100 Years after Alfred Wegener's Opus on Tornadoes in Europe

Bogdan Antonescu, David Schultz, Hugo Ricketts
University of Manchester
Wegener (1917):  
*Tornados and Waterspouts in Europe*

- catalog of tornadoes in Europe since 1456
- synthesis of proposed tornado mechanisms
- first pan-European climatology before 2014
- American versus European tornadoes
“The Race to the Sea”
(17 Sep–19 Oct 1914)
Puisieux (France)
(4 October)

Alfred Wegener (1914)
Mülhausen (1916)
correspondence between Alfred Wegener and Wladimir Köppen between 1915-1917 from the archive of Deutsches Museum
“Im Felde, im August 1916”
Tornadoes and Waterspouts in Europa (1917) by Alfred Wegener with marginalia by Johannes Letzmann

A dedication on the first page from Wegener to Letzmann

Herrn Letzmann

vom Verfasser

Alfred Wegener (1880–1930)

Johannes Letzmann (1885–1971)
There was a time when tornado research was more active in Europe than in the United States.
“Meteorology: Observations and experimental research on the causes that contribute to the formation of tornadoes”
a tornado that occurred on 24 August 1456 described in the *History of Florence*
hypotheses on tornado formation

Thermodynamic hypothesis
Tornadoes are associated with atmospheric perturbations produced by sudden air dilation or contraction or by the collision of opposing winds.

Electrical hypothesis
Tornadoes are a result of cloud electrification which can produce intense wind by accelerating charged cloud particles in an electric field.

Mechanical hypothesis
Tornadoes are produced by the winds trapped in the cloud spinning around trying to get out and producing cone or column shaped clouds.
hypotheses on tornado formation

Thermodynamic hypothesis
Tornadoes are associated with atmospheric perturbations produced by sudden air dilation or contraction or by the collision of opposing winds.

Mechanical hypothesis
Tornadoes are produced by the winds trapped in the cloud spinning around trying to get out, producing cone-shaped clouds.

thermodynamic hypothesis
Tornadoes are associated with atmospheric perturbations produced by sudden air dilation or contraction or by collision of opposing winds.
hypotheses on tornado formation

**mechanical hypothesis**

Tornadoes are produced by the wind trapped in the cloud spinning around trying to get out and producing a cone or column-shaped clouds.
hypotheses on tornado formation

mechanical hypothesis

Tornadoes are a result of cloud electrification which can produce intense wind by accelerating charged cloud particles in an electric field.

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**Electrical hypothesis**

Tornadoes are a result of cloud electrification which can produce intense wind by accelerating charged cloud particles in an electric field.

"Electricity is the cause of whirlwinds as shown by an experiment in which an electric conductor is carried beyond a water droplet above a pair of brass plates. When the conductor is charged the suspension droplet is charged and the author of the experiment, Franklin, formed a tornado in his hand. (Beccaria, "Idea dell'isteria e del tornado," 1753)"

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**Thermodynamic hypothesis**

Tornadoes are associated with atmospheric perturbations produced by sudden air dilation or contraction or by the collision of opposing winds.
Tornadoes and Waterspout in Europe (1917)

monthly distribution

diurnal distribution

tornado reports relative to the centre of the low pressure system
Tornadoes in Europe: Synthesis of the Observational Datasets (2016)

Antonescu et al. (2016, Monthly Weather Review)
Tornado research in Europe after World War I

Contributions to the mechanics of waterspouts and tornadoes (1928)

Guidelines for Research on Funnels, Tornadoes, Waterspouts, and Whirlwinds (1937)

Alfred Wegener (1880–1930)

Johannes Letzmann (1885–1971)

Harald Koschmieder (1897–1966)
Wegener (1917): *Tornadoes and Waterspouts in Europe*

- catalog of tornadoes in Europe since 1456
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bogdan.antonescu@manchester.ac.uk
david.schultz@manchester.ac.uk