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Study on total lightning and flight characteristics during thunderstorm occurrences

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Thunderstorms may be considered as an uncontrolled user of the airspace which reduces the available airspace capacity. If the flight route of a certain aircraft is occupied by a thunderstorm, a new route must be found implying flight delays and an increase in fuel consumption.

The aim of our study is to investigate the pilot situation awareness during thunderstorm occurrences in vicinity of the Frankfurt Airport (FRA). The analysed data set contains the LINET total lightning data and aircraft position information across the German territory for 5 days in 2006: 29.05., 28.07., 11.08., 27.08. and 28.08. A day is regarded as a thunderstorm day if there was a thunderstorm entry in the SYNOP data of the meteorological station "Frankfurt Airport". The focus is on the investigation of the minimum distance between the lightning observations and aircraft during the flight from/to FRA and the corresponding aircraft height. In addition, operational efficiency at Frankfurt Airport has been studied in context of the weather, lightning situation and flight delays in terms of punctuality.

Most strikes to jets occur either in the climb or descent to landing phase. As shown in our study, the distance to an electrically active area is smallest during exactly these flight phases, implying that due to a necessity to land or keep the departure slot, a risk of lightning strike will be accepted. The former also points to a need for operational lightning forecast tools for the airports terminal manoeuvring areas in order to keep the aircraft at safe distance from thunderstorms.