

Tornadoes [\[pdf\]](#)

A tornado is a violently rotating column of air that is in contact with both a cumulonimbus cloud base and the surface of the earth. This is the first line of the definition provided by [Wikipedia](#).

I came into contact with tornadoes - or better tornado research - in 2002 when Nikolai Dotzek wrote me an email starting a discussion on tornado intensity distributions. He gathered quite some national data sets on tornado occurrences and partly also on intensity distributions. We started investigating the various "national" intensity distributions and searched for a common description and characteristic regional differences. We saw that all comprehensive data sets could be described by Weibull distributions. This was our first result. It allows characterizing local tornado intensity distributions by two Weibull parameters (shape and dispersion). As a consequence we expected that different regions with similar tornado intensity distributions could be found by drawing each data set as a dot in a shape-parameter vs. dispersion-parameter plot. We hoped to see cluster in that plot and feared to see no structures but we found that all dots were located on a curved line. We could not mathematically describe nor explain the line but published the finding in order to attract others to deal with this interesting effect ([Dotzek, Grieser, Brooks, 2003](#)).

Bernold Feuerstein contacted us and we explained our findings to him on a Friday afternoon. Late at the same Friday night he replied our email and attached the mathematical description and the reason of the curve we found in the first paper. An ad-hoc invariant was found that is common to each observed tornado-intensity distribution regardless of the period or region of the data source. And so we published a second paper ([Feuerstein, Dotzek, Grieser, 2005](#)).

We now had a mathematical description of an observed phenomenon but didn't understand it from a physical point of view. In September 2004 I gave a talk on that subject on the German-Austrian-Swiss Meeting on Meteorology (DACH MT). Andreas Will happened to be in the audience and pointed us to Michael Kurgansky, a Russian colleague, working in Chile. At the same time also Peter Névir from Freie Universität Berlin came up with some comments on the intensity distribution of tornadoes based on energetic assumptions. Michael Kurgansky offered a concept for the evidence of a certain tornado intensity distribution, which was in line with our pure statistical description of the data. Putting all this together led to the third paper ([Dotzek, Kurgansky, Grieser, Feuerstein, Névir, 2005](#)).

Independent of our work Peter Bissolli from the German Meteorological Service (DWD) and a student (M. Welsch) from University Mainz started to investigate the statistical relation between the occurrences of tornadoes in Germany and specific weather types. They compared the number of observed tornadoes with the number of thunderstorm days and published that "The fraction between the

number of tornadoes and thunderstorm days has a high variability within Germany and is highest in some north-western areas of Germany (values up to 0.63 tornadoes per thunderstorm day).”, see <http://www.cosis.net/abstracts/EGU05/07957/EGU05-J-07957.pdf> .They did not realize that they divided the number of observed tornadoes within a 24-year period by the average annual number of thunderstorm days and that this was the reason for their obviously wrong but published results. Nikolai Dotzek and myself helped to improve their calculations. The resulting paper is published in Global and Planetary Change ([Bissolli, Grieser, Dotzek, Welsch, 2007](#)).

If I was asked to give a short statement on our major findings with respect to tornado distributions I'd say that

- a) it is wrong to distinguish between real US American tornadoes on the one hand and European mini tornadoes on the other hand and
- b) the number of tornadoes needs not to have increased just because the number of observed tornadoes has increased considerably.

More details on European tornadoes can be found at: <http://www.torDACH.org>