whereas the negative charge region was attenuated. So the charge region had four layers in convective areas during dissipation stage. The above result shows that the advantage charge generation mechanism often generates dipole or tripole charge structure and does not generate multipole charge structure. This paper also analyzes a negative cloud-to-ground flash discharge process. Its charge structure is the same with the thunderstorm charge structure. So the thunderstorm charge structure can be illustrated by the observation of three-dimensional lightning mapping system.

Keywords Charge structure, The range of radar echo, Positive charge region, Negative charge region

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