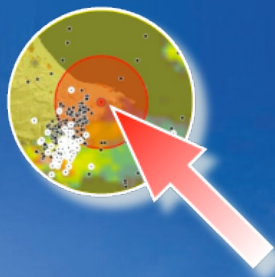


HAREN



Advanced Products: Forecasting Heavy Rainfall Cells At European Scale Using OPERA composite

Vera Meyer and Lukas Tüchler

Central Institute for Meteorology and Geodynamics (ZAMG),
Vienna, Austria

vera.meyer@zamg.ac.at



ZAMG

Zentralanstalt für
Meteorologie und
Geodynamik

RADAR DATA

08/07/13

Folie 2

OPERA Mosaic - HAREN PROJECT

Reflectivity Radar Accumulations Rain Alerts PEPS



Apr 2013

Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

Today

Number of Frames: 32

Hour/Minute: 24 00

Topographies

- Google Physical
- Google Streets
- Google Satellite
- Google Hybrid

Layers

- Reflectivity (dBZ)
- Forecast Reflectivity (dBZ)
- FMI
- Forecast FMI

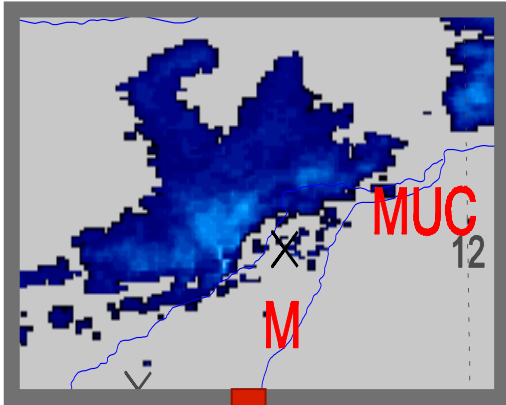


TIME: 2013-04-10 08:15 UTC

Center Lon.: -14.88 Lat.: 65.68 X (Km utm): -1656768.85 Y (Km utm): 9790116.45

Navigation controls: back, forward, stop, play. Timeline: 2013-04-10 07:30 to 2013-04-10 15:15

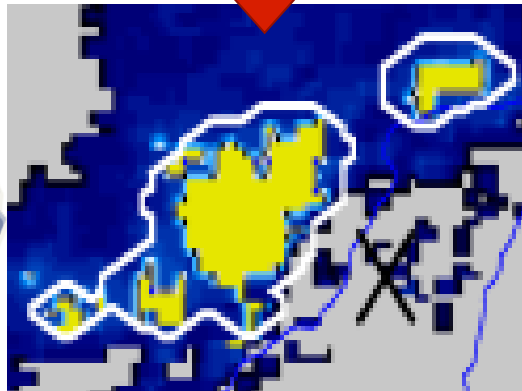
PRECIPITATION-CELL TRACKING - METHOD



A-TNT Algorithmus

[V. Meyer 2013, K. Kober 2009]

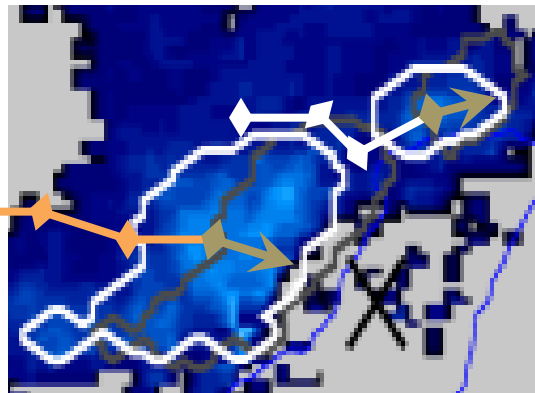
2D radar-precipitation maps
smoothed by 2D Gaussian filter



CELL IDENTIFICATION

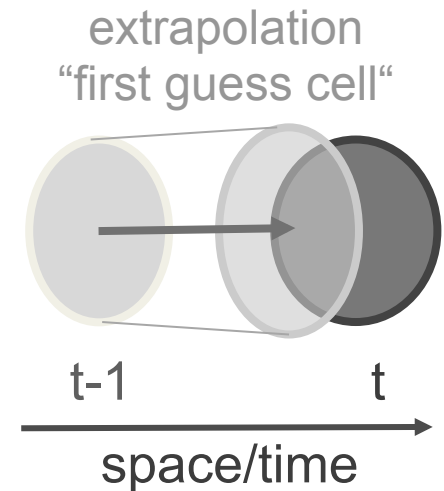
threshold 7 mm/h

min. area 13 pixel (52 km²)



DISPLACEMENT

via exp. weighted
extrapolation of previous 3
cell centers



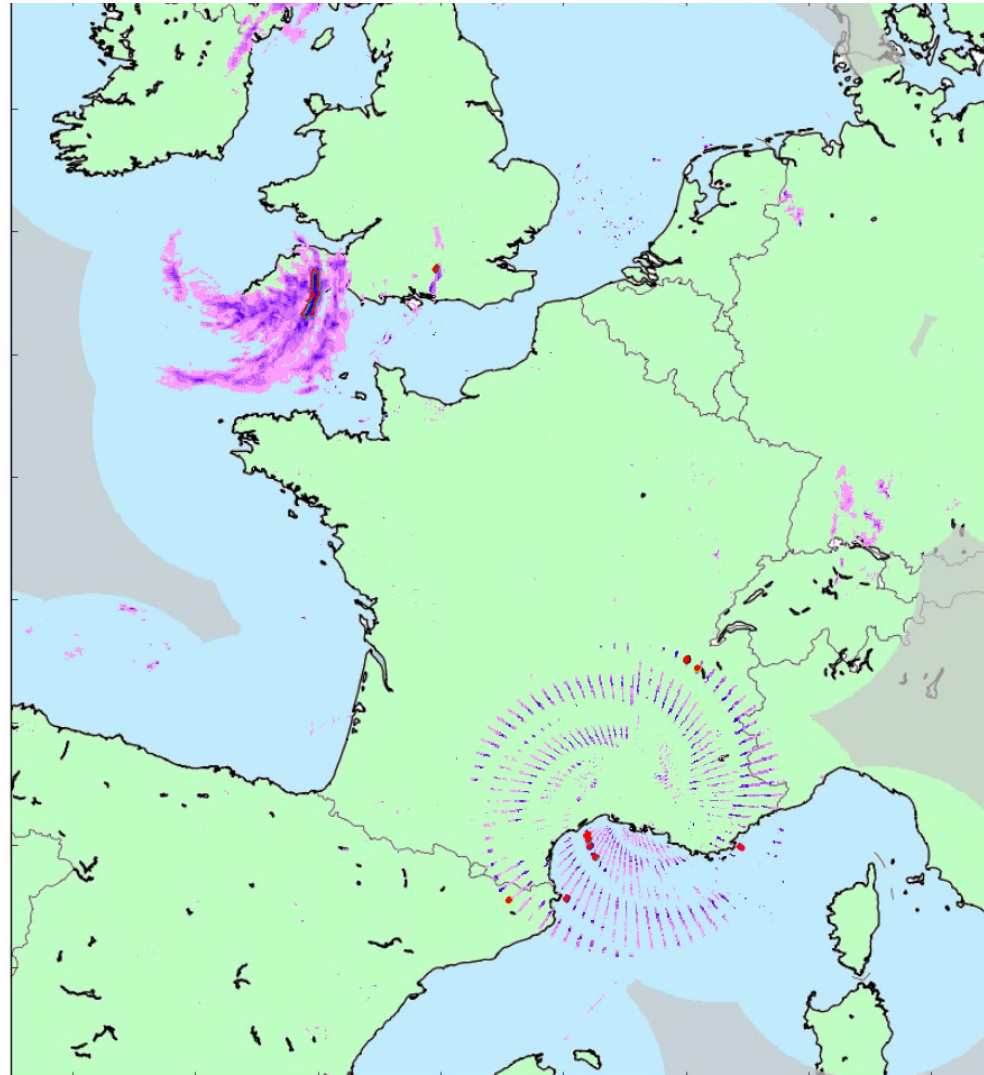
ASSIGNMENT
via first guess cells

PRECIPITATION-CELL TRACKING - FIRST RESULTS

08/07/13

Folie 4

2012-07-07



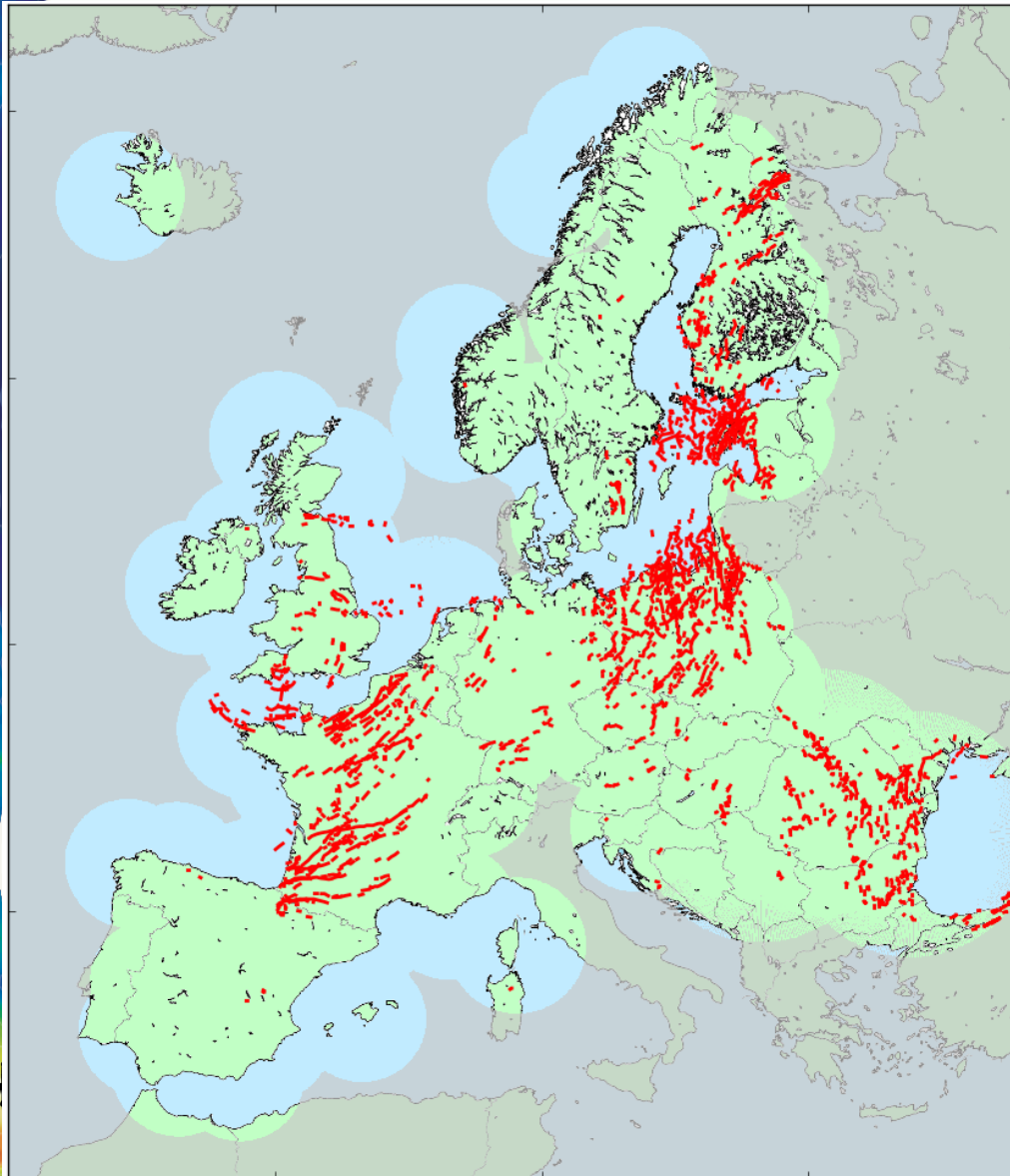
20120707_trance_forecastloop_q2.avi



PRECIPITATION-CELL TRACKING

08/07/13

Folie 5



ACCUMULATED CELL TRACKS

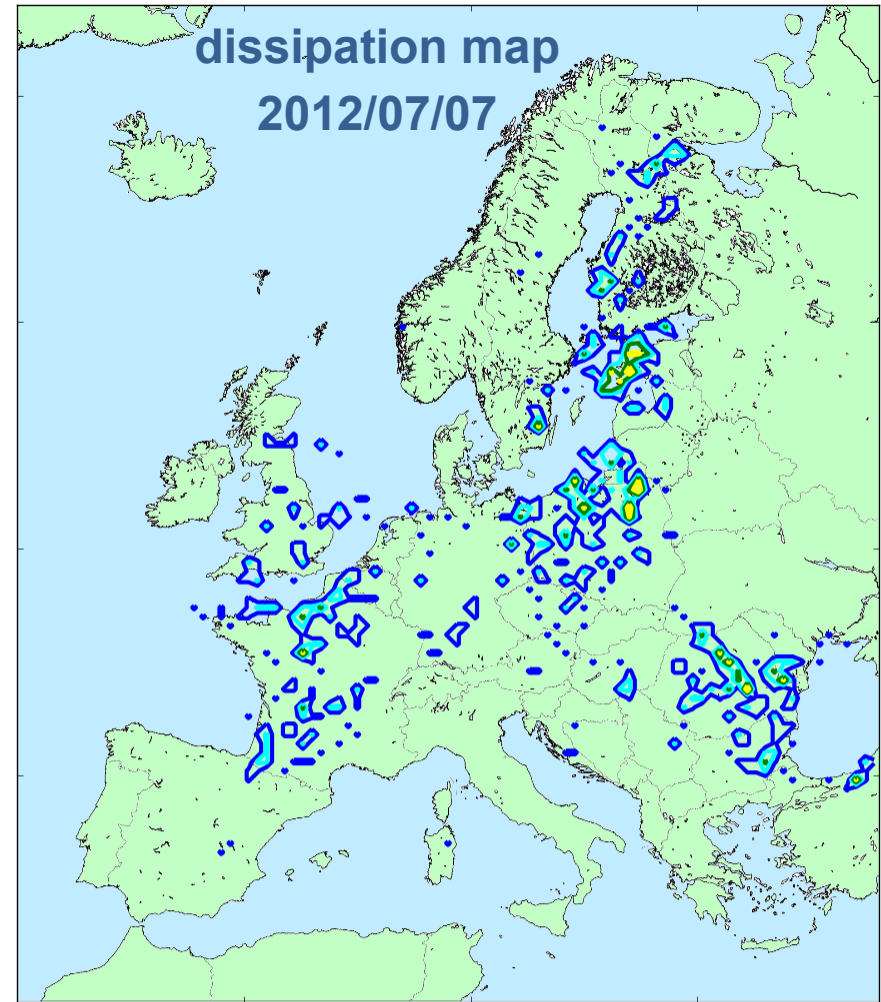
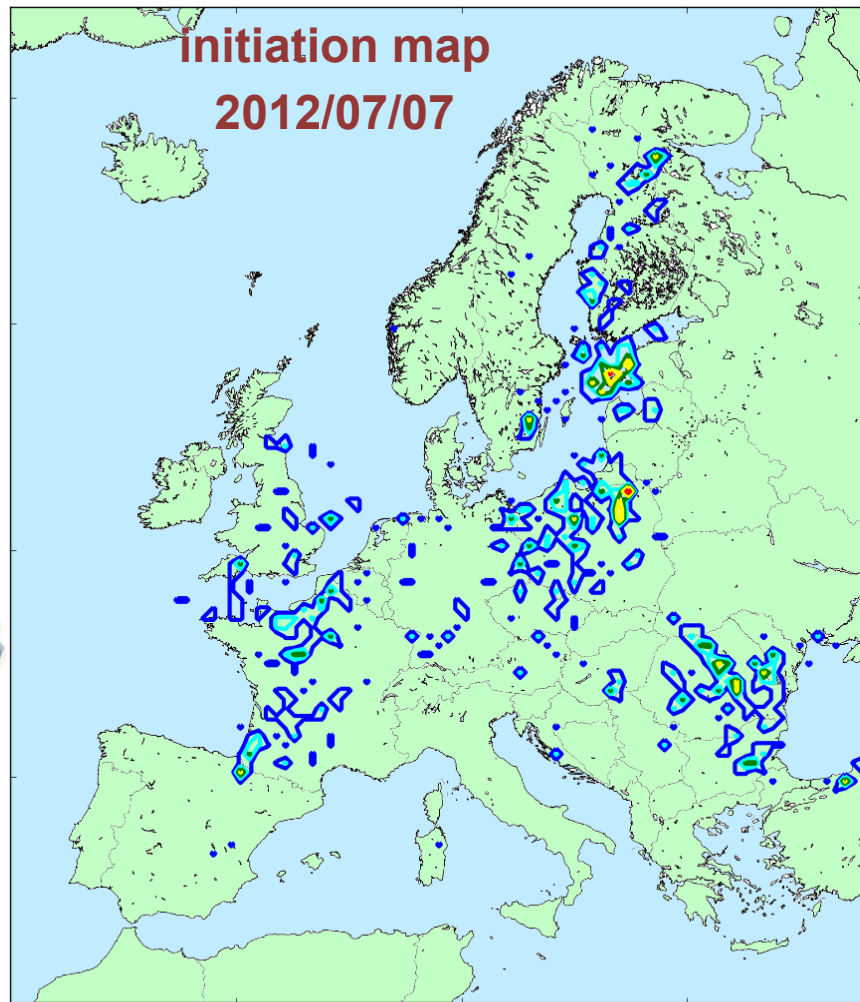
2012/07/07

min. lifetime	30 min
No. tracks	1363

PRECIPITATION INITIATION and DISSIPATION MAPS

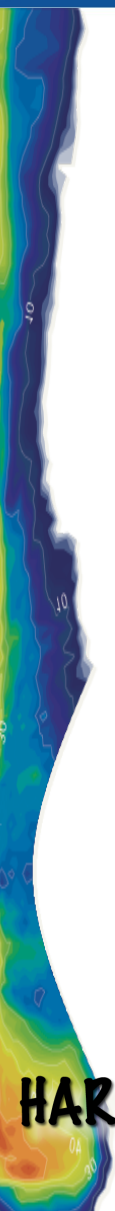
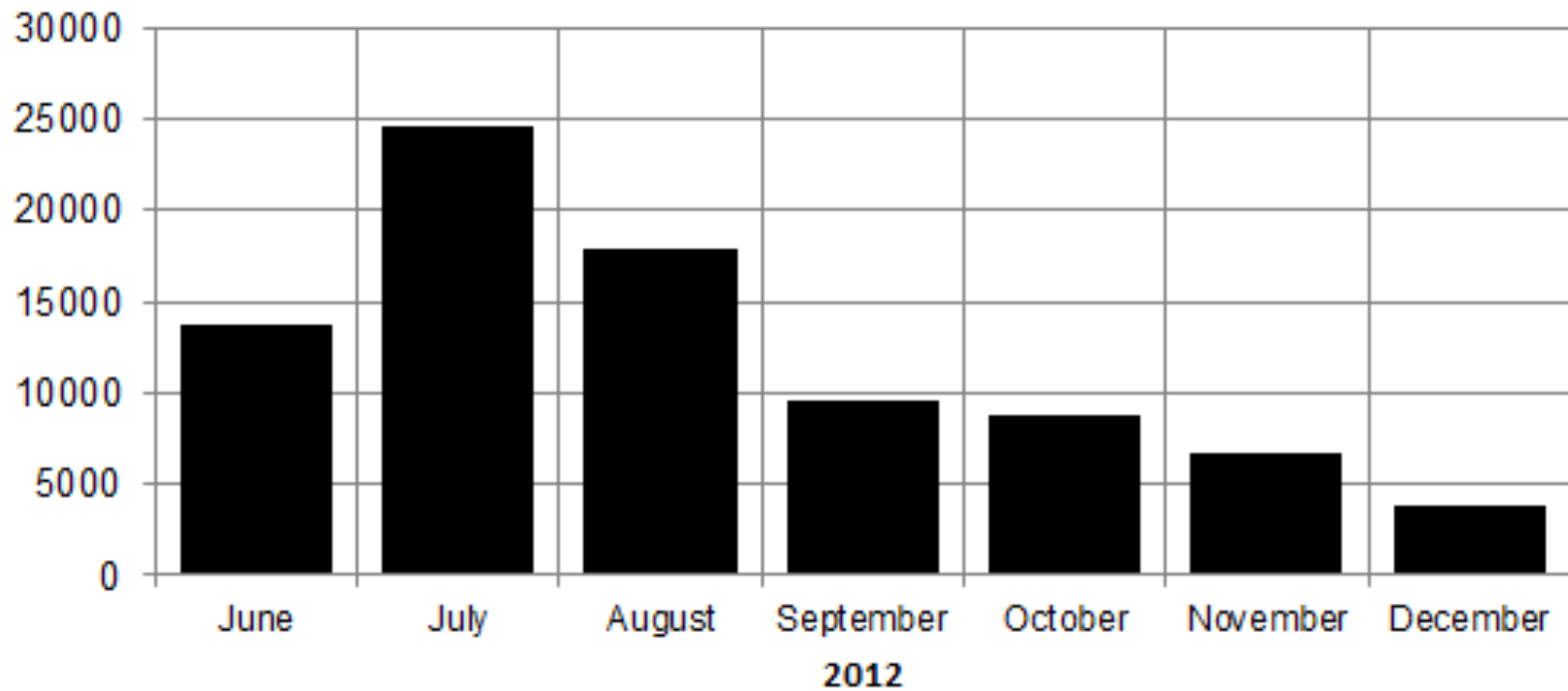
08/07/13

Folie 6



frequency

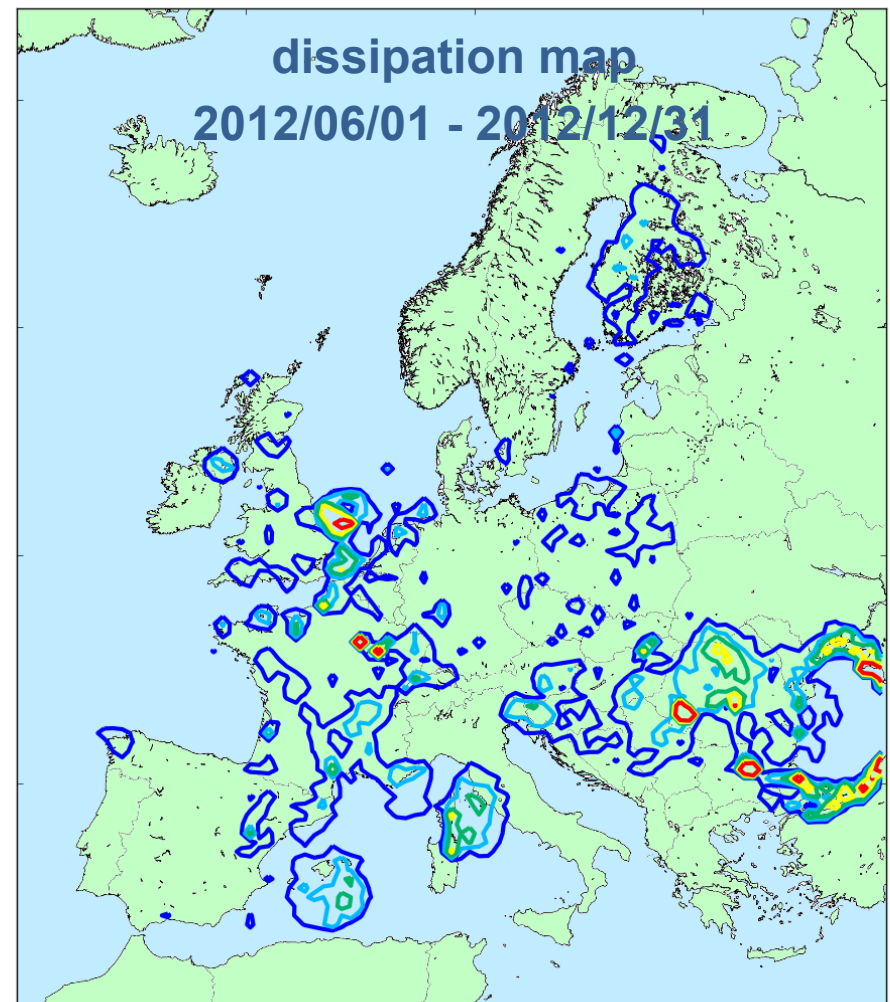
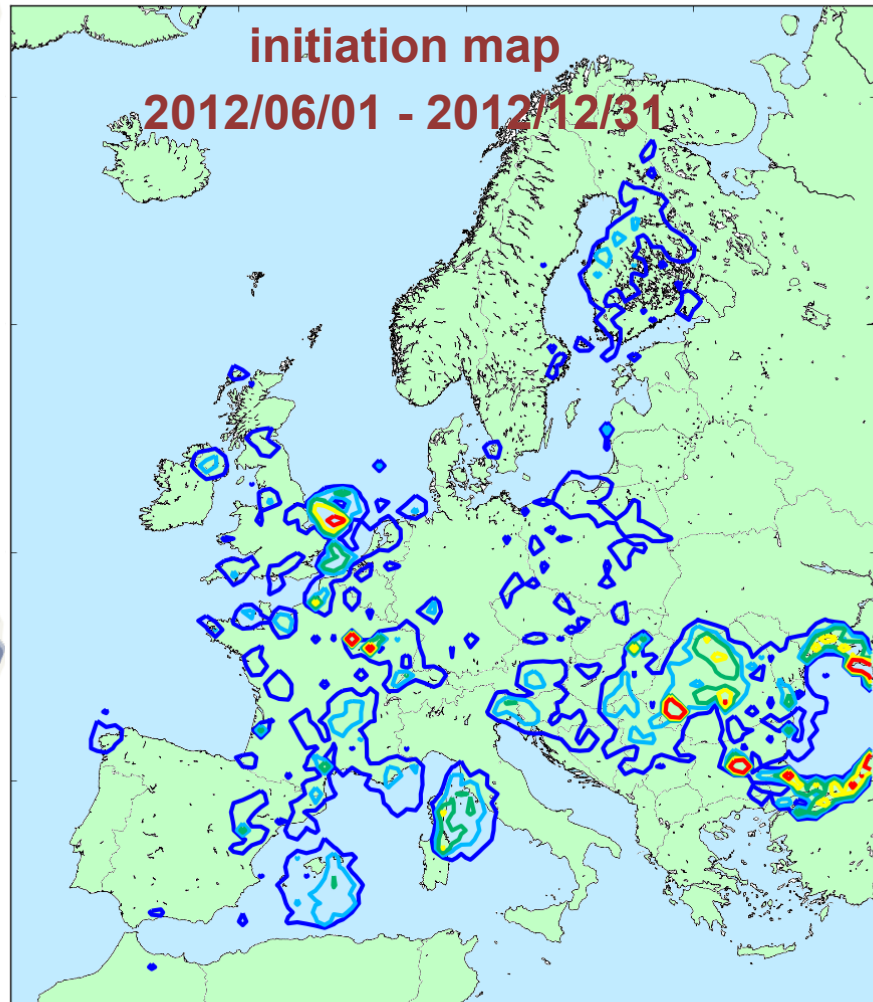
number of cells per month



PRECIPITATION INITIATION and DISSIPATION MAPS

08/07/13

Folie 8



frequency

1

2

3

4

6

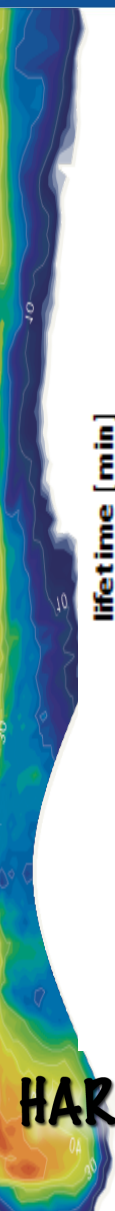
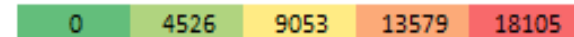
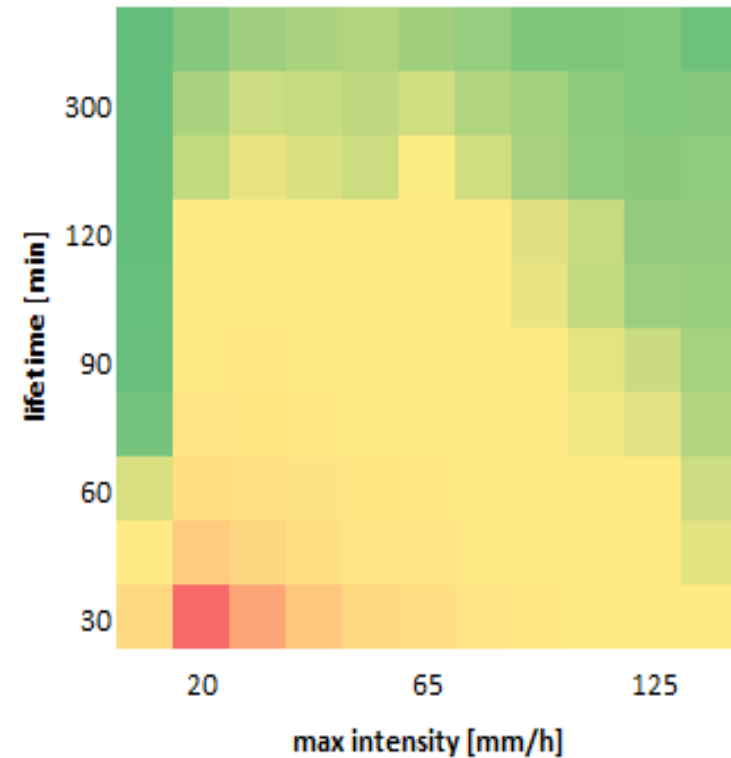
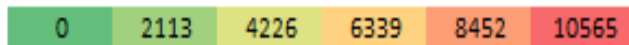
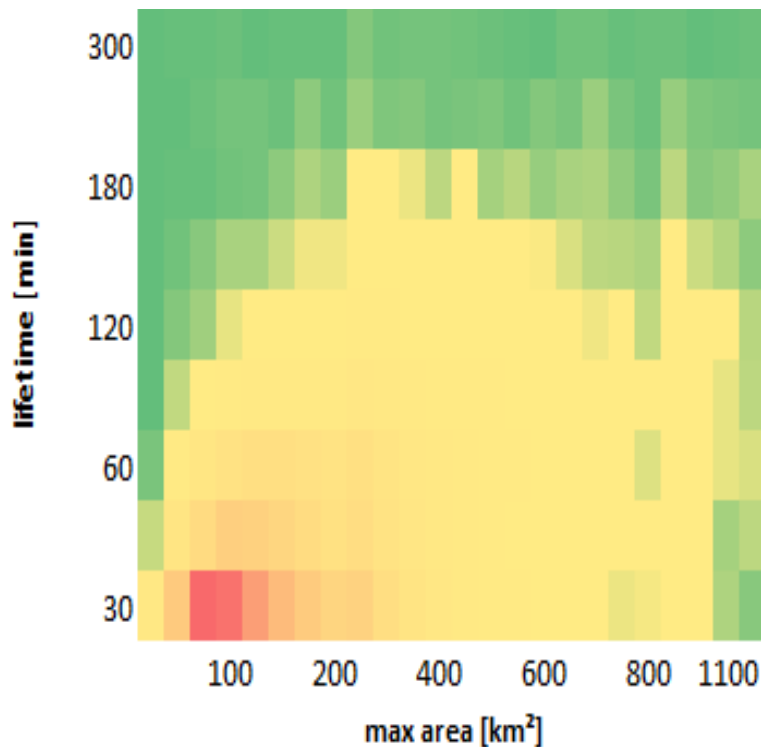
HA

RADAR-CELL PARAMETER STATISTICS

08/07/13

Folie 9

cell-track frequency distribution
2012/06/01 - 2012/12/31



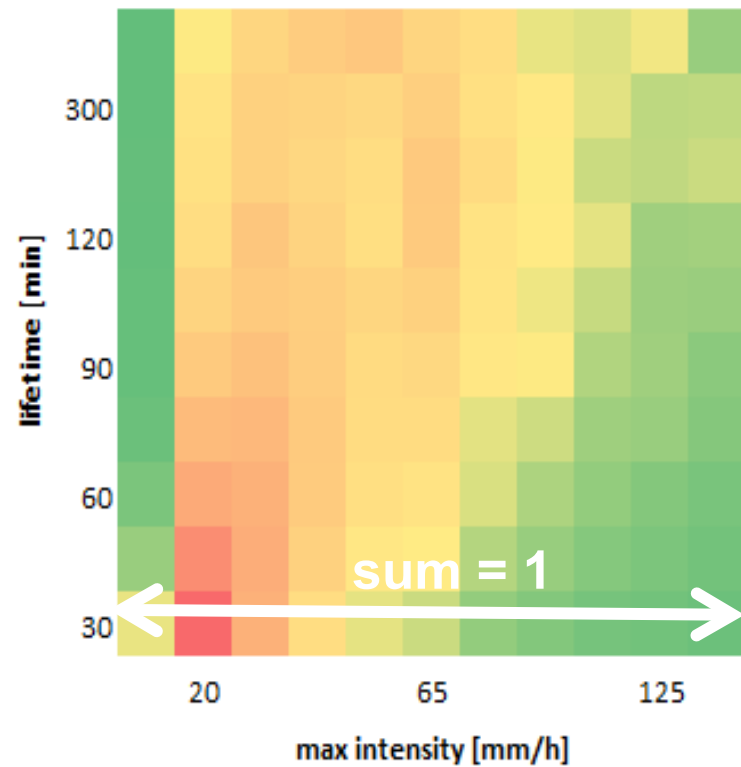
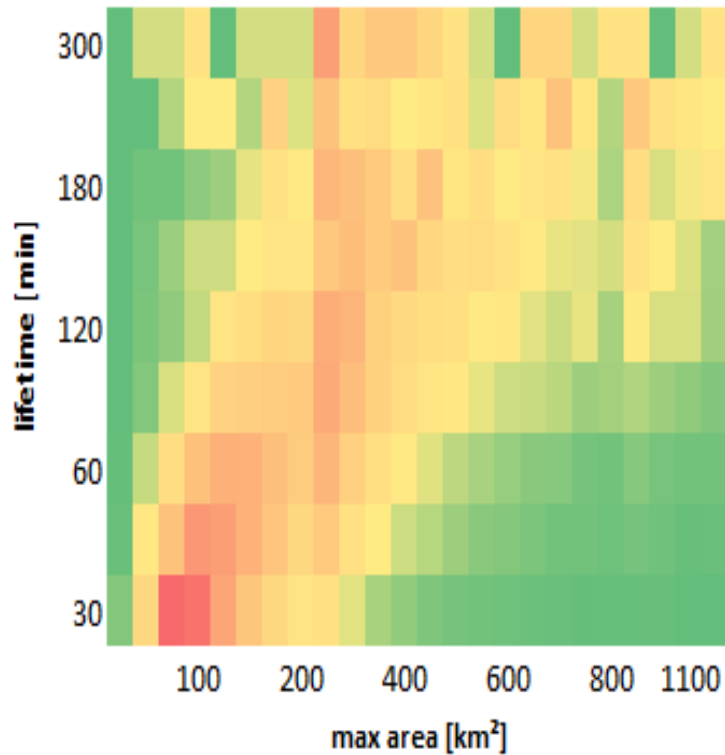
HAREN

RADAR-CELL PARAMETER STATISTICS

08/07/13

Folie 10

Normalized cell-track frequency distribution
2012/06/01 - 2012/12/31

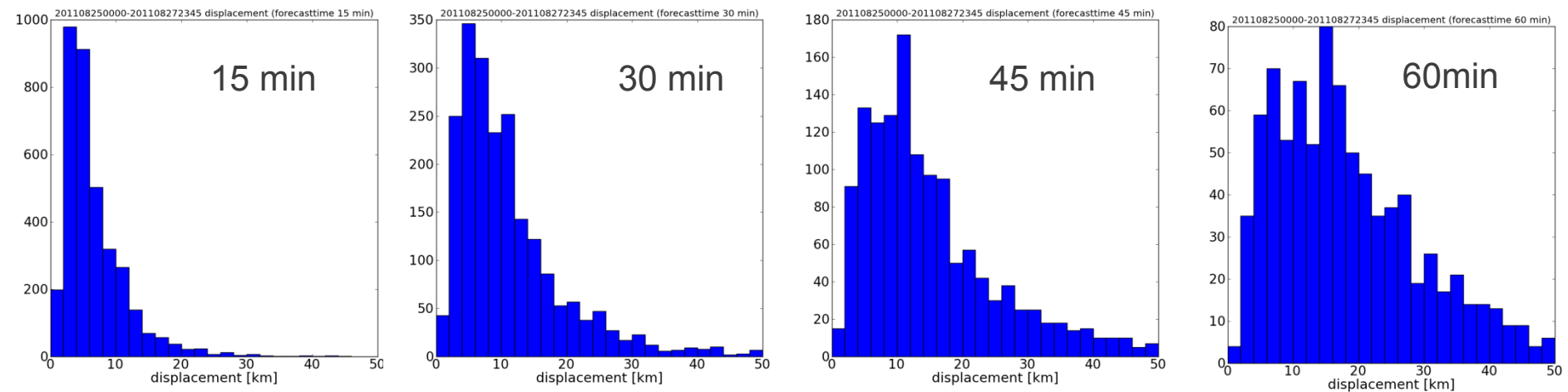
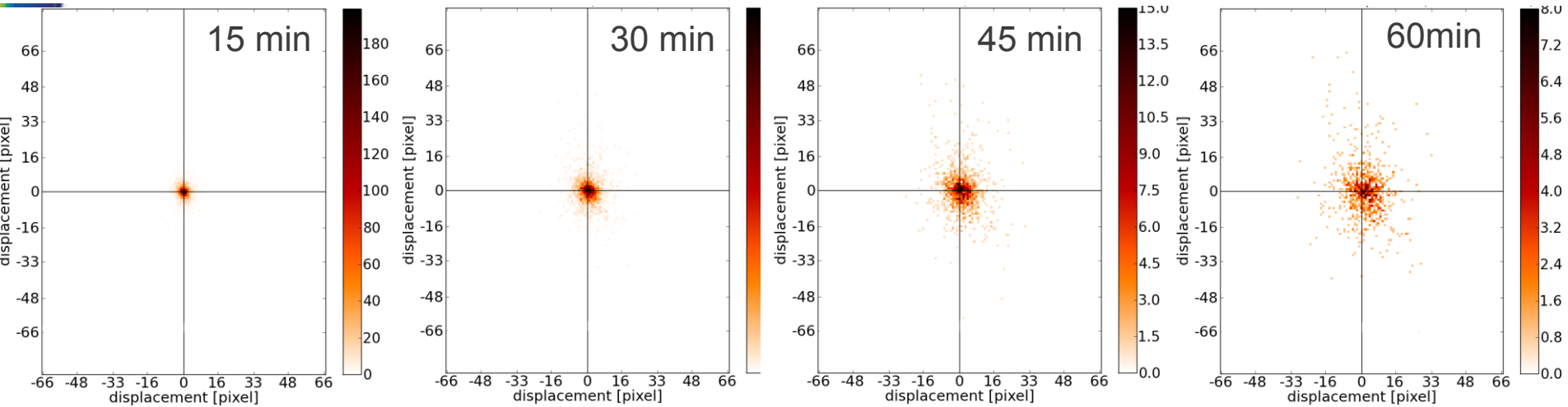


PRECIPITATION-CELL NOWCASTING

08/07/13

Folie 11

2011/08/25



LIGHTNING-CELL TRACKING - METHOD

[V. Meyer 2013]

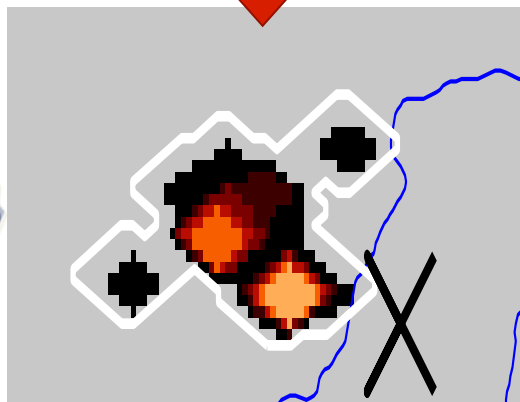
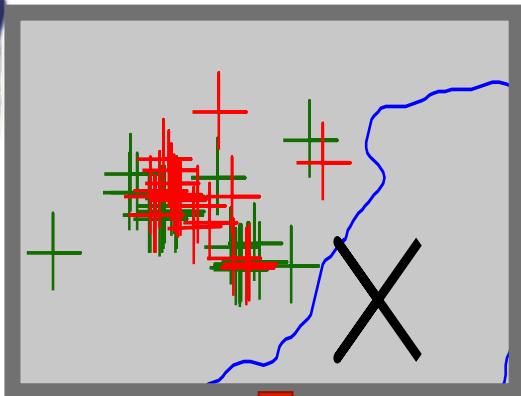
A-TNT Algorithmus

EUCLID lightning data www.euclid.org

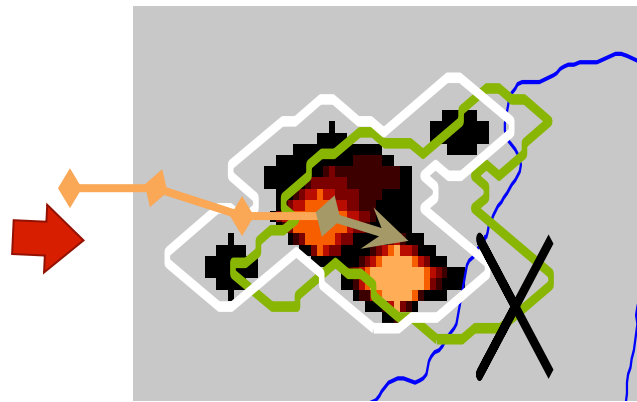
collaboration of national lightning detection networks

2D discharge event maps at 5 min time-steps

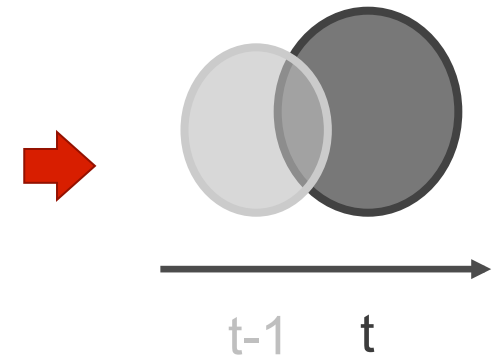
cell clustering:	accum. time	5 min
	min. distance	8 km



CELL IDENTIFICATION
threshold 1 event



DISPLACEMENT
via exp. weighted
extrapolation of previous 3
cell centers



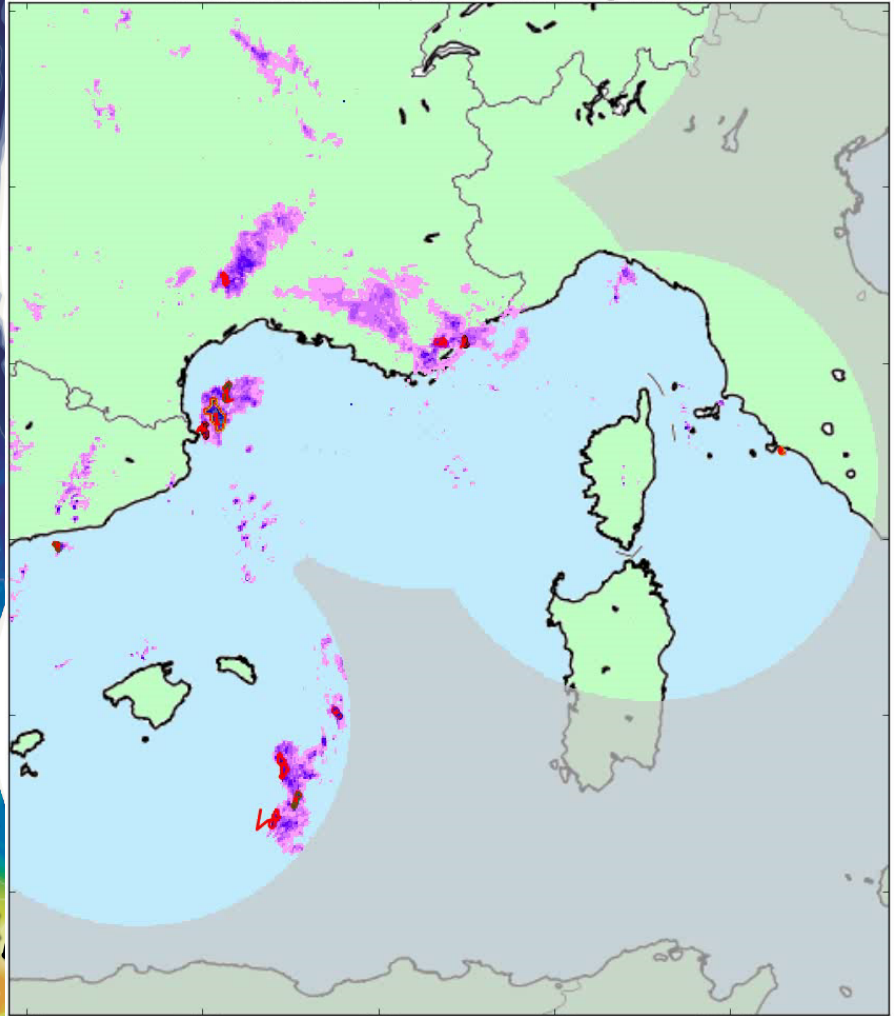
ASSIGNMENT
via direct overlap



RADAR- and LIGHTNING-CELL TRACKING

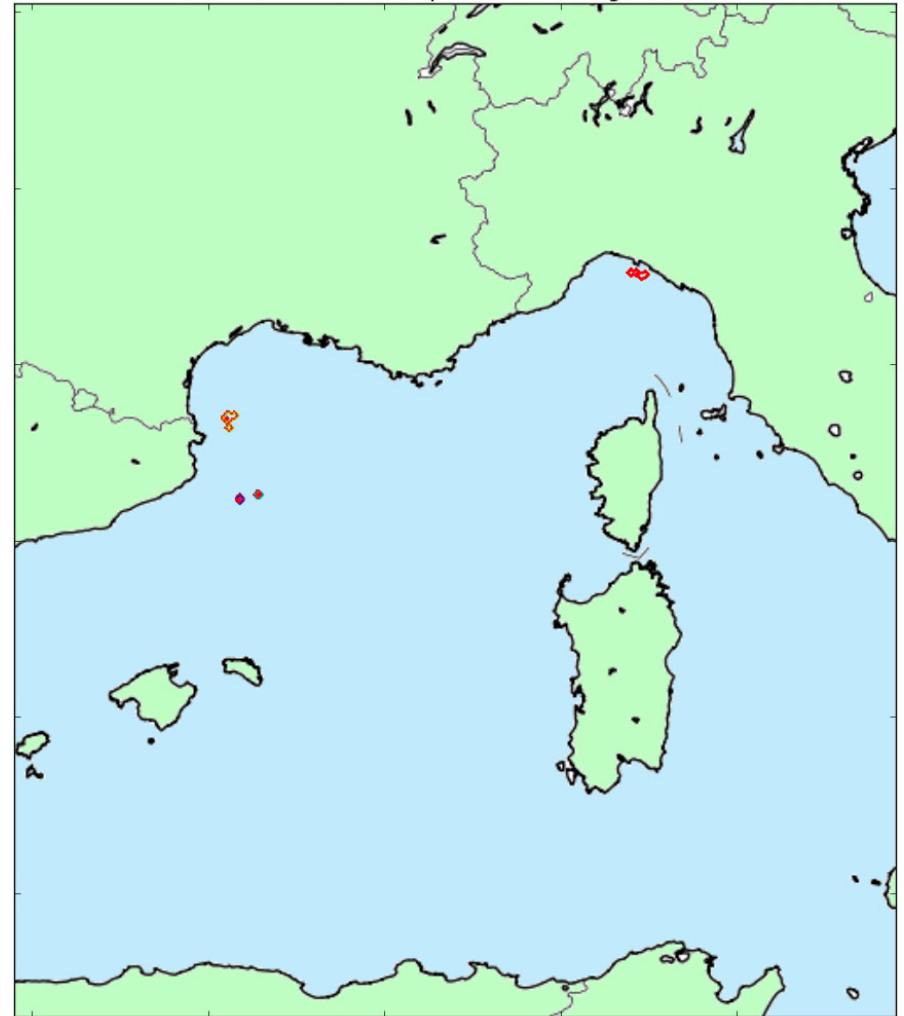
radar-cell tracking

2012/10/26 06.00 UTC to 21.00 UTC



lightning-cell tracking

2012/10/26 06.00 UTC to 21.00 UTC

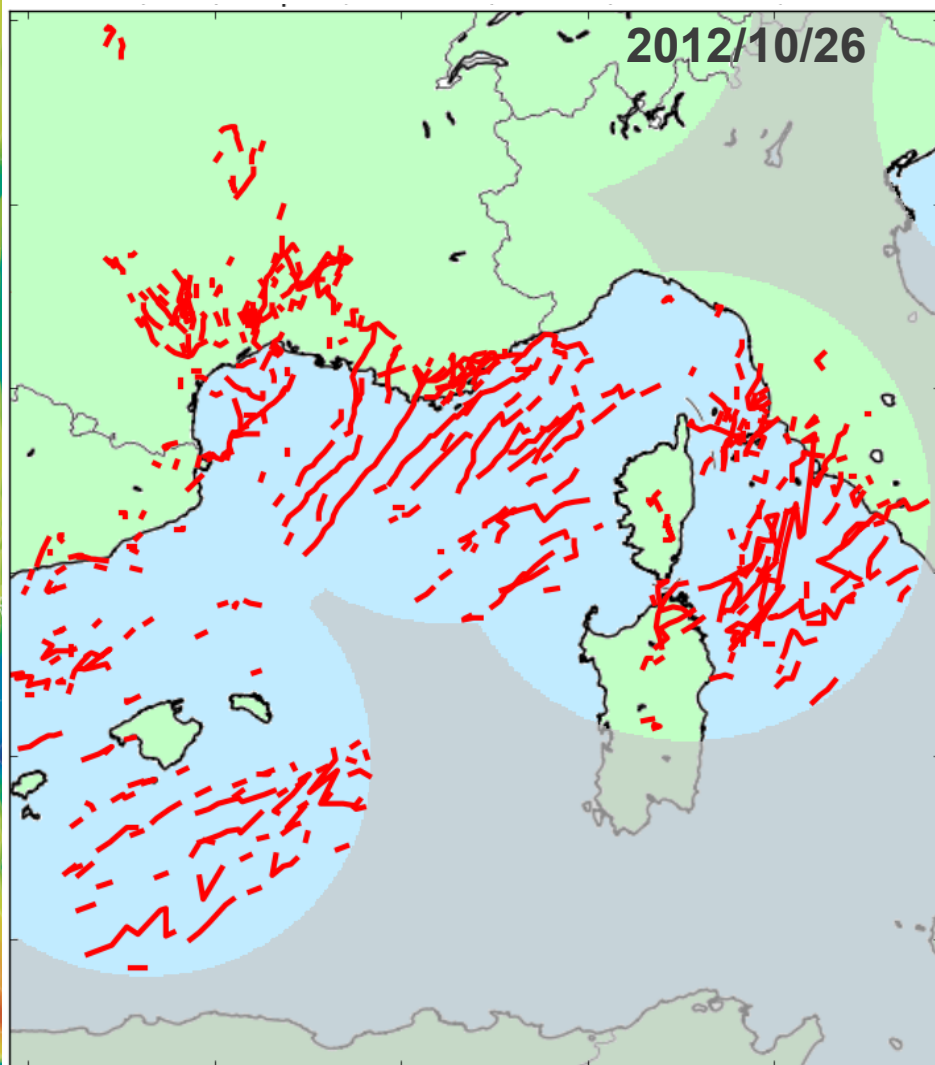


RADAR- and LIGHTNING-CELL TRACKING

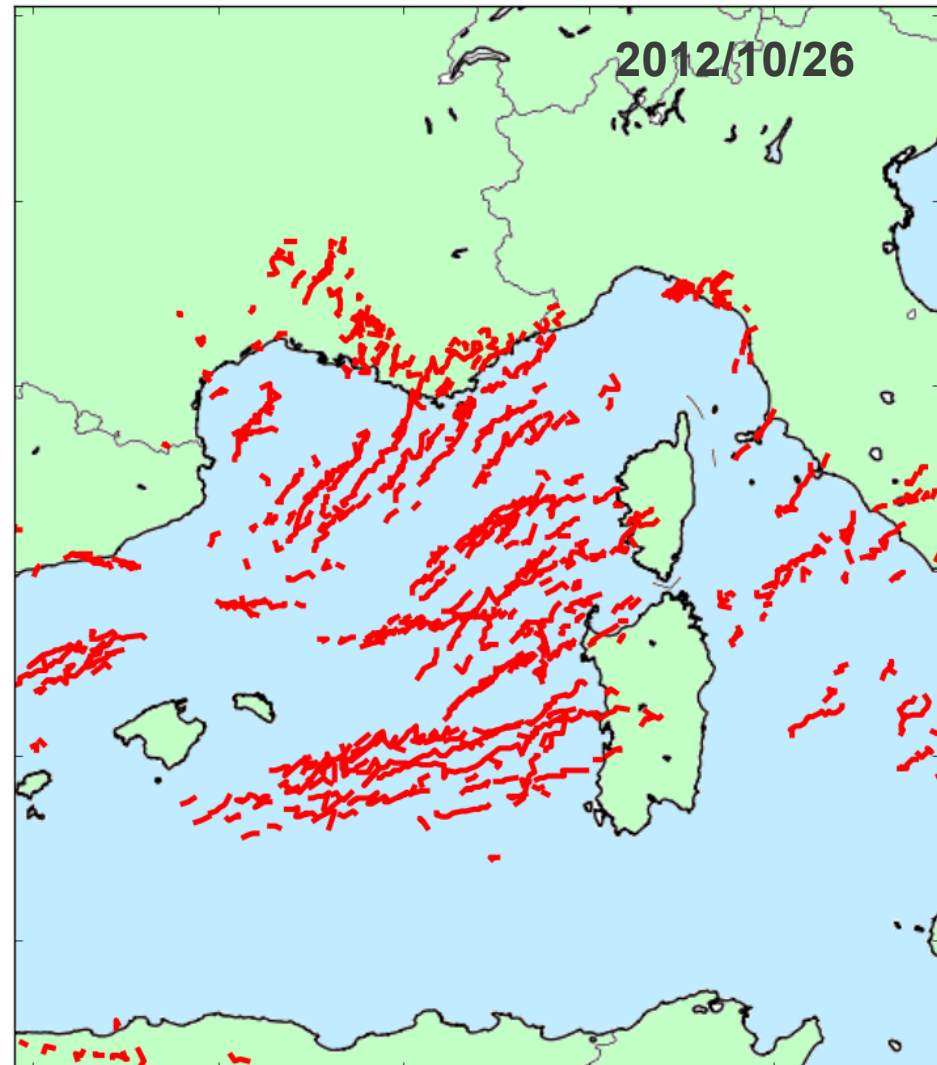
08/07/13

Folie 14

accumulated radar-cell tracks
min. lifetime 15 min



accumulated lightning-cell tracks
min. lifetime 15 min



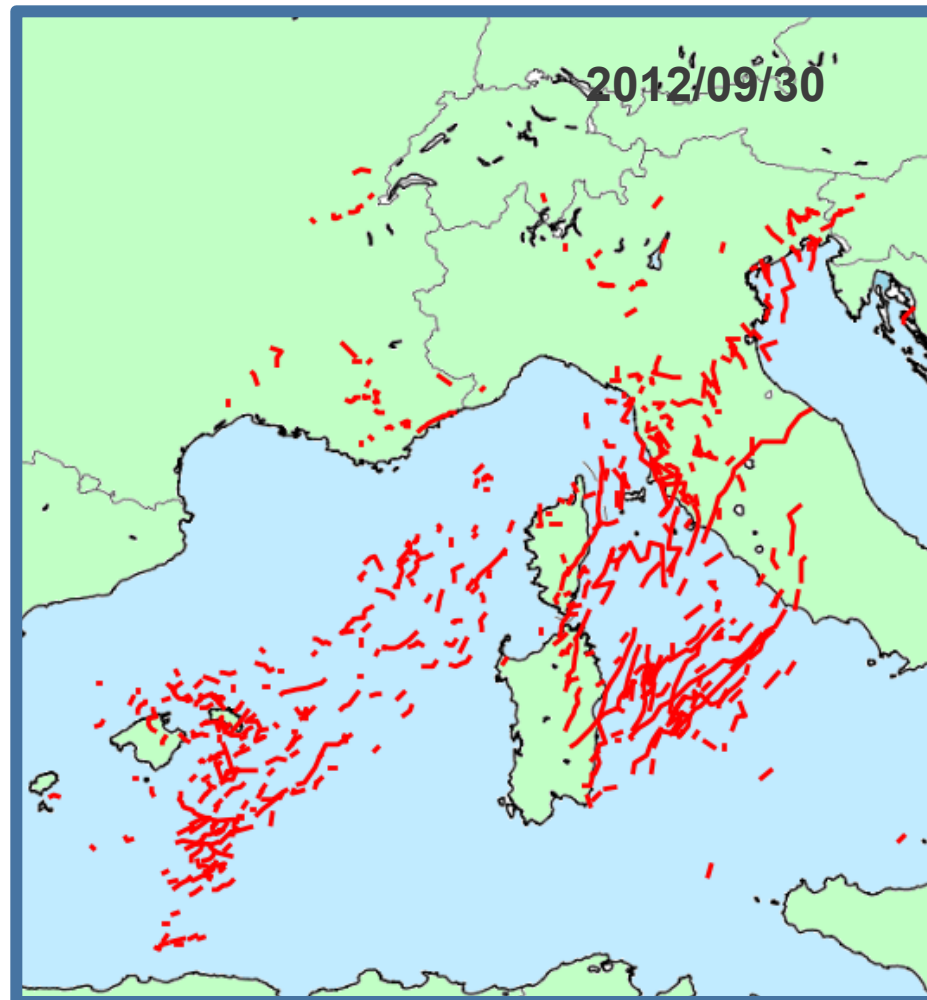
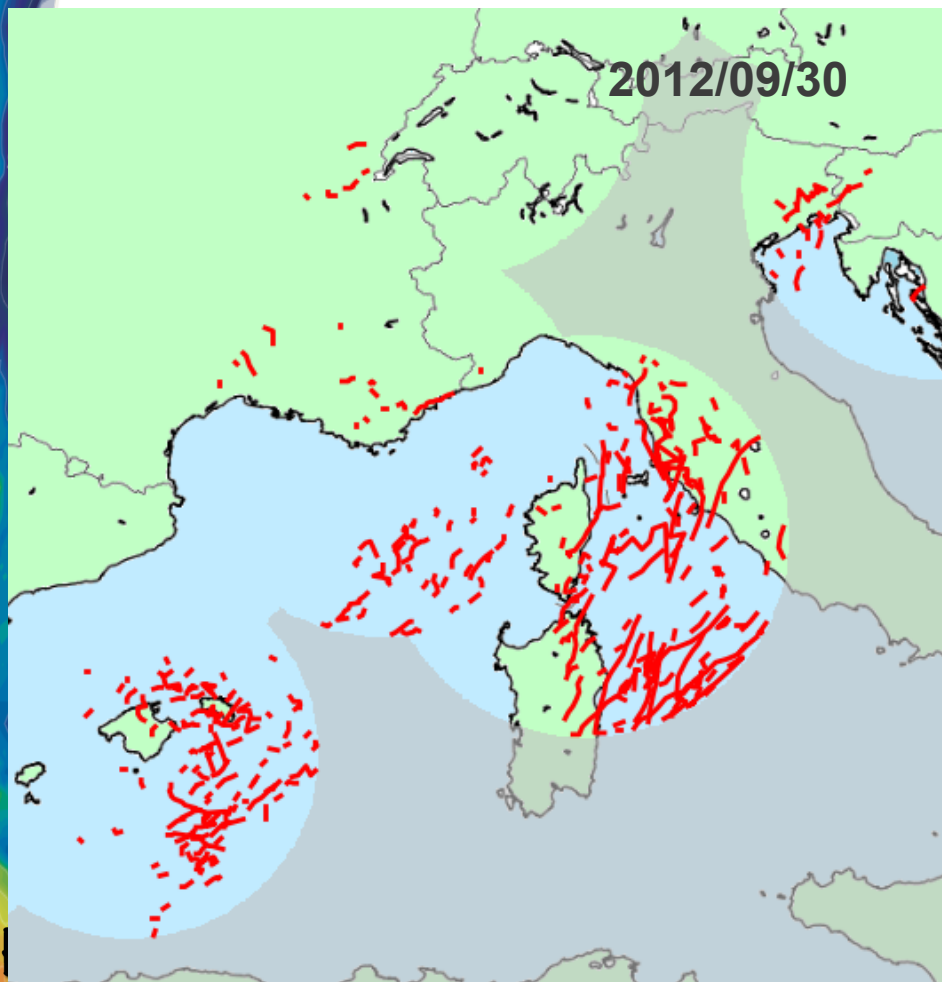
RADAR- and LIGHTNING-CELL TRACKING

Folie 15

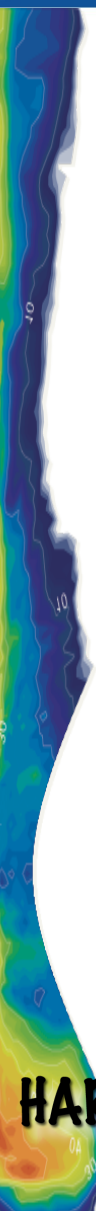
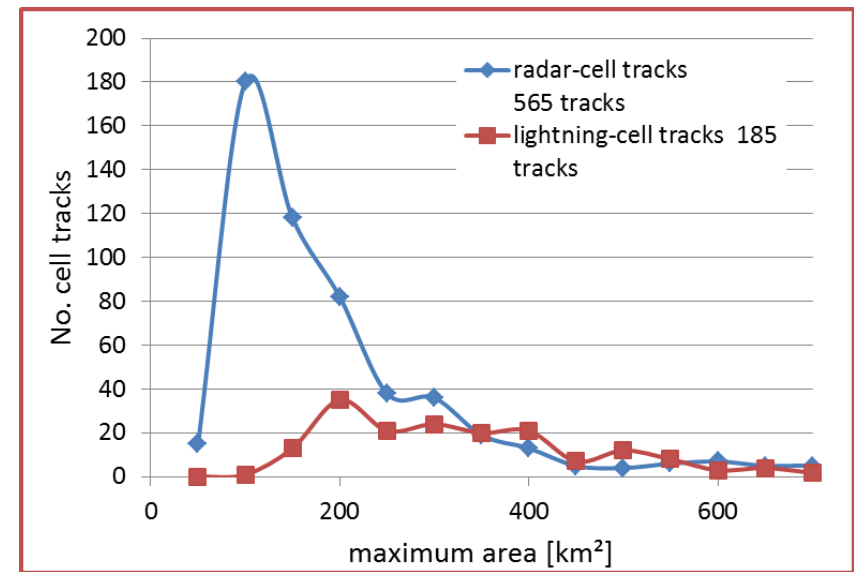
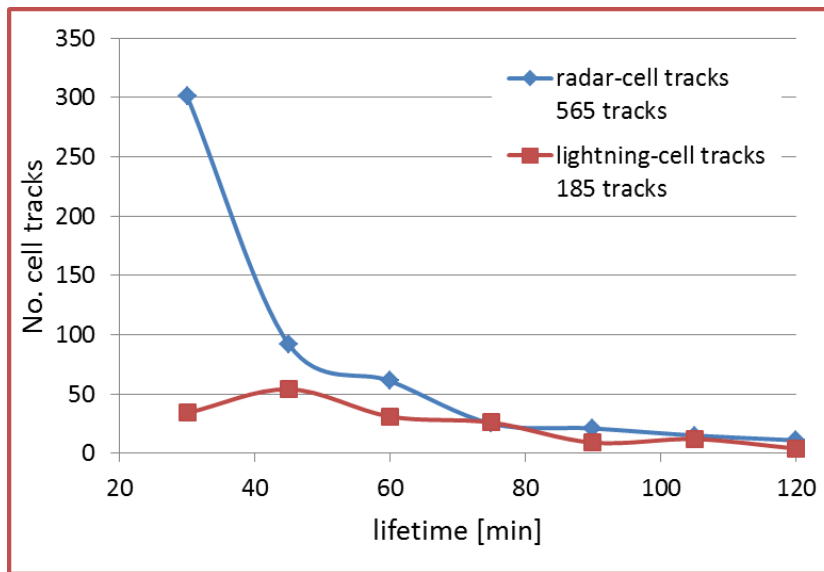
08/07/13

accumulated radar-cell tracks
min. lifetime 15 min

combined cell-tracking
min. lifetime 15 min



2012/10/26



European radar mosaic (OPERA)

- promises valuable for cross-bordering high resolution information about convective situation for forecasters and civil protection
- promising for local and European climatologies -> stricter data selection required
- restricted to data quality

Integration of other data sources - like European lightning data

to combined object-oriented convection monitoring & nowcasting tool promises:

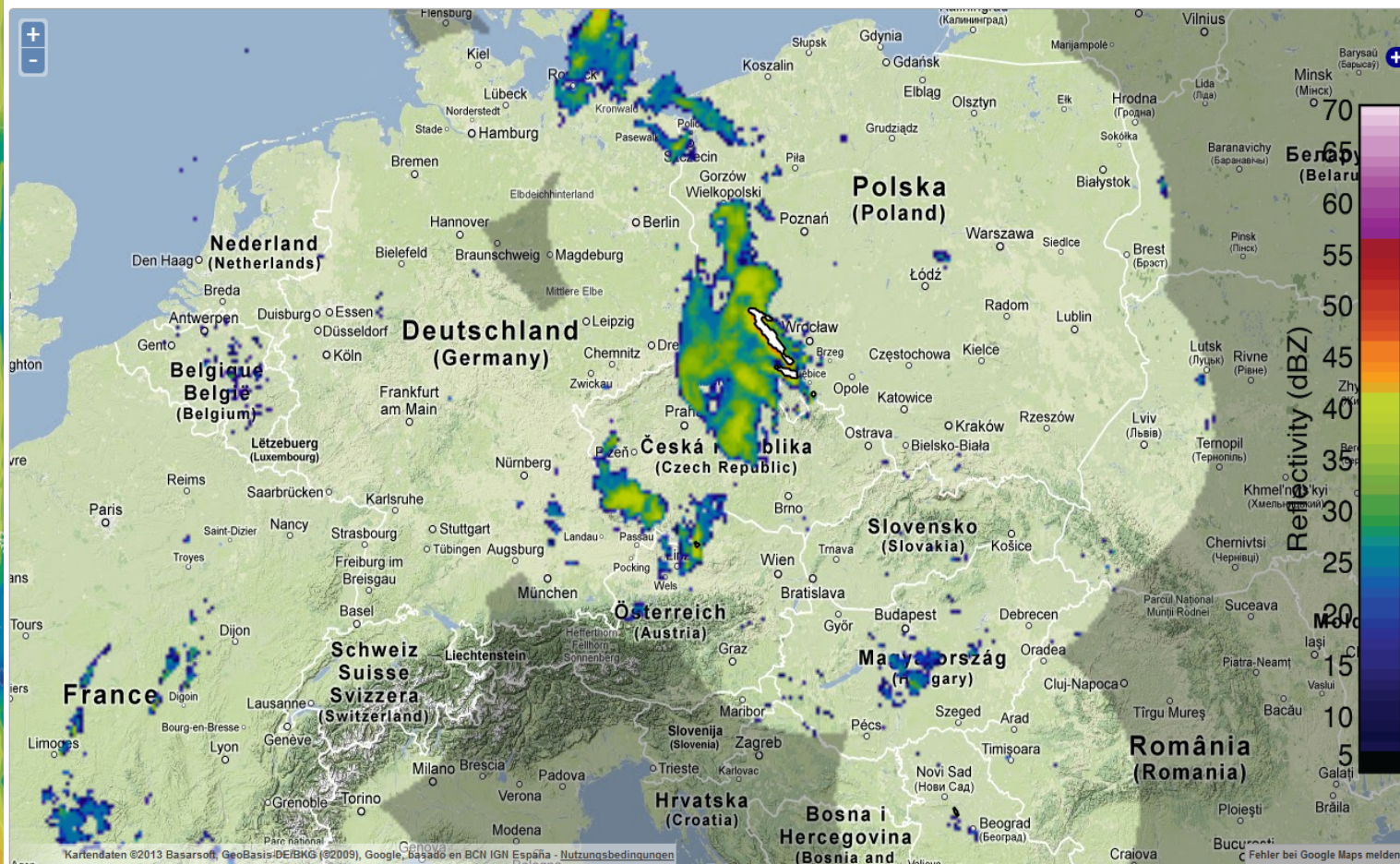
- more consistent and reliable cell tracking (complementing data sources)
- refinement of cell classification (pure precipitation cell versus tst)
- sorting out false alarms due to erroneous data and failures in data delivery
- extend observation domain beyond radar domain (monitor systems approaching from the sea)

THE HAREN PROJECT

08/07/13 Folie 18

OPERA Mosaic

Convective Area



Aug 2011

Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Today

Number of Frames: 8
Hour/Minute: 24:00

Topographies

- Google Physical
- Google Streets
- Google Satellite
- Google Hybrid

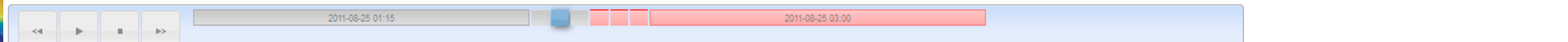
Layers

- Reflectivity (dBZ)
- Forecast Reflectivity (dBZ)
- Convective Area
- FMI
- Forecast FMI



TIME: 2011-08-25 01:45 UTC

Center Lon.:24.78 Lat.:44.82 X (Km utm):2758233.90 Y (Km utm):.5592806.35

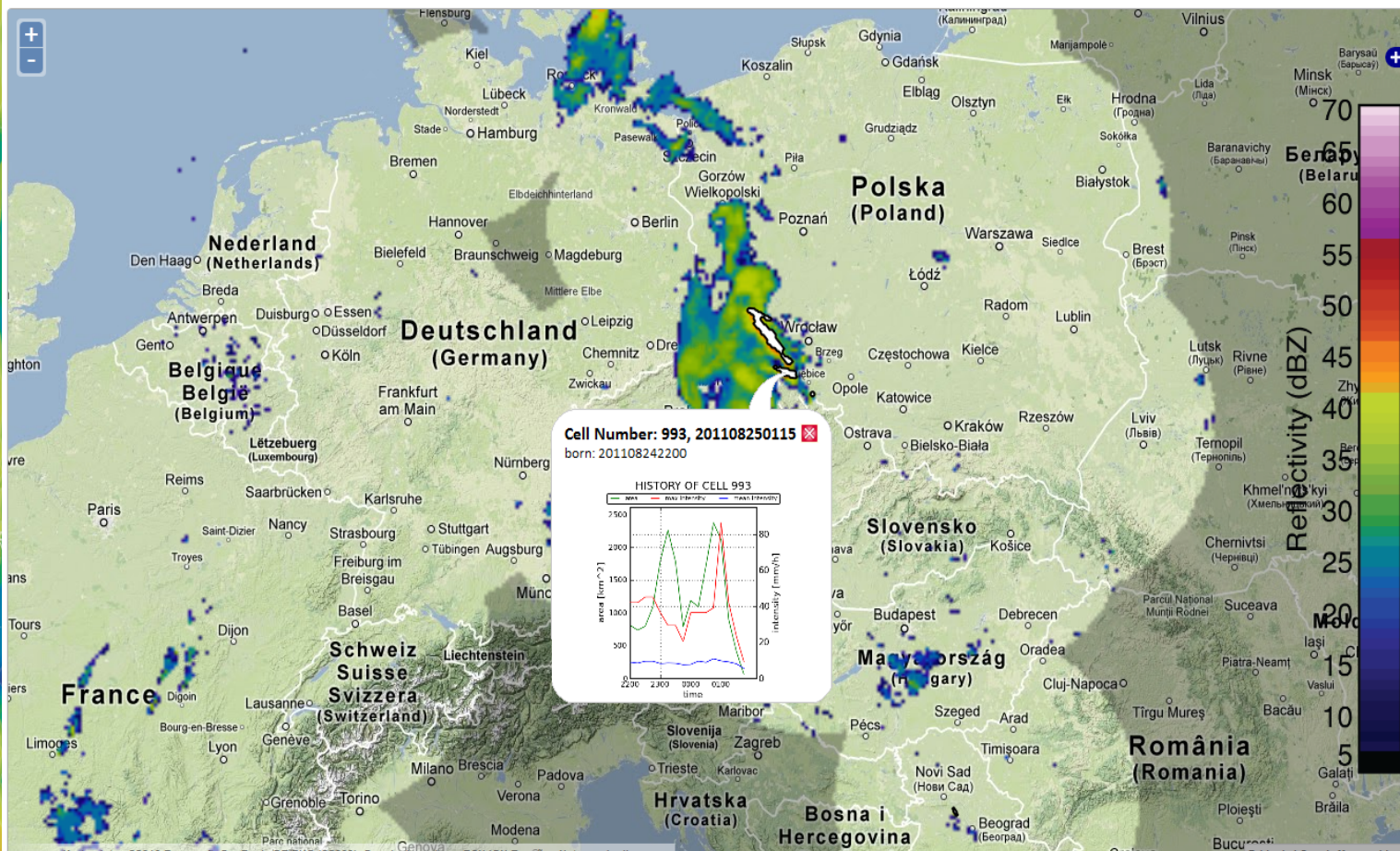


THE HAREN PROJECT

08/07/13 Folie 19

OPERA Mosaic

Convective Area



Aug 2011

Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Today

Number of Frames: 8
Hour/Minute: 24 / 00

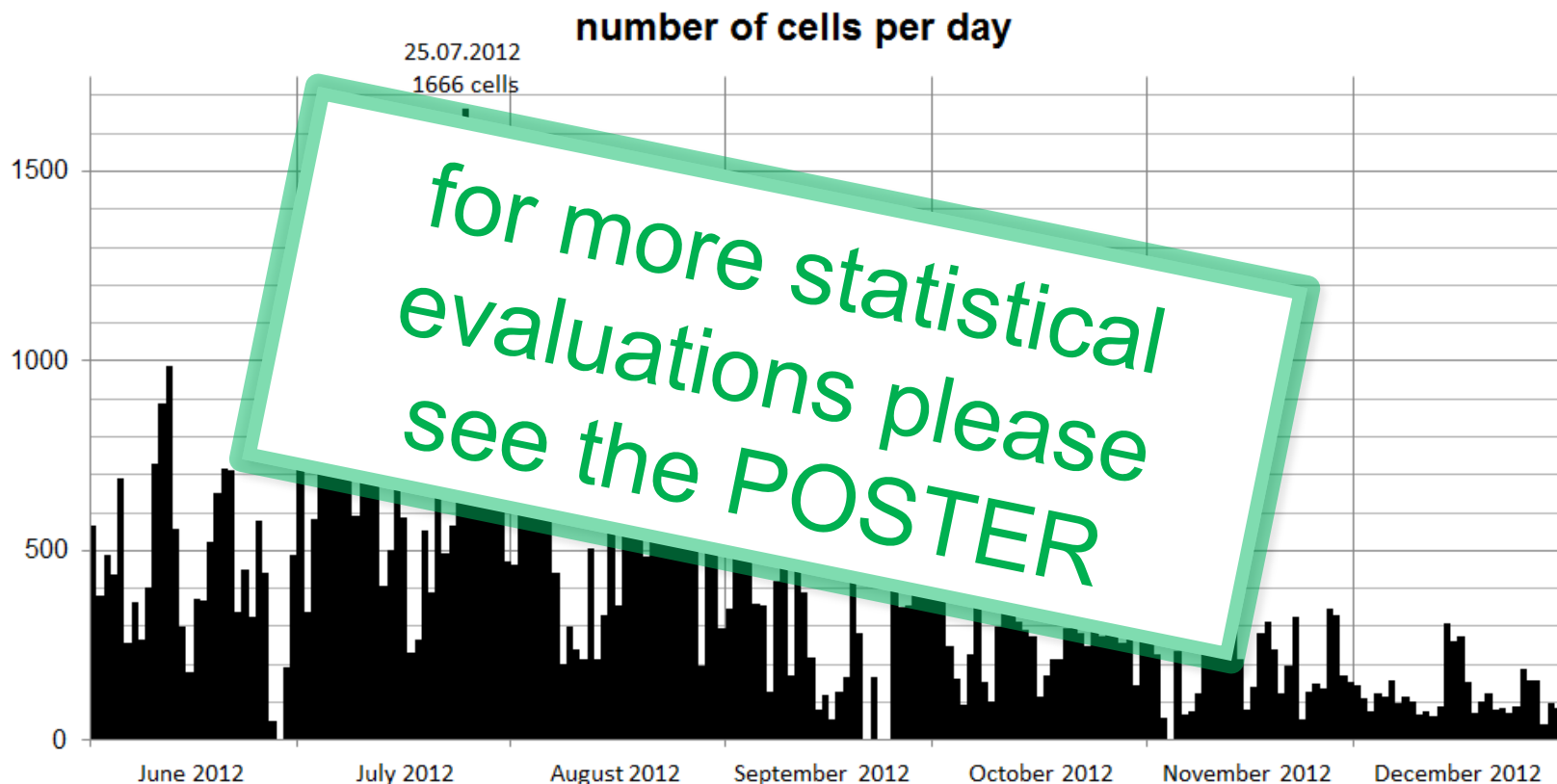
- Topographies**
- Google Physical
 - Google Streets
 - Google Satellite
 - Google Hybrid

- Layers**
- Reflectivity (dBZ)
 - Forecast Reflectivity (dBZ)
 - Convective Area
 - FMI
 - Forecast FMI



TIME: 2011-08-25 01:45 UTC

Center Lon.:25.74 Lat.:44.71 X (Km utm):2865857.24 Y (Km utm):.5575684.4



Thank you for your attention!

Acknowledgment:



European
Civil Protection



DIRECCIÓN GENERAL
DE PROTECCIÓN CIVIL
Y EMERGENCIAS



SISÄASIAINMINISTERIÖ
INRIKESMINISTERIET

References:

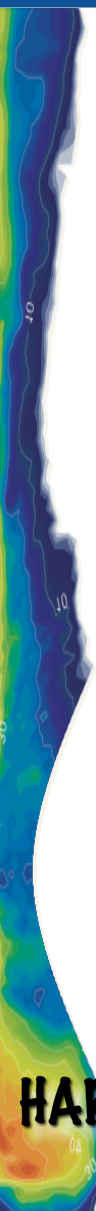
Kober, K. and Tafferner A.: Tracking and nowcasting of convective cells using remote sensing data from radar and satellite, Meteorolog. Z., 18, 75-84, 2009.

Meyer, V. K., Höller, H., and Betz, H. D.: Automated thunderstorm tracking: utilization of three-dimensional lightning and radar data, Atmos. Chem. Phys., 13, 5137-5150, doi:10.5194/acp-13-5137-2013, 2013.

PRECIPITATION-CELL NOWCASTING

08/07/13

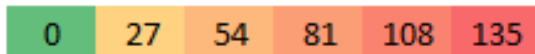
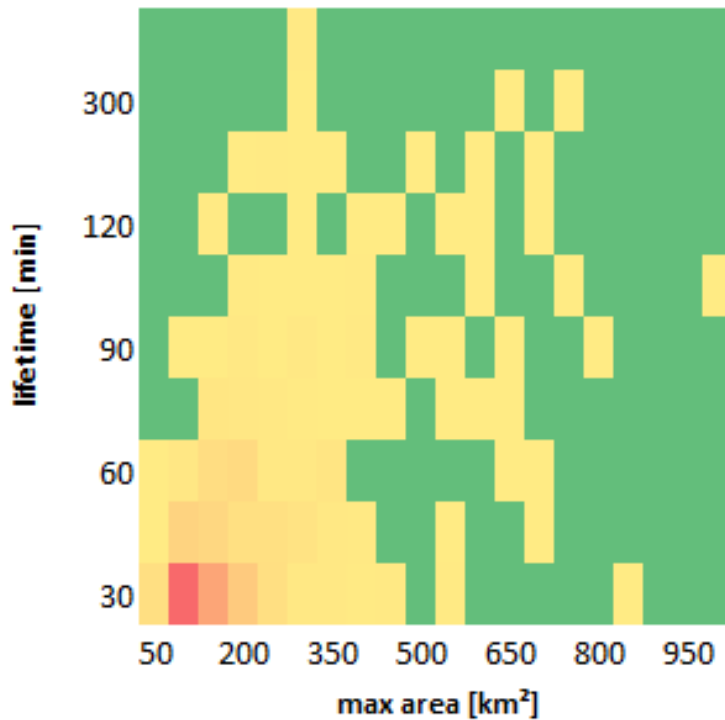
Folie 22



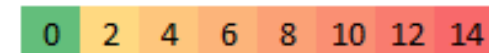
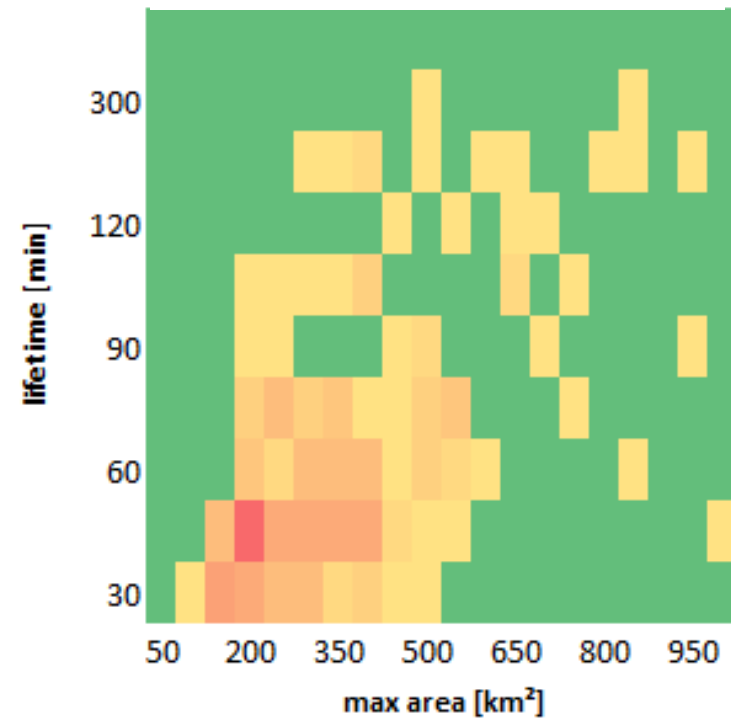
HAREN

cell-track frequency distribution

radar-cell tracks
2012/10/26

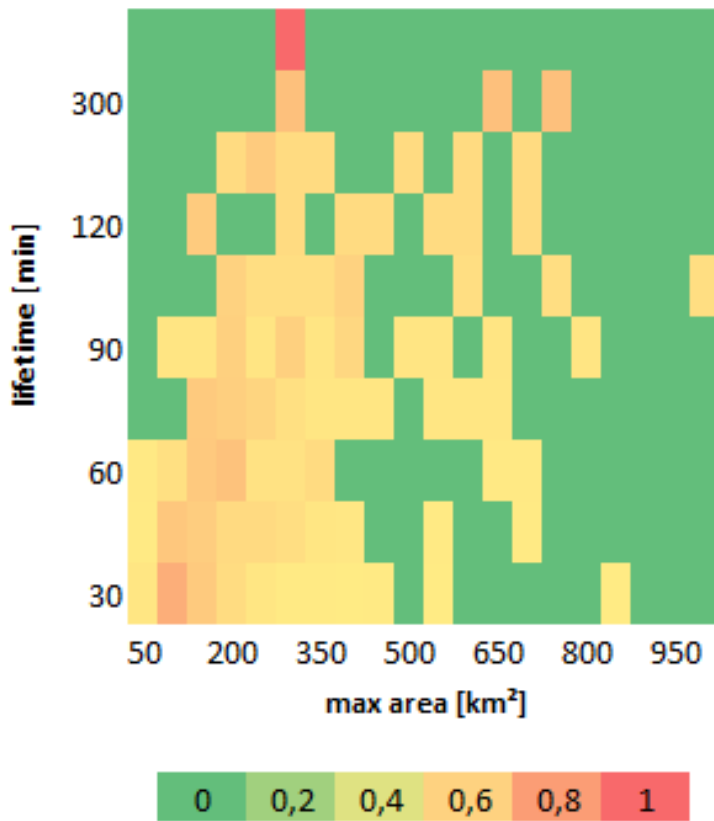


lightning-cell tracks
2012/10/26

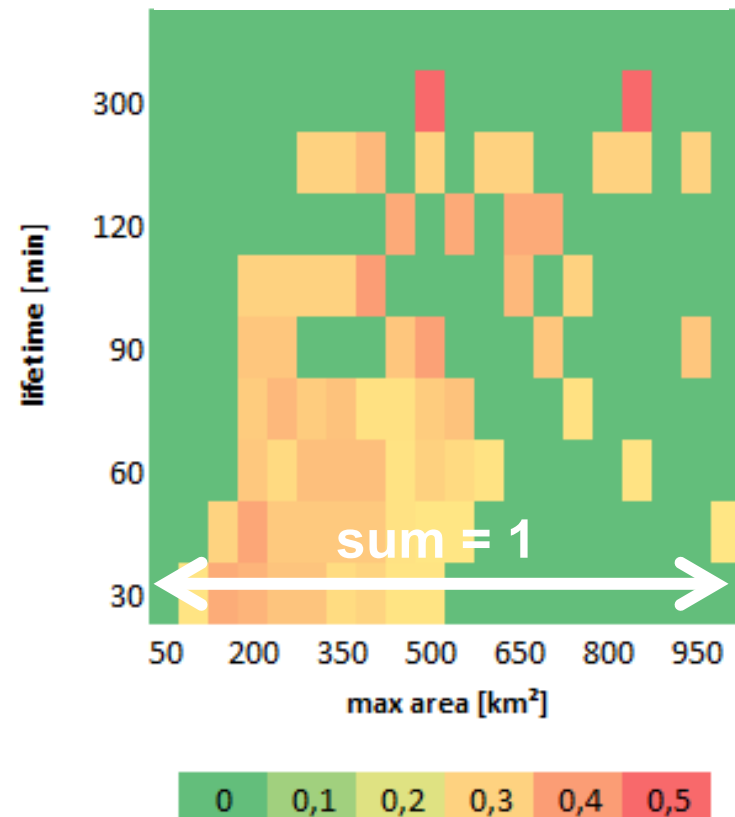


normalized cell-track frequency distribution

radar-cell tracks
2012/10/26



lightning-cell tracks
2012/10/26



Hazard Assessment based on Rainfall European Nowcasts

-HAREN-



European
Civil Protection



Centre de Recerca Aplicada
en Hidrometeorologia

UNIVERSITAT POLITÈCNICA DE CATALUNYA



ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE



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SISÄASIAINMINISTERIÖ
INRIKESMINISTERIET



OPERA
EIG EUMETNET PROGRAMME

meteoalarm
alerting europe for extreme weather



DIRECCIÓN GENERAL
DE PROTECCIÓN CIVIL
Y EMERGENCIAS



HAREN



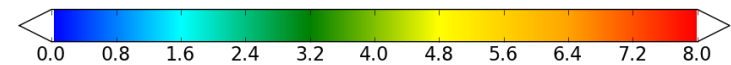
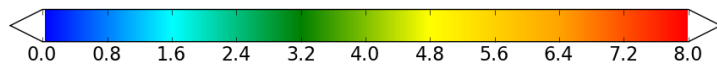
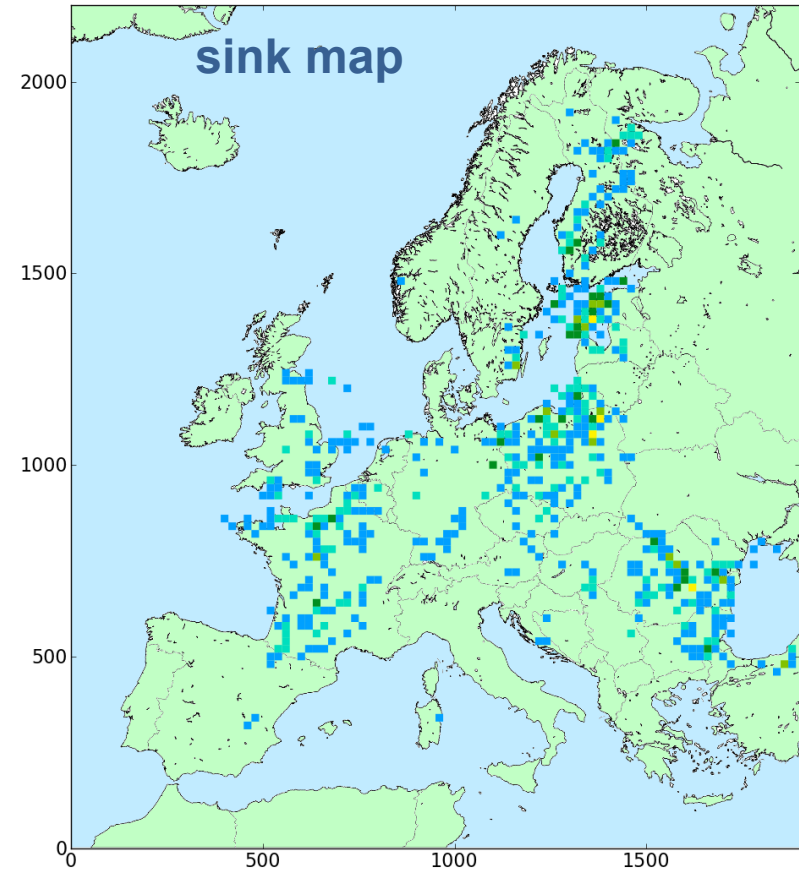
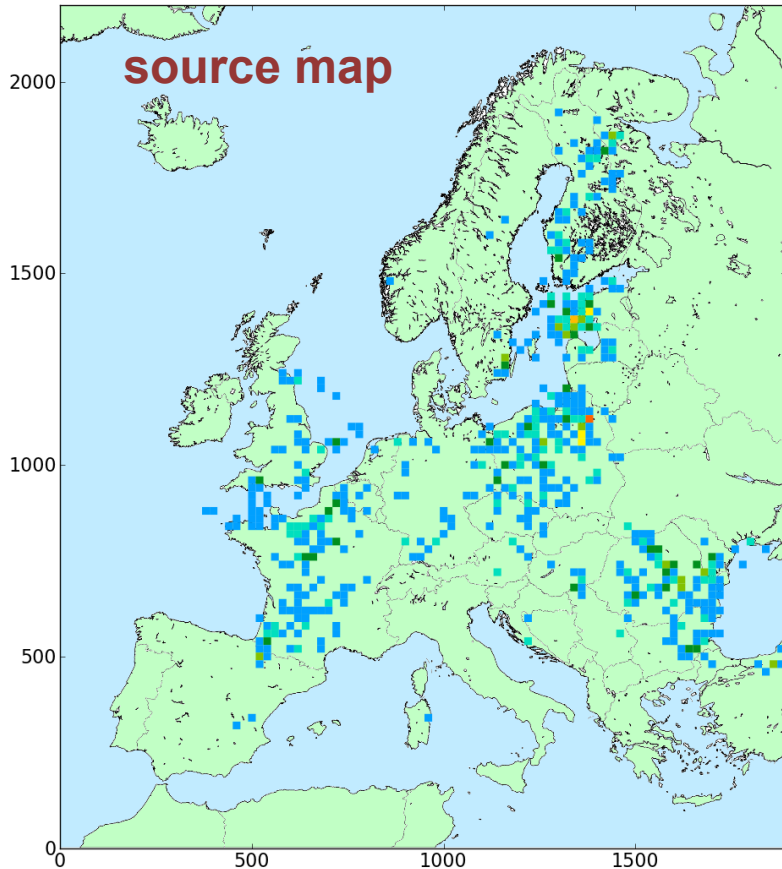
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PRECIPITATION SOURCE and SINK MAP (tentative results for 2012/07/07)

08/07/13

Folie 26

2012-07-07



frequency

CASE STUDY 2011/08/25 to 27

08/07/13

Folie 27

23.08.2011	0	C	A	W	5no	klare, lange und kurze tracks nw von Oesterreich	1. Tief am Atlantik mit einer Kaltfront vor der küste Spaniens und Frkr. 2. Tief über Frankreich mit Kaltfront über Frankreich und starke Konvektion nahe des Okklusionspunktes in Belgien u i.d. warmfront. auflösende Kaltfront hinterlasst Gewitter in der Schweiz und in Deutshland. Österreich im Warmluftsektor
24.08.2011	6	C	A	D	38no	klare, lange und kurze tracks nw von Oesterreich, in Bayern und in Sbg	1. Tief im Atlantik, Kaltfront quer über die Insel, warmfront in Island. 2. Kaltfront quer über Deutschland und Frankreich mit starken Gewittern und Warmfront von S-Schweden, Polen richtung Ukraine
25.08.2011	6	C	A	W	7no bis o	lange und kurze, sprunghafte tracks im waldviertel und nordl von Oesterreich	1. Tief über Irland, mit Kaltfront über Schottland, England und Frankreich. 2. das östlichere System hat sich aufgelöst mit einem MCS in Polen und Gewitter aktivität in Frankreich.
26.08.2011	6	C	A	W	1	kurzer track in N-Italien	1. Tief im Golf von Biskaya und Kaltfront über Frkr mit Gewittern am leading Edge, warmfront in der Nordsee.
27.08.2011	0	C	C	D	28no	lange, klare tracks im osten Oesterreichs und einzelne in N-Italien und Schweiz	1. Kaltfront zieht über Österreich, Deutschland bis zur Nordsee, Warmfront über Skandinavien
28.08.2011	6	A	A	D	0		1. Kaltfront ist abgezogen und fast aufgelöst

