



Refined tornado climatology of France

Emmanuel WESOLEK and Pierre MAHIEU

KERAUNOS, Lille, France (e.wesolek@keraunos.org)

The climatology of tornadoes in France, which is now studied for about two centuries, has significantly improved in accuracy over the last decade. The first detailed study was published by J. Dessens and J. Snow in 1989. Their inventory of F2+ tornadoes brought out 107 events in the period 1680-1988. Since the early 2000s, Keraunos, the Tornadoes and Severe Storms French Observatory, is performing a systematic inventory of tornadoes in France for current years, and is conducting further research in newspapers archives to discover new tornado cases in the historical period. This work makes now possible to establish an inventory of 640 tornado cases in France over the 1680-2014 period, and thus to have a larger database in order to realize detailed analyzes.

The purpose of this study is to build an updated climatology of tornadoes in France. The study especially deals with the spatial distribution of tornadoes, their frequency, their seasonality, and their physical characteristics (intensity, width, distance, duration, translation speed). About 70% of tornadoes occur during the warm season, with maximum frequency in June and August, and a diurnal peak between 15.00 and 16.00 UTC. An estimated average of 40 tornadoes occur each year in France, most of them (94%) with EF0 or EF1 intensity. Strong or violent tornadoes are rare, but can produce sometimes very severe damage and many deaths, as the 24-25 June 1967 tornado outbreak in northern France, or the 3 August 2008 EF4 tornado in Hautmont.

Some original features are highlighted for specific French regions : higher tornado frequency in cold season than in warm season in the western part of the country, influence of the relief on the distribution of tornadoes in the eastern part of the country, higher proportion of significant tornadoes in northern France.

The meteorological situations associated with tornadic storms are also discussed, with the support of NCEP reanalysis data and WRF reforecast data, which permit to identify the main synoptic and mesoscale features conducive to tornado formation in France. The analysis of the characteristics of tornado-producing storms also shows a wide variety of structures, from supercell storms to narrow cold-frontal rainbands. The significant proportion of non-supercell tornadoes occurring in poor unstable environments explains why tornado forecasting remains a challenge in France.