

7th European Conference on Severe Storms (ECSS2013) , 3 - 7 June 2013, Helsinki, Finland

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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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 devastated Austria“

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Juni 14, 2013 Folie 3

320-km/h-Tornado in den USA

Hagel verwüstet Österreich

Horror- Wetter im Mai

Schule zerstört

Zwei Kinder beten
vor ihren zerstörten
Elternhäusern in Moore.

■ **24 Tote bei Sturm in Oklahoma**
■ **Riesige Hagel-Schäden bei uns**

Ein Meter Hagel

Viele Schneepflüge
mussten in Salzburg
Straßen räumen.



A reliable way of documentation – 1st)

Hail detection, according to the intensity

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Juni 14, 2013 Folie 4

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](http://www.torro.org.uk/site/hscale.php)



TORRO Hailstorm Intensity Scale

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Juni 14, 2013 Folie 5

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

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Juni 14, 2013 Folie 6

“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)

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Juni 14, 2013 Folie 7

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



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.

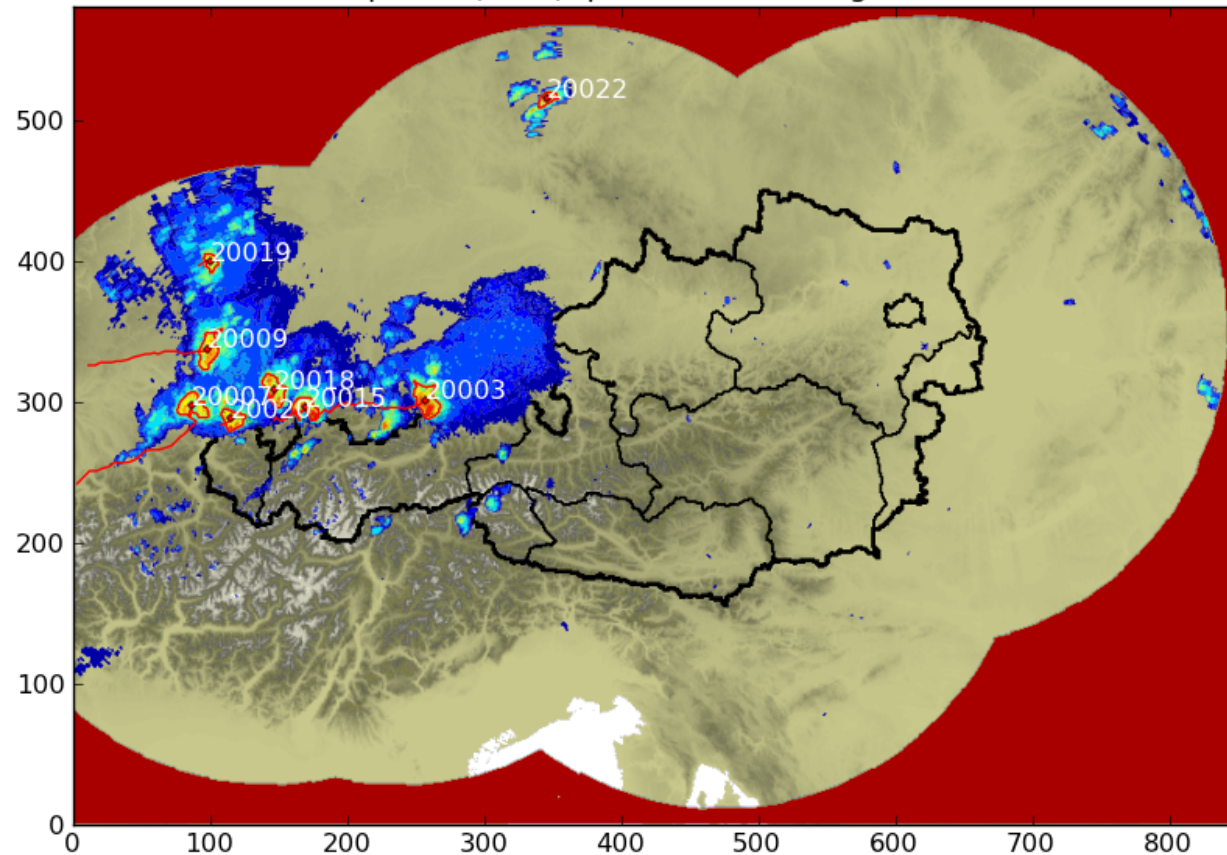


Cell identification and tracking

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Juni 14, 2013 Folie 9

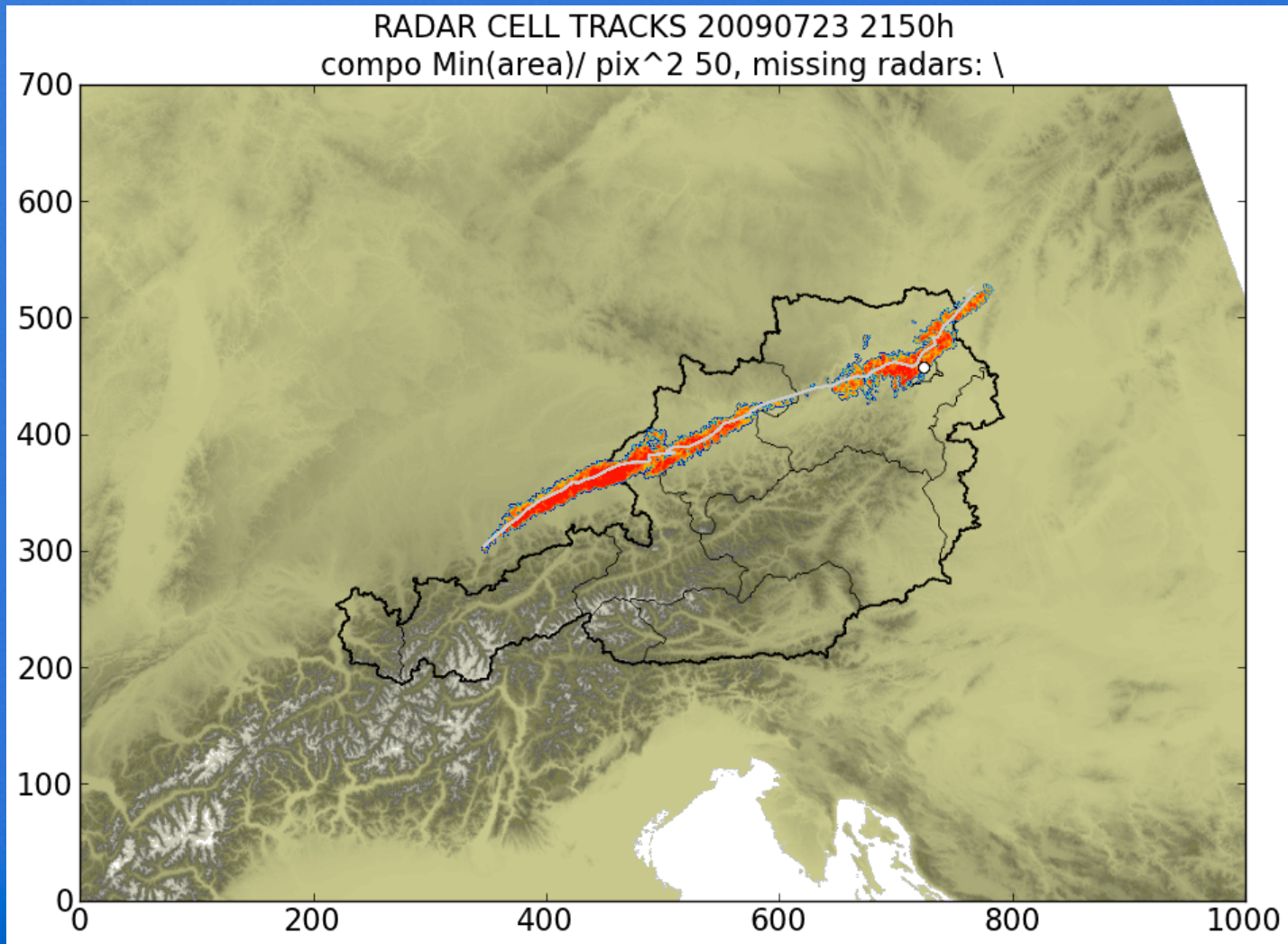
RADAR CELL TRACKS 20100722 1610h
compo Min(area)/ pix² 50, missing radars: \



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

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Juni 14, 2013 Folie 10

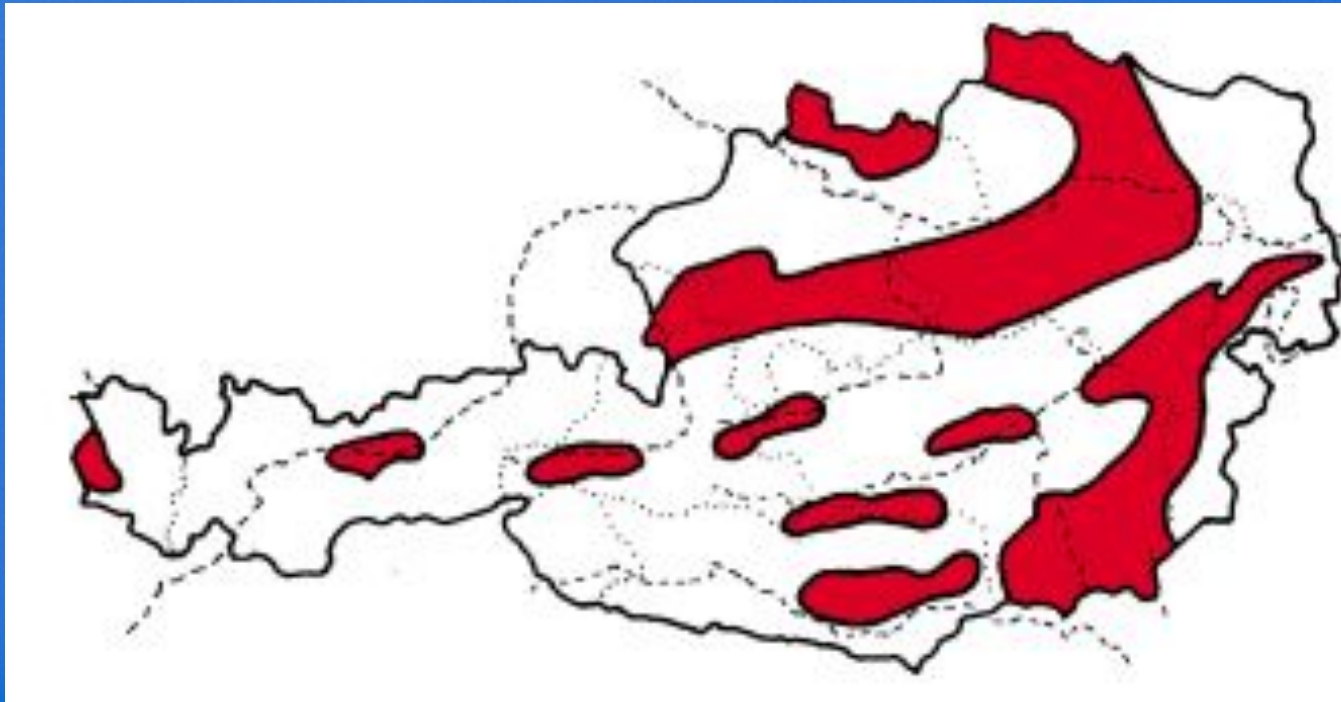


HAIL DETECTION: quantitative and comprehensive

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Juni 14, 2013 Folie 11

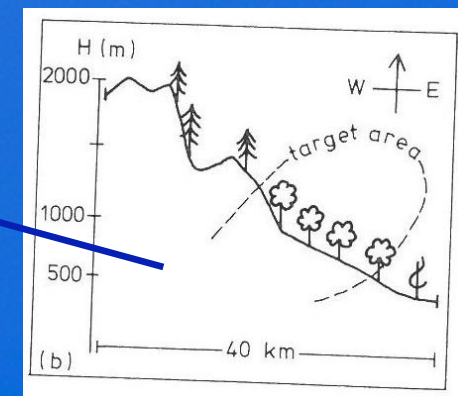
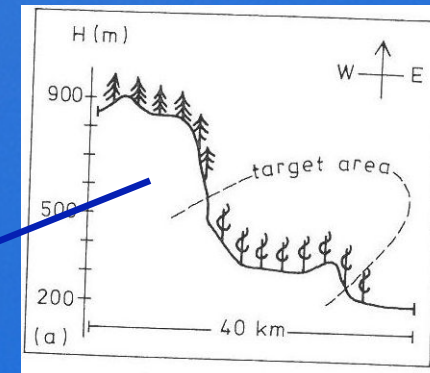
First approach:
for each station is the ratio of the average annual number of days with hail to the average annual number of days with thunderstorms calculated (study period 1951-1985)



Terrain profile around hail risk areas

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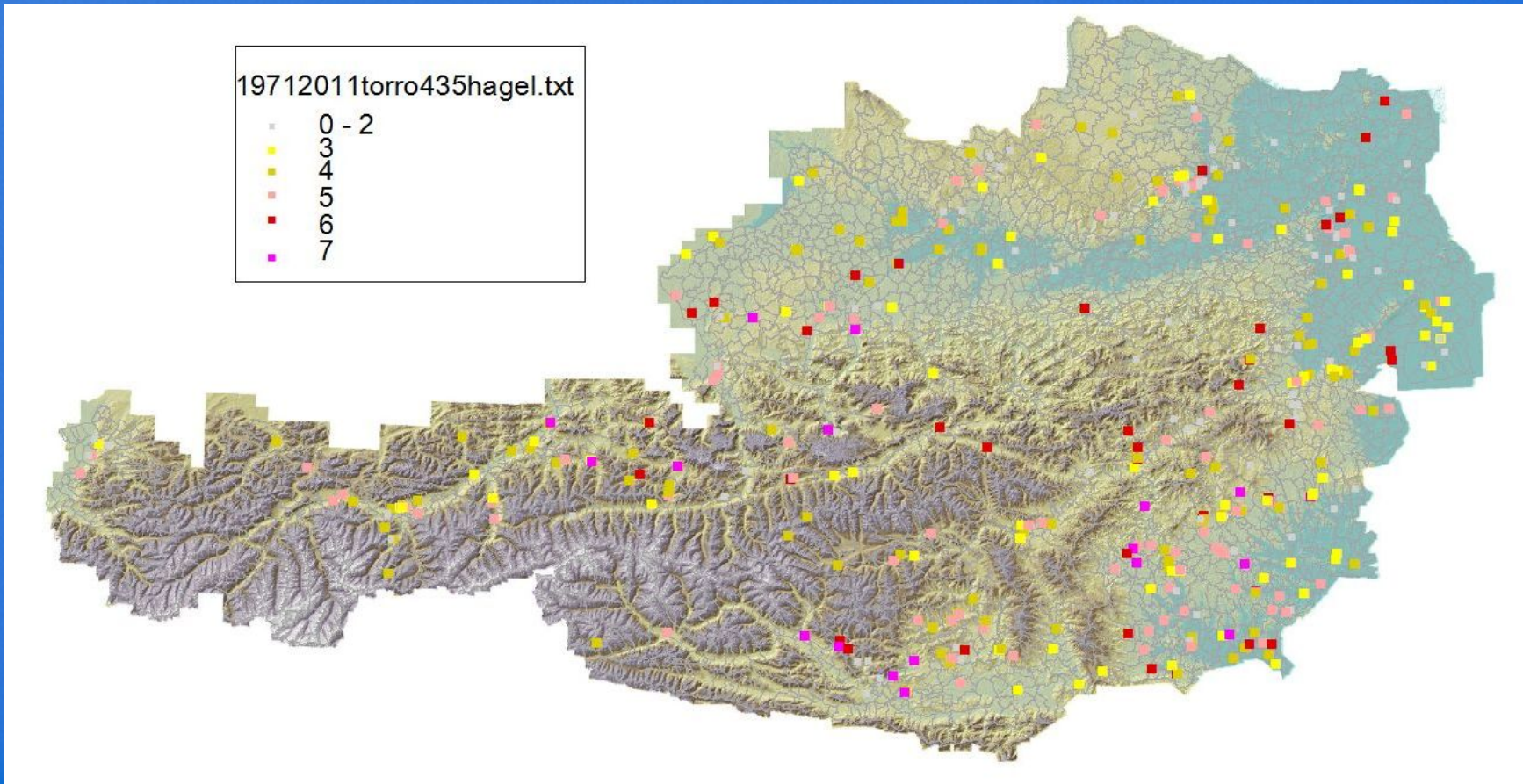
Juni 14, 2013 Folie 12



Chronicle ZAMG: 435 hail events, 1971 – 2011

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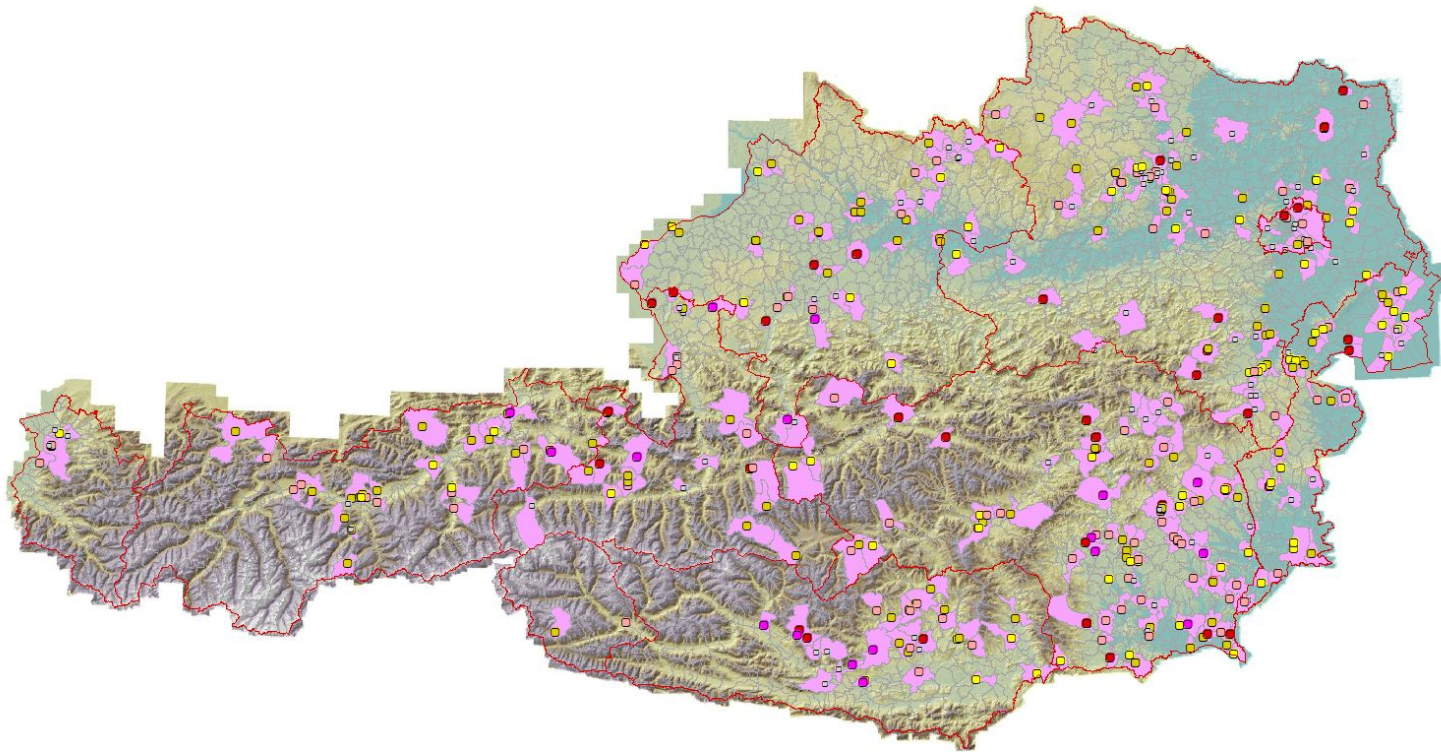
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435 classified hail cases within 310 communities

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Juni 14, 2013 Folie 14

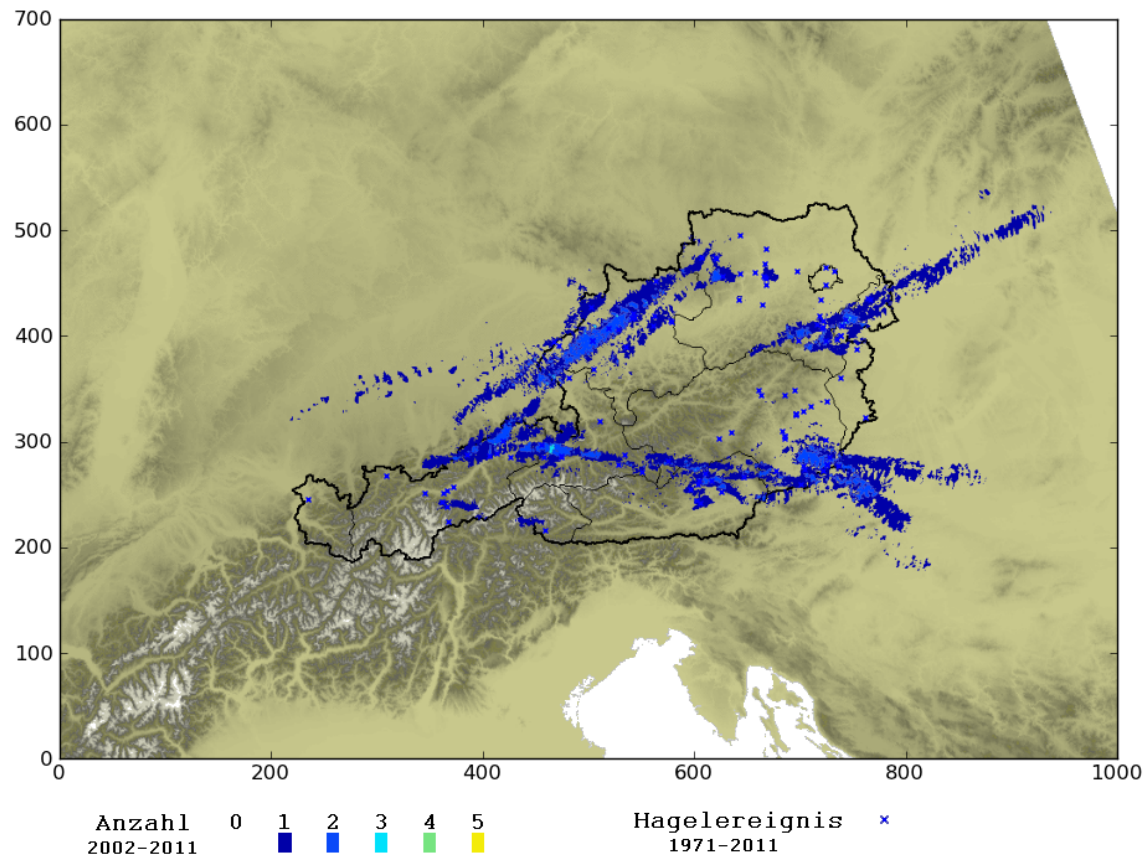


2002-2011, 46 cases TORRO 4 radar cell tracks, and frequency

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Juni 14, 2013 Folie 15

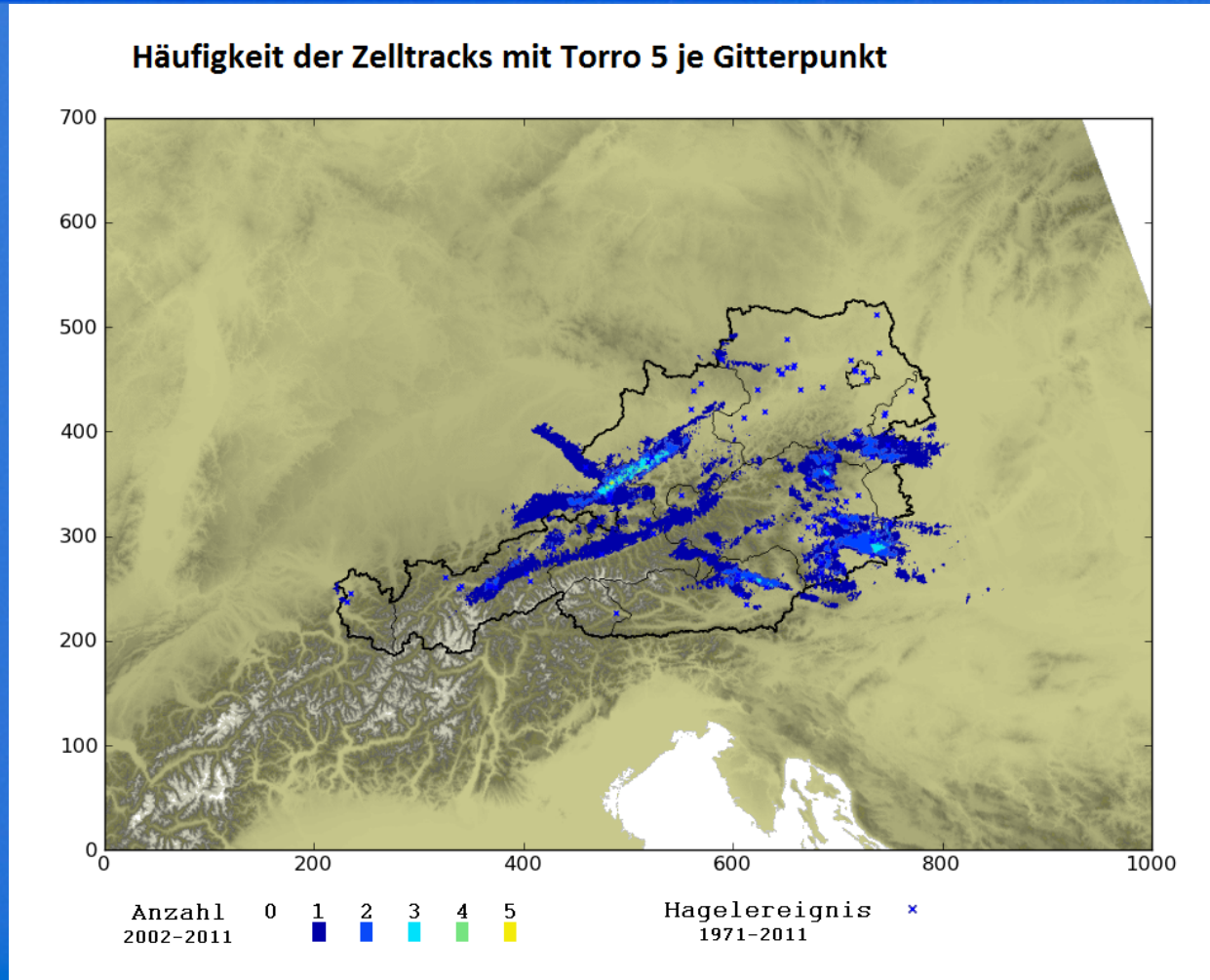
Häufigkeit der Zelltracks mit Torro 4 je Gitterpunkt



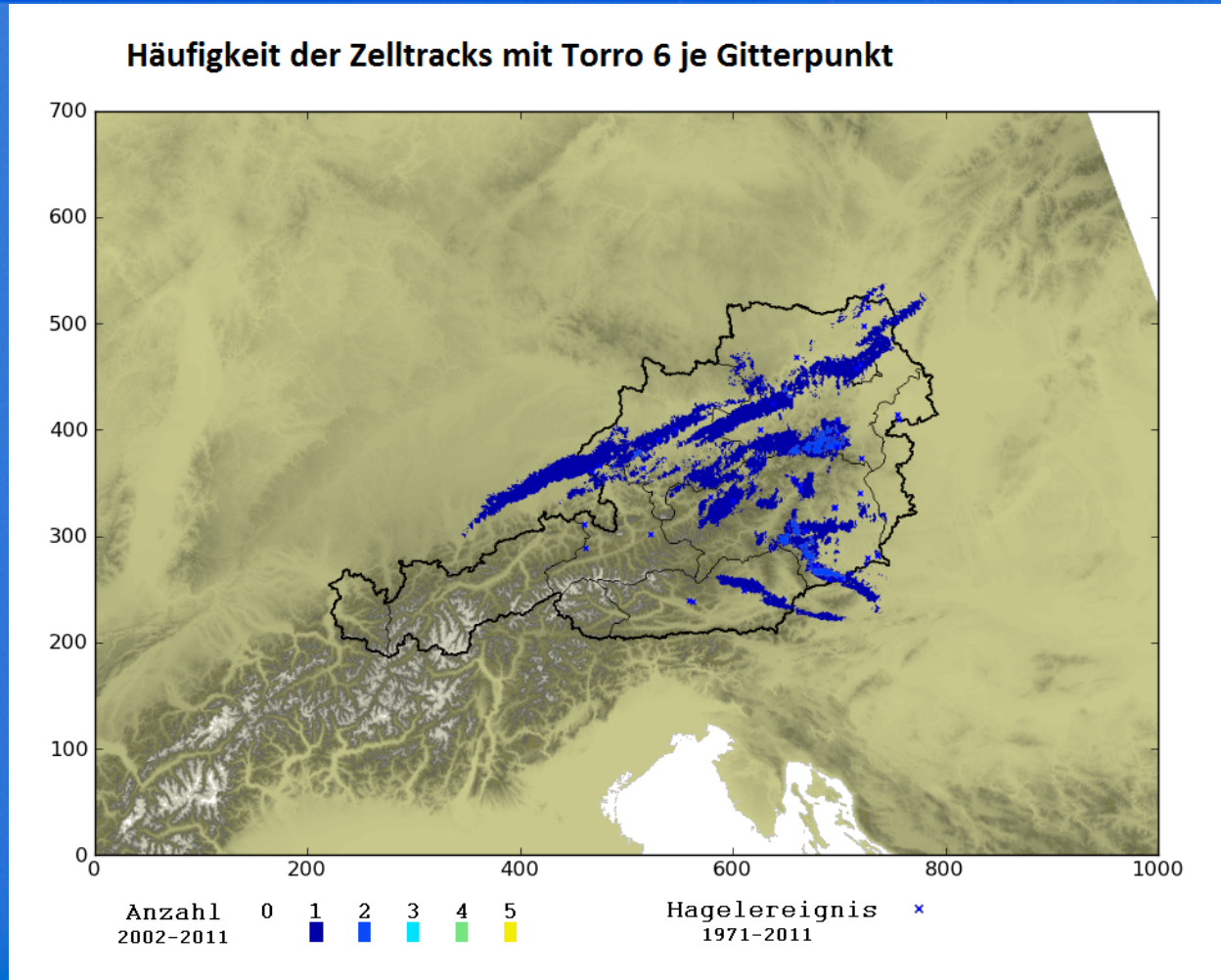
2002-2011, 35 cases TORRO 5 radar cell tracks, and frequency

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Juni 14, 2013 Folie 16



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

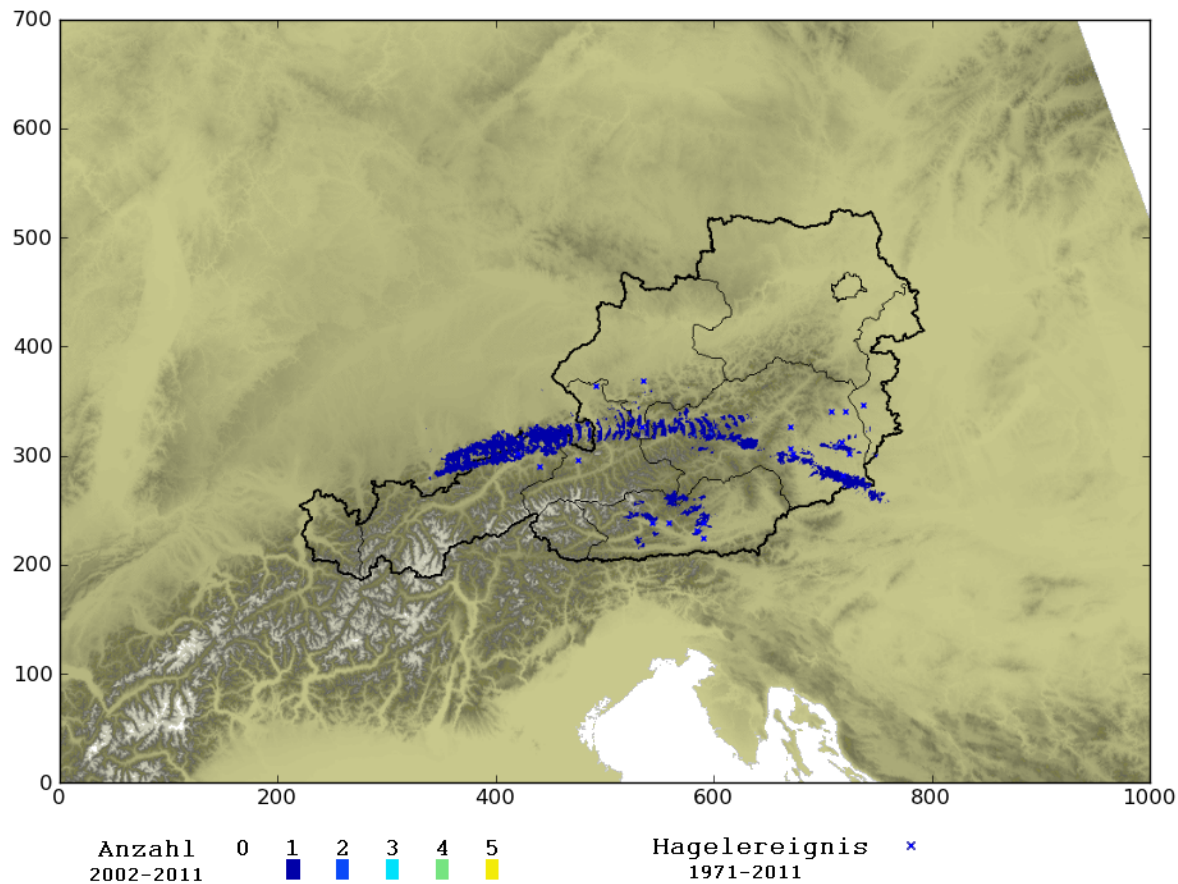


2002-2011, 6 cases TORRO 7 radar cell tracks, and frequency

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Juni 14, 2013 Folie 18

Häufigkeit der Zelltracks mit Torro 7 je Gitterpunkt

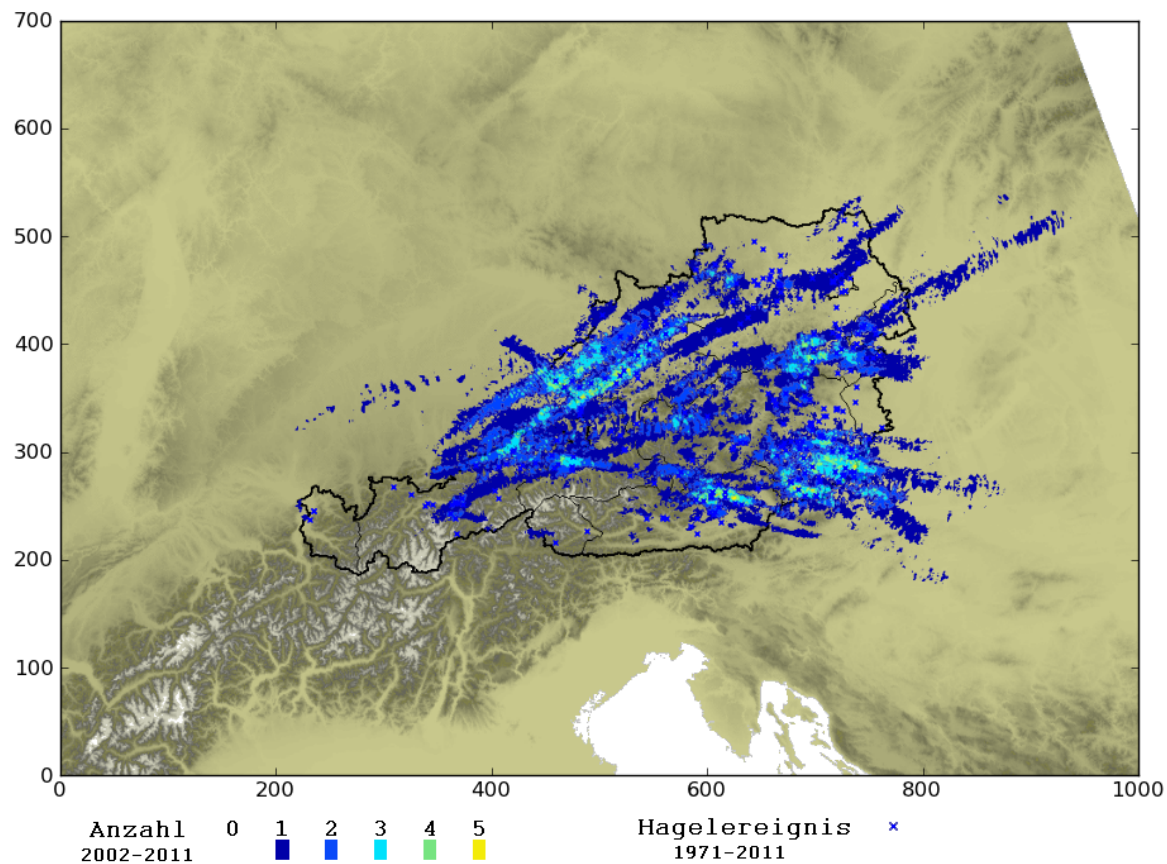


TORRO 4-7, 105 radar cell tracks, and frequency

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Juni 14, 2013 Folie 19

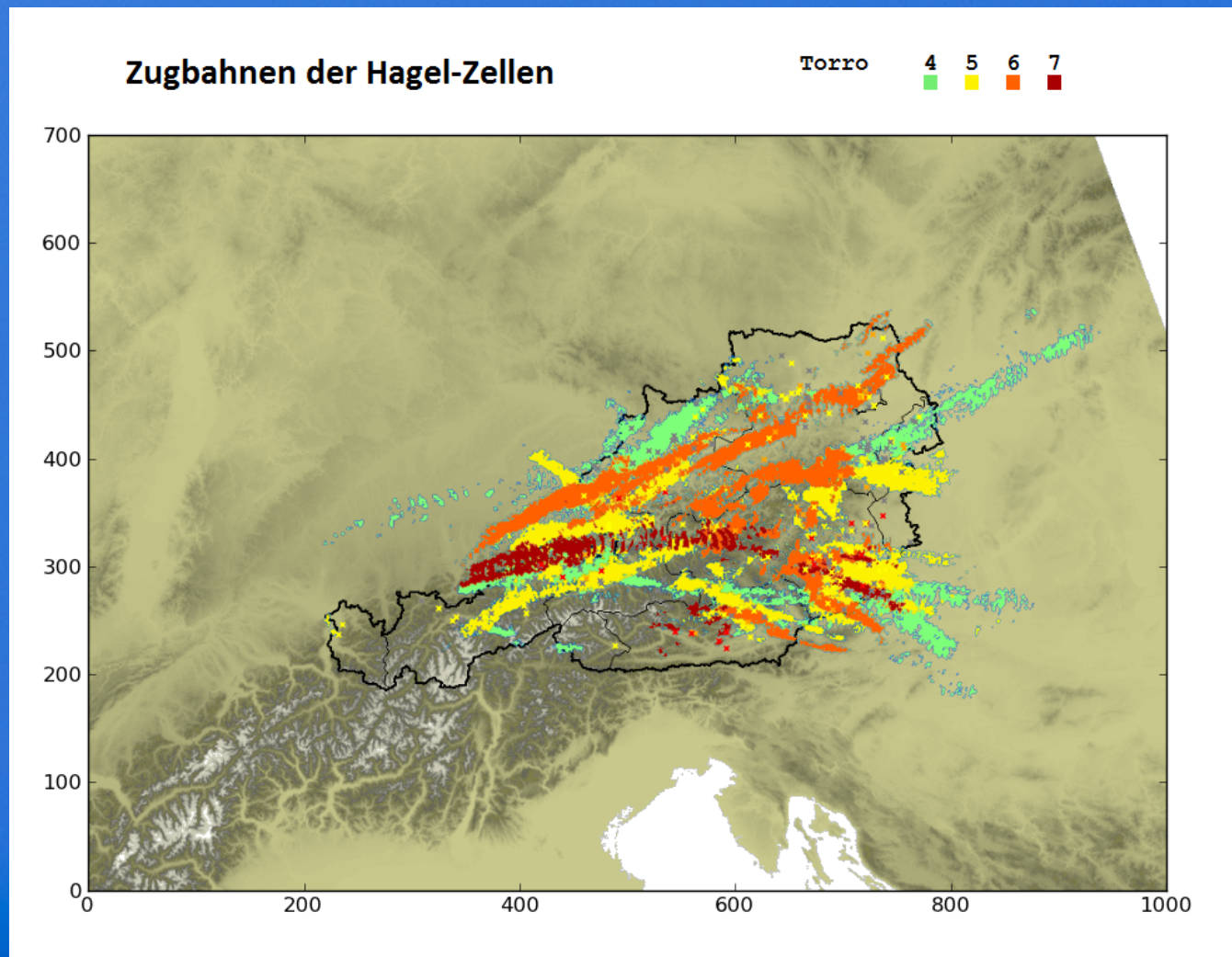
Häufigkeit der Zelltracks mit Torro 4 bis Torro 7 je Gitterpunkt



All detected tracks

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Juni 14, 2013 Folie 20

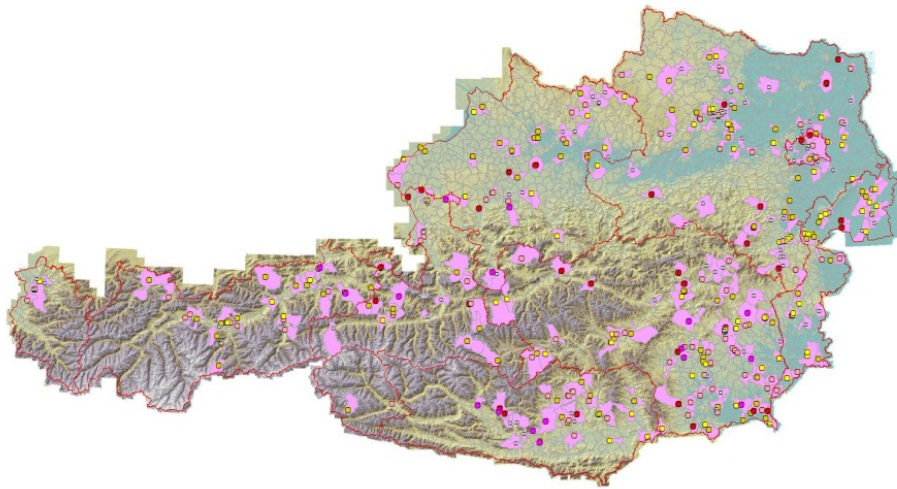


Intersection Chronicle and radar values

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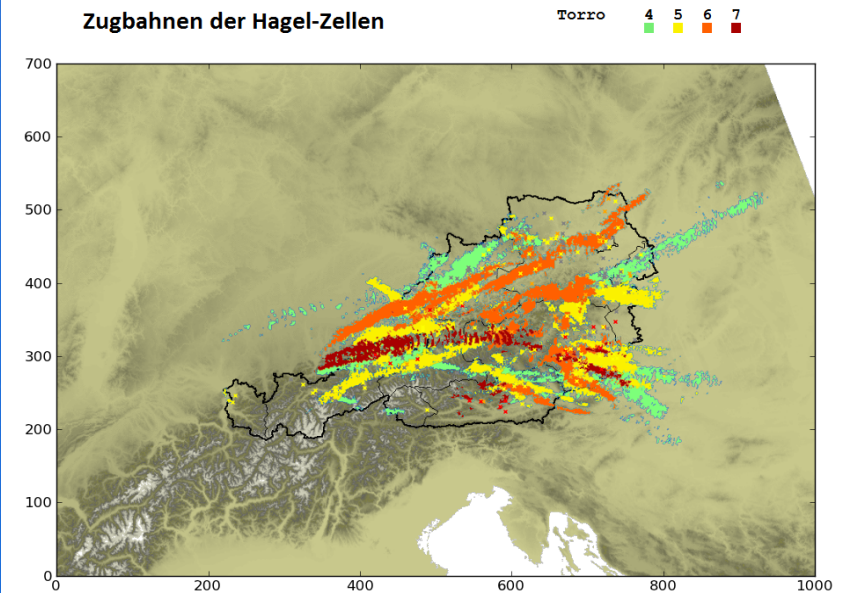
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local damage information



Radar:

Tracking the associated maximum intensities



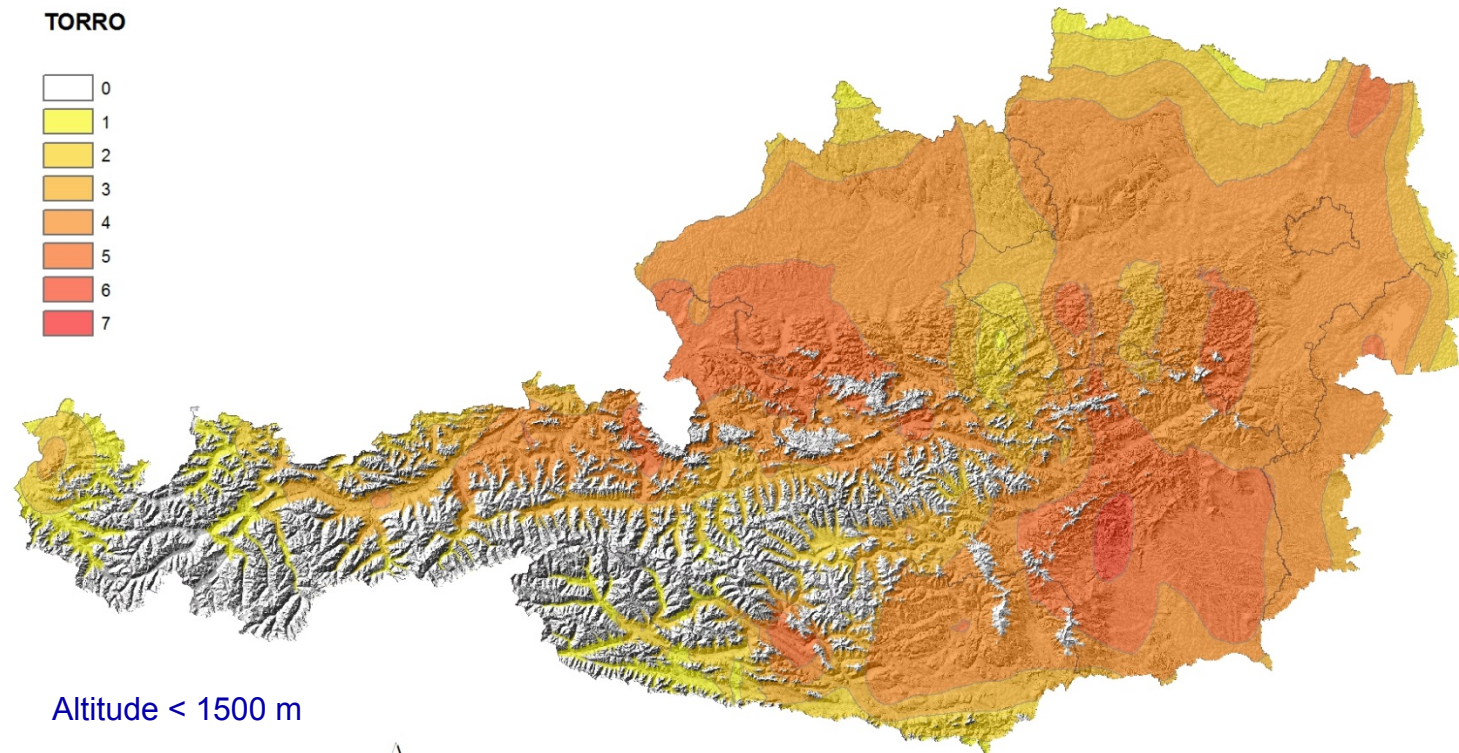
Spatial distribution of all 435 Torro- classified hail cases

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Juni 14, 2013 Folie 22

Hagelpotential in Österreich Daten 1971 - 2011

TORRO



Altitude < 1500 m

0 25 50 75 100
Kilometer



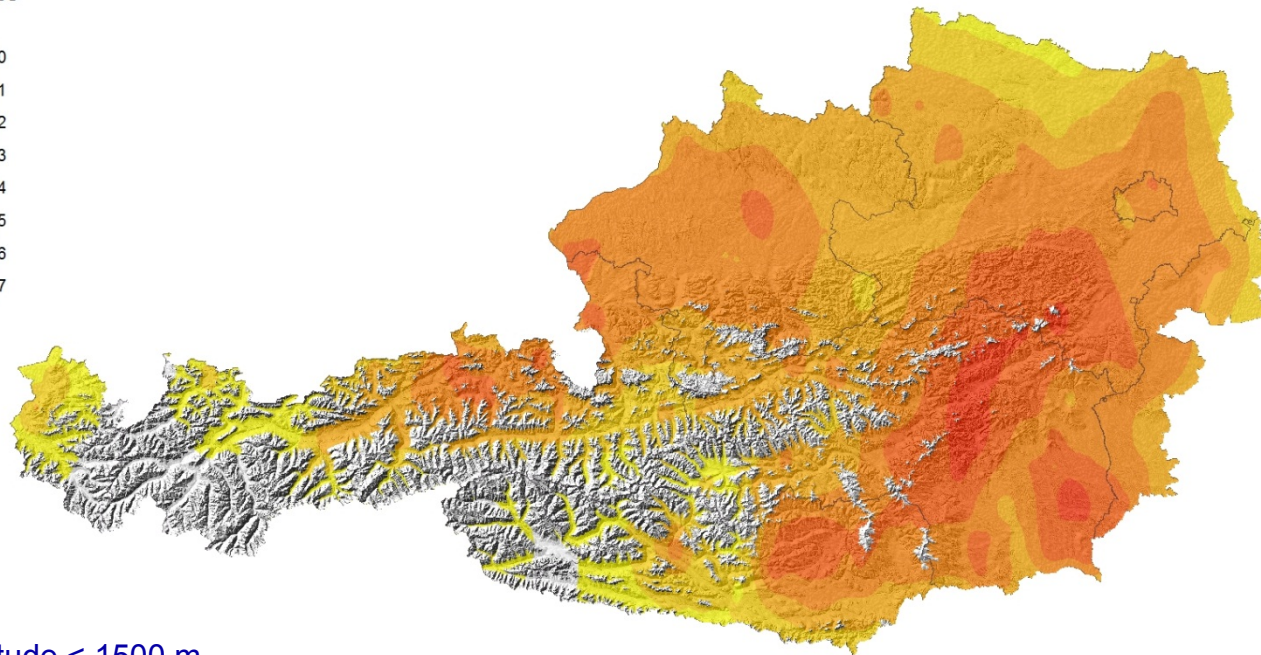
Spatial distribution of the 162 Torro- classified „radar cases“

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Juni 14, 2013 Folie 23

Hagelpotential in Österreich Daten 2002 - 2011

TORRO



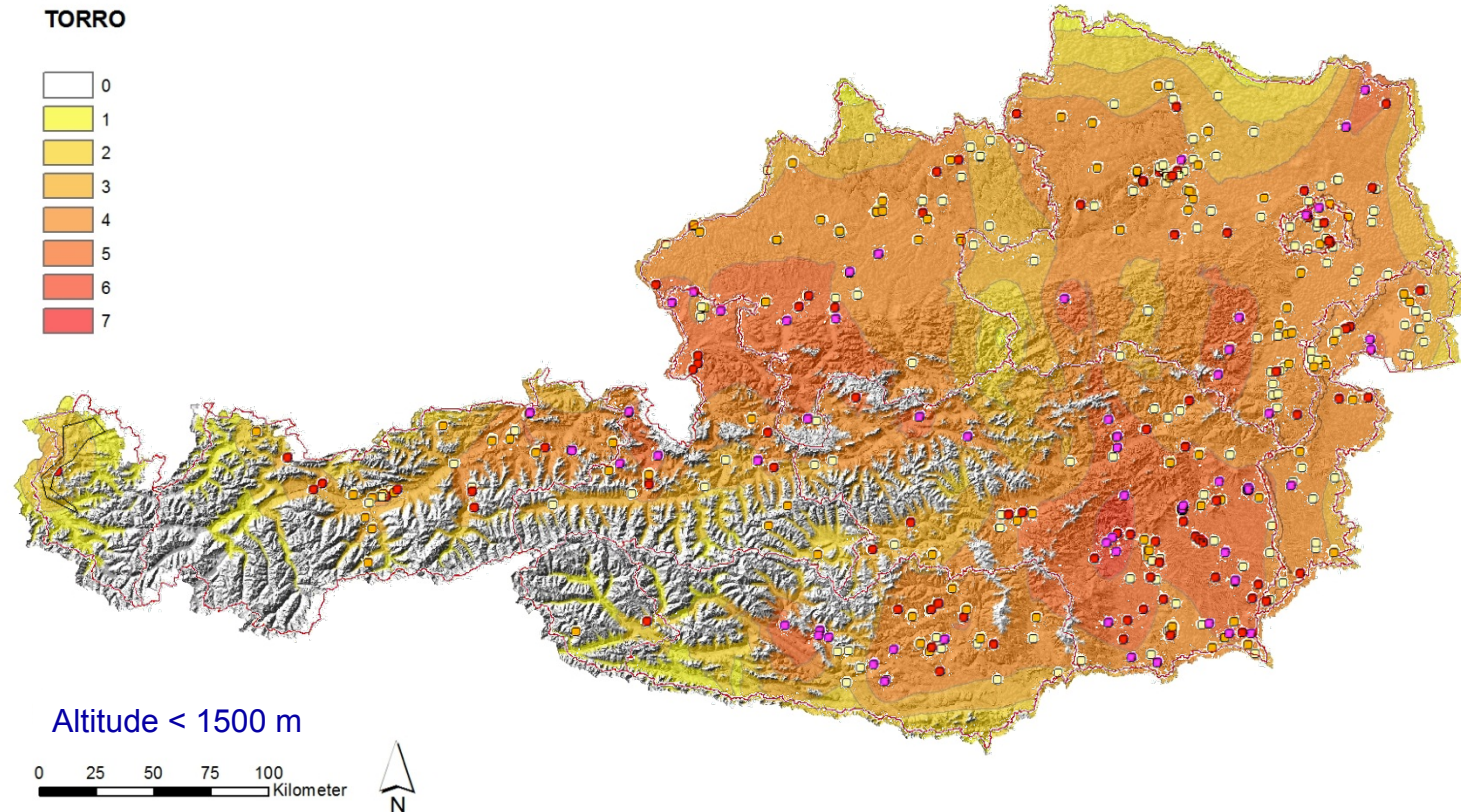
Altitude < 1500 m

0 25 50 75 100 Kilometer



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

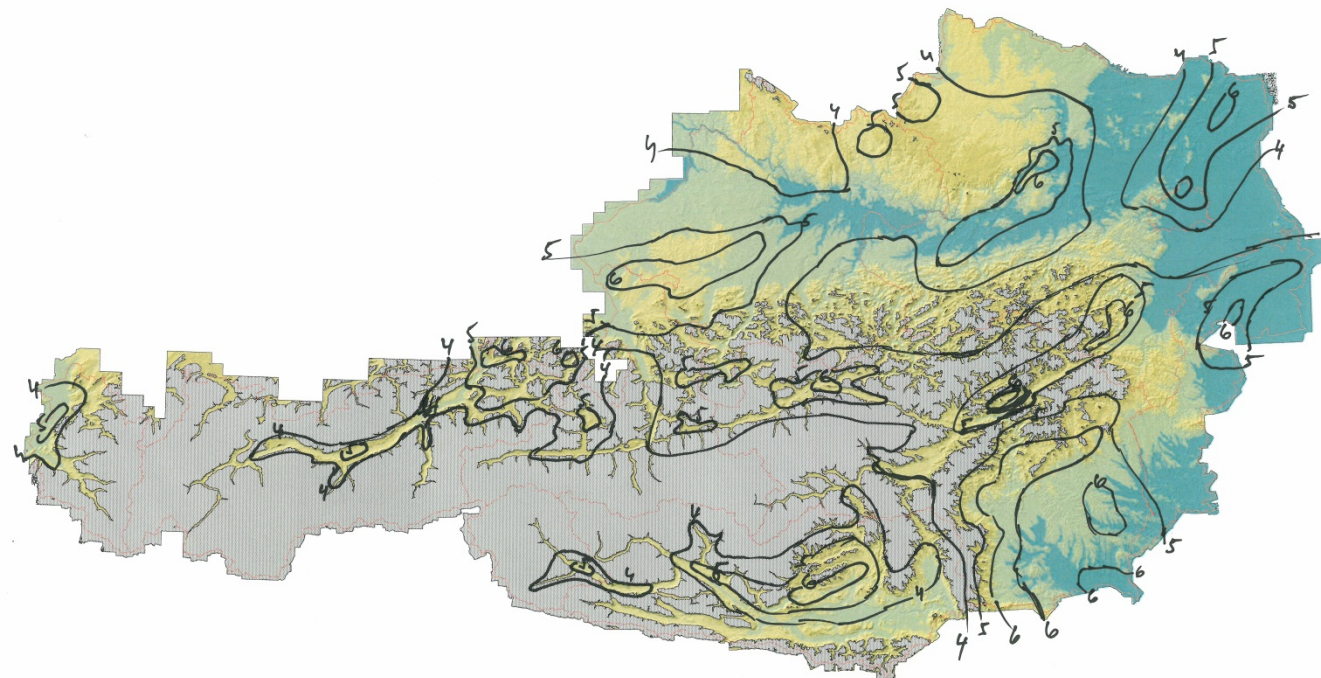
Hagelpotential in Österreich Daten 1971 - 2011



Solution: back to the good old “handmade”

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Juni 14, 2013 Folie 25



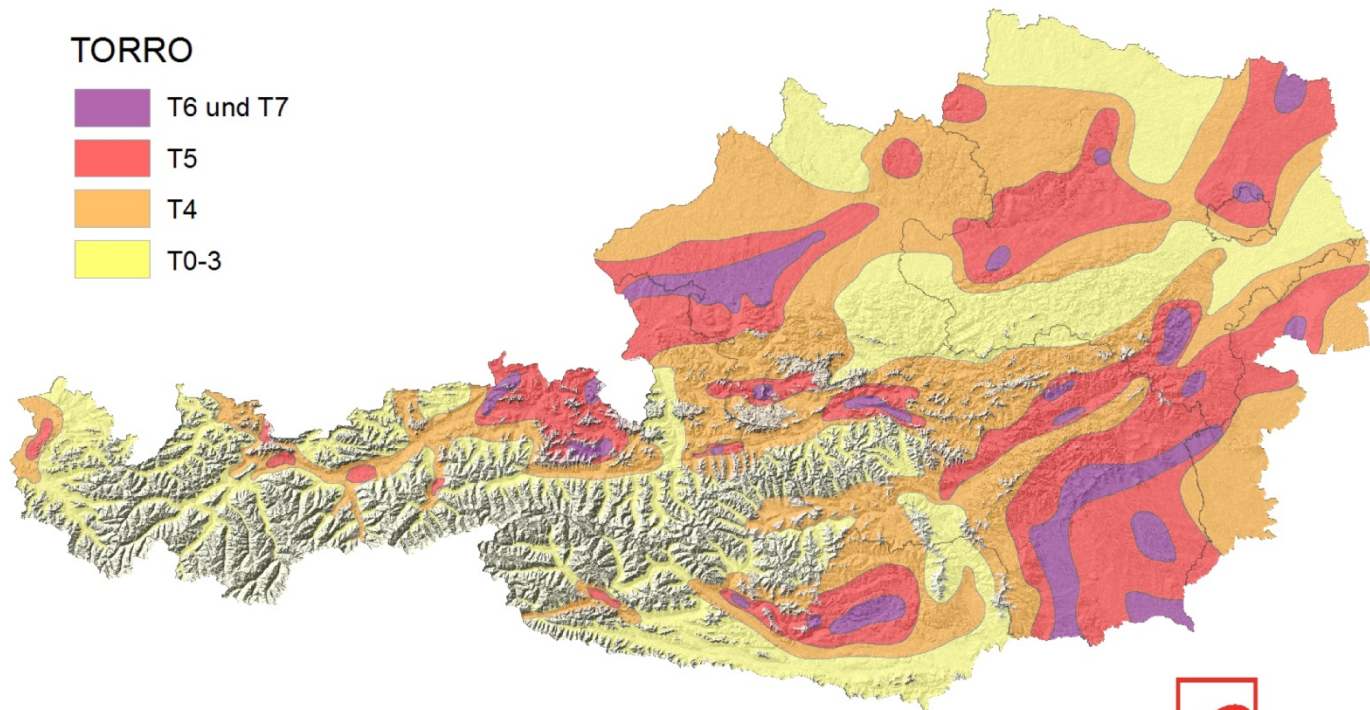
Altitude < 1500 m



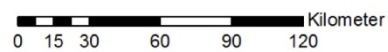
Hagelgefährdungskarte Österreich

Meldungen 1971 - 2011 - Radardaten 2002 - 2011

TORRO



Altitude < 1500 m



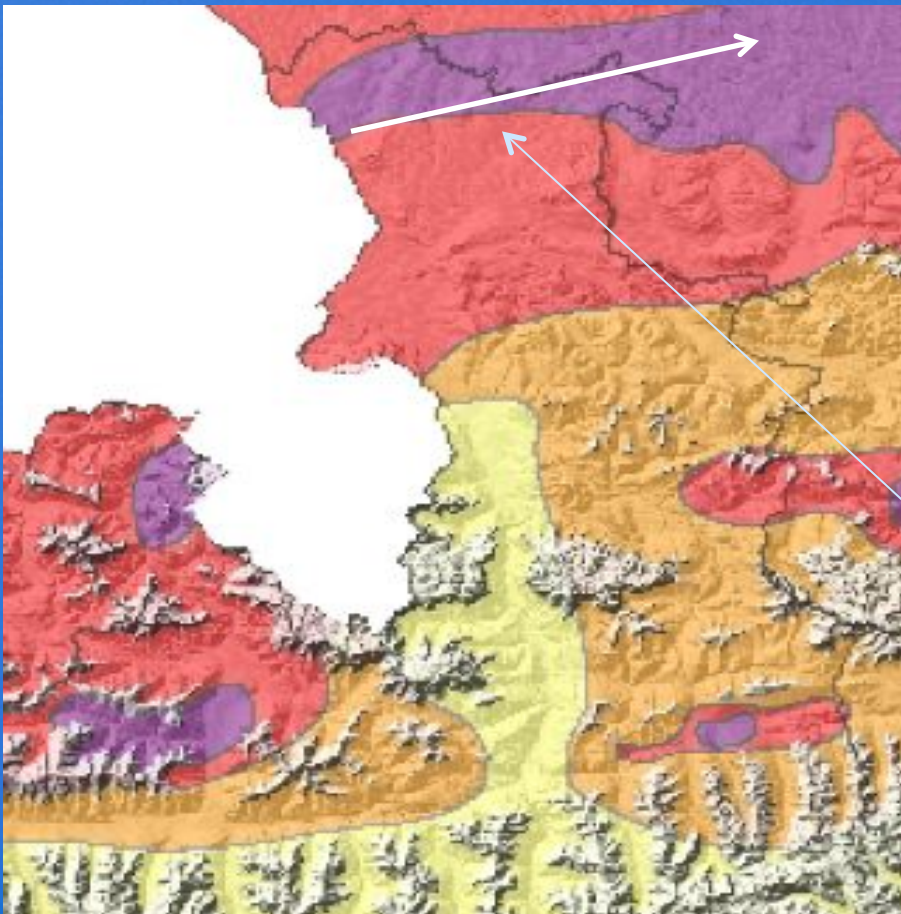
ZAMG
Zentralanstalt für
Meteorologie und
Geodynamik



Salzburg, in detail, and hail on 2013 05 20

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Juni 14, 2013 Folie 27



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

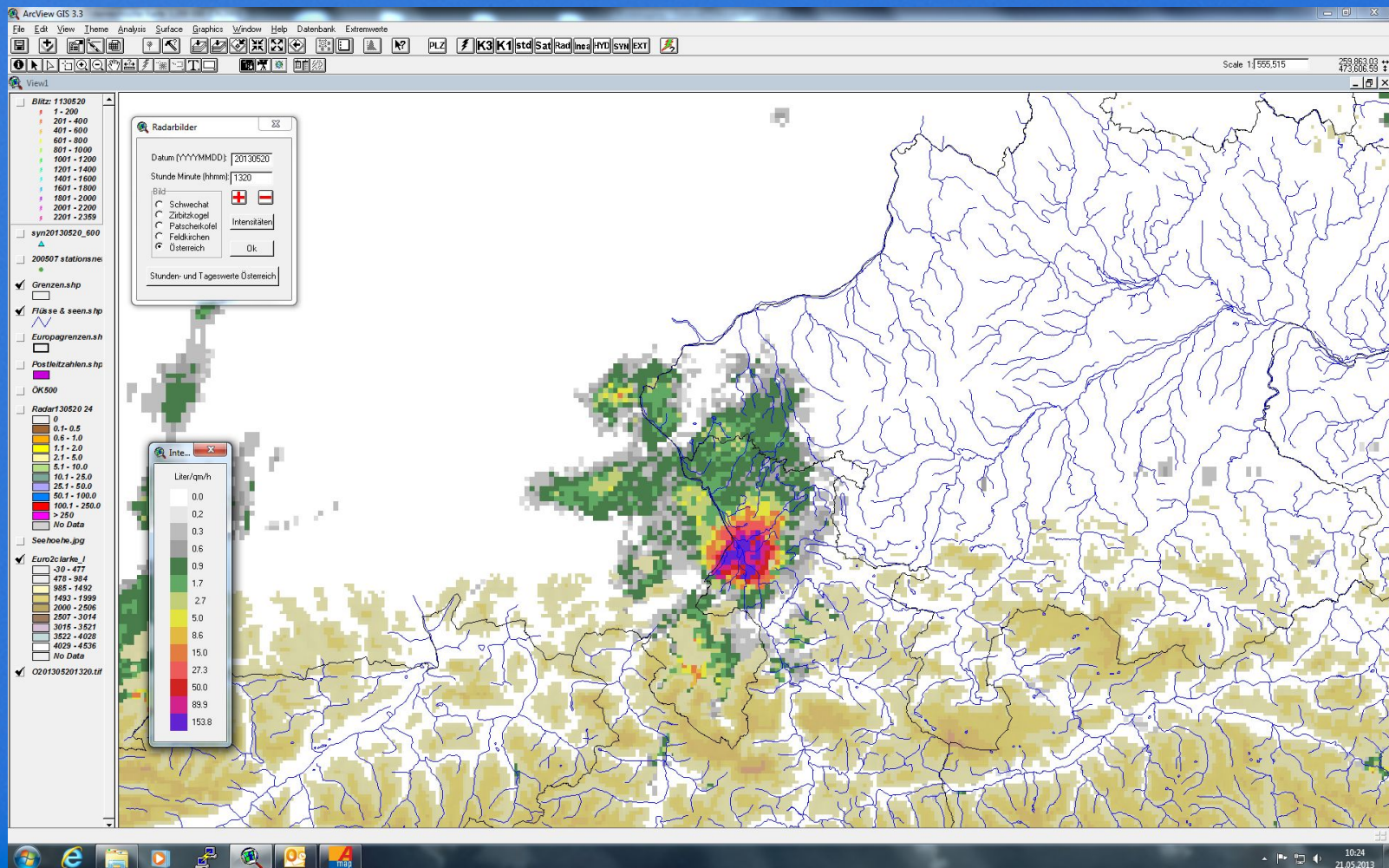
Movement of the hailing cell
2013 05 20



2013 05 20, Hail over capital town Salzburg

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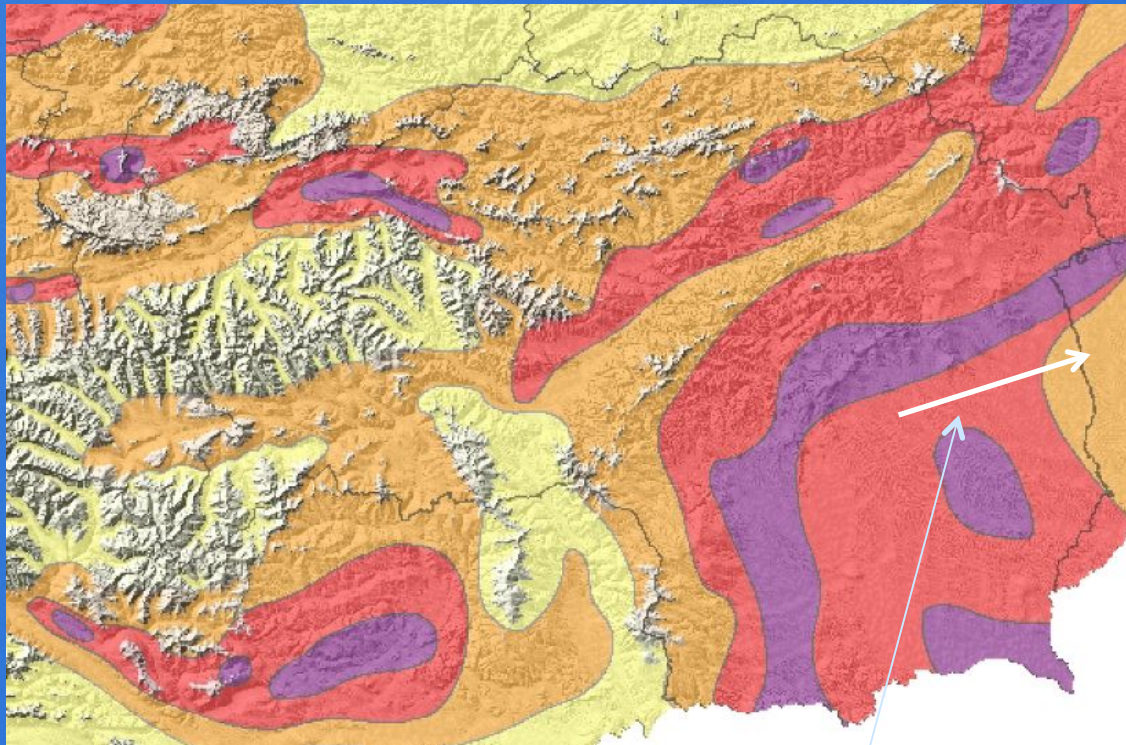
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Styria, in detail, and hail on 2013 05 20

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Juni 14, 2013 Folie 29



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 Mürzsteiger Alpen im Mürztal, besonders im Raum Kapfenberg. Schwere Hagelschläge traten wiederholt in den Bezirken Hartberg, Weiz, Graz- Umgebung, Feldbach und Radkersburg auf.

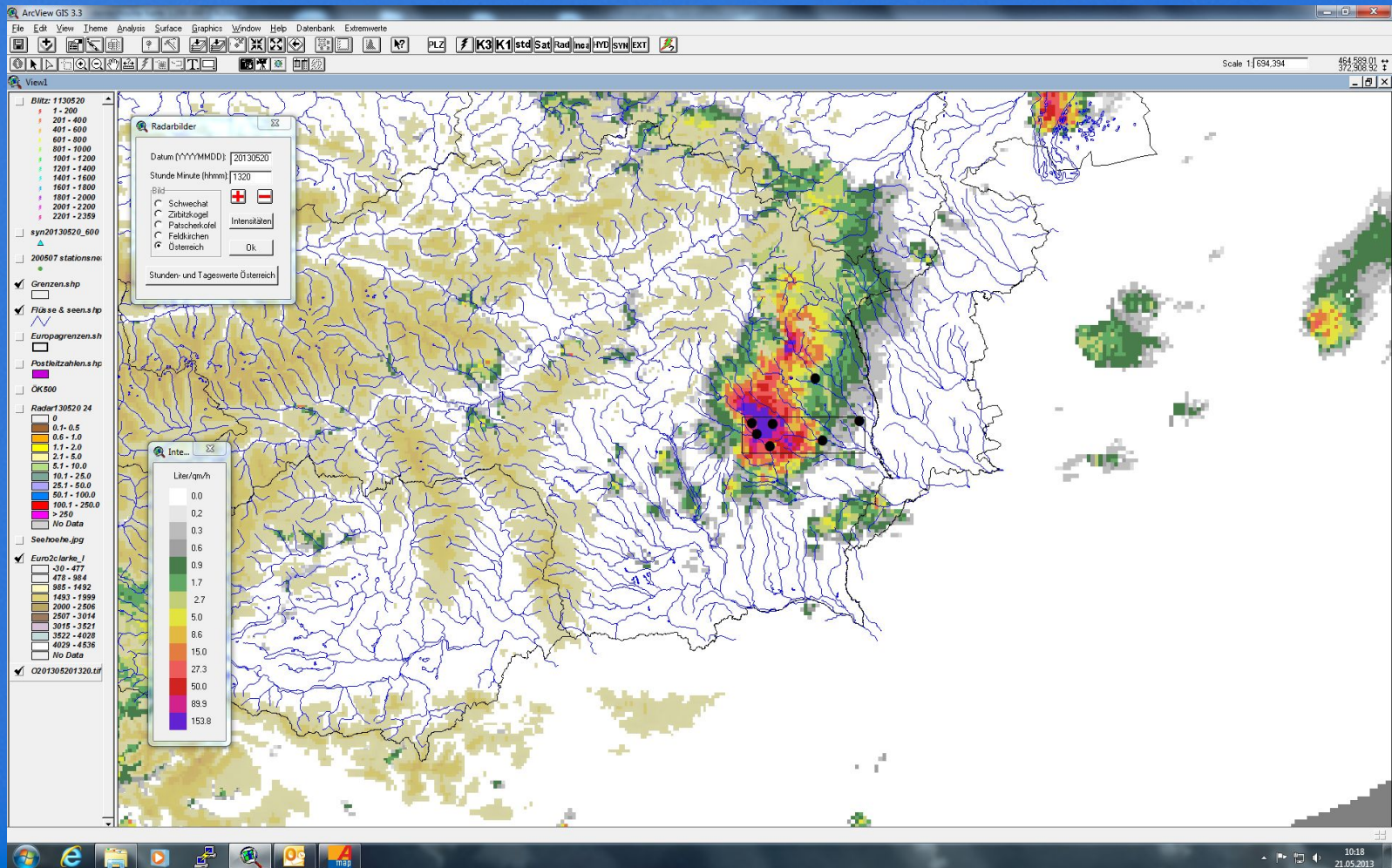
Movement of the hailing cell
2013 05 20



2013 05 20, Hail over the district Gleisdorf, Styria

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Juni 14, 2013 Folie 30

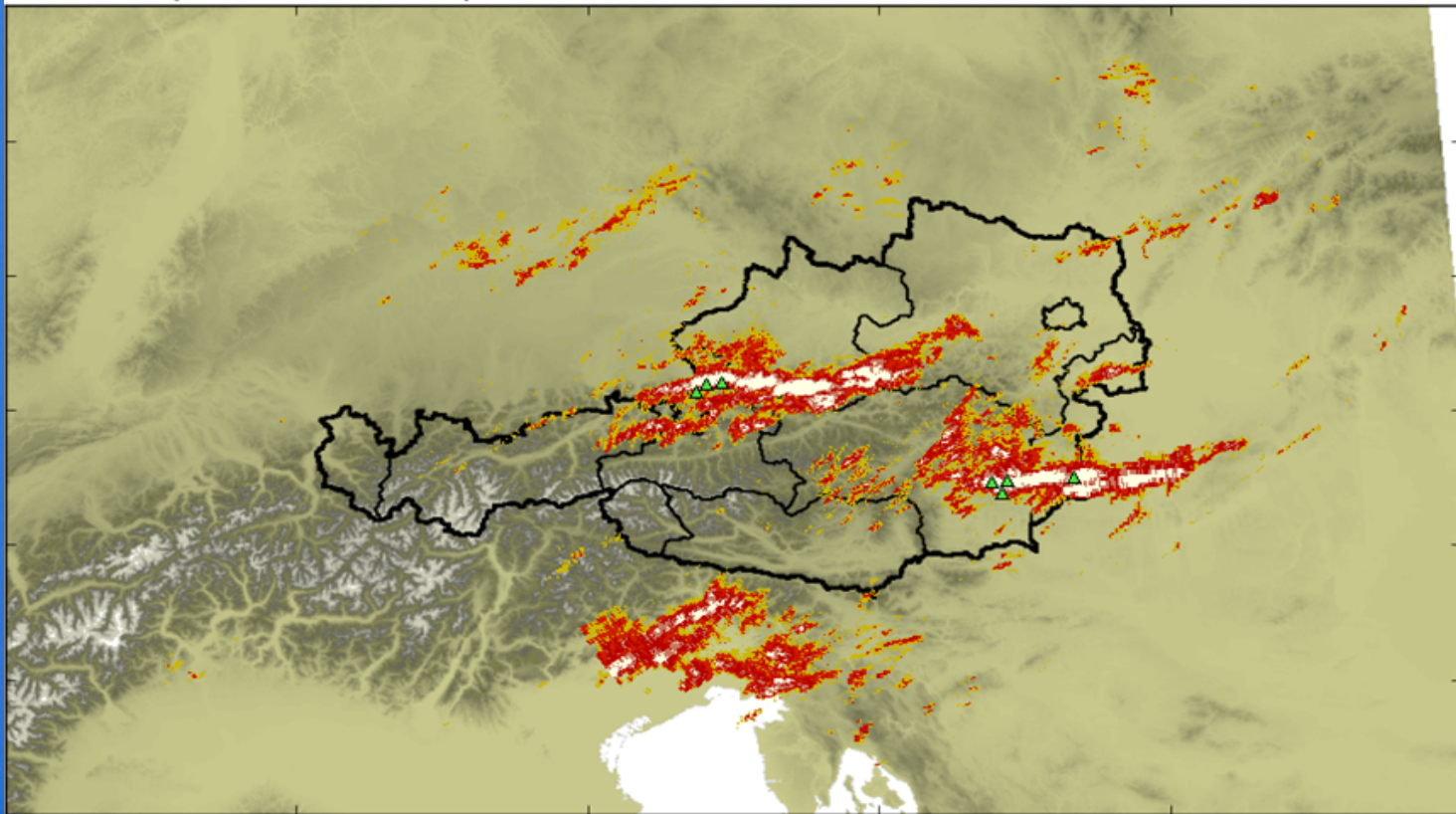


The severe weather events 2013 05 20 >> confirm

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Juni 14, 2013 Folie 31

RADAR CELL TRACKS 20130520 0000 - 20130521 0000
compo Min(area) 5 pix2, Min-Max(lifetime) 5-inf min, No.track 2100



Reflectivity >38dBZ

Triangles: reported damages



The presented map „Hail Risk Areas in Austria“

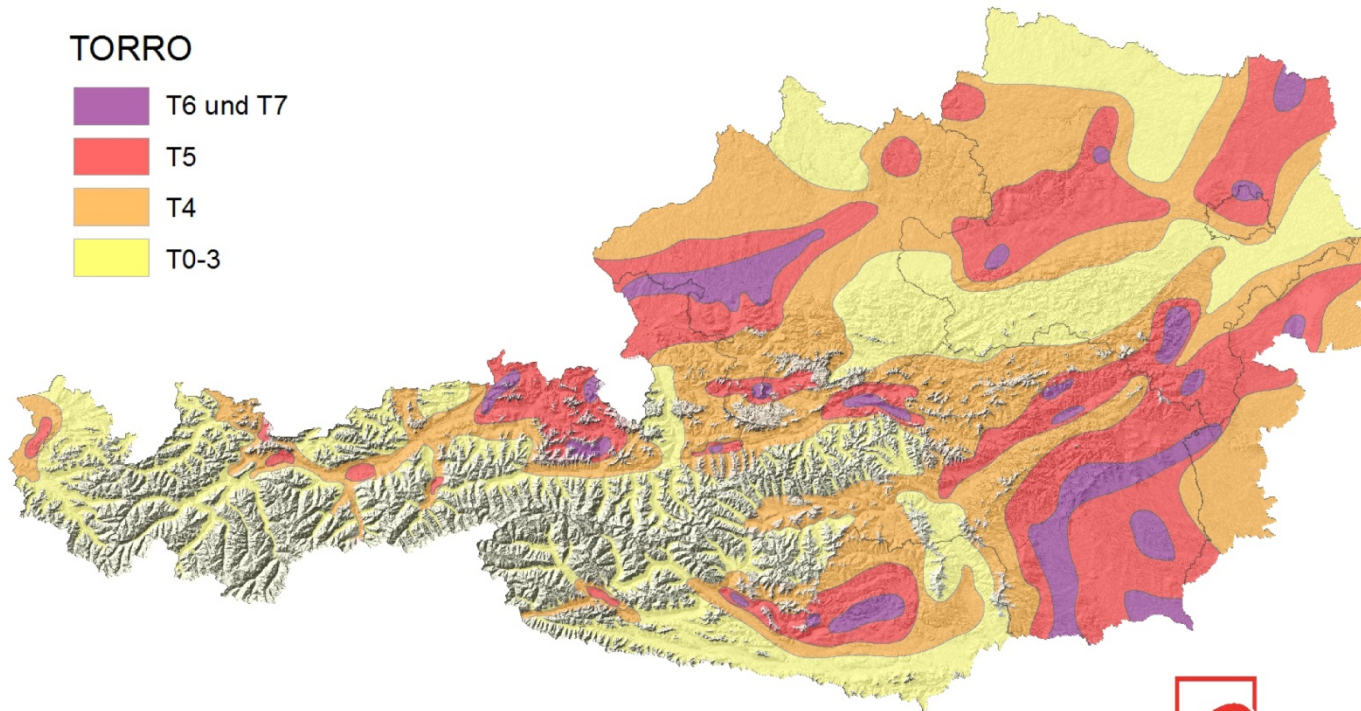
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Juni 14, 2013 Folie 32

Hagelgefährdungskarte Österreich

Meldungen 1971 - 2011 - Radardaten 2002 - 2011

TORRO



Höhenbarriere 1500 m

0 15 30 60 90 120 Kilometer



THANK YOU FOR YOUR ATTENTION, ready for questions

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Juni 14, 2013 Folie 33



Dan
ke!
Kiito

