

Using historical information sources to reconstruct historical severe storm cases in Central Europe

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Nicolai, Friedrich (1765): Illustration shows the violent tornado near Feldberg (Mecklenburg) in northern Germany in 1764.



Introduction:

• Some pioneers:

Alfred Wegener (1880 – 1930) Johannes P. Letzmann (1885 – 1971) Nikolai Dotzek (1966 – 2010) Jean Dessens

 \rightarrow ESWD, initiated in 2004 \rightarrow ESSL, founded in 2006

European Severe Weather Database

• Severe storm events are better recorded than ever before (2001 – 2011)



Motivation:

• Lack of information regarding severe storm events from the periods before the year 2000



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- Lack of information regarding severe storm events from the periods before the year 2000
 - 1. Filling the gap
 - 2. Expanding climatological knowledge regarding historical severe storm occurrence
 - 3. Finding out what details are contained and how reliable they are
 - 4. Enable reconstruction of historical severe storms (chronol. mapping)



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Motivation:

- Lack of information regarding severe storm events from the periods before the year 2000
 - 1. Filling the gap
 - 2. Expanding climatological knowledge regarding historical severe storm occurrence (Climatology / Meteorology)
 - 3. Finding out what details are contained and how reliable they are (Media Studies / Cultural Studies / Social Studies)
 - 4. Enable reconstruction of historical severe storms (chronol. mapping)



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Methods:

Collecting historical information about...

"Windstorms" (straight line winds)TornadoesHailstorms (large hail & damage caused by hail)Heavy rain (incl. flash floods caused by heavy rain)

... in ...

- Local & regional chronicles
- Newspaper articles
- Church records
- Historical & recent scientific works
- Written individual records of witnesses (e.g. Genzmer, 1765)
- Analyzing the data by sorting the information into quantities and qualities
- Finding out which quantities and qualities are necessary to reconstruct storms



Presentation of Research:

- 2 629 events were found from the period 500 to 1950
- combined with the former TorDACH data and recent data in the ESWD (n = 3 451)





Presentation of Research:

- 2 629 events were found from the period 500 to 1950
- combined with the former TorDACH data and recent data in the ESWD (n = 3 451)
- most events occured over parts of Central Europe
- → limit the investigation area to: 47°N – 55°N 5°E – 19°E
- most events were found from the time period 1730 to 1950 (n = 2 255)
- \rightarrow expand the time period to a 250-year-period from 1700 to 1949 (n = 2 341)





Presentation of Research:

First results:





Presentation of Research:



FIG. 4: Distribution of hail reports from 1700 to 1949. ESWD.

FIG. 6: "Keppelner Hagelkreuz" (b.1912) near Keppeln, Germany . (Hail Calvary of Keppeln). Heimatverein Keppeln.

WW I



Presentation of Research:

Analyzing the reported context factors:

Quantities (A)

A1: Date

- A11: Event occurred within 6 hrs.A12: Event occurred within 3 hrs.A13: Event occurred within 1 hr.A14: Event occurred within 30 mins.layer
- A2: Place(-s) (relative area)

A21: Event occurred over land
A22: Event occurred over farmland
A23: Event occurred over a village / town
A231: Historical aspects of A23

A3: Movement direction

Qualities (B)

B1: Hailstorm characteristics

B11: Size(-s) of hailstones

- B12: Weight of hailstones
- B13: Constitution of hailstones
- B14: Hail

B15: Duration (B11

B2: Damage

B21: Damage causedB22: Damage caused to farmlandB23: Damage caused to buildingsB24: Animals injured or killedB25: People injured or killed



Presentation of Research:

Analyzing the reported context factors (n = 957):

Quantities (A)

- A1: Date 86.0% (823)
 - A11: 6 hrs.14.3% (137)A12: 3 hrs.7.7% (74)A13: 1 hr.26.9% (257)A14: 30 mins.3.1% (31)
- A2: Place(-s) (relative area) 91.0% (871)

A21: land	97.6% (934)
A22: farmland	60.0% (574)
A23: village/town	31.0% (297)
A231: hist.asp.	n.d.

A3: Movement direction **55.0%** (574)

Qualities (B)

B1: Hailstorm characteristics

20.7% (198)
2.0% (19)
1.9% (18)
0.5% (5)

B2: Damage

B21: Damage	8.6% (83)
B22: Damaged farmland	60.0% (574)
B23: Damaged buildings	26.9% (257)
B24: Animals injured or killed	2.5% (24)
B25: People injured or killed	0.2% (2)

≥50.0%	
49.9% ·	- 20.0%
19.9%	- 8.0%
7.9%	- 3.2%
≤3.	1%



Results:





FIG. 7: Distribution of hail sizes, 1700 - 1949 (n = 198; 20.7 %)



Results:

(B11) Hailstone sizes:



- perception of hail sizes
- weighted hailstones
 + given perception:
 - $\rightarrow \textbf{plausible}$

but sometimes: → underestimated perception (?)

FIG. 7: Distribution of hail sizes, 1700 - 1949 (n = 198; 20.7 %)

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Results:

Which context factors (of all event types) are needed to reconstruct severe storms?

Context factor	<u>Focus</u>	<u>Prop. in % (n = 3 461)</u>
() Event type	any	-
A1 Date	exact	87.2%
A14 Local time	+/- 15 mins.	2.4%
A2 Place	relative area	90.1%
A3 Movement direction	variable	67.5%

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Results:

Which context factors (parameters) are needed to reconstruct severe storms?

Context factor	<u>Focus</u>	<u>Prop. in % (n = 3 461)</u>	Required data
() Event type	any	-	at least one type
A1 Date	exact date	87.2%	exact date
A14 Local time	+/- 15 mins.	2.4%	day period
A2 Place	relative area	90.1%	at least 4 places
A3 Movement direction	variable	67.5%	at least a tendency

- "Local time: +/- 15 minutes" is not given continuously
- No uniform application of "Local time" before the year 1850 in Europe

 \rightarrow "Local time" is not suitable as a parameter

→ "Local time" can be exchanged by given movement direction including a day period of occurrence



Results:

Reconstructing severe storms (prototype):

Date: 07 August 1738 State: Poland Region: woj. Lubuskie

Historical: Kingdom of Prussia (German Empire)

Event:hailDay period:afternoonPlaces:6 different places

Movement dir.: S/SSO -> N/NNW

Hail size(-s): Hail constitution: Damage: 5 cm i.d. spiky stones farmland devastated windows smashed



FIG. 8: Prototype of severe storm reconstruction: 07 August 1738



Conclusion & future outlook:

- Reconstruction of historical severe storms is possible when basic data is available (exact date / day period / at least 4 places / tendencial (or exact) movement direction)
- Hail reports partly have differences in size of assessment (perception & measuring) and too less data including quality parameters of the events

Conclusion: Quality parameters can not be used primarily as main criteria to construct chronological mapping of historical storms.

• Improving chronological mapping and constructing further historical severe storms

13 08 1562	S Germany
15 02 1734	E Germany / W Poland
24 05 1773	W & Central France
01 07 1891	W Germany
10 07 1896	N Germany
18 06 1898	Central & N Hungary
04 07 1929	S Germany / W, Central & N Czech Republic
22 07 1939	E Czech Republic
08 06 1945	S Germany
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Thank you for your attention