

The Nature of Winter Thunderstorms in Japan

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For about several centuries, studies concerning summer thunderstorms in the middle latitude zone have accumulated data both on their meteorological and electrical features. By contrast, winter thunderstorms have been studied only for the last few decades. It is well known that lightning discharges from winter thunderclouds to aircraft and ground have frequently occurred around Komatsu Airport, Japan Sea coastal area. In winter over the Hokuriku coastal area including Komatsu Airport, an interesting statistical correlation is found between the lightning activity associated with the life cycle of radar echoes in winter convective cloud systems and altitude of the -10 degree of centigrade level over Komatsu Airport. Particularly, in midwinter (January and February, mainly), even if no natural lightning discharges occur, aircrafts invading thunderclouds or convective clouds can trigger lightning strikes to them. Lightning damage to aircrafts along the Sea of Japan coast has become a rather serious problem and the improvement of avoidance and protection against winter lightning has come to the fore as a task for meteorological researchers working on aviation weather. In this way, studies on winter thunderstorms have become one of the focuses of lightning research. In winter time, especially in midwinter, it can be inferred that lightning strikes may occur when aircrafts invade the lower layer near -10 degree of centigrade level with a more intense electric field in the mature stage of thundercloud.

Electrical aspects of winter thunderstorms are summarized as follows:

In midwinter, lightning strikes to aircraft may be triggered by aircrafts invading the region of intense electric field. Strong negative and positive electric fields may be generated by precipitation particles associated with radar echoes in low altitude below thundercloud. At the present time, we cannot distinguish with the lightning strike to aircraft case and the safety take-off case by using field mill data and another meteorological observation data. Many observations and analyses will be needed for the future, in order to prevent aircrafts thunderbolts in winter seasons at take-off and landing situations. The nature of winter thunderstorms in Japan and recent prevention method of lightning strikes to aircraft and latest statistics will be presented in the conference.

Keywords: winter thunderstorms , lightning strikes to aircraft, triggered by aircrafts, upper air conditions, prevention method