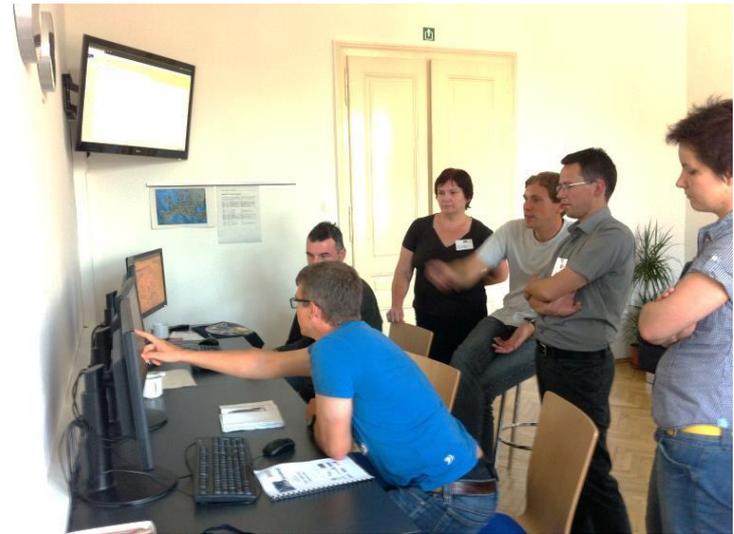
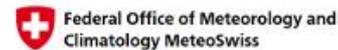




The ESSL Testbed Data Interface



The ESSL Testbed is organized
with support from:



Pieter Groenemeijer
Alois M. Holzer
Tomáš Púčik



This demonstration

1. Introduction to the ESSL Testbed
2. Introduction to the Data Interface
3. Exercise / Demonstration
4. Conclusion

Goals of the ESSL Testbed

1. Train Europe's forecasters in severe convective weather forecasting and nowcasting



2. Evaluate new forecast-supporting products

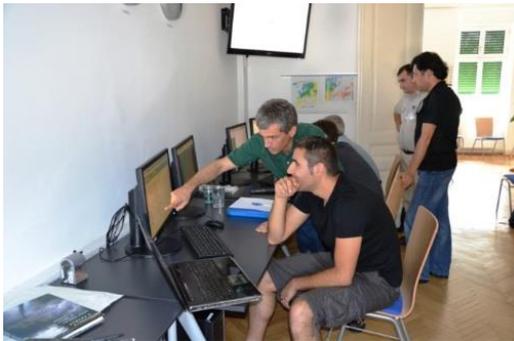




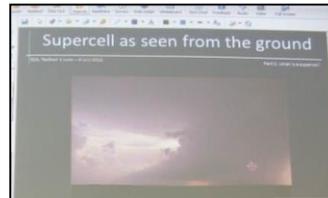
ESSL Testbed

Procedure

1. Participants jointly **make forecasts and nowcasts**
2. These are **verified** against observations
3. Products are **evaluated**
 - Discussion
 - Testbed Blog
 - Questionnaires



Training by Researchers & Developers and by forecasting experts from Europe and overseas (e.g. NOAA Storm Prediction Center, National Severe Storms Laboratory)



Procedure

1. Participants jointly **make forecasts and nowcasts**
2. These are **verified** against observations
3. Products are **evaluated**
 - Discussions on site
 - Teleconferences
 - Testbed Blog
 - Questionnaires



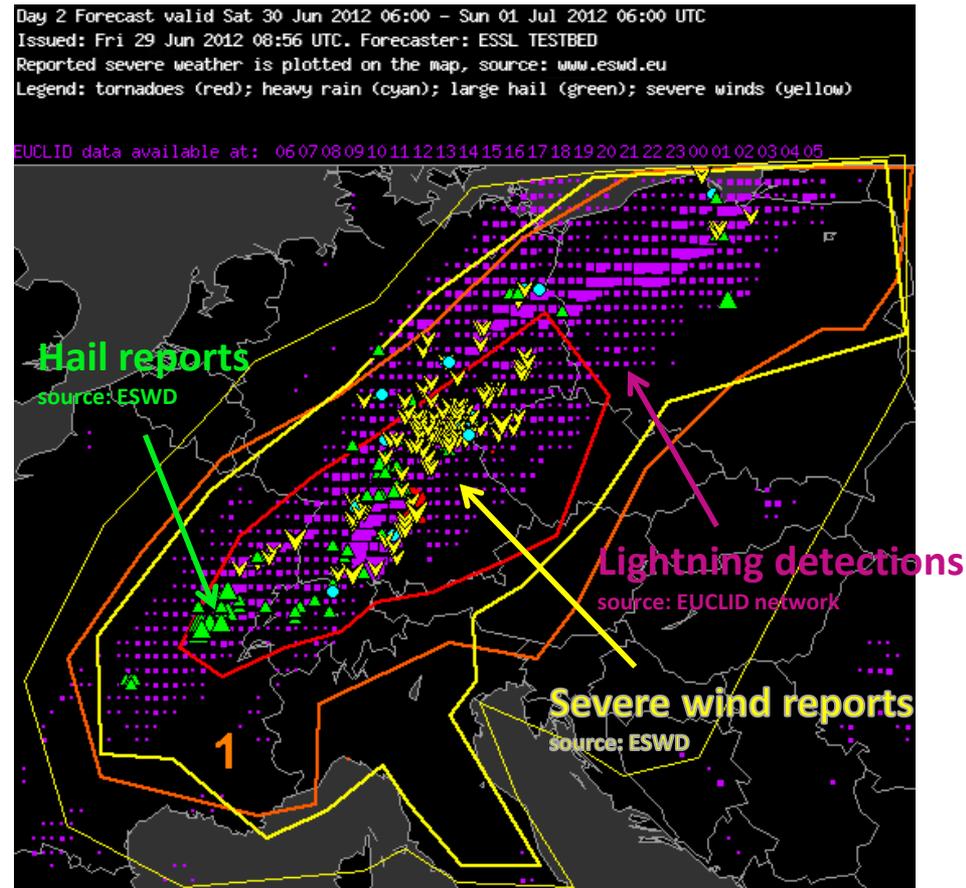
Forecasting and Nowcasting at the Testbed

1. Forecasting convective hazard
 - day 1 (today)
 - day 2 (tomorrow)
 - day 3, 4 and 5

2. Nowcasting two hours ahead
 - challenging timeframe

Forecasting and Nowcasting at the Testbed

1. Forecasting convective hazard
 - day 1 (today)
 - day 2 (tomorrow)
 - day 3, 4 and 5
2. Nowcasting two hours ahead
 - challenging timeframe



Day 2 forecast (coloured lines) with verification data (symbols reflect severe weather reports, magenta = lightning).

ESSL Testbed Data Interface



NWP Models

9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60 63 66 69 72 78 84 90 96 102 108 114 1

Initialization time ?
2017061409 select
yyyyymmddhh

Models ?

- GFS 06
- ICON-EU 00
- ECMWF 00

Parameters ?

Pressure levels

- 300
- 500
- 700
- 850

Instability and moisture

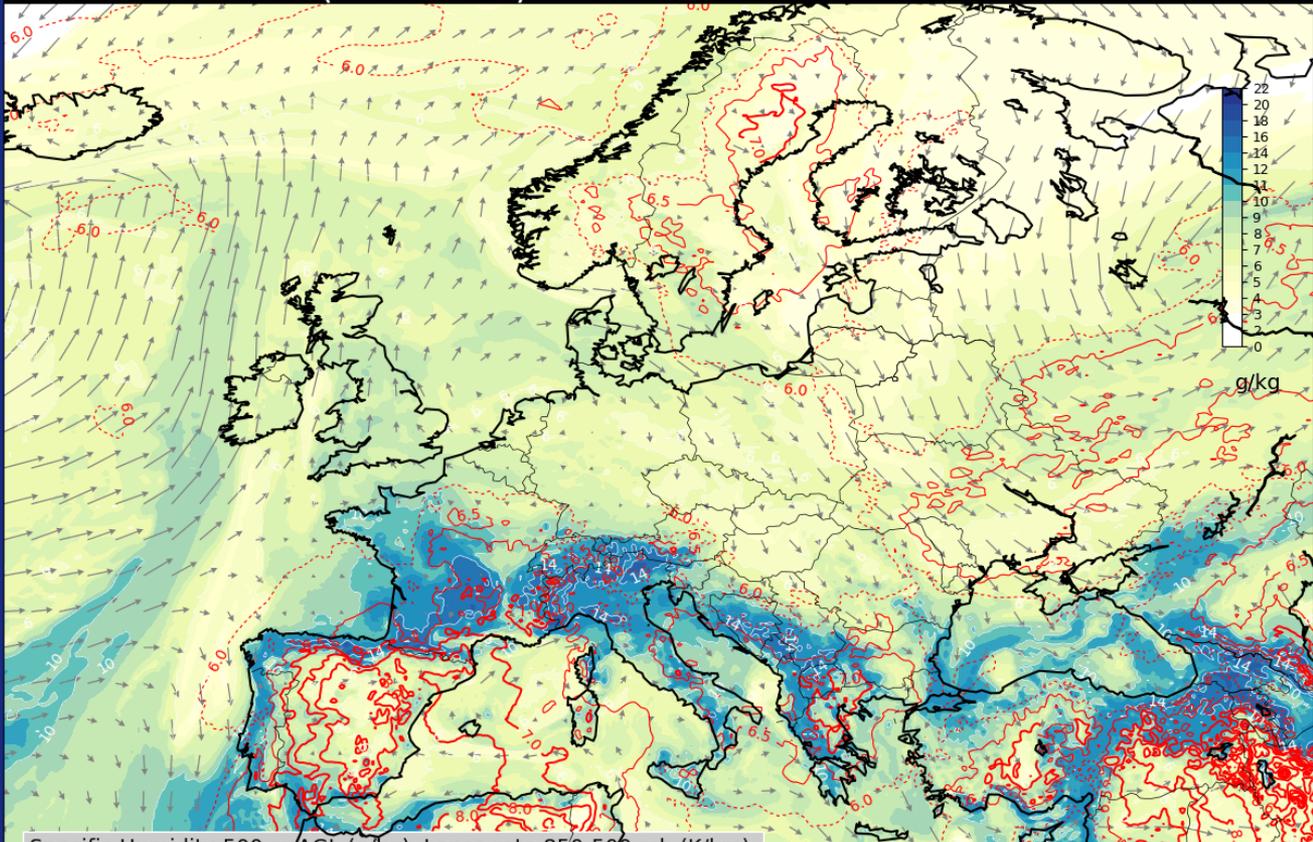
- CAPE & CIN
- Lapse rate & Moisture
- Wind shear
- 0-6 km shear
- 0-3 km shear
- 0-1 km shear

Other parameters

- T 2m
- Accumulated Precipitation
- 10m wind
- test please ignore
- Td 2m

Nowcast data Model data COSMO Ensembles Surface Maps Make Nowcast Verification Product Evaluation External Links

ECMWF Wed 14 Jun 2017 15 UTC (Wed 14 Jun 00 +15h) EUROPE lmoisture



Specific Humidity 500 m/AGL (g/kg), Lapse rate 850-500 mb (K/km)

Domains ?

East	West
Central	South
North	Alps
FarNorth	NorthGermany
EUROPE	SouthEast
NorthEast	NorthWest
SouthWest	

Roaming Sounding

Forecast Tool ?

Select risk area to draw:

- Low prob. thunder
- High prob. thunder
- Level 1
- Level 2
- Level 3

Markers: ?

R123

- Close area
- Remove last point
- Clear forecast
- Remove markers
- Write forecast text

Drawn areas:

Scientific forecasting of convection

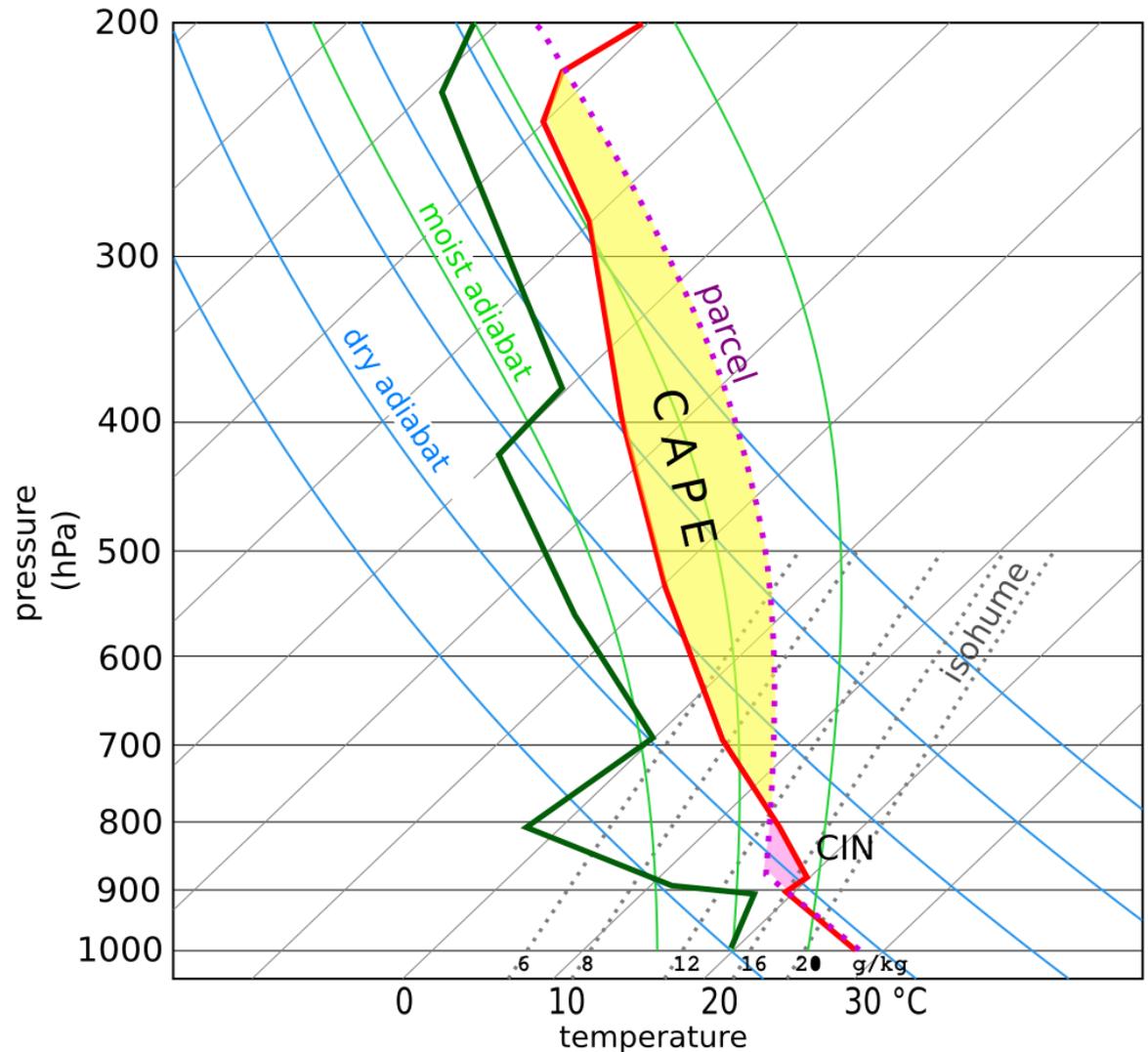
- Q: *What do all convective storms have in common?*
- A: Air that rises due to positive buoyancy (in which water vapour condenses).

- Q: *When is the air positively buoyant?*
- A: Parcel theory: When it is less dense (typically warmer) than its environment

- Q: *How realistic is the parcel theory?*
- A: It has many unrealistic assumptions. Be aware of them!

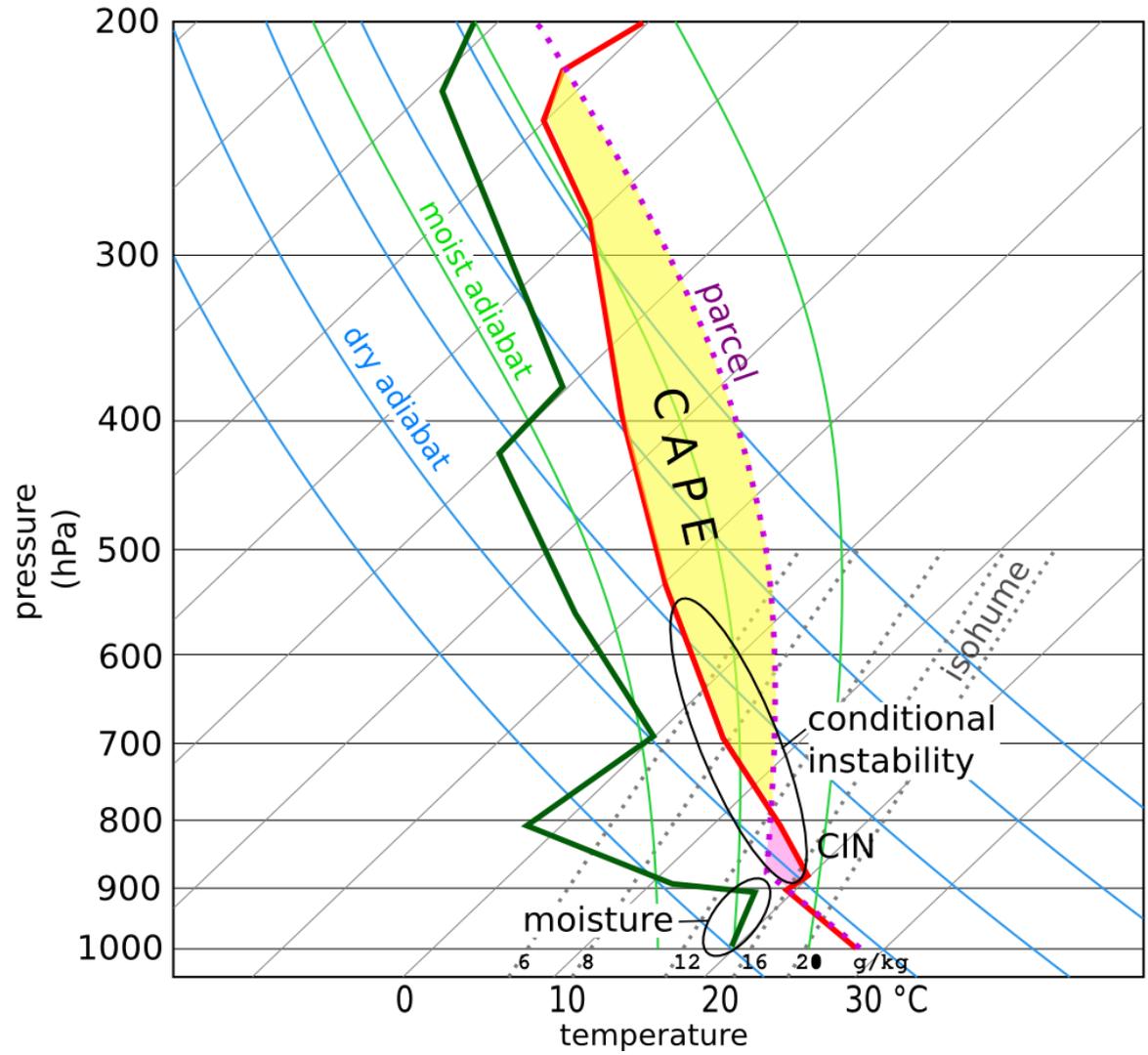
Buoyancy

- A buoyant parcel means that the parcel has CAPE
- CAPE requires:
 1. steep lapse rates
 2. low-level moisture



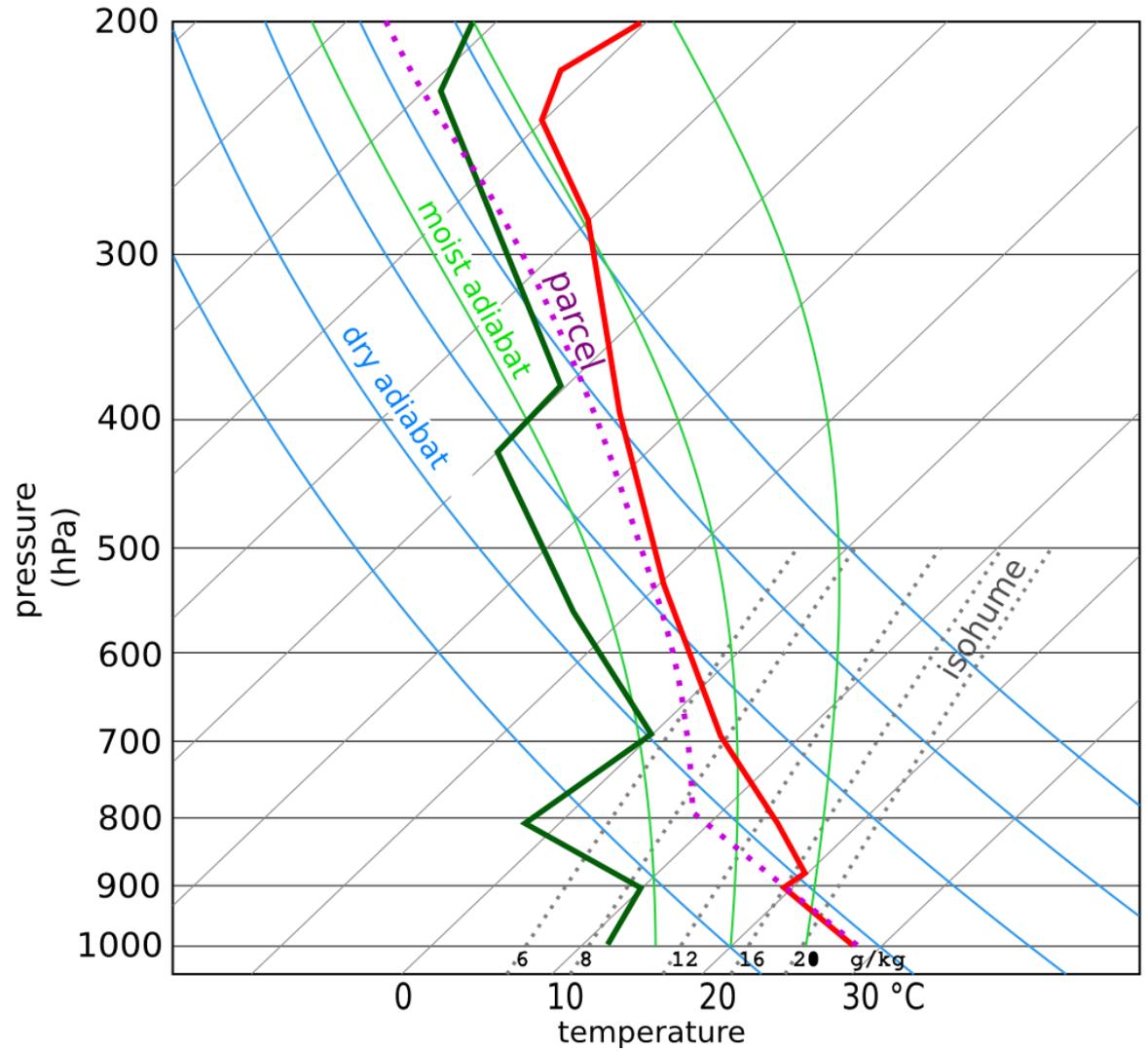
Buoyancy

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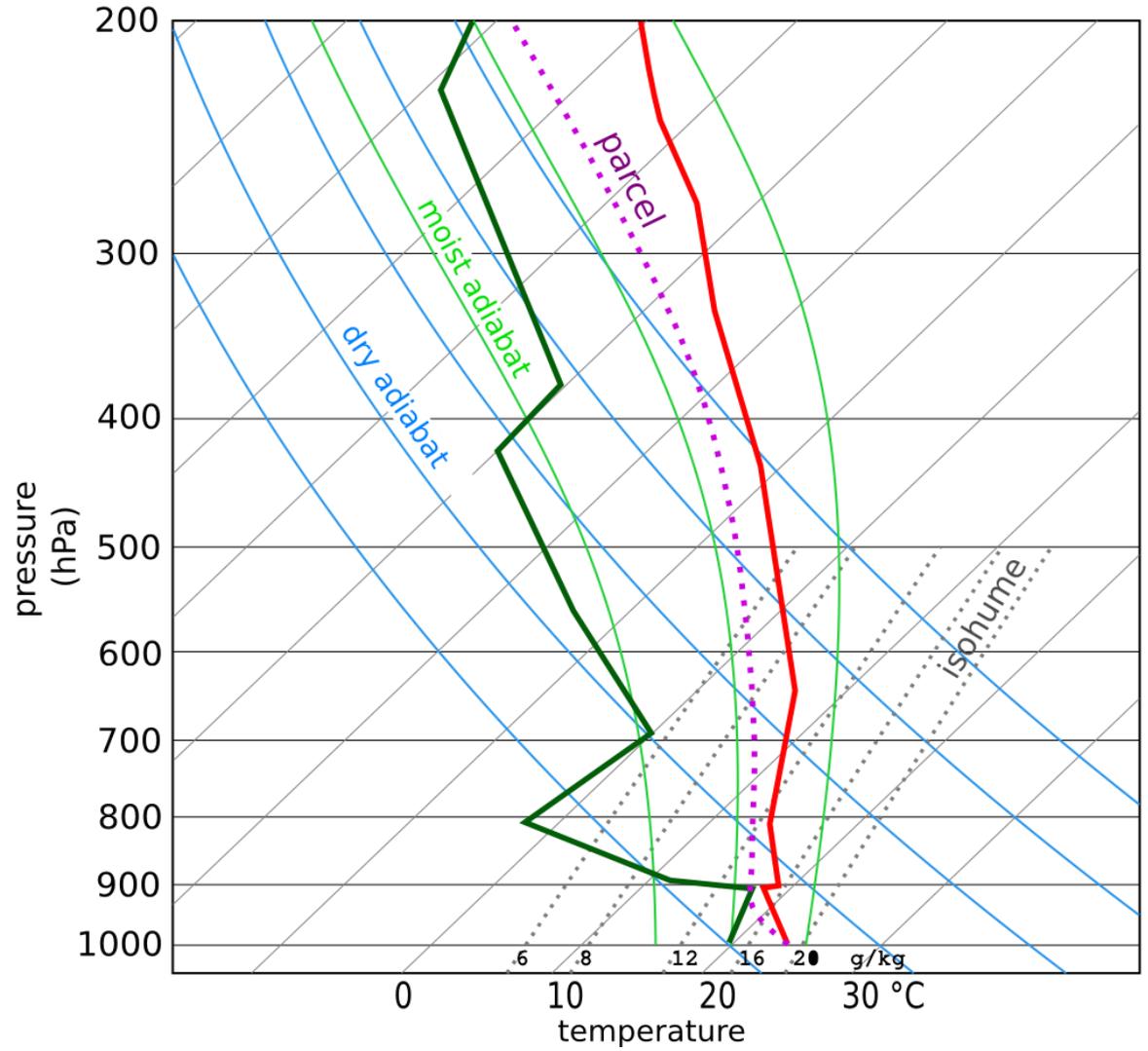
Buoyancy

No moisture:
no CAPE



Buoyancy

No lapse rates:
no CAPE either

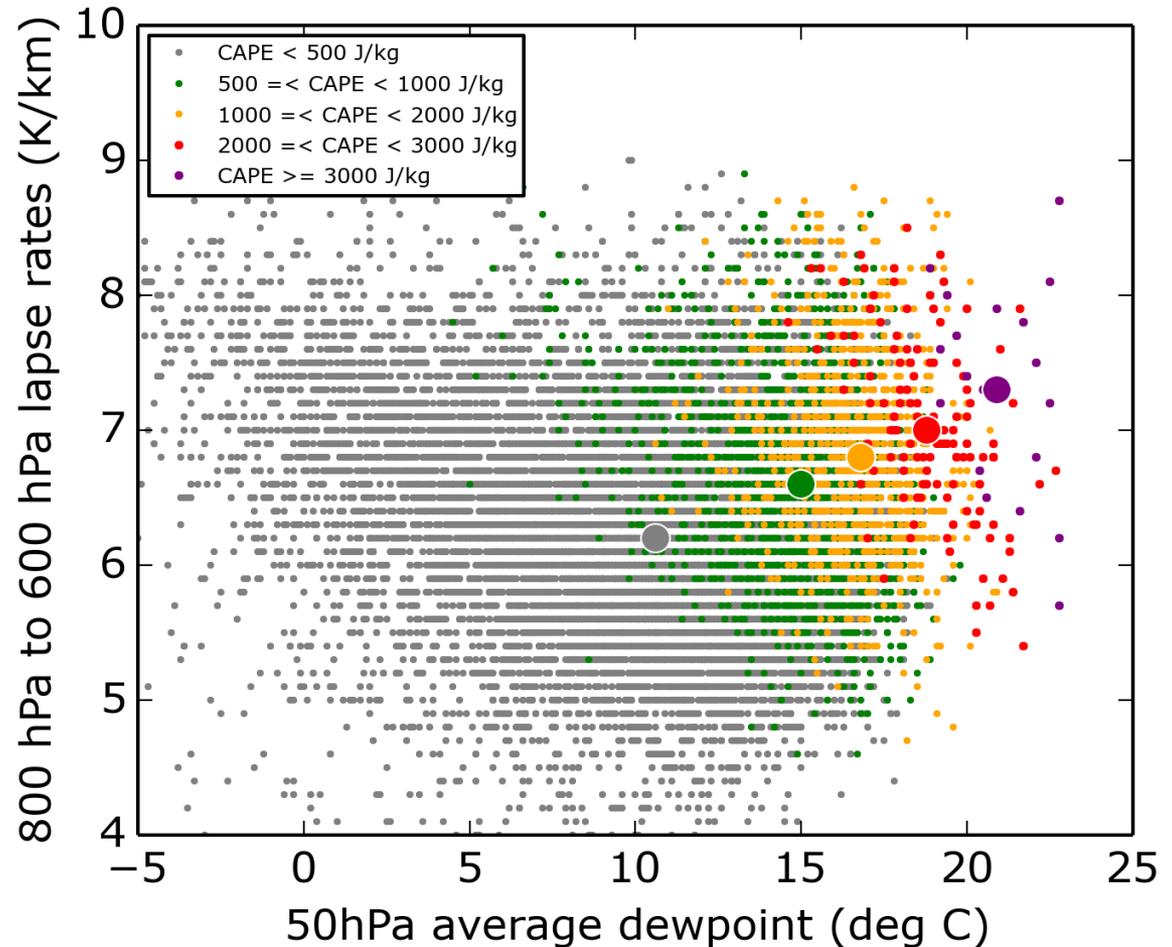


CAPE vs moisture and lapse rates

Higher **CAPE** values occur with

Steeper lapse rates

Higher low-level moisture



Tracking moisture and lapse rates

Moisture and lapse rates evolve relatively **independently**:

Low-level moisture

- travels with *low-level winds*
- increases through evapotranspiration
- decreases by condensation or mixing with drier air.

Lapse rates:

- conserved in geostrophic flow, travelling with *low to mid-level winds*
- modified slowly(!) by large-scale ascent and subsidence
- and rapidly by diabatic processes (heating)

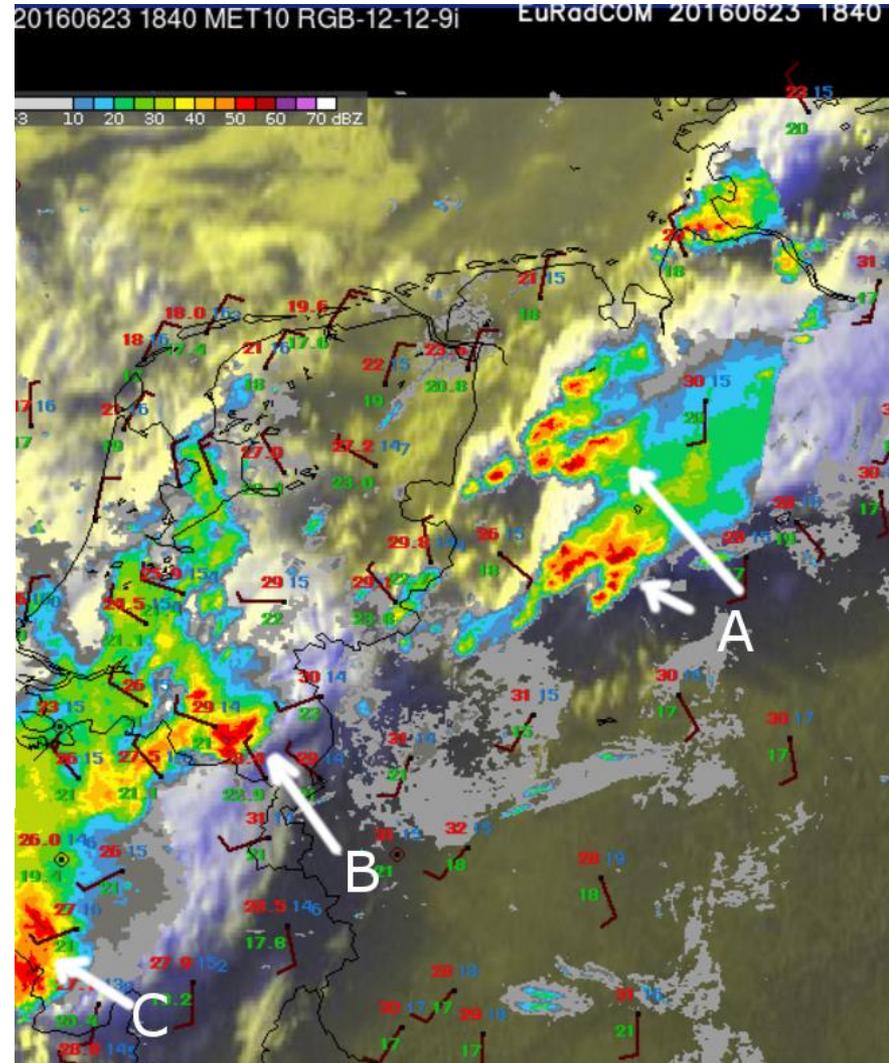
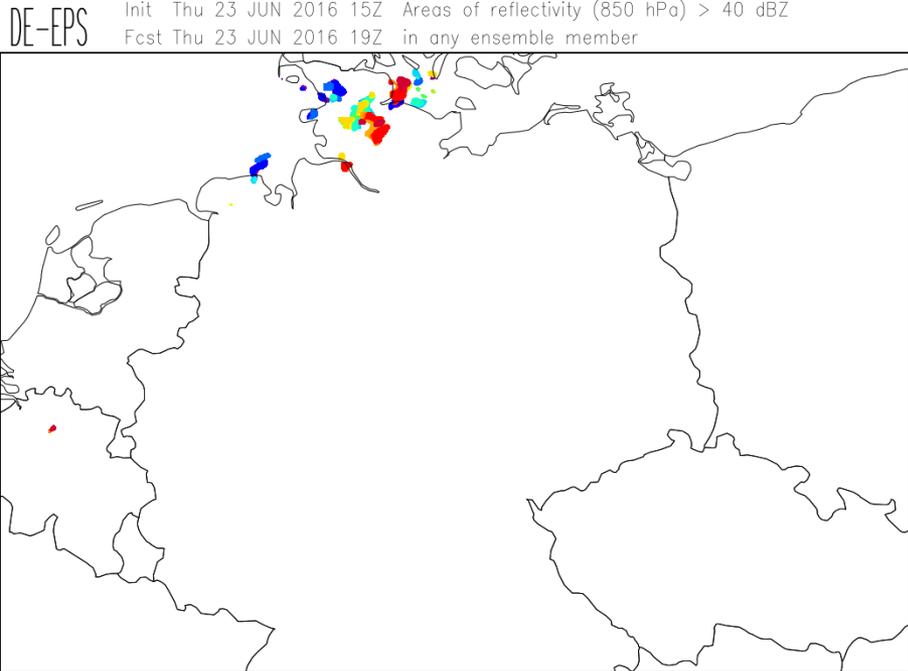
In contrast: **CAPE**, in model output just suddenly pops up.



ESSI Testbed

NWP: COSMO-DE-EPS

Case 23 June 2016



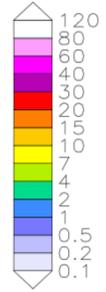
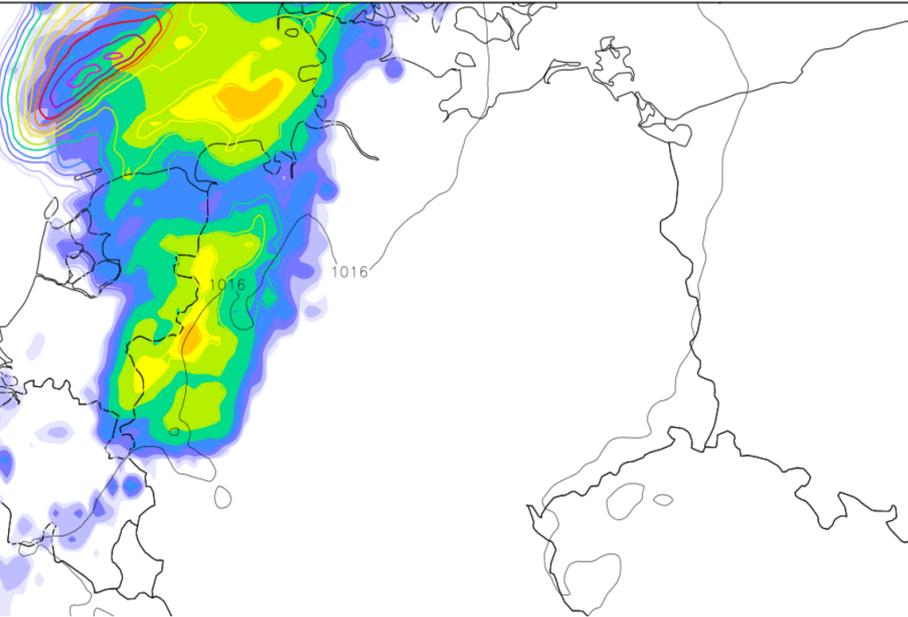


ESSI Testbed

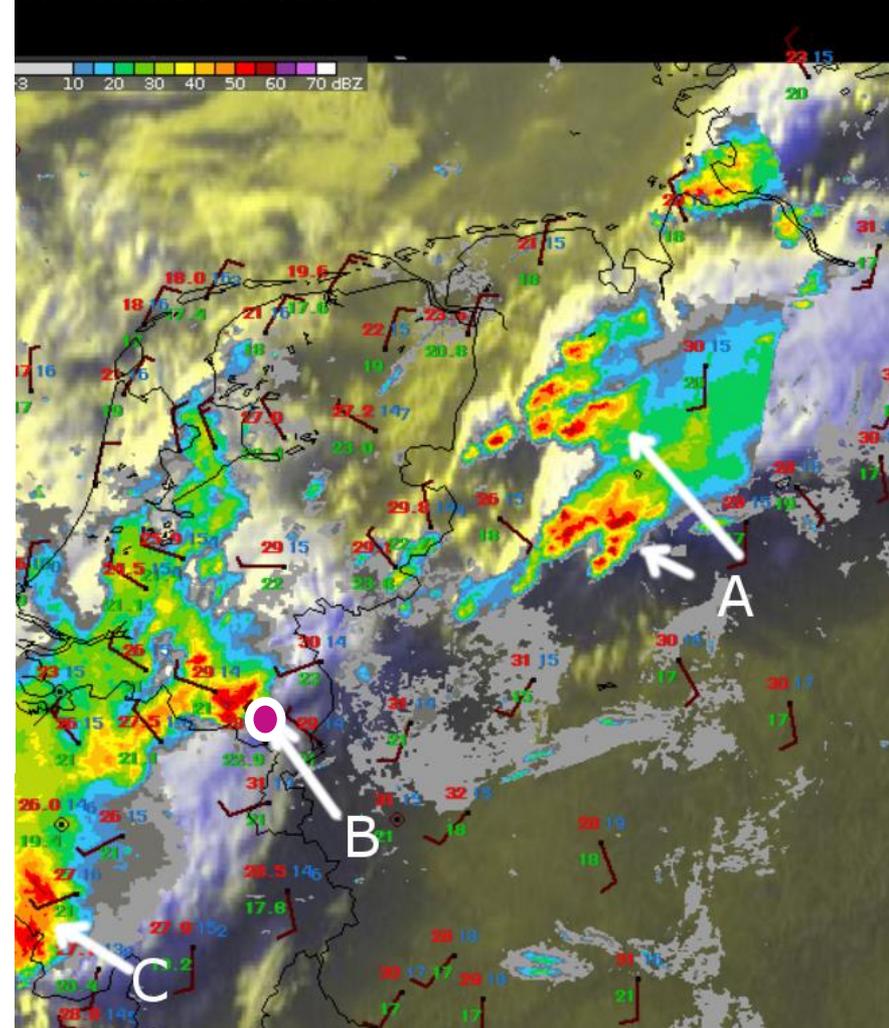
NWP: ECMWF

Case 23 June 2016

ECMWF Init Thu 23 JUN 2016 00Z 3 hourly accumulated precipitation
Fcst Thu 23 JUN 2016 18Z (convective=shaded, total=contours)



20160623 1840 MET10 RGB-12-12-9i EuRadCOM 20160623 1840





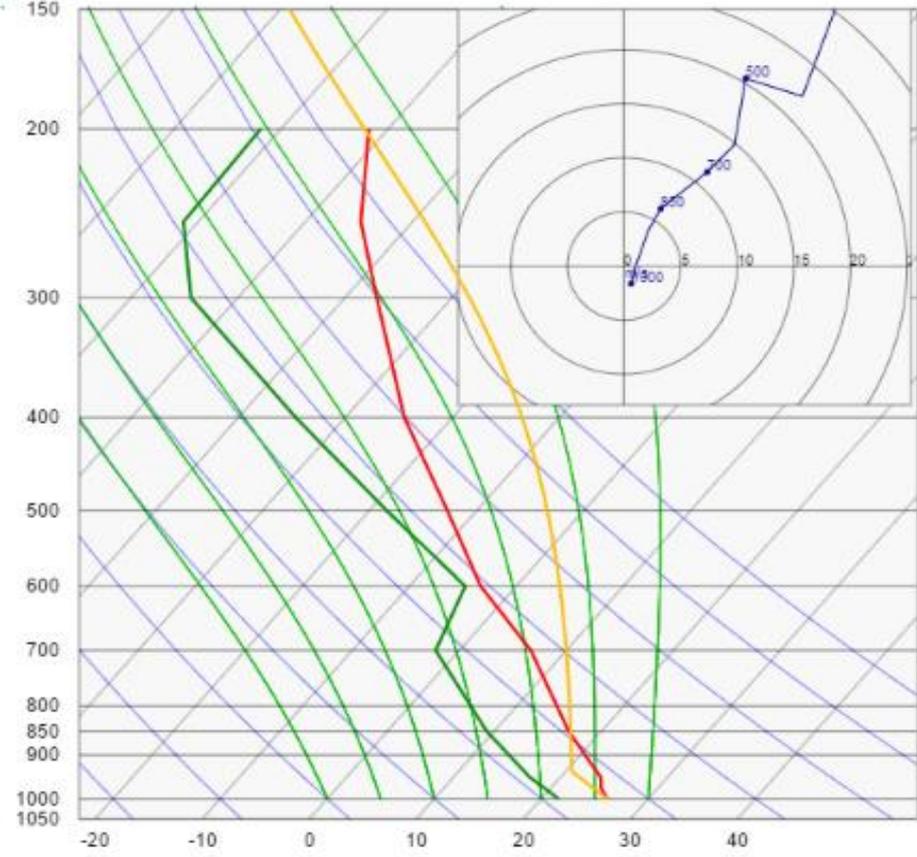
ESSI Testbed

COSMO model evaluation

Case 23 June 2016

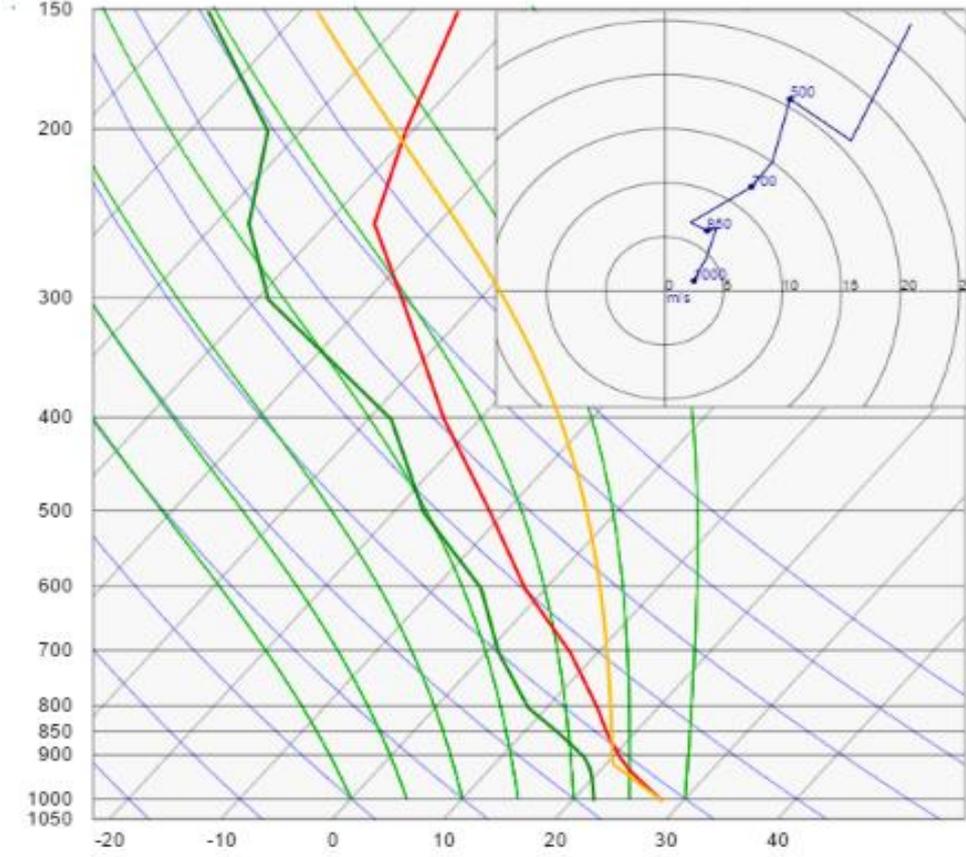
MODEL SOUNDINGS at 18 UTC (12 UTC+06)
right ahead of developing cell

COSMO-DE 2016062312 +6h NORTHGERMANY



COSMO-DE

ECMWF 2016062312 +6h NORTHGERMANY



ECMWF

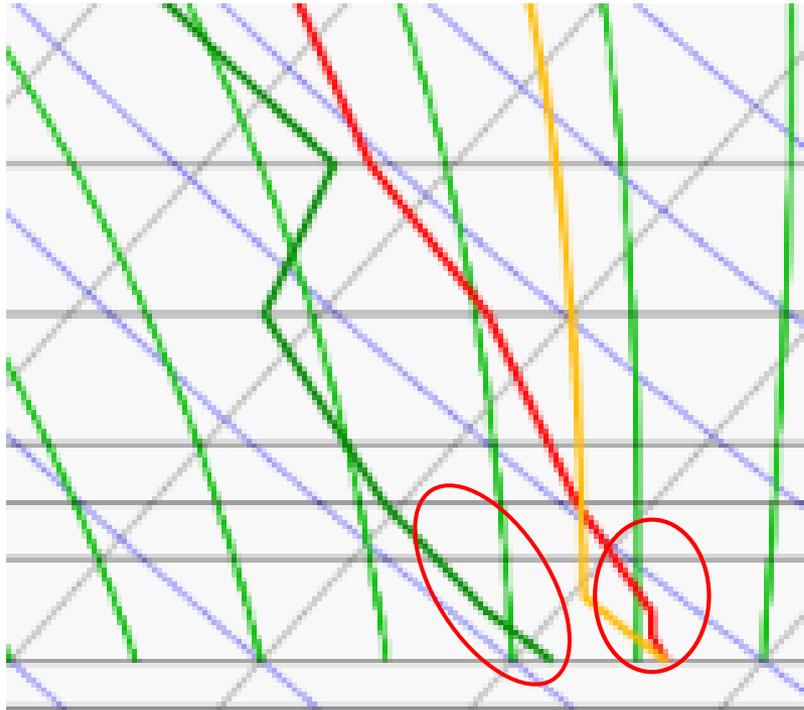


ESSI Testbed

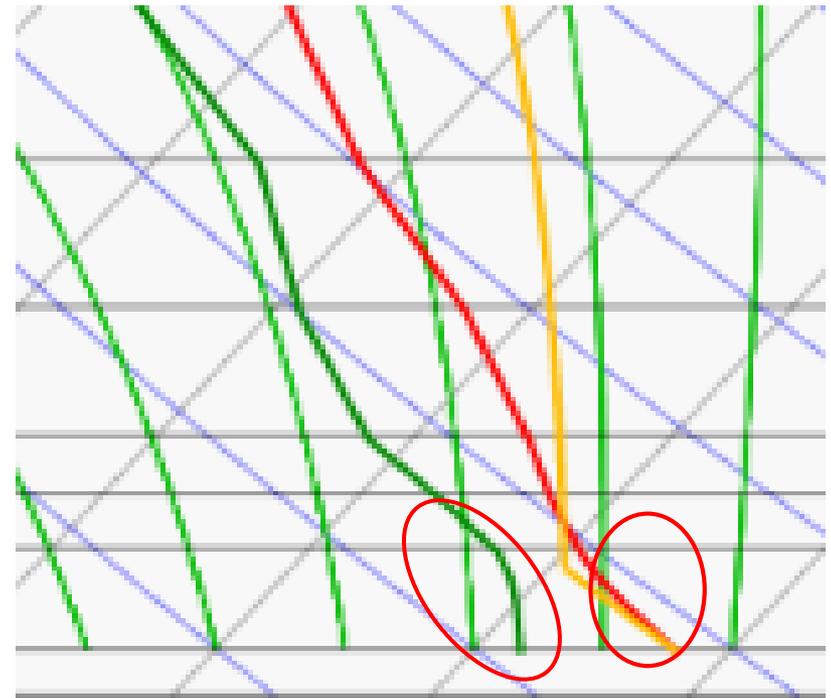
COSMO model evaluation

Case 23 June 2016

MODEL SOUNDINGS at 18 UTC (12 UTC+06)
right ahead of developing cell



COSMO-DE



ECMWF



ESSLTestbed

ESSL Testbed Data Interface

Please open:

weather.essl.org/testbed

Username:

testbed

Password:

2016neustadt

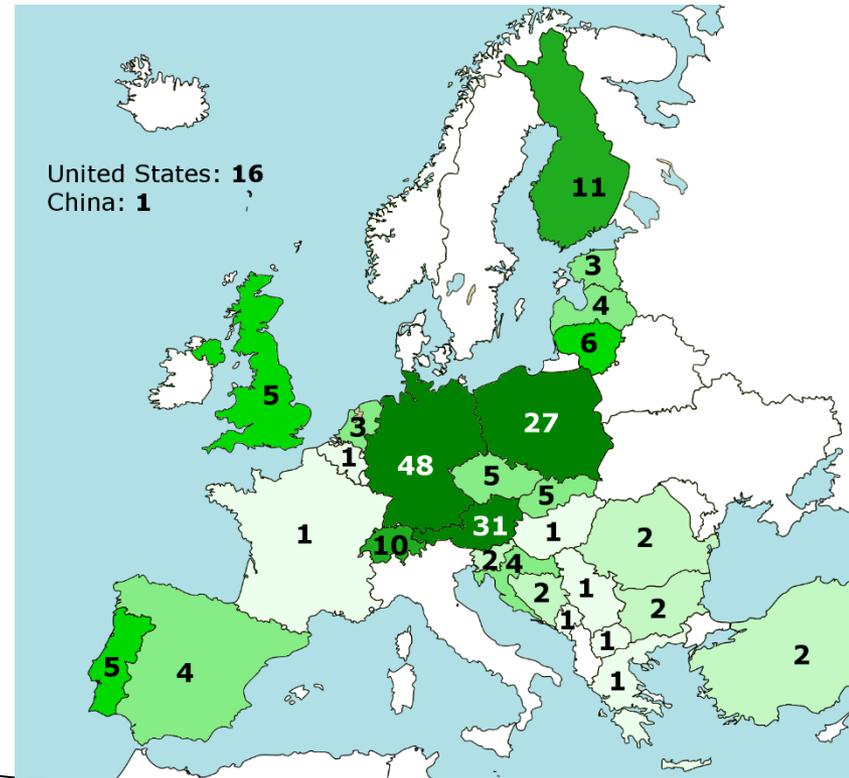
Exercise

1. Select domain “West”
2. Identify where the ingredients of deep, moist convection are forecast to occur simultaneously later today:
 - low-level humidity and steep lapse rates
-> jointly resulting in Convective Available Potential Energy
 - A source of lift
(convergent 10 m winds, large-scale upward motion, modelled precipitation)
3. Check the forecast wind shear in these areas
4. Issue a forecast (**level 1**, **level 2**, **level 3**?)
5. Do not forget to check back tomorrow to see what happened



ESSL Testbed

- 5 editions since 2016
- over 200 unique participants from 29 countries
- average participant grade on a 0-10 scale: 9.1



Number of participants per country (2012-2016)

Thanks a lot for all your knowledge meet that you transfer to me. I will for sure try to improve better and better in my country about deep-connection.

WHAT AN AMAZING EXPERIENCE!
I LEARNED A LOT AND LOOK FORWARD TO FUTURE COLLABORATIONS!

I'm SO HAPPY THAT I CAN'T SPELL PROPERLY! 😊

Concluding remarks

1. Congratulations on issuing your first ESSL Testbed forecast!
2. We will be including more products into the data interface in the coming time, including ensemble products

2017 Testbed Edition

Nowcast Products:

- Nowcast-SAF Products
 - including Convective Initiation, RDT and stability products
- New COSMO-DE(-EPS) fields relevant to severe convection
 - updraft helicity, -velocity, and vorticity – tracks
 - integrated condensed water
- ICON-EPS from week 2
- DWD radar, lightning products
- NowcastMIX

Group photos 2016:



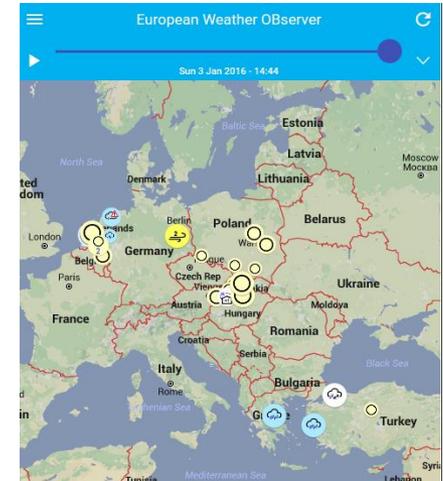


Advertisements ☺



Do you know the free
European Weather Observer app?

Look for: **EWOB**
Available for iOS and Android



2017

ESSL Testbed

Unfortunately, there are no places left this year
Testbed 2018 is from 11 June – 13 July.



ECSS2017
European Conference on Severe Storms
18-22 September 2017
in Pula, Croatia

Registration open; abstract submission has closed.

in cooperation with:



BONUS SLIDES...



Nowcasting at the Testbed

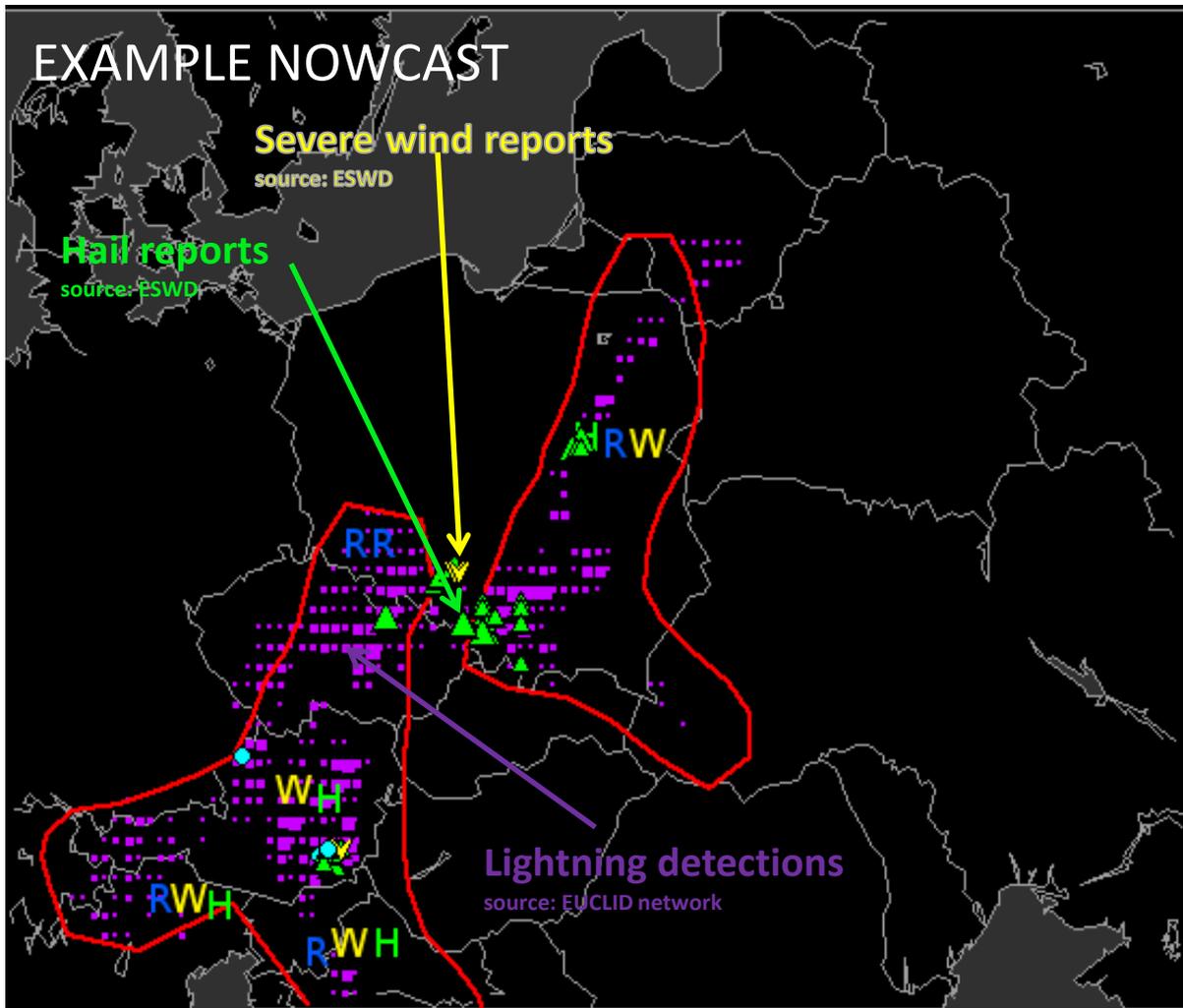
Forecast for the **next day** (coloured lines) with verification data (symbols reflect severe weather reports, magenta = lightning).

Activity:
Compare forecast to the real observed severe weather.

Red lines indicate where severe weather is forecast in the next 2 hours

Characters indicate the expected type of severe weather: **R**ain, **H**ail, **W**ind, or **T**ornadoes.

Verification data are small coloured symbols and lightning detections in **magenta**.



Nowcasting at the Testbed

Products:

Lightning detection

- VAISALA GLD360 2013 - 2016
- DWD Lightning 2016 -

NWP

- DWD COSMO-DE(-EPS) 2012-
- MeteoSwiss
COSMO-E/COSMO-1 2015-2016

Hybrid

- DWD NowcastMIX 2012-

Satellite

- U Wisconsin NearCast 2013
- Overshooting Tops (SS&SI @NASA) 2013
- U Wisc. Cloud-top cooling rate 2013
- NowcastSAF product suite 2017

Radar

DWD radar products 2013 - ...

- VIL-, VII-, rotation-track
- Mesocyclone detection

- OPERA composite 2013

Data display

NWP Models

defined 850
status: gfs 2016062400 78 Central 850 0

Forecast hours ?

0	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	78	84	90	96	102	108	114	120	126	132	138	144	150	156	162	168
---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Initialization time ?
2016062400 select
yyyyymmddhh

Nowcast data

Model data

High Resolution Ensembles

Surface Maps

Make Nowcast

Verification

Product Evaluation

External Links

Domains ?

TheAlps	NorthGermany
East	West
Central	South
North	FarNorth
Europe	SouthEast
NorthEast	NorthWest
SouthWest	

Roaming Sounding

Forecast Tool ?

Select risk area to draw:

Low prob. thunder
High prob. thunder
Level 1
Level 2
Level 3

Markers: ?

R123

Close area
Remove last point
Clear forecast
Remove markers
Write forecast text

Drawn areas: ?

Parameters ?

Pres

Select a different parameter by clicking on the respective box. Move the mouse over the box with the left button pressed to see the parameter for the currently selected model and forecast time.

Instability

CAI

lapse ra

Large-scale vertical motion

320K IPV

500 hPa vorticity

Wind shear

0-6 km shear

0-3 km shear

0-1 km shear

0-3 km SRH

0-1 km SRH

Other parameters

T 2m

precipitation

10m wind

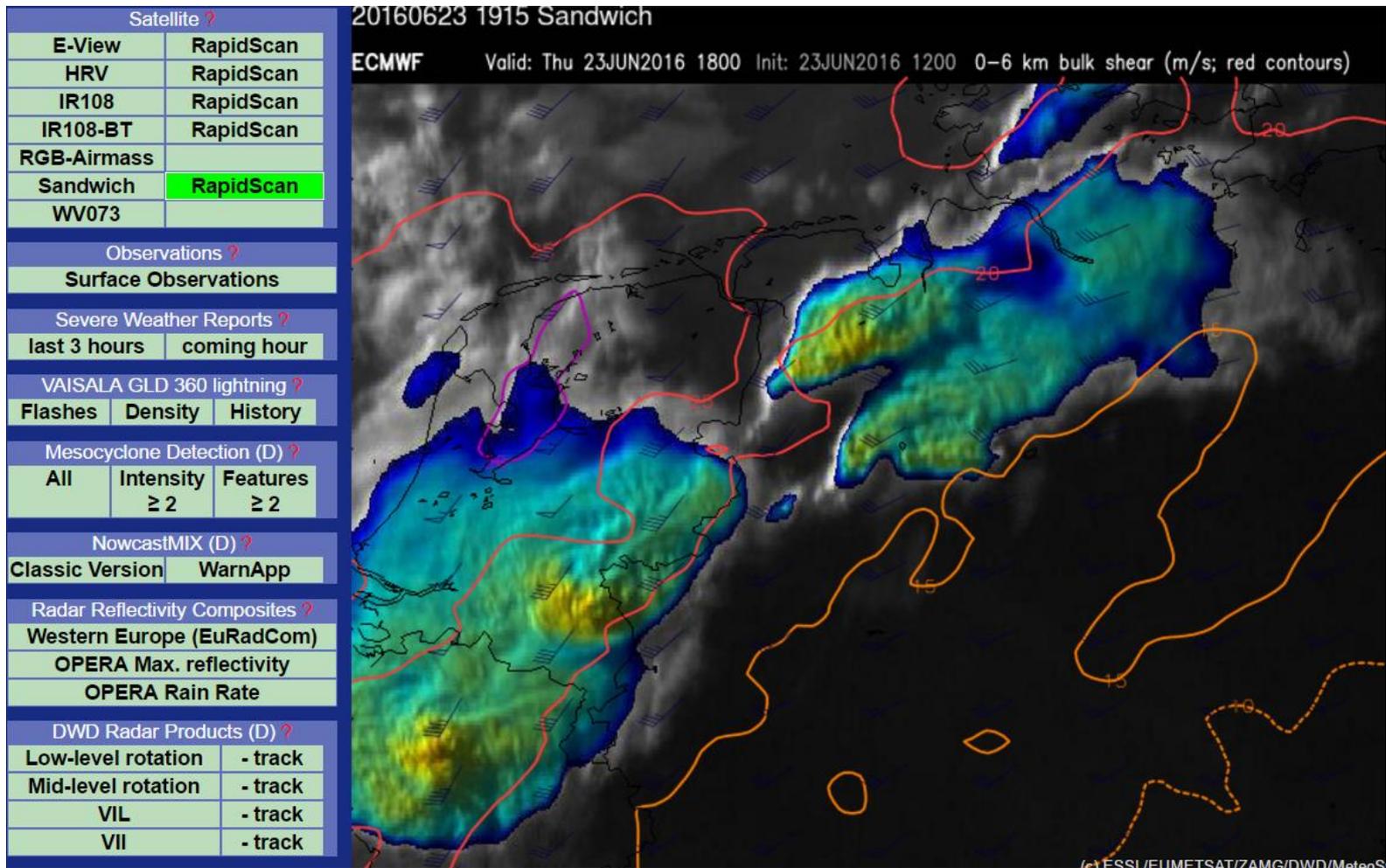
frontogenesis

Td 2m

GFS Init Fri 24 JUN 2016 00Z Wind speed at 850 hPa in m/s (contours/barbs)
Fcst Mon 27 JUN 2016 06Z Temperature (shaded) and geopotential height at 850 hPa (black)

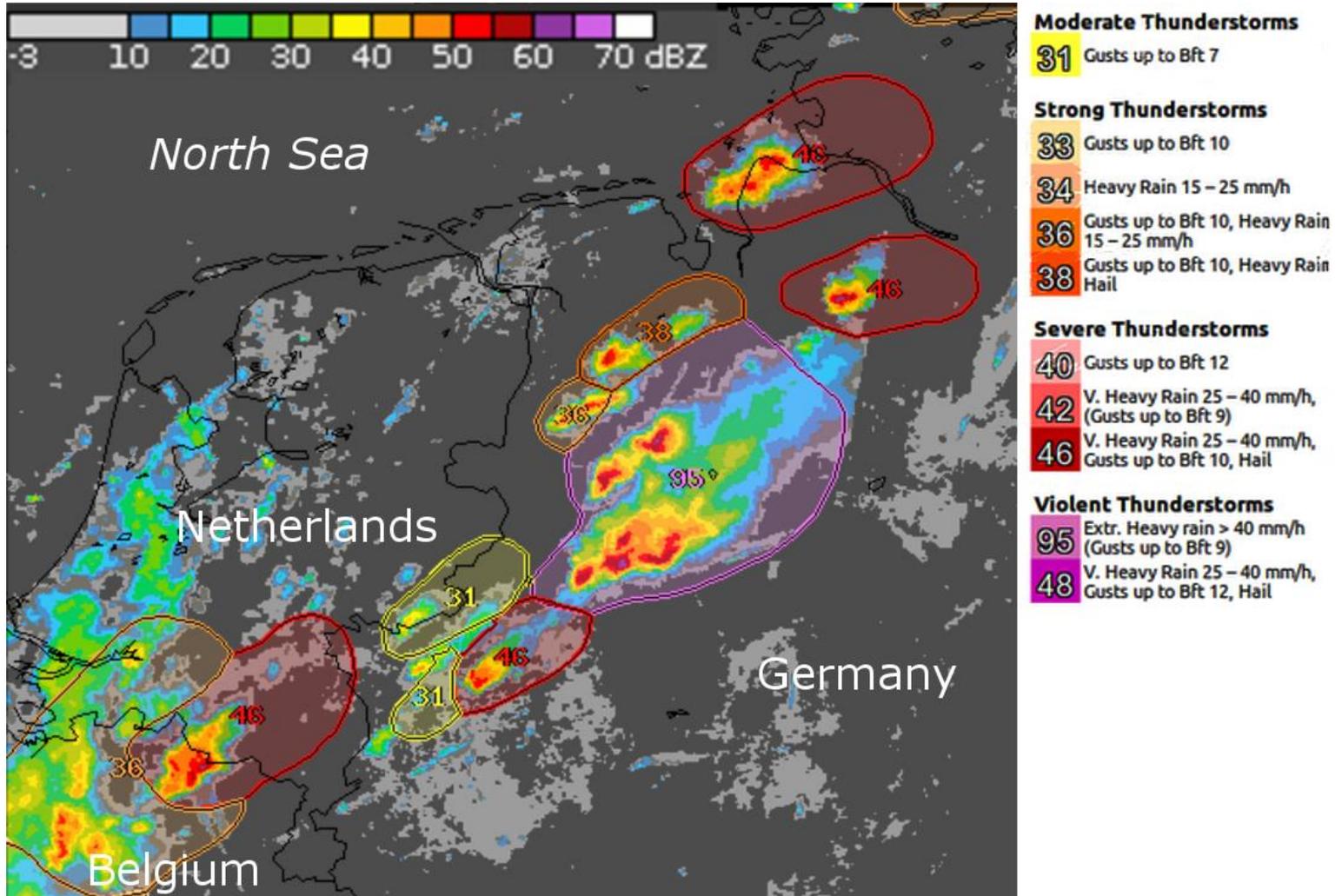


Data display





NowcastMIX



NowcastMIX Rotation and VIL-track

16 June 2016 1445 UTC

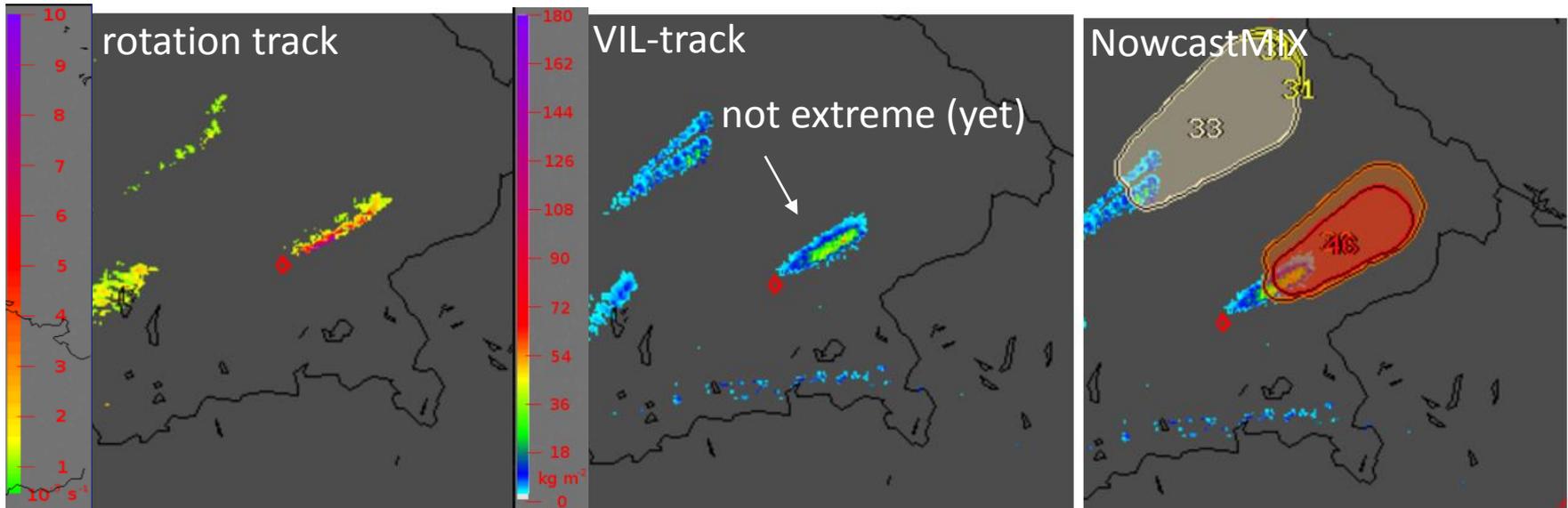
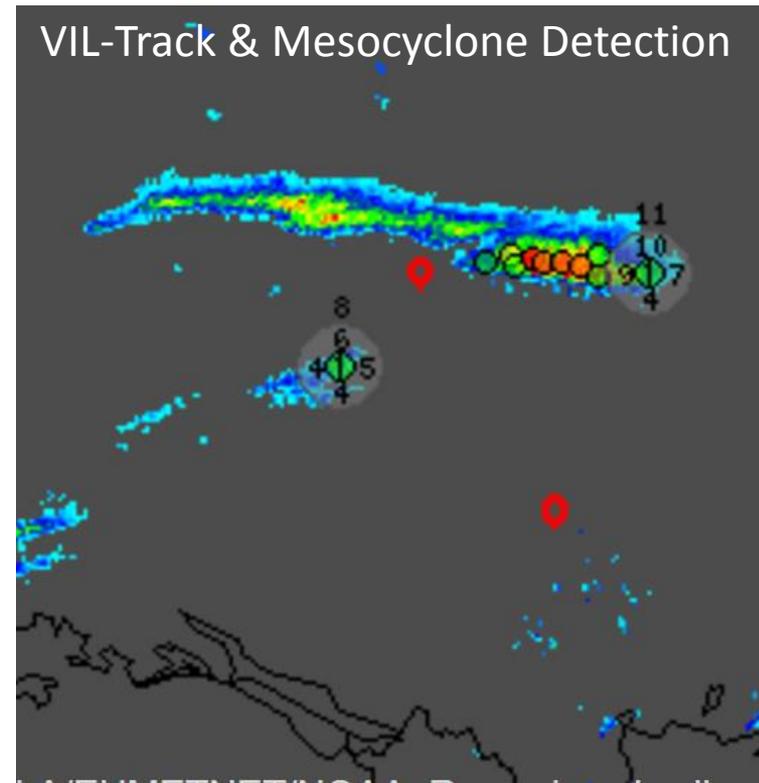
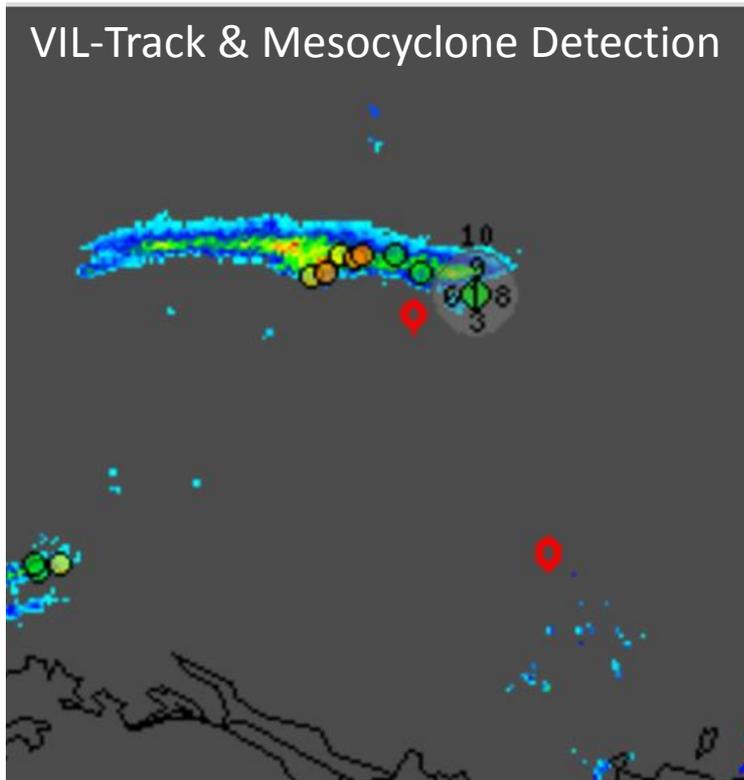


Fig. 3. 16 June 2016 1445 UTC. First 46 warning issued by WarnApp NowcastMIX was quite late, considering the strong mid-level rotation track (left) and the modest VIL (centre).



Mesocyclone Detection Algorithm

- Overall performance



- good detections, not many self-evident false alarms

Nowcast Display

Nowcast Display

- - 02 02 02 03 03 03 03 04 04 04 04 05 05 05 06 06 06 06 07 07 07 07 07 08 09 10 11 12 13 14 15 16 17 18 19
 12 6 15 30 45 00 15 30 45 00 15 30 45 00 15 30 45 00 15 30 45 00 15 30 45 00 00 00 00 00 00 00 00 00 00 00
 hr hr

Date & Time
 201705040800
 YYYYMMDDHHMM

Satellite ?

E-View	
HRV	
IR108	
IR108-BT	
RGB-Airmass	
Sandwich	
WV073	

Observations ?

Surface Observations

Severe Weather Reports ?

last 3 hours coming hour

VAISALA GLD 360 lightning ?

Flashes Density History

Mesocyclone Detection (D) ?

All	Intensity	Features
	≥ 2	≥ 2

NowcastMIX (D) ?

Classic Version WarnApp

Radar Reflectivity Composites ?

Western Europe (EuRadCom)

OPERA Max. reflectivity

OPERA Rain Rate

DWD Radar Products (D) ?

Low-level rotation	- track
Mid-level rotation	- track
VIL	- track
VII	- track

DWD Lightning (D) ?

LINET Flash Density - track

NOWCAST-SAF products ?

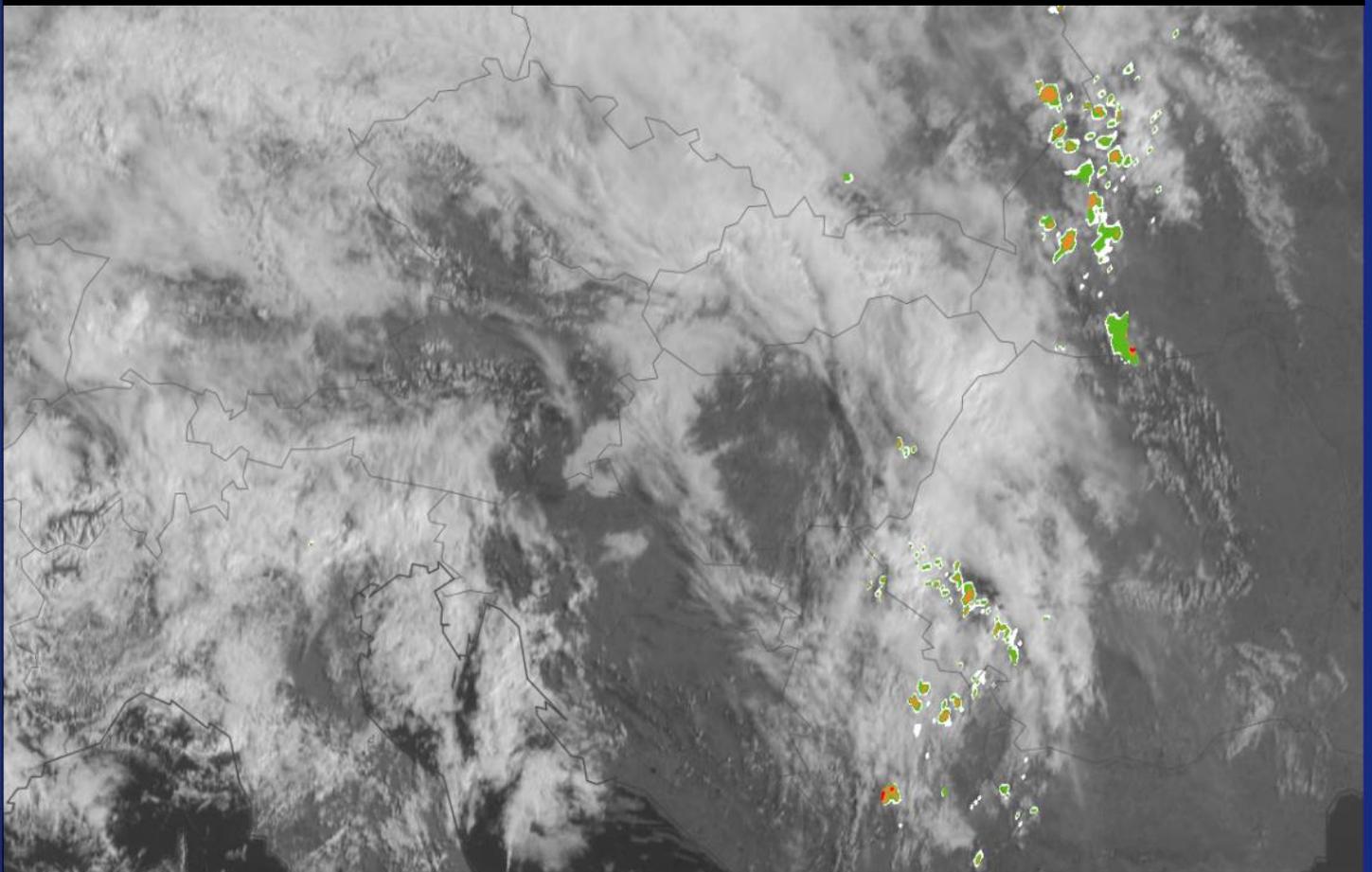
CI Convective Initiation

TPW Total Precipitable Water

Nowcast data	Model data	High Resolution Ensembles	Surface Maps	Make Nowcast	Verification	Product Evaluation	External Links
--------------	------------	---------------------------	--------------	--------------	--------------	--------------------	----------------

20170504 0745 MET10 HRV

NOWCAST-SAF Convective Initiation probability next 30 min. 0-25 25-50 50-75 75-100 %



Domains ?

Europe	Fa
NorthWest	M
NorthEast	W
Central	
SouthWest	S
SouthEast	TH
NorthGermany	

NWP Models

	E	C
	G	M
	F	S
	F	S
	S	F
300 hPa	X	
500 hPa	X	
700 hPa	X	
850 hPa	X	
CAPE	X	
320K IPV	X	
lapse rate	X	
3h acc. prp.	X	
0.1km shear	X	
0.3km shear	X	
0.6km shear	X	
0.1 SRH	X	
0.3 SRH	X	
T 2m	X	
Td 2m	X	
500 hPa vort	X	
10m wind	X	

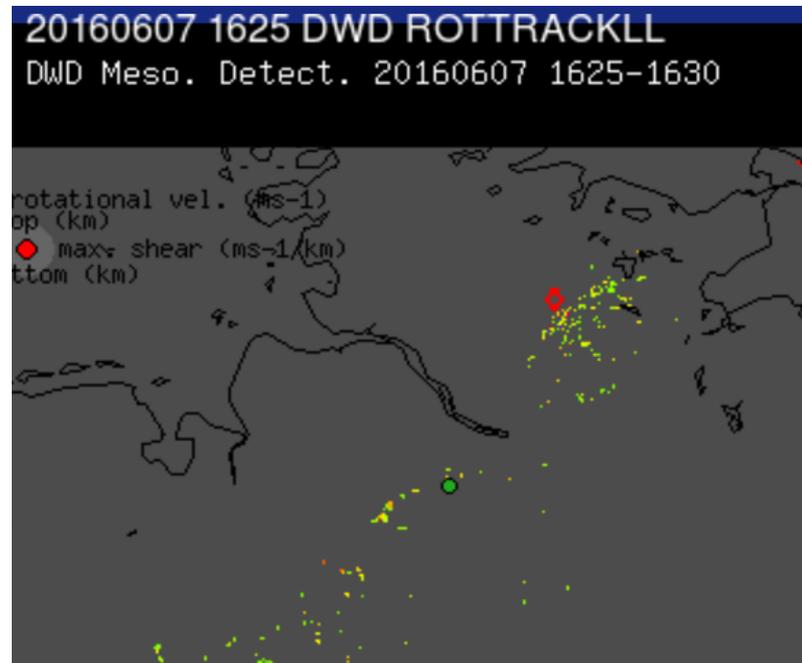
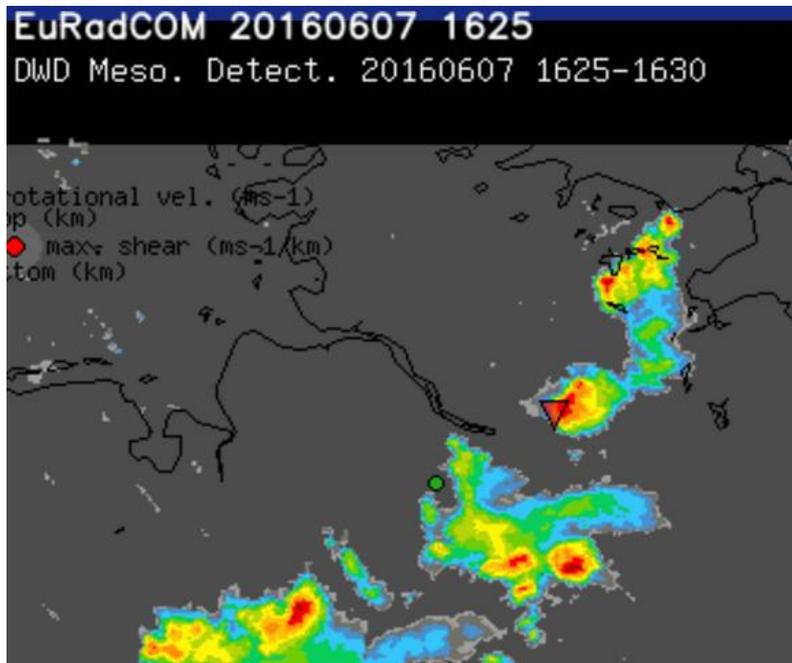
Roaming Sounding

Switch on?

VIL/VII- and Rotation-Track products

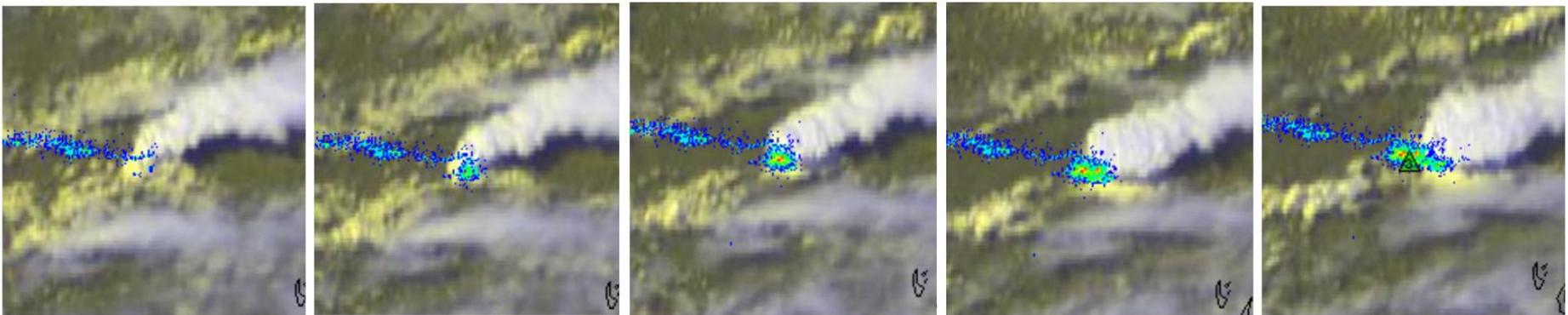
Evaluation focus points:

- Rotation track performance
 - product not suited for detecting non-mesocyclonic tornadoes
- reminder: it worked well on 13 May 2015 ☺



Lightning Track Product

- occasionally lightning jumps preceded severe weather; on other occasions it did not
- resolution of the data was a returning point of discussion. probably, on ESSL display, the 1 x 1 km grid was rather fine, but zoomed-in it was good.
- colorscale was not liked by everyone (more contrasting colors requested)
- someone noted that slow-moving storms would seem to have higher flash rates than fast-moving ones. **Cell-based flash rate** was suggested.



Storm on 27 May north of Ulm at 1410, 1420, 1430, 1440 and 1450 UTC. Hail was reported at 1445 after a lightning jump between 1410 and 1420 UTC.



Financing of Testbed 2016

Revenues		Expenses	
Testing fees	41000	Share of IT costs (server, IT-support)	10000
Participation fees	22000	Other infrastructure (rent, office equipment, cleaning...) and travel costs	12000
		Consumables (paper, coffee, toner,...)	2000
		ESSL personnel on site during testbed (3 persons; 1 month)	18000
		Secretary to support registration	3000
		Preparations, project management, reporting, all programming work	14000
Total:	63000		63000