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Zentralanstalt für Meteorologie und Geodynamik

HAIL RISK AREAS IN AUSTRIA,
ON THE BASIS OF REPORTS 1971-2011 AND WEATHER RADAR IMAGES 2002-2011

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Phenomenon Hail

NEEDS:

- Reliable observation and documentation
- Detection of thunderstorm and hail intensity
- >> creating a hazard map

- „CLIMATE problem“: full coverage of hailstorms (in Austria)

PR: the wrong way of documentation

- „Horror Weather in May“ - „Hail devasted Austria“

A reliable way of documentation – 1st)

Hail detection, according to the intensity

Source:

the annual severe weather summaries of ZAMG

Damage patterns of individual hailstorms are assigned an intensity level.

Classification according to the TORRO - Hailstorm Intensity Scale

www.torro.org.uk / site / hscale.php

TORRO Hailstorm Intensity Scale

Intensity	Intensity Category	Typical Hail Diameter (mm)*	Probable Kinetic Energy, J-m^2	Typical Damage Impacts
H0	Hard Hail	**5**	0-20	No damage
H1	Potentially Damaging	05-**15**	>20	Slight general damage to plants, crops
H2	Significant	10-**20**	>100	Significant damage to fruit, crops, vegetation
H3	Severe	20-**30**	>300	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	25-**40**	>500	Widespread glass damage, vehicle bodywork damage
H5	Destructive	30-**50**	>800	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	40-**60**		Bodywork of grounded aircraft dented, brick walls pitted
H7	Destructive	50-**75**		Severe roof damage, risk of serious injuries
H8	Destructive	60-**90**		(Severest recorded in the British Isles) Severe damage to aircraft bodywork
H9	Super Hailstorms	75-**100**		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	>100		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

TORRO 6 – example: Vienna, 2003 05 13

"Severe thunderstorm with hail passed Vienna on May 13 2003. 20 minutes lasting hailstorm with hailstones up to 4 cm diameter caused damages on roofs, glasses and vehicles."

A reliable way of documentation – 2nd)

A-TNT (Austrian Thunderstorm Nowcasting Tool)

The recently established thunderstorm tracking and nowcasting algorithm

A-TNT (Austrian Thunderstorm Nowcasting Tool)

has been used to identify and track intense precipitation cells based on MaxCAPPI radar data

and to map potential hail regions.

ZAMG, Section Remote Sensing, Vera MEYER

ZAMG RADAR-CELL MONITORING

INPUT DATA: 2-dim Radar-precipitation data maximum projection composites maps (MaxCAPPI)

- from 2002: time/space resolution: 10 min / 2 km x 2 km, 7 Levels
- from 2004: time/space resolution: 5 min / 2 km x 2 km, 14 levels
- from 2008: time/space resolution: 5 min / 1 km x 1 km, 14 levels

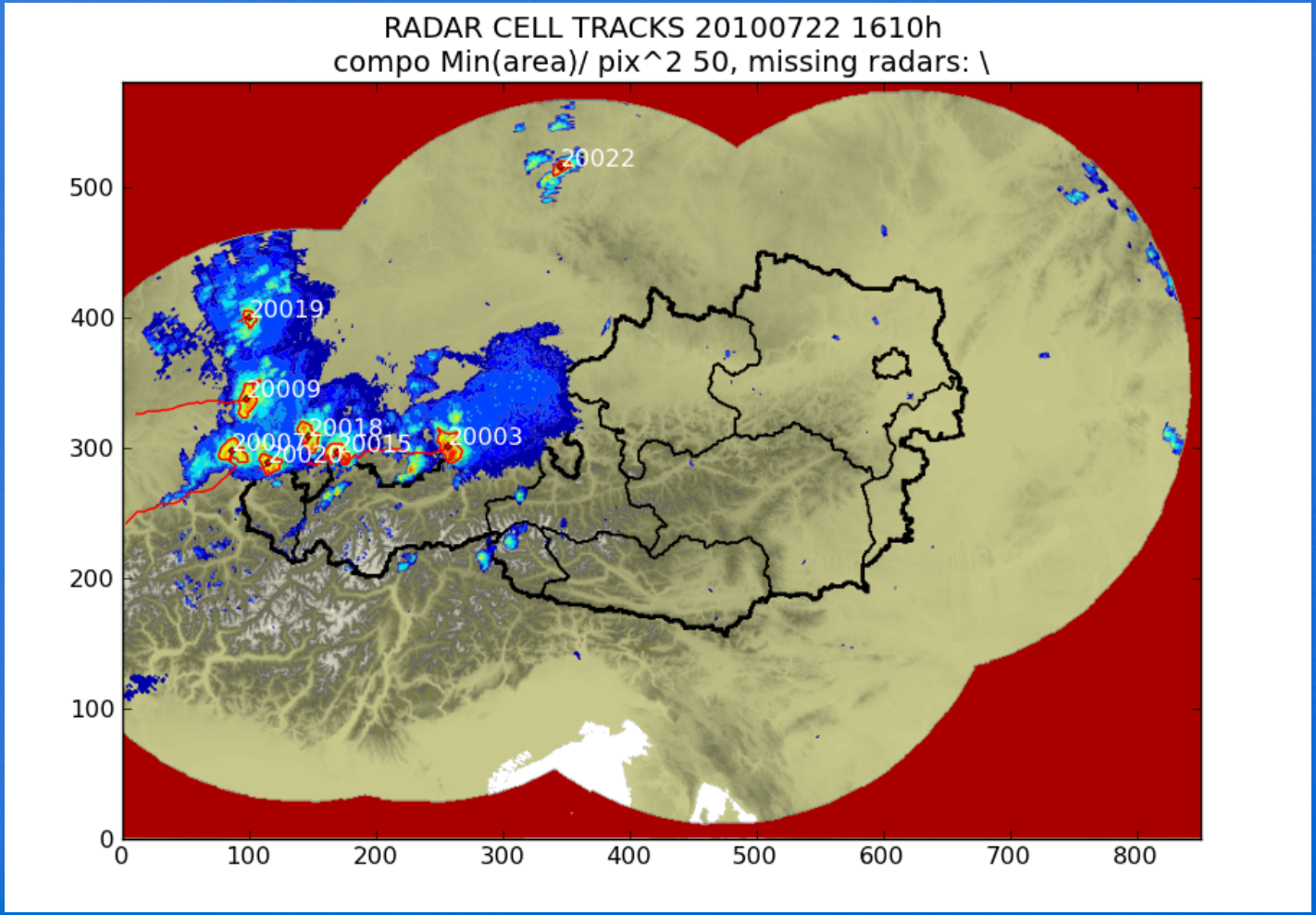
CELL IDENTIFICATION:

- threshold value 38 dBZ (~ 9 mm/h)
- min. cell size 50 pixels (~ 50 km²)

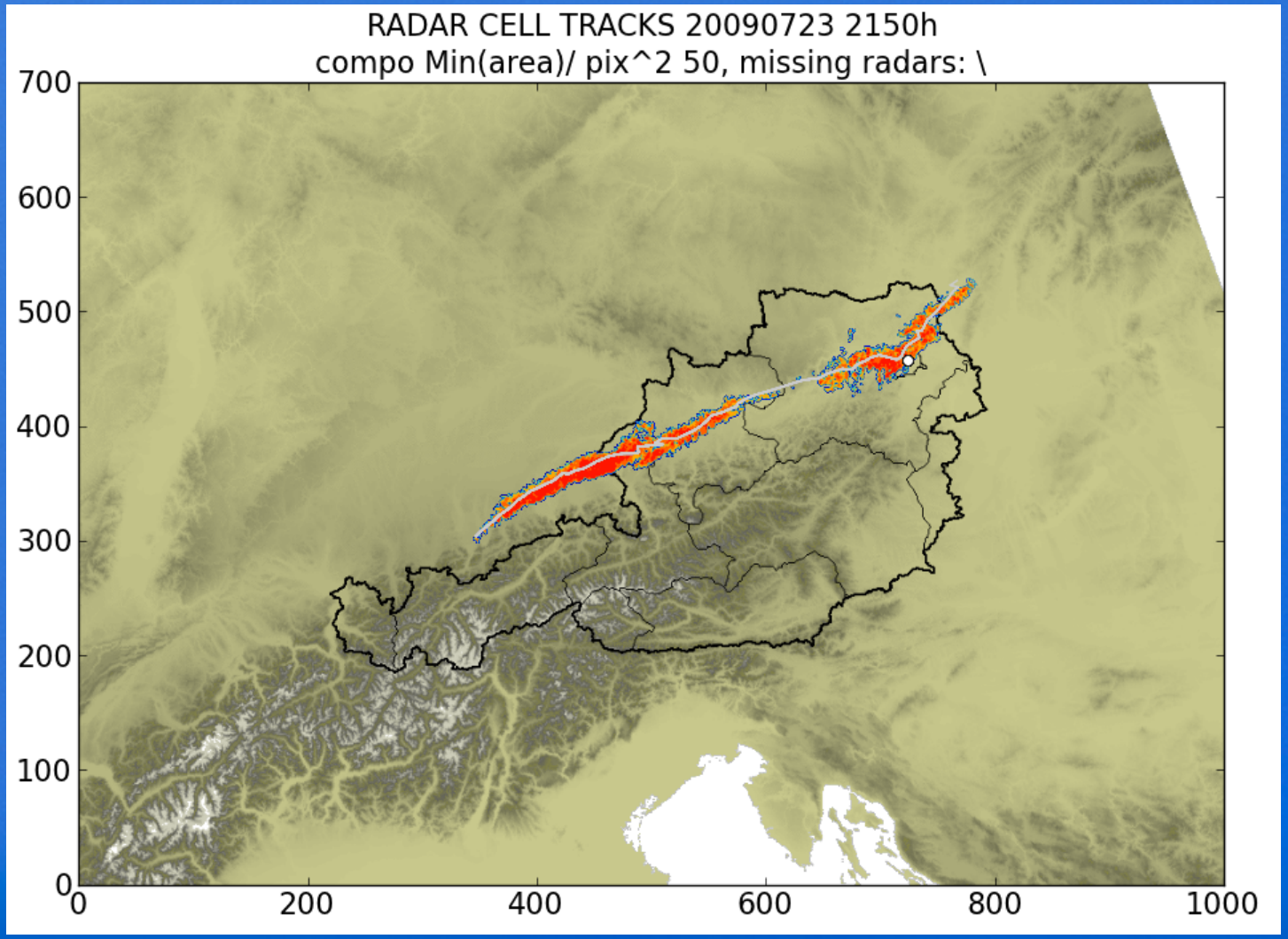
TRACKING:

based on the detection of overlapping areas between detected cells in two consecutive radar-images.

Cell identification and tracking

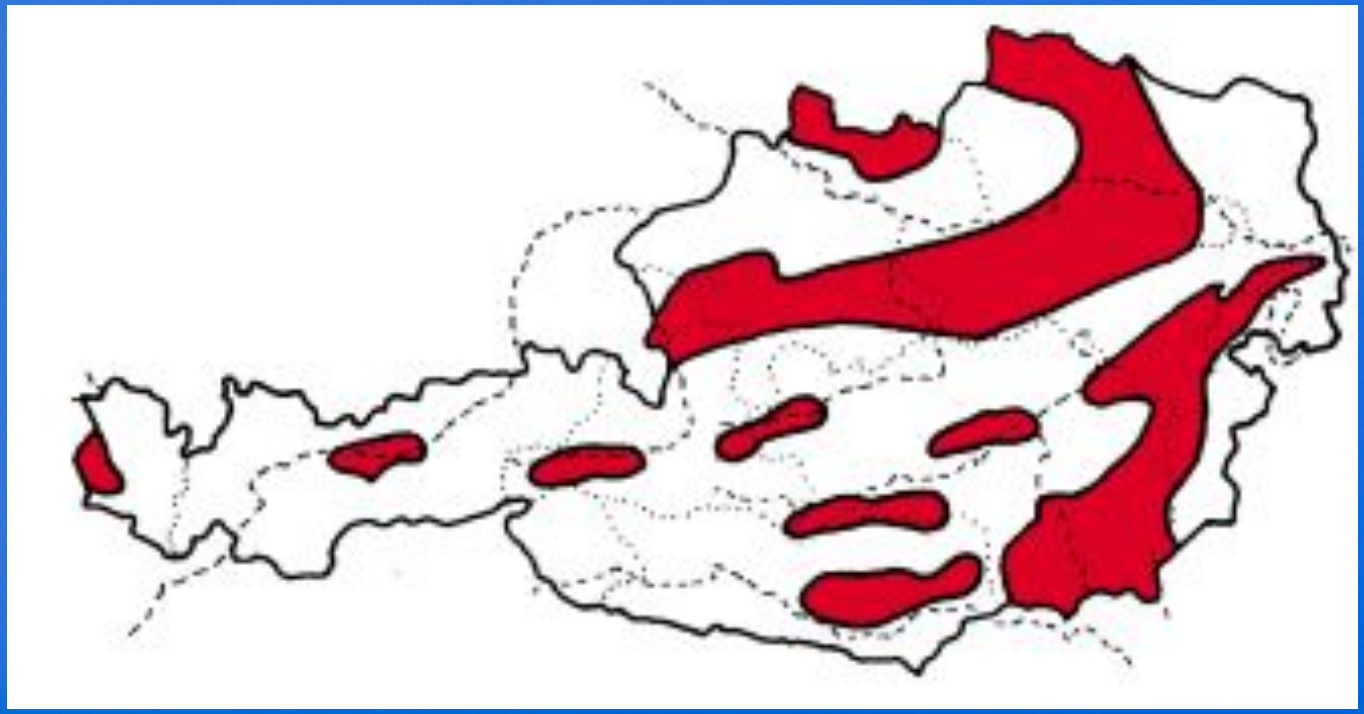


Example: 23.07.2009, cell-nr. 30040 (16:05-21:50 UTC)

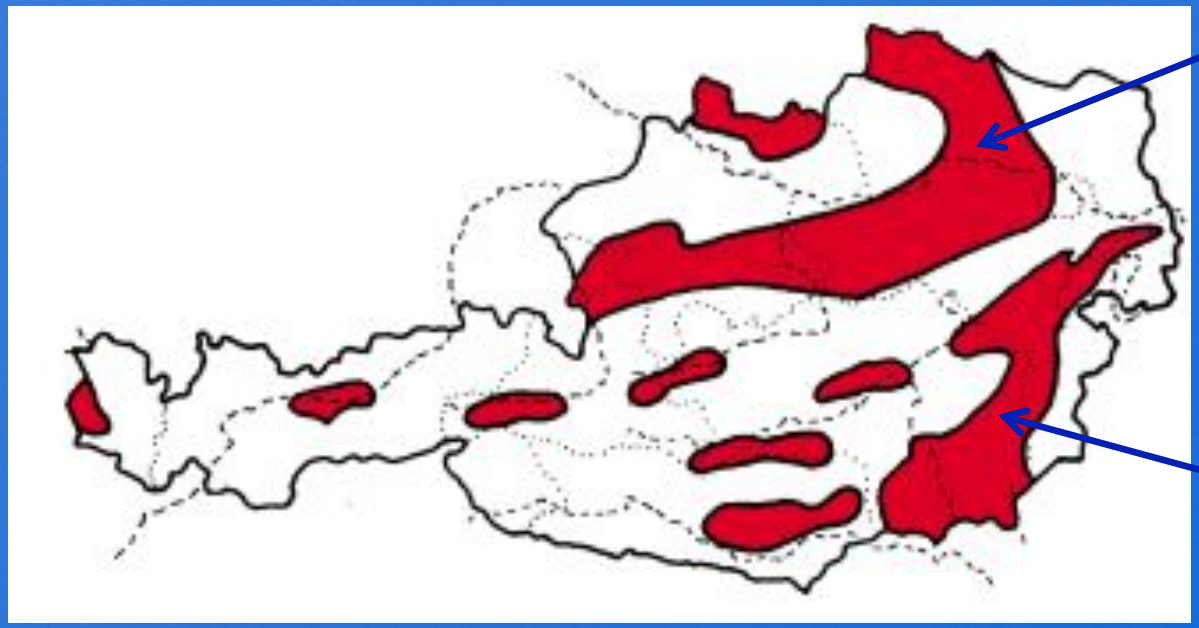


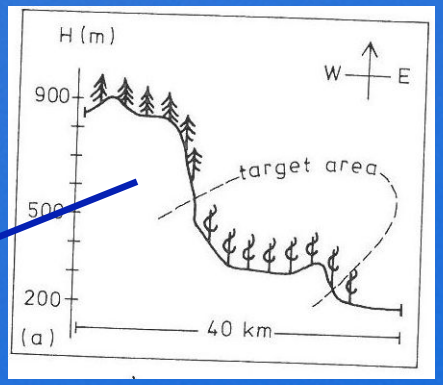
HAIL DETECTION: quantitative and comprehensive

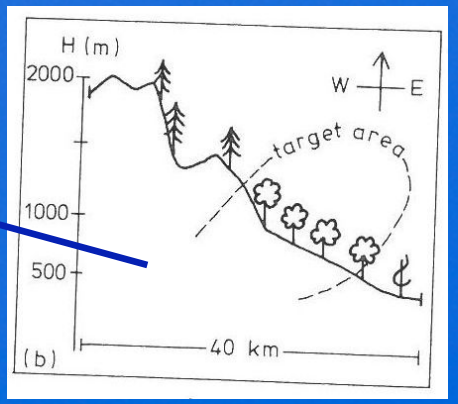
First approach:
for each station is the ratio of the average annual number of days with hail to the average annual number of days with thunderstorms calculated (study period 1951-1985)



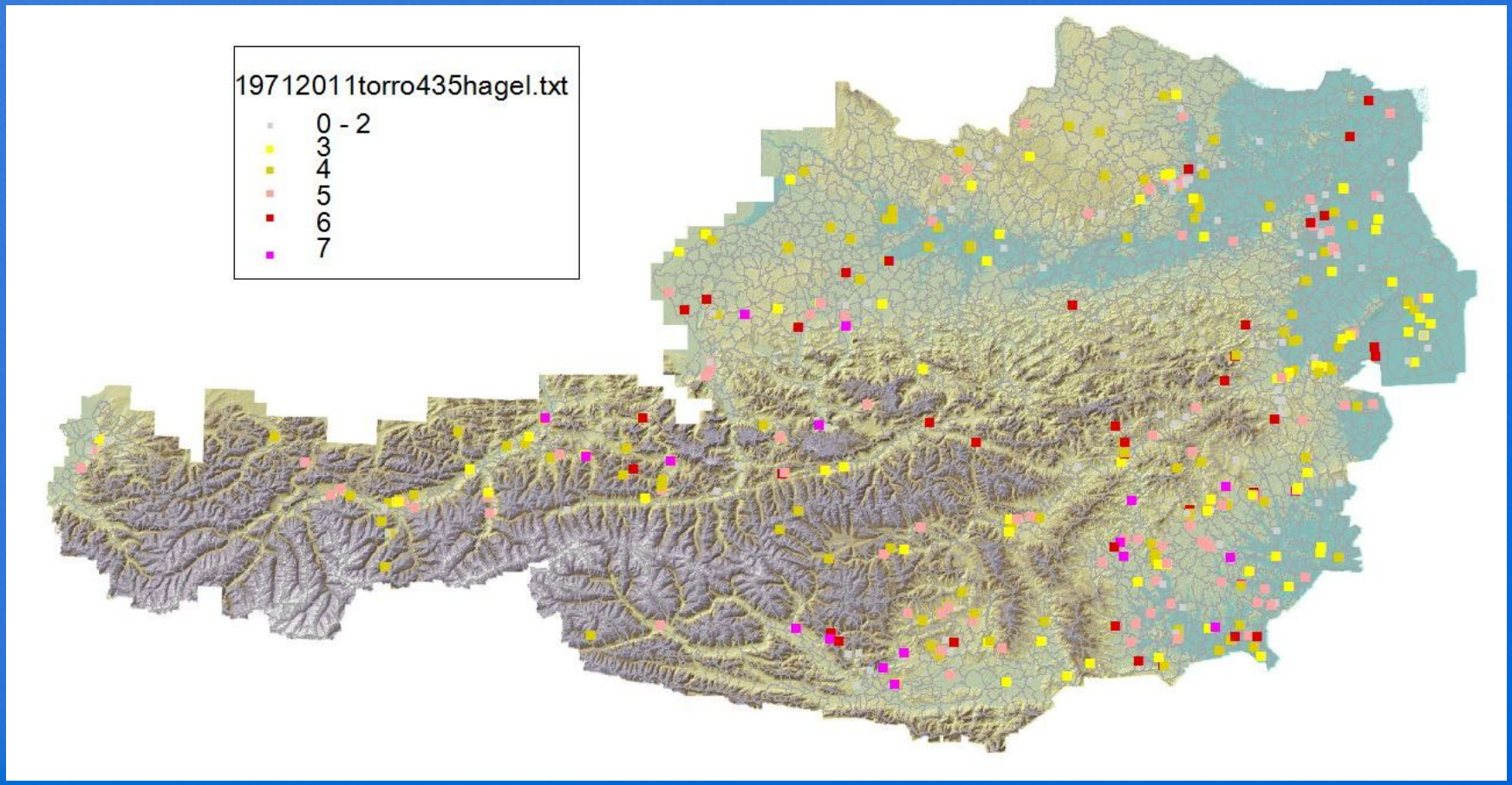
Terrain profile around hail risk areas



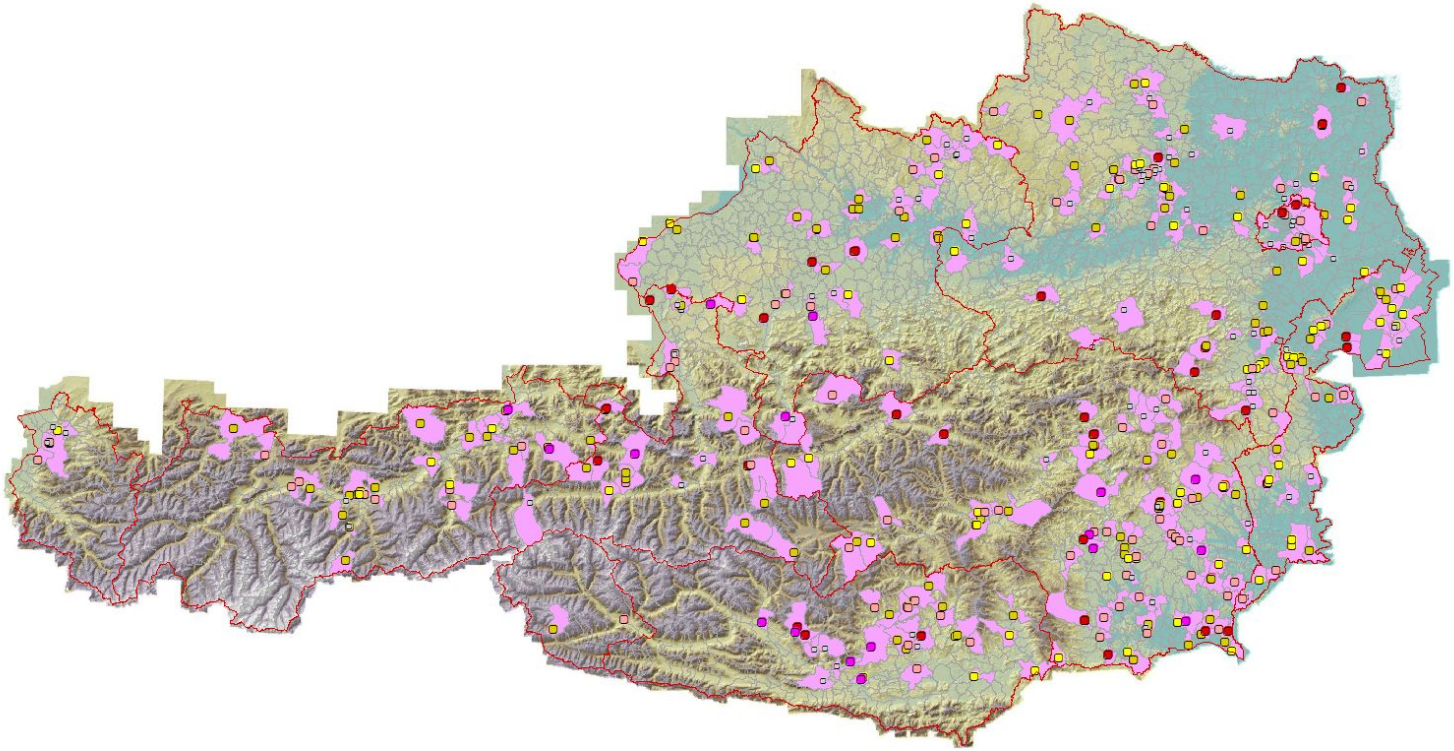




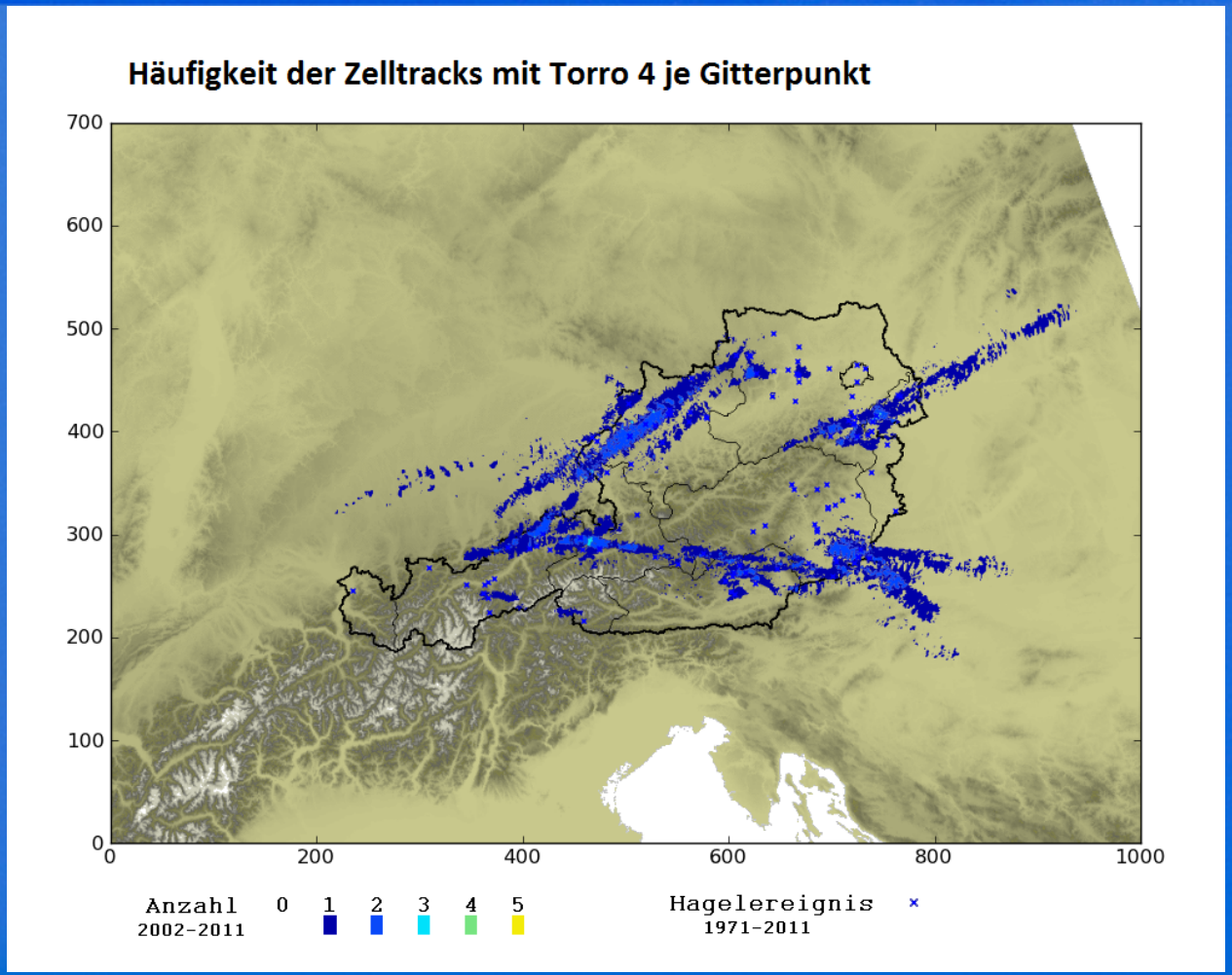
Chronicle ZAMG: 435 hail events, 1971 – 2011



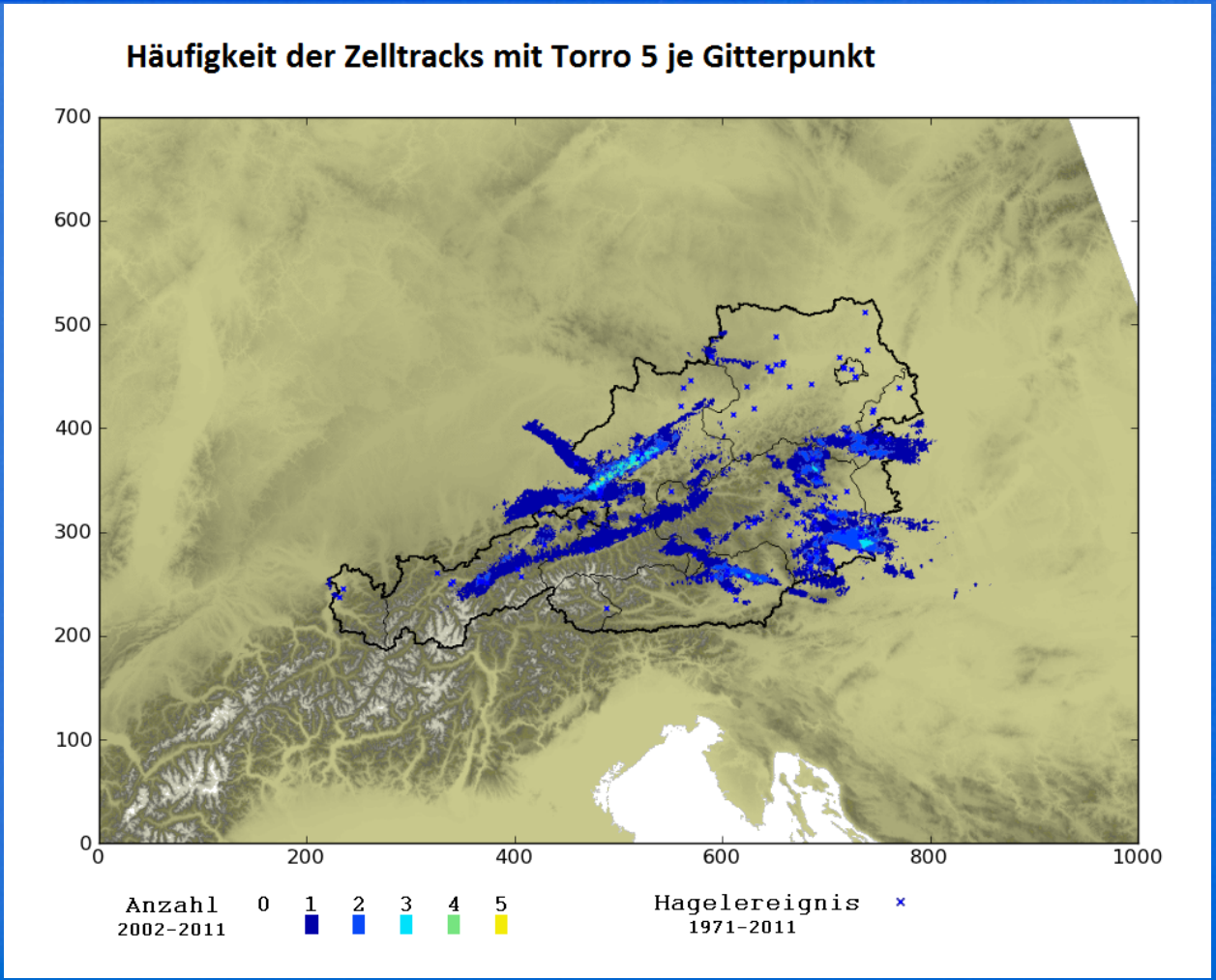
435 classified hail cases within 310 communities



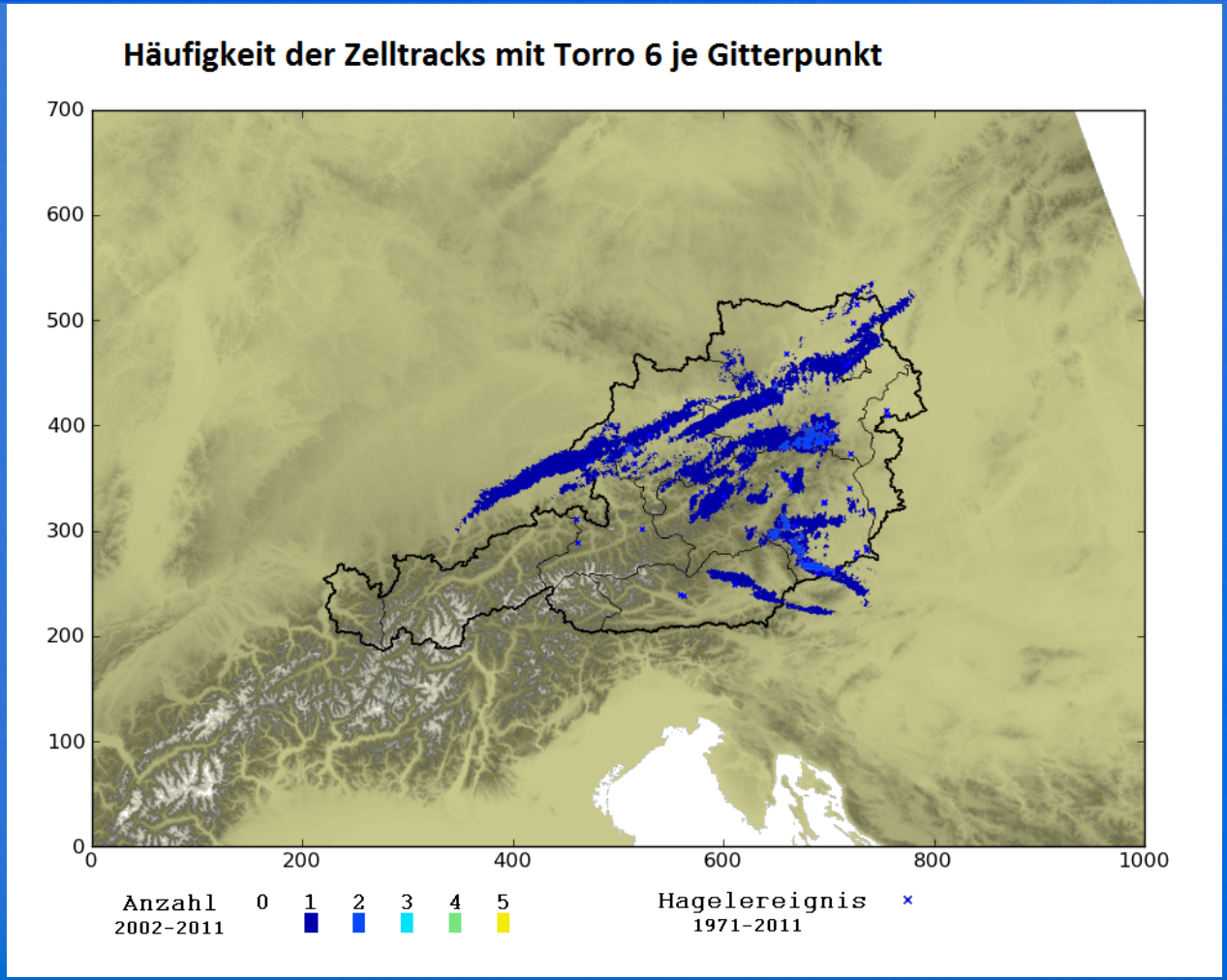
2002-2011, 46 cases TORRO 4 radar cell tracks, and frequency



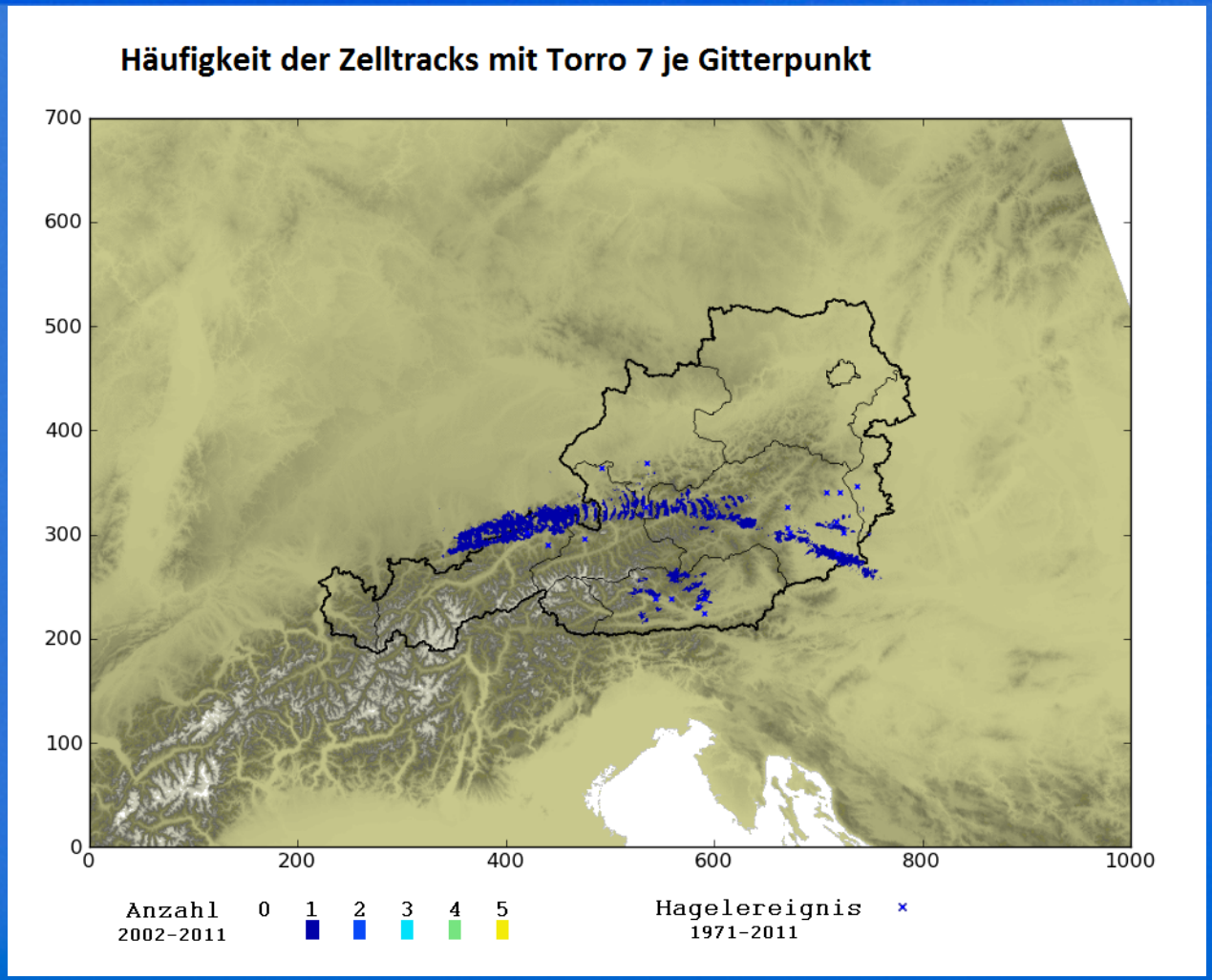
2002-2011, 35 cases TORRO 5 radar cell tracks, and frequency



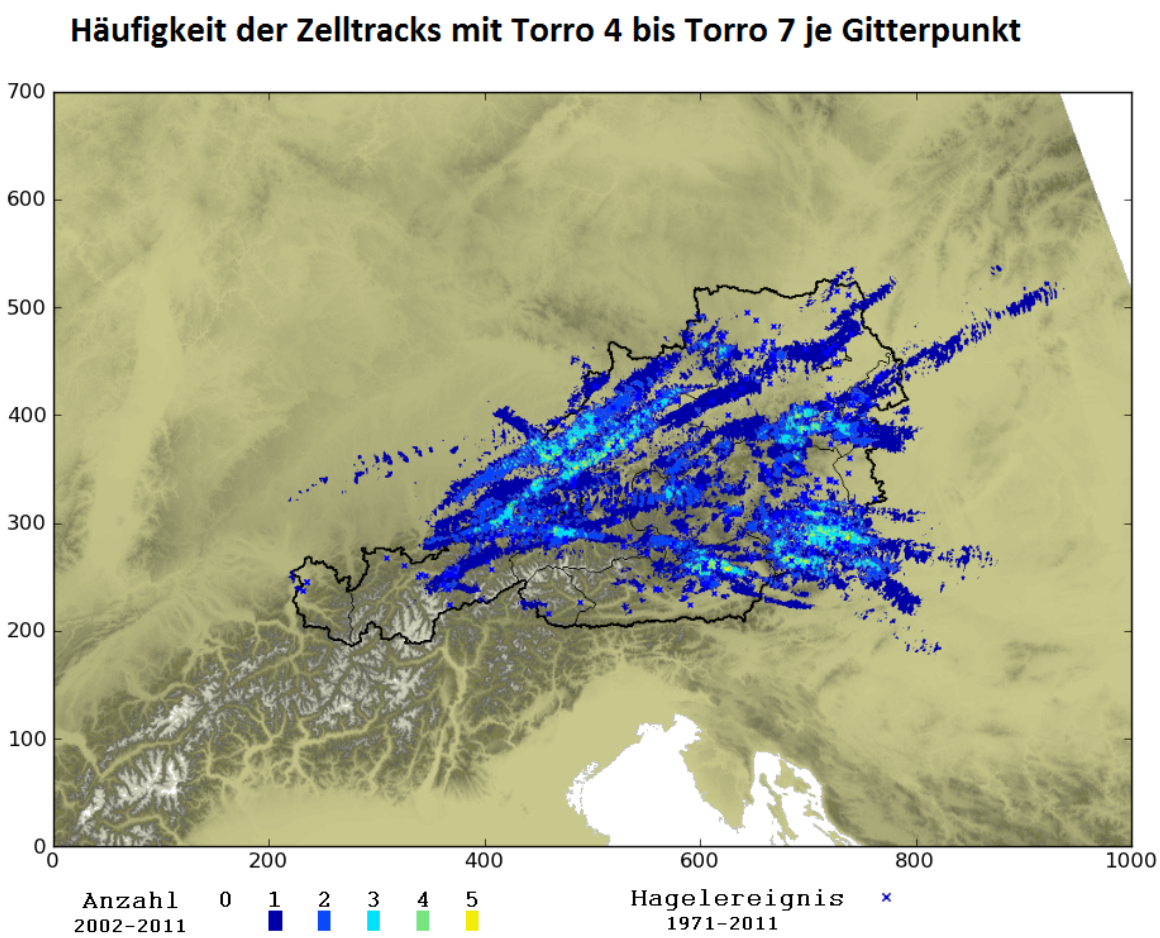
2002-2011, 18 cases TORRO 6 radar cell tracks, and frequency



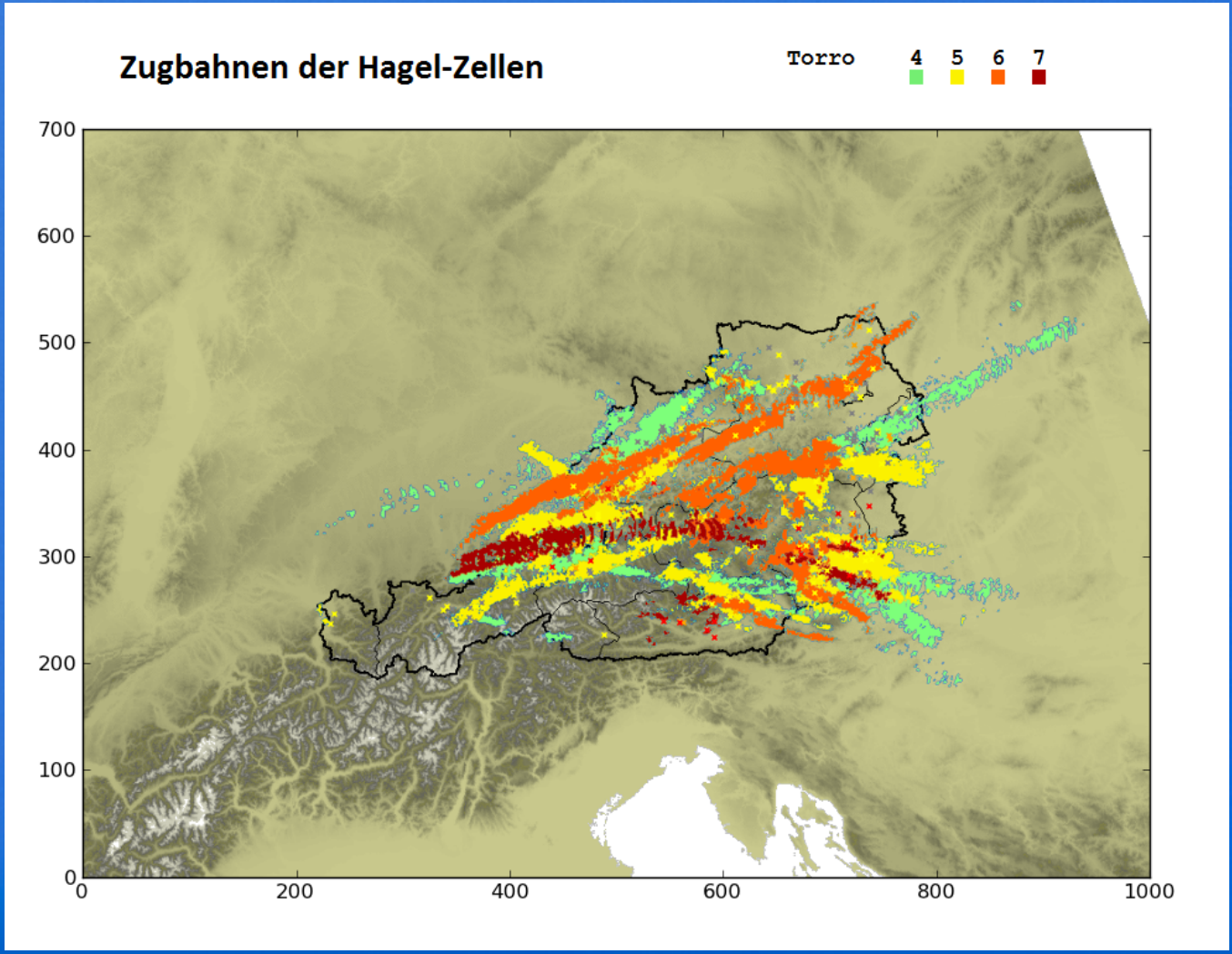
2002-2011, 6 cases TORRO 7 radar cell tracks, and frequency



TORRO 4-7, 105 radar cell tracks, and frequency

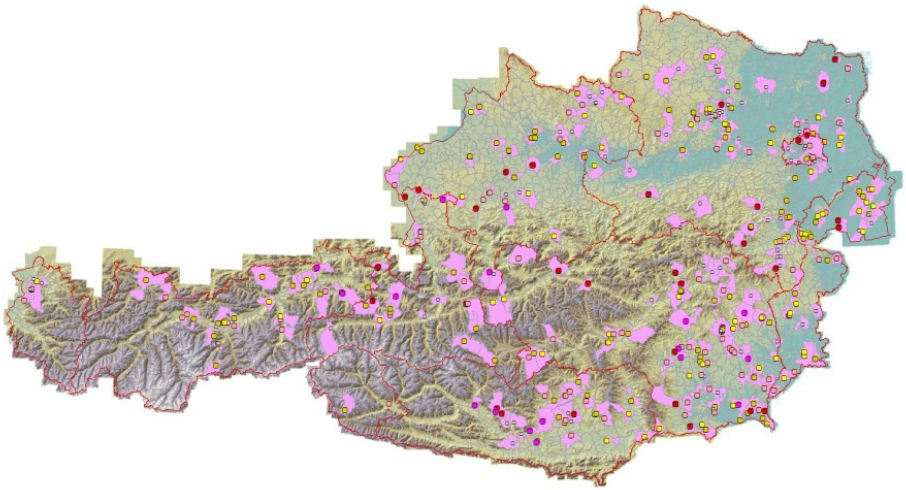


All detected tracks

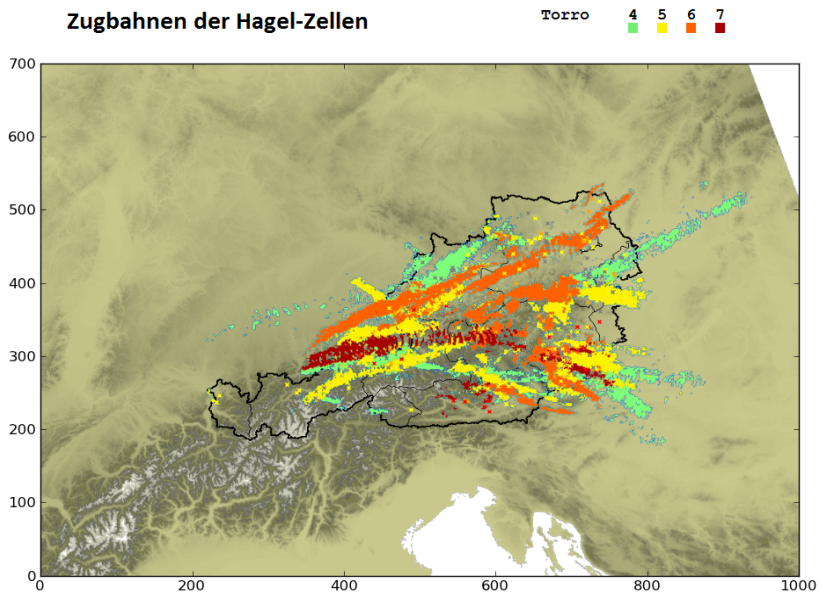


Intersection Chronicle and radar values

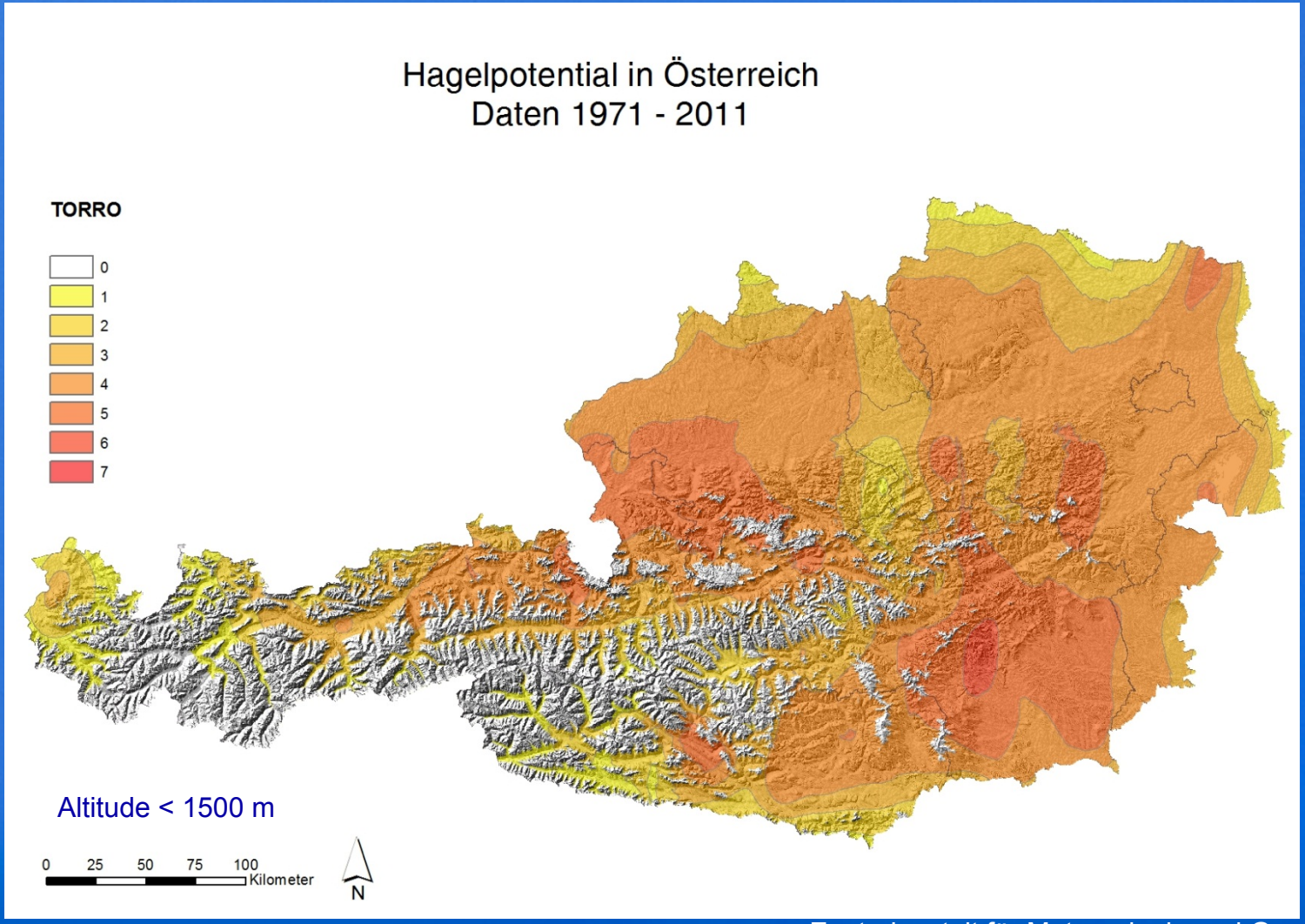
local damage information



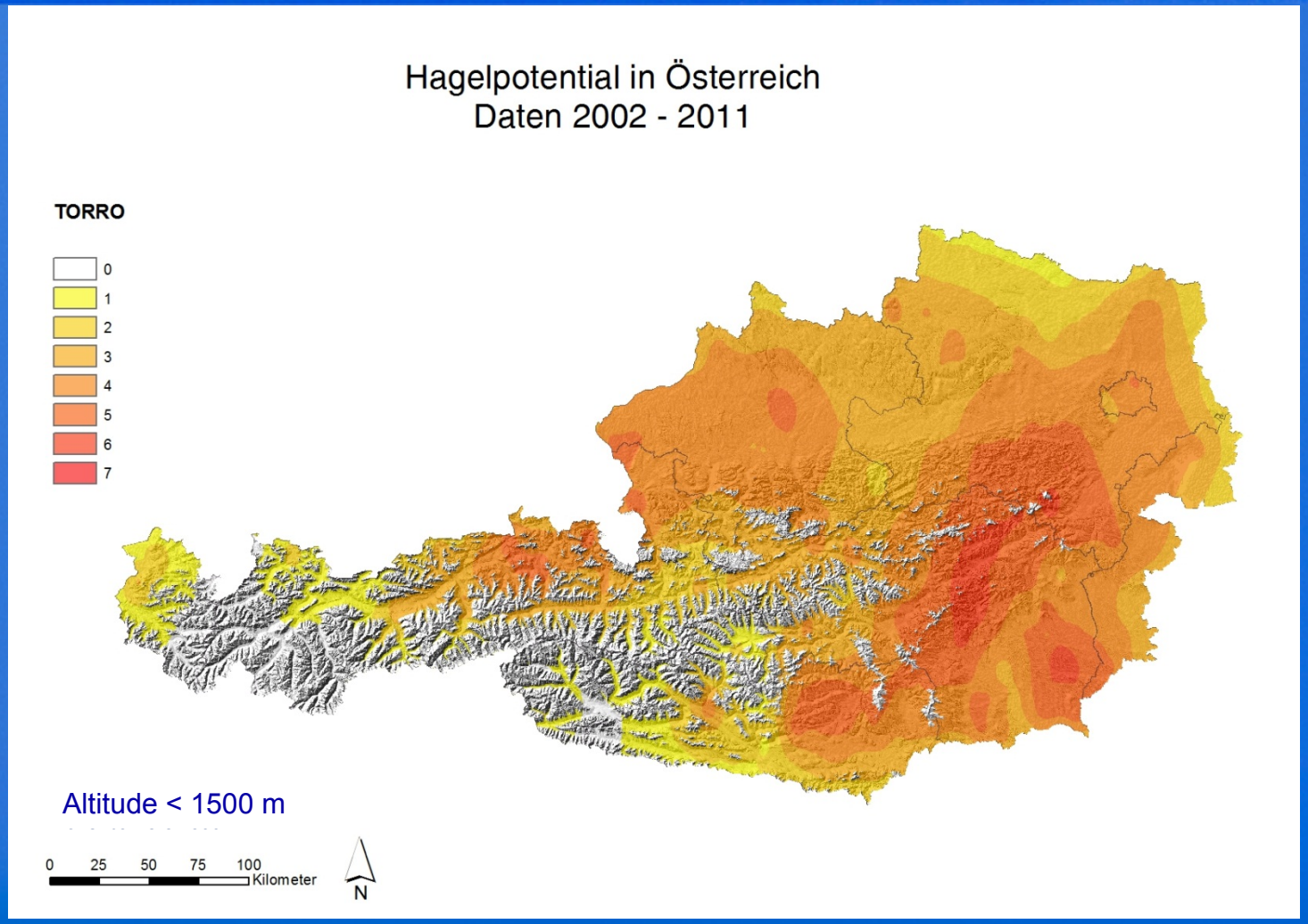
Radar:
Tracking the associated maximum intensities



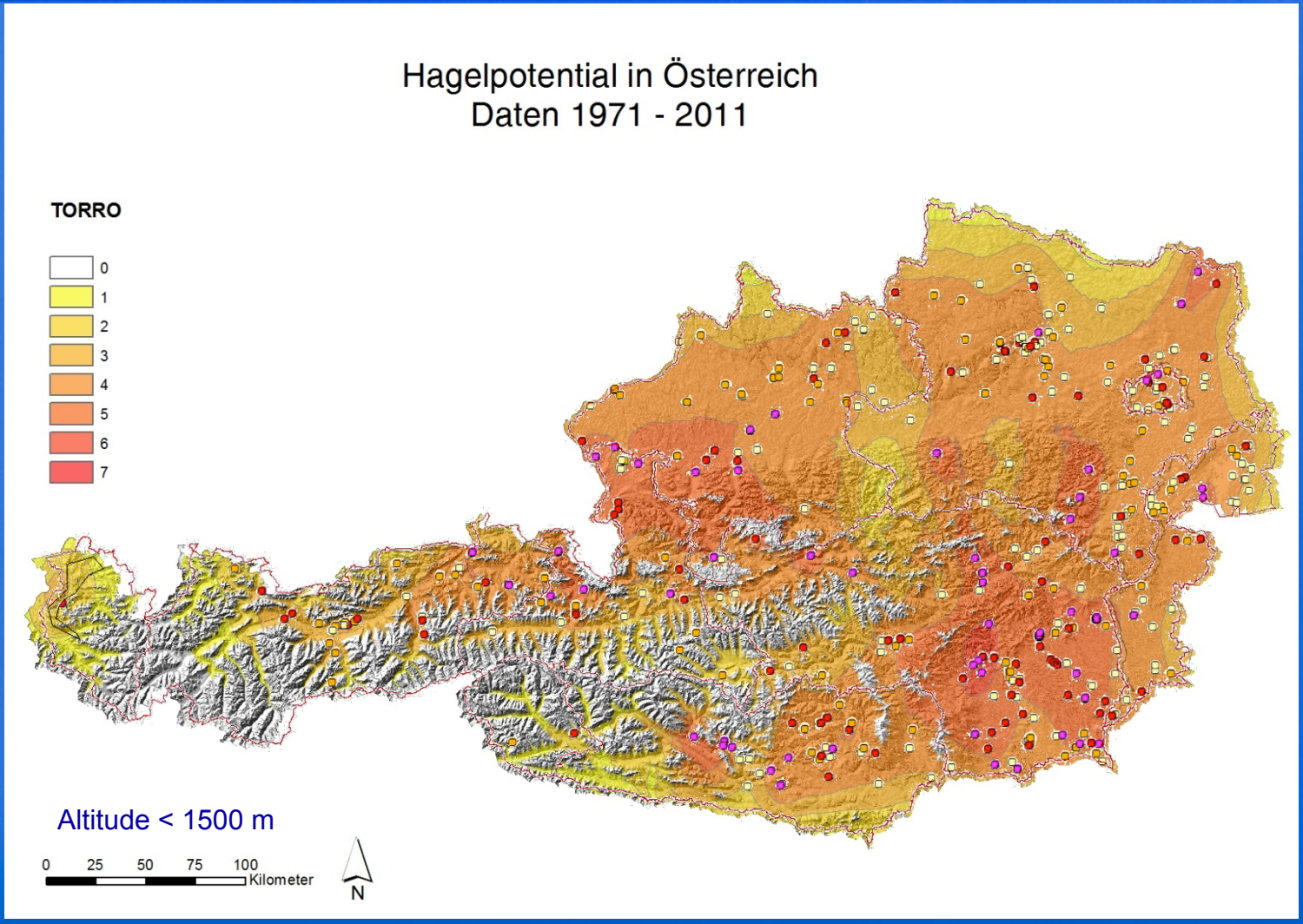
Spatial distribution of all 435 Torro- classified hail cases



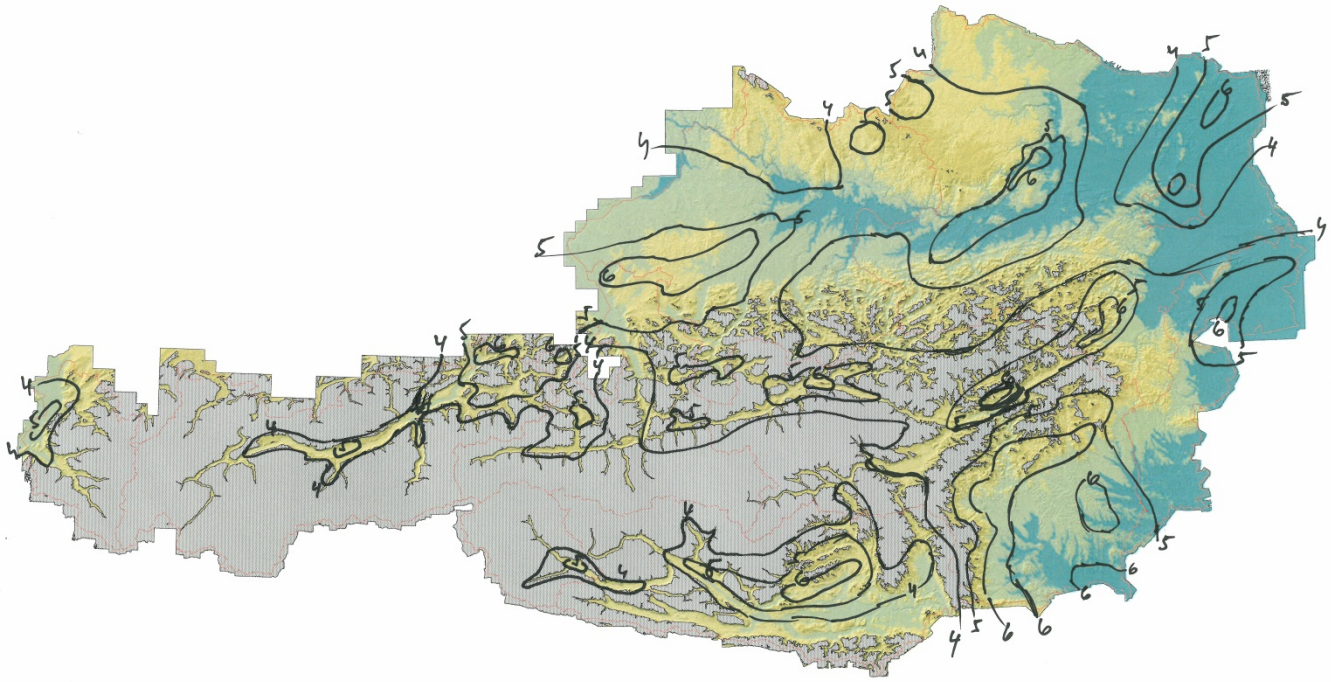
Spatial distribution of the 162 Torro- classified „radar cases“



classified cases were not completely within the computed distribution of the hail intensities

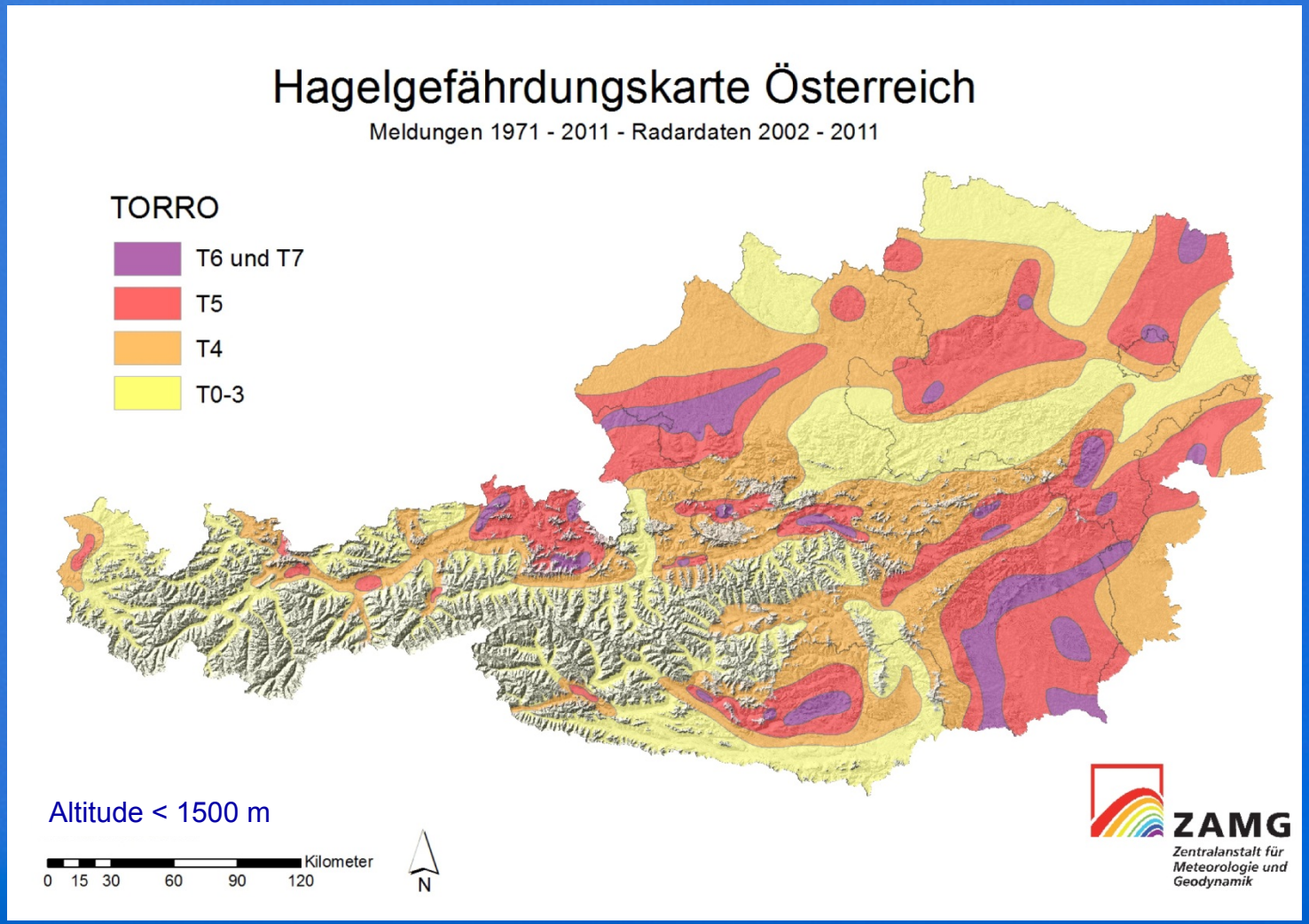


Solution: back to the good old “handmade”

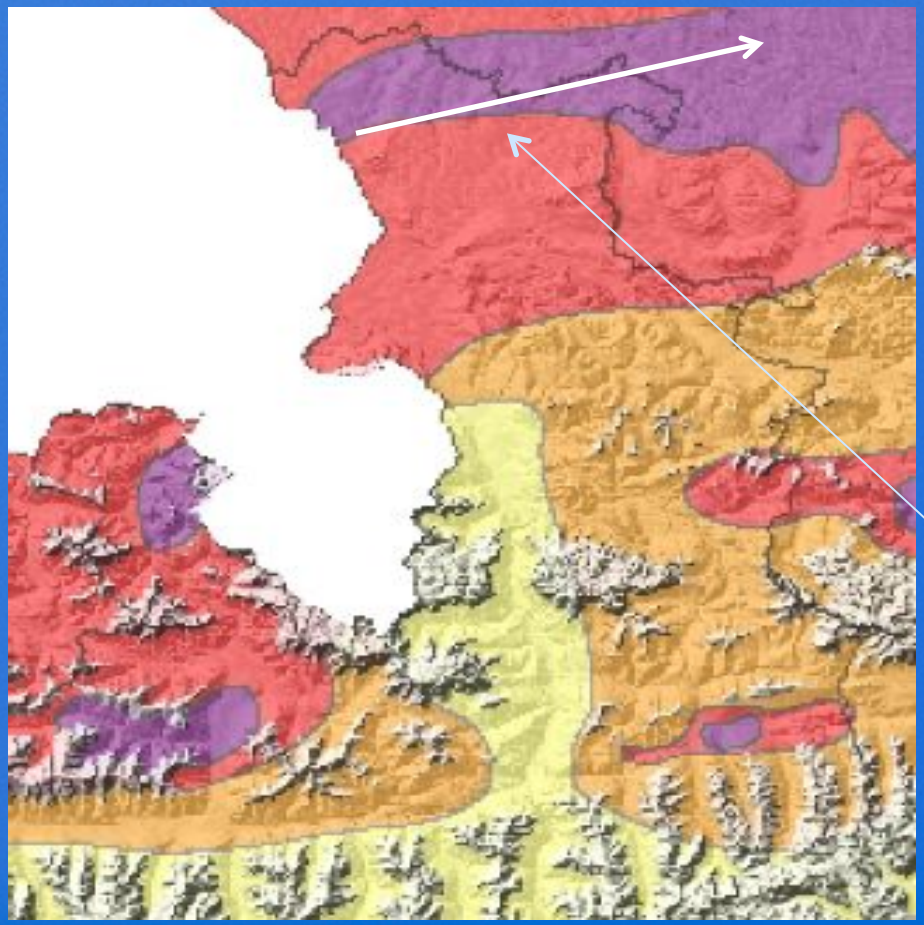


Altitude < 1500 m

Hail Risk Areas in Austria, reports 1971-2011, radar 2002-2011



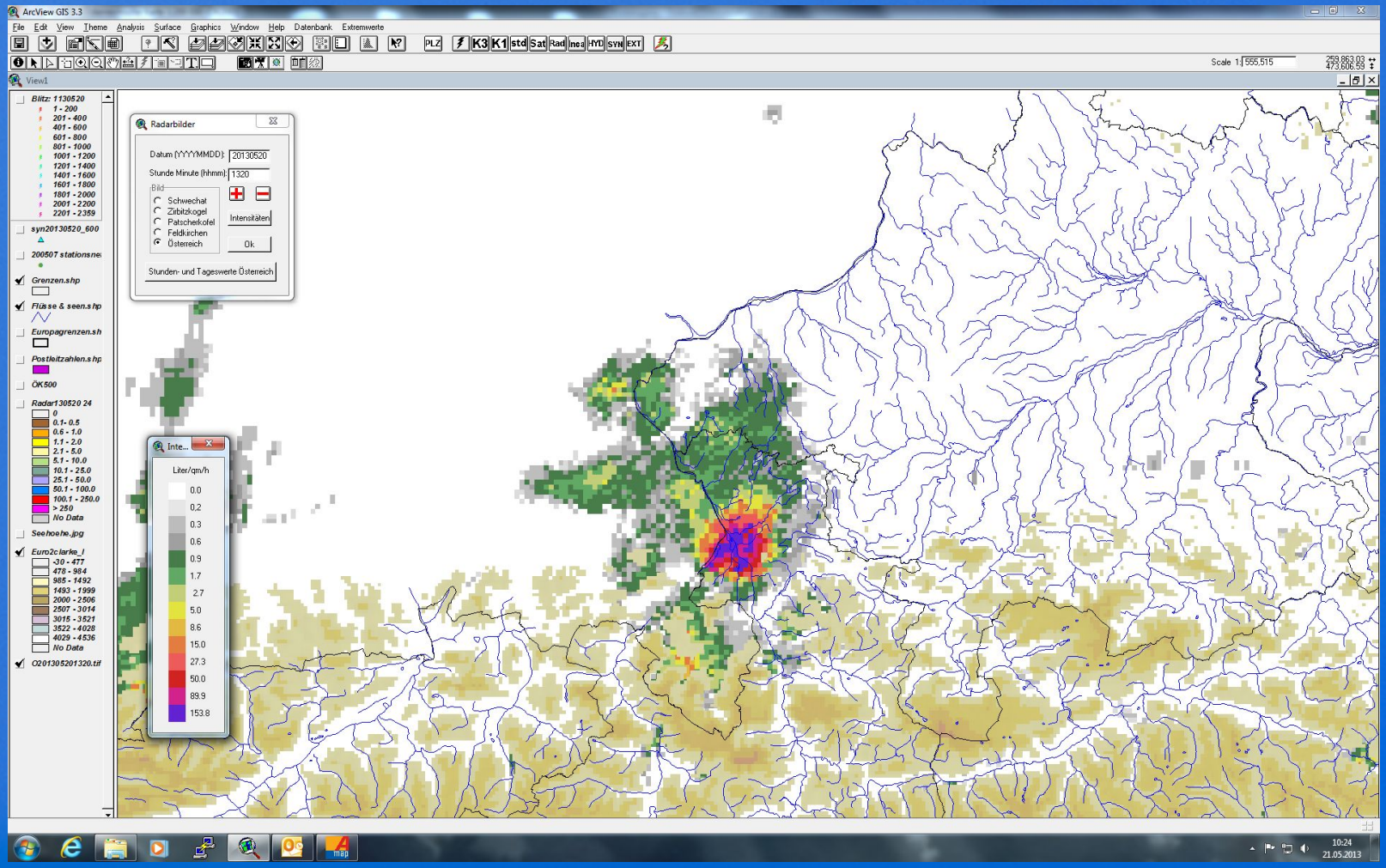
Salzburg, in detail, and hail on 2013 05 20



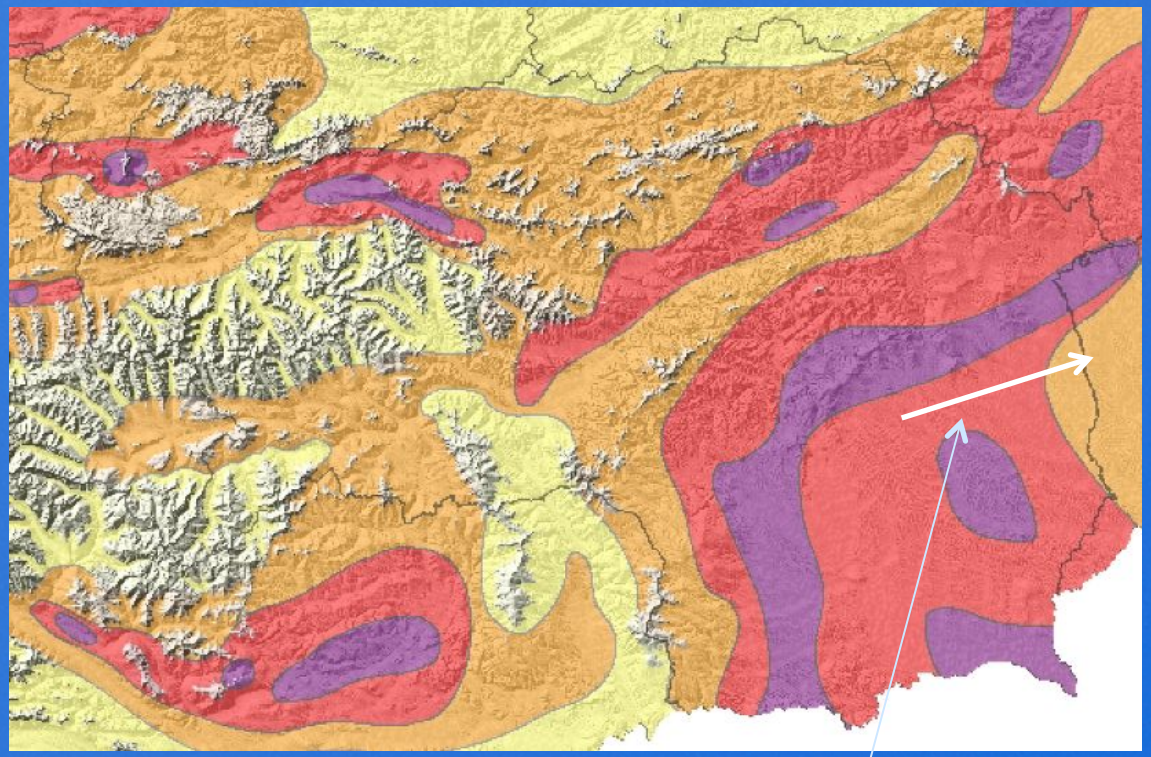
Movement of the hailing cell 2013 05 20

Description of hail risk areas within the country Salzburg:
rund um die Stadt Salzburg und im Flachgau.;, weiter im Pongau im Ennstal von Eben bis Radstadt; im Pinzgau im Bezirk Zell am See, nämlich im Saalbachtal, in Saalfelden

2013 05 20, Hail over capital town Salzburg



Styria, in detail, and hail on 2013 05 20

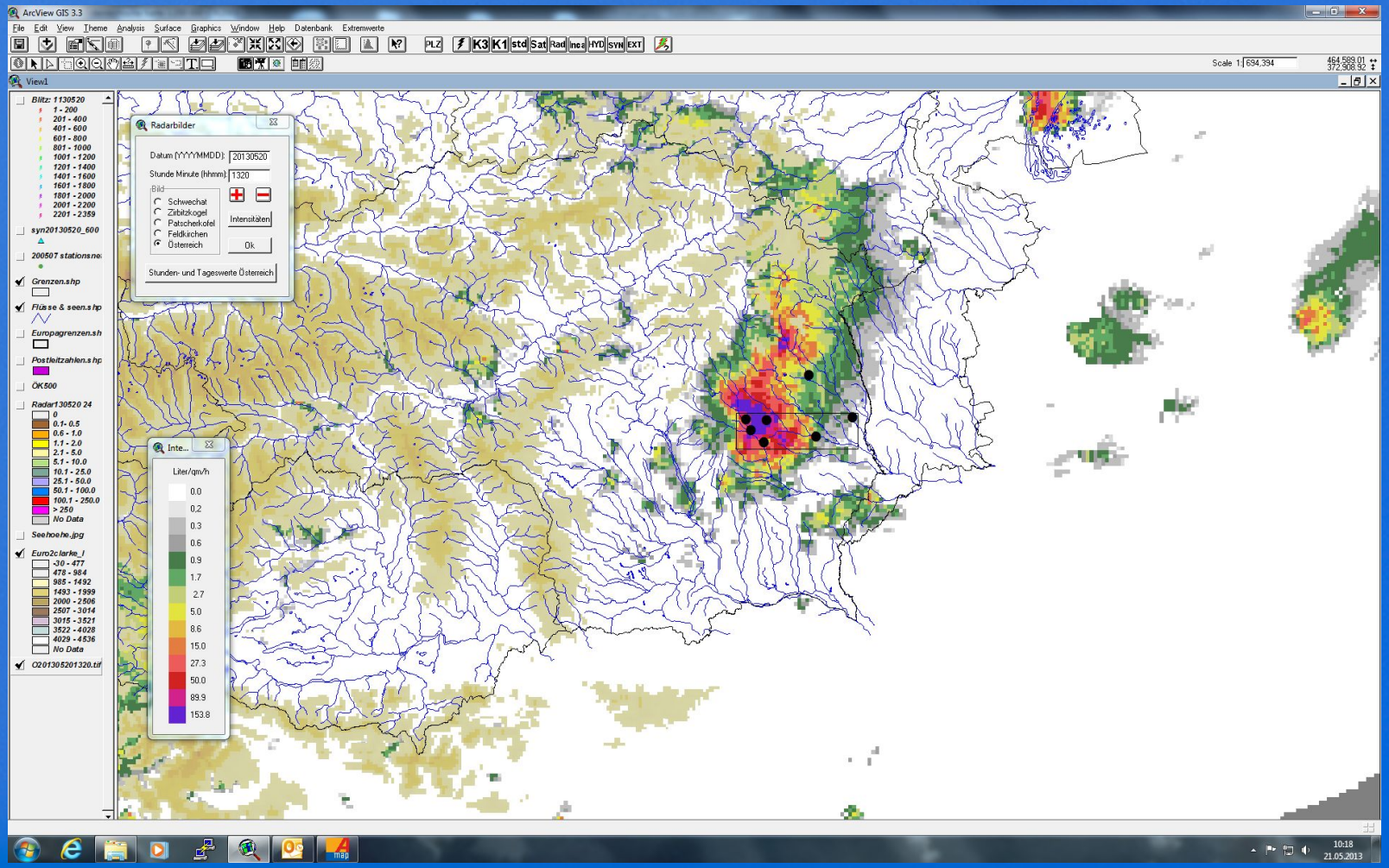


Movement of the hailing cell
2013 05 20

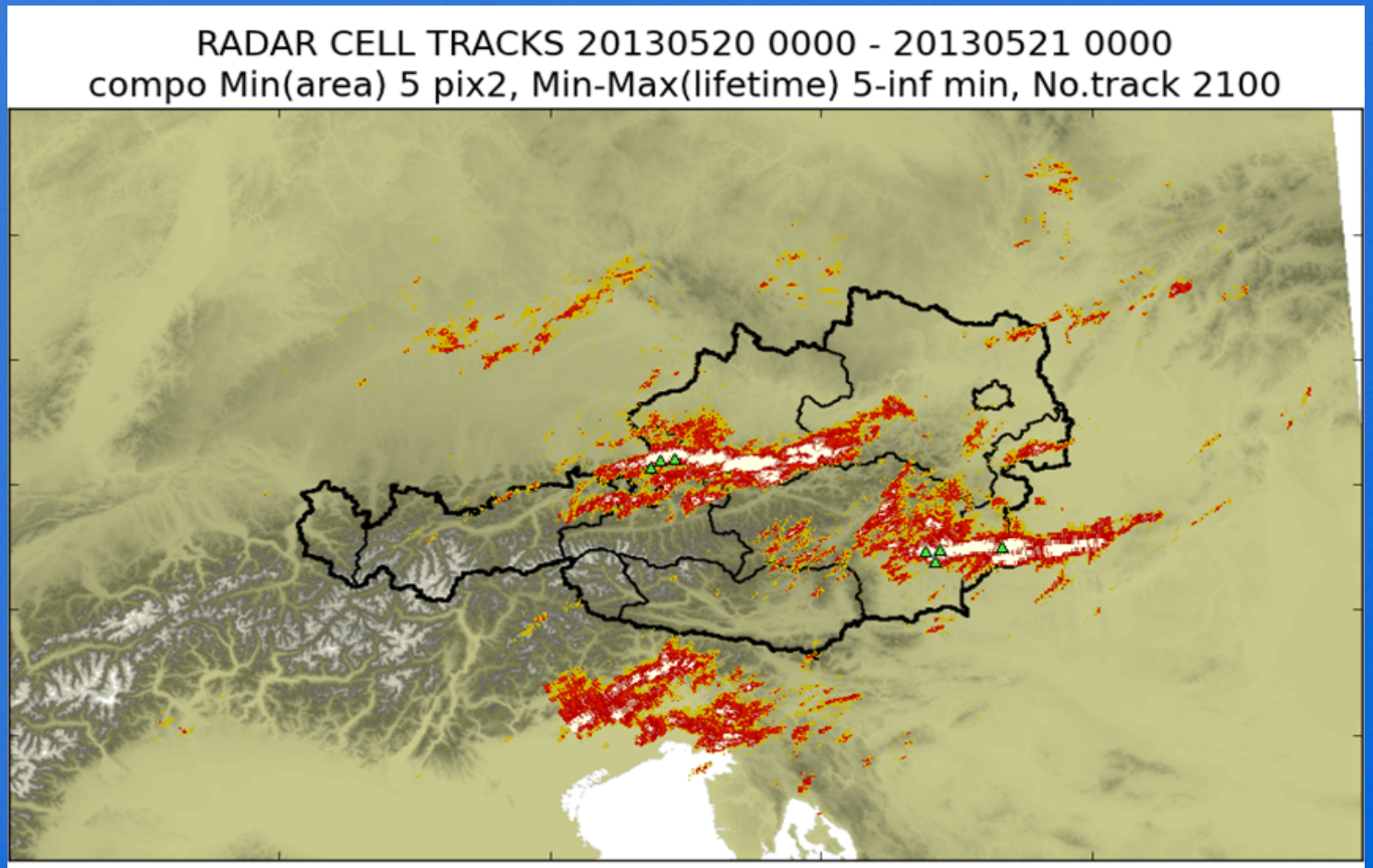
Description of hail risk areas within the country

Styria:
hier treten Hagelschläge am häufigsten und intensivsten auf, mit den Schwerpunkten unmittelbar östlich und südöstlich der abfallenden Bergzüge. Weitere schwere Hagelschläge finden sich südlich der Mürzsteger Alpen im Mürztal, besonders im Raum Kapfenberg. Schwere Hagelschläge traten wiederholt in den Bezirken Hartberg, Weiz, Graz- Umgebung, Feldbach und Radkersburg auf.

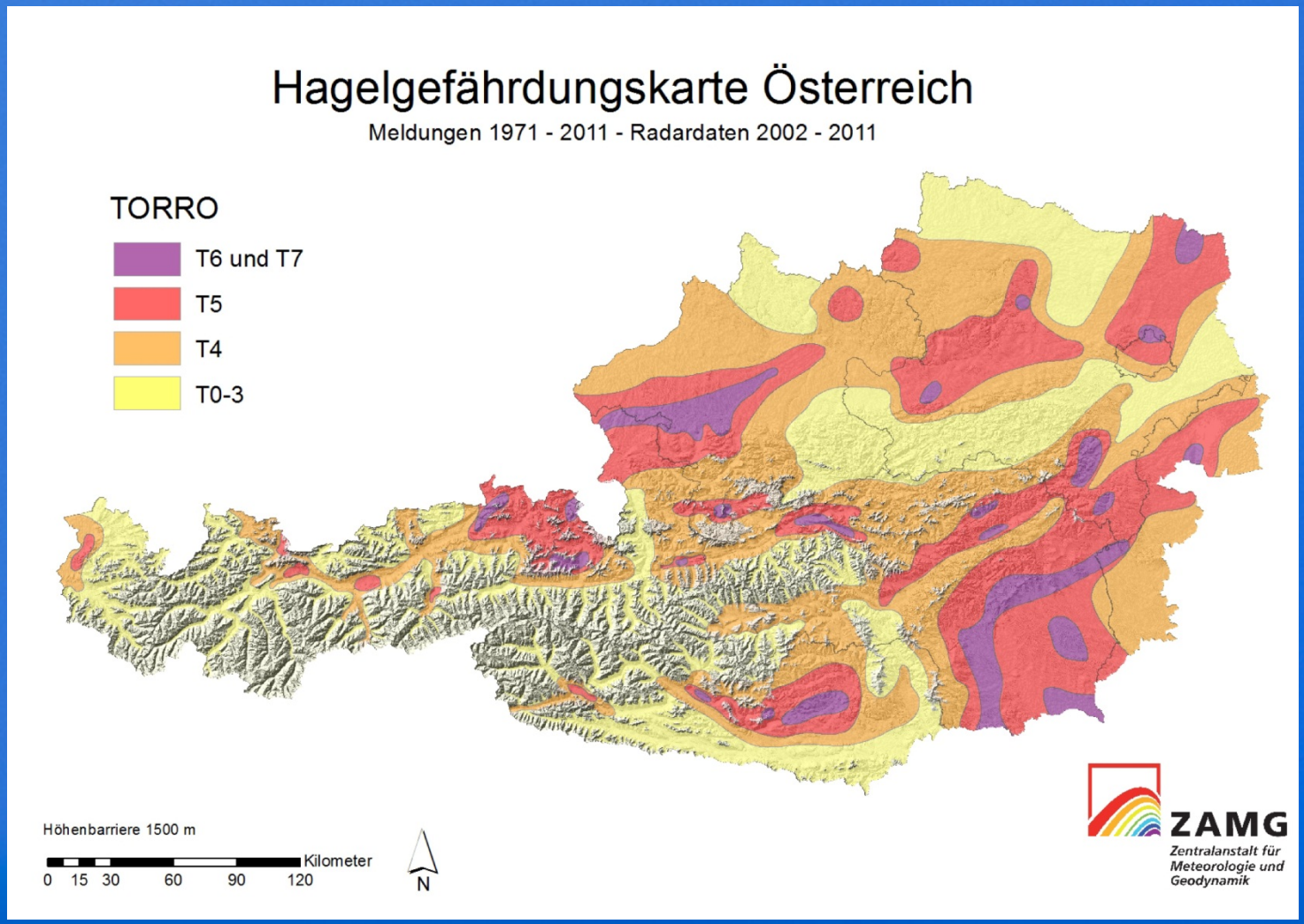
2013 05 20, Hail over the district Gleisdorf, Styria



The severe weather events 2013 05 20 >> confirm



The presented map „Hail Risk Areas in Austria“



THANK YOU FOR YOUR ATTENTION, ready for questions

Danke! Kiitos