4–8 November 2019, Kraków, Poland
ECSS2019-75

A Climatology of Thunderstorms across Europe from a Synthesis of Multiple Data Sources

Mateusz Taszarek (1), John Allen (3), Tomáš Púčik (4), Pieter Groenemeijer (4), Bartosz Czernecki (1), Leszek Kolendowicz (1), Kostas Lagouvardos (5), Vasiliki Kotroni (5), and Wolfgang Schulz (6)

(1) Adam Mickiewicz University, Department of Climatology, Poznań, Poland (mateusz.taszarek@amu.edu.pl), (3) Central Michigan University, Mount Pleasant, Michigan, (4) European Severe Storms Laboratory, Wessling, Germany, (5) Institute of Environmental Research and Sustainable Development, National Observatory of Athens, Athens, Greece, (6) Austrian Electrotechnical Association–Austrian Lightning Detection and Information System (OVE-ALDIS), Vienna, Austria

The climatology of (severe) thunderstorm days is investigated on a pan-European scale for the period of 1979–2017. For this purpose, sounding measurements, surface observations, lightning data from ZEUS (a European-wide lightning detection system) and European Cooperation for Lightning Detection (EUCLID), ERA-Interim, and severe weather reports are compared and their respective strengths and weaknesses are discussed. The research focuses on the annual cycles in thunderstorm activity and their spatial variability. According to all datasets thunderstorms are the most frequent in the central Mediterranean, the Alps, the Balkan Peninsula, and the Carpathians. Proxies for severe thunderstorm environments show similar patterns, but severe weather reports instead have their highest frequency over central Europe. Annual peak thunderstorm activity is in July and August over northern, eastern, and central Europe, contrasting with peaks in May and June over western and southeastern Europe. The Mediterranean, driven by the warm waters, has predominant activity in the fall (western part) and winter (eastern part) while the nearby Iberian Peninsula and eastern Turkey have peaks in April and May. Trend analysis of the mean annual number of days with thunderstorms since 1979 indicates an increase over the Alps and central, southeastern, and eastern Europe with a decrease over the southwest. Multiannual changes refer also to changes in the pattern of the annual cycle. Comparison of different data sources revealed that although lightning data provide the most objective sampling of thunderstorm activity, short operating periods and areas devoid of sensors limit their utility. In contrast, reanalysis complements these disadvantages to provide a longer climatology, but is prone to errors related to modeling thunderstorm occurrence and the numerical simulation itself.