



## **Annual and daily changes of thunderstorms and air temperature in subpolar, temperate and subtropical climate in Europe**

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Extreme weather phenomena, and among them thunderstorms, may pose a threat to human life and activities. The aim of the study is to show and compare variation of the annual and daily course of thunderstorms and air temperature in selected European cities in 2005-2011.

A number of thunderstorm instances has been used in order to characterise the daily thunderstorm cycle, as there were days with more than one thunderstorm. Data on thunderstorms and air temperature originate from dispatches METAR for four airport stations: Murmansk (Russia), Tampere Pirkkala (Finland), Warsaw Okecie (Poland) and Naples Capodichino (Italy). These cities represent the various types of climate: subpolar, cold temperate, warm temperate and subtropical.

Weather METAR reports are coded and sent every 30 minutes. The frequency of sending messages influences the time span scheduled for a thunderstorm, which cannot be shorter than 30 minutes. Despite these inconveniences, METAR reports enable to define the time of the day which can be characterised by the biggest thunderstorm activity.

Thunderstorms mostly occurred in Naples and Warsaw. Thunderstorms were the least in Murmansk and Tampere. The maximum of thunderstorms frequency, in the yearly course, in all towns occurred in July. Thunderstorms predominantly started at afternoon and night in Murmansk, evening and night in Warsaw and Naples. There were dominated, at all stations, brief thunderstorms, which lasted for 30 minutes. The longest thunderstorm remained 9 hours in Warsaw and Naples.

The supply of heat and water vapor into a storm cloud is associated with thermal-humidity conditions that prevail at the surface of the earth on a local scale and in different climatic zones. The course of daily air temperature and storms will determine the probability of a storm at designated temperature ranges.

**Key words:** thunderstorms, temperature, annual course, diurnal course, subpolar, temperate, subtropical climate, Murmansk, Tampere, Warsaw, Naples