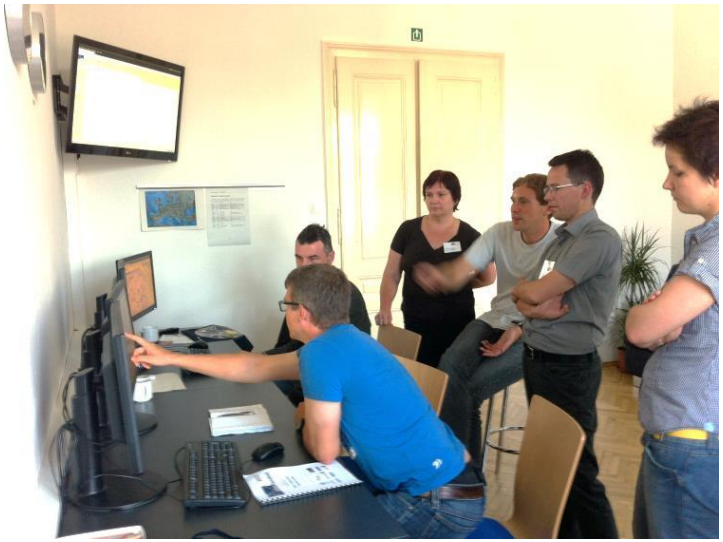
ESSL Testbed



The ESSL Testbed Data Interface

The ESSL Testbed is organized with support from:

Pieter Groenemeijer
Alois M. Holzer
Tomáš Púčik

Photos courtesy of Magdalena Pichler, Lucia Sokolová, Alois M. Holzer, Mateusz Taszarek, Isabelle Varga

ESSL Testbed

This demonstration

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

ESSL Testbed

Goals of the ESSL Testbed

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

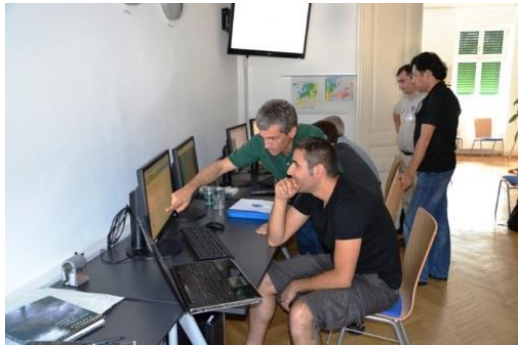
2. Evaluate new forecast-supporting products

ESSLTestbed

Procedure

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

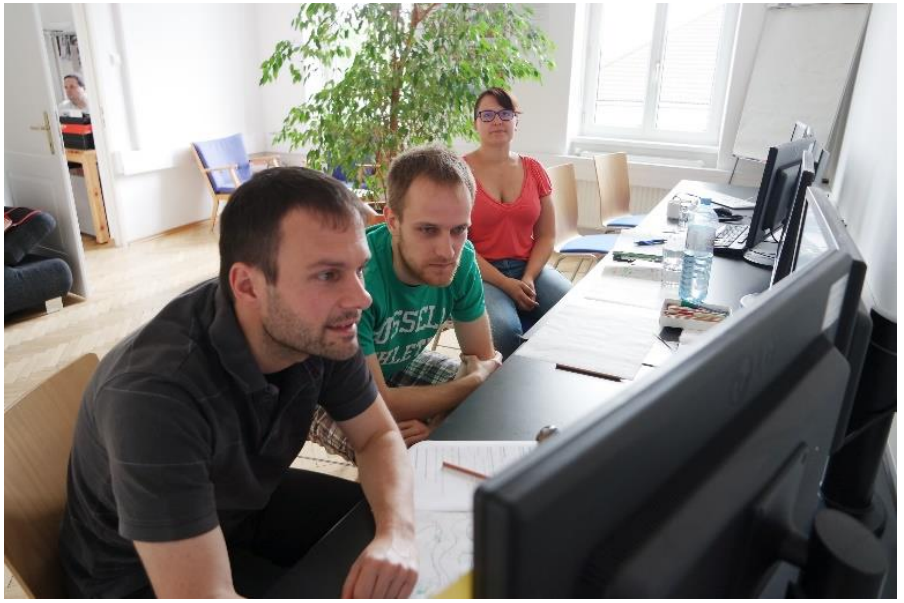
1. Participants jointly **make forecasts and nowcasts**
2. These are **verified** against observations
3. Products are **evaluated**
    - Discussion
    - Testbed Blog
    - Questionnaires



ESSL Testbed

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



ESSL Testbed

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

ESSL Testbed

Forecasting and Nowcasting at the Testbed

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   - day 1 (today)
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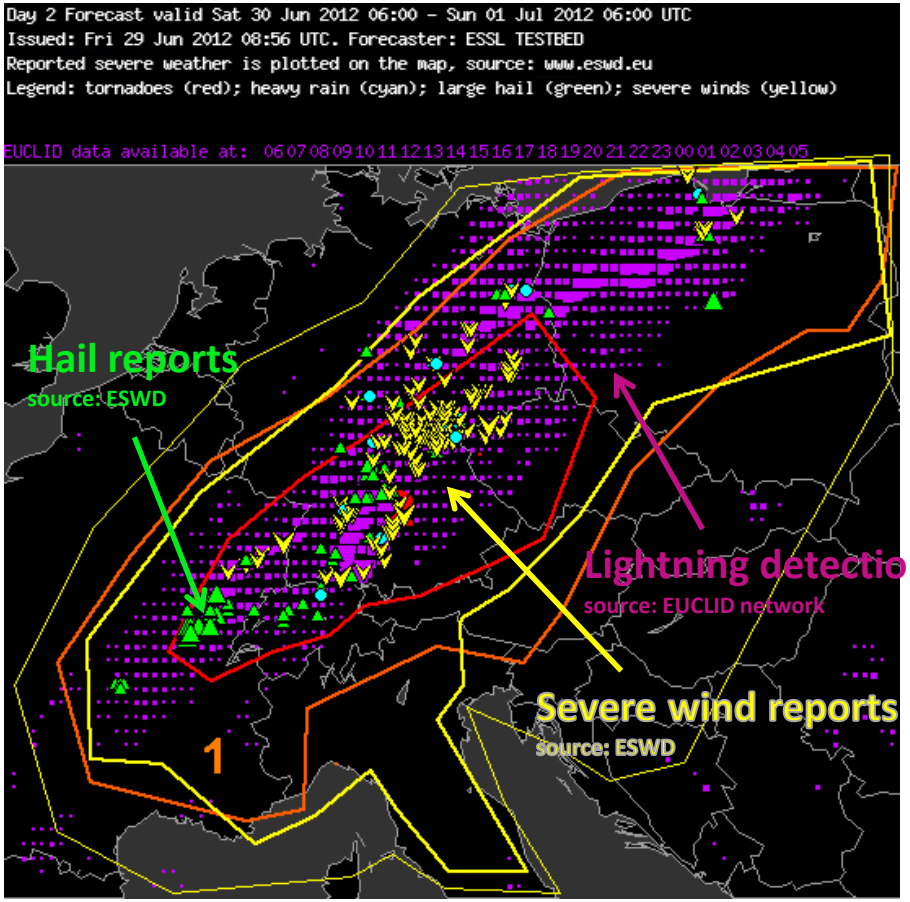
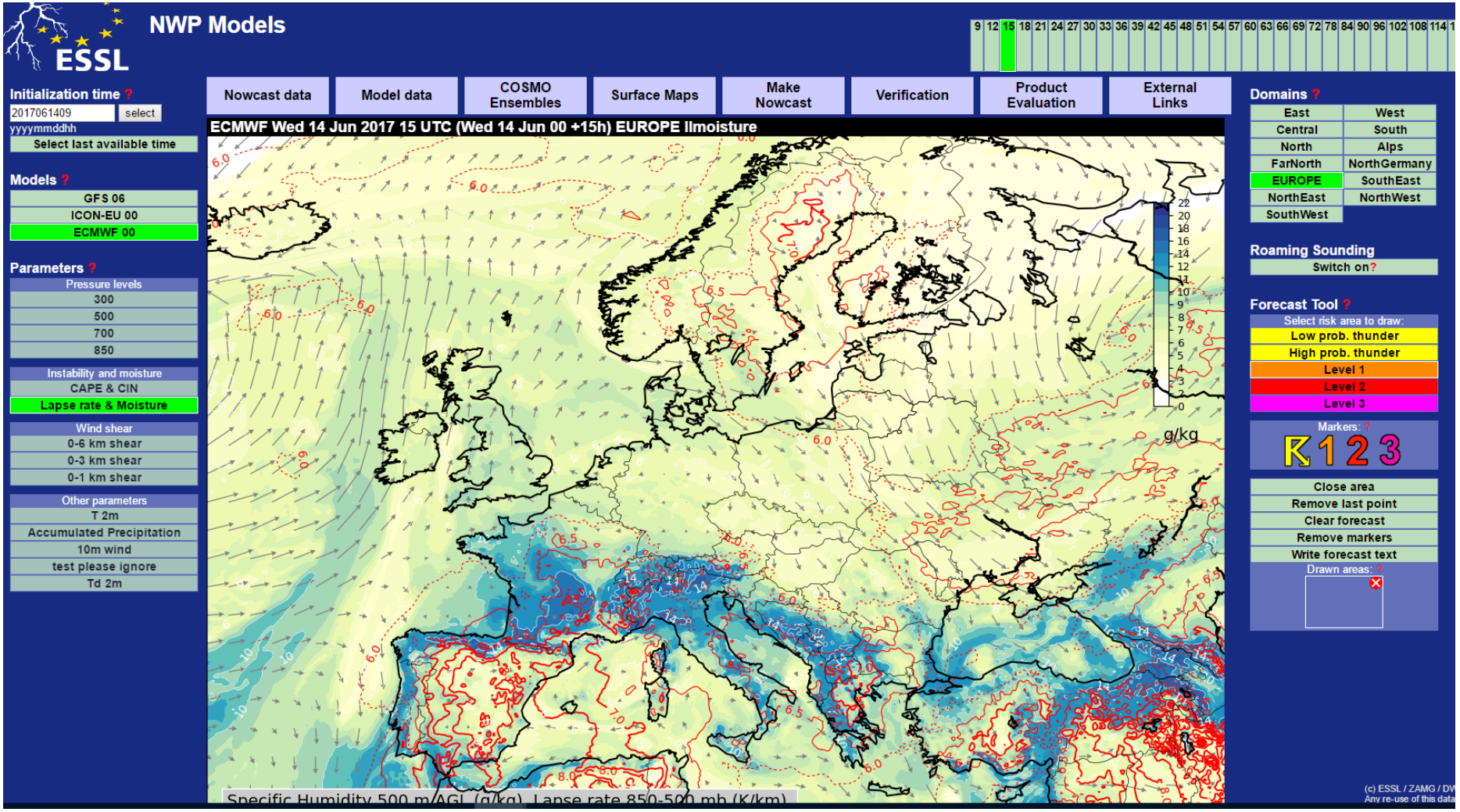


Day 2 forecast (coloured lines) with verification data (symbols reflect severe weather reports, magenta = lightning).

ESSL Testbed

ESSL Testbed Data Interface



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).

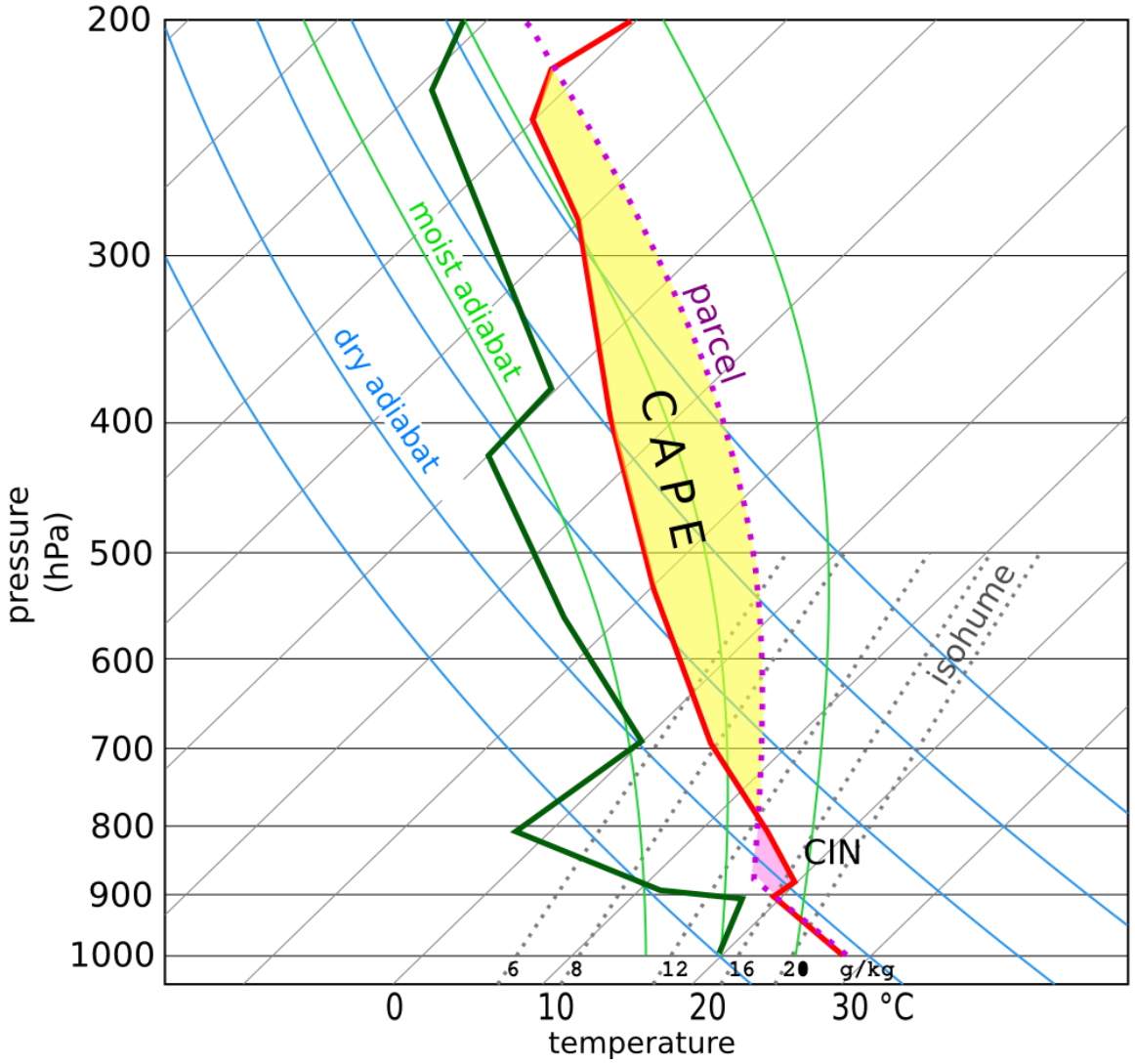
- Q: *When is the air positively buoyant?*
- A: Parcel theory: When it is less dense (typically warmer) than its environment

- 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



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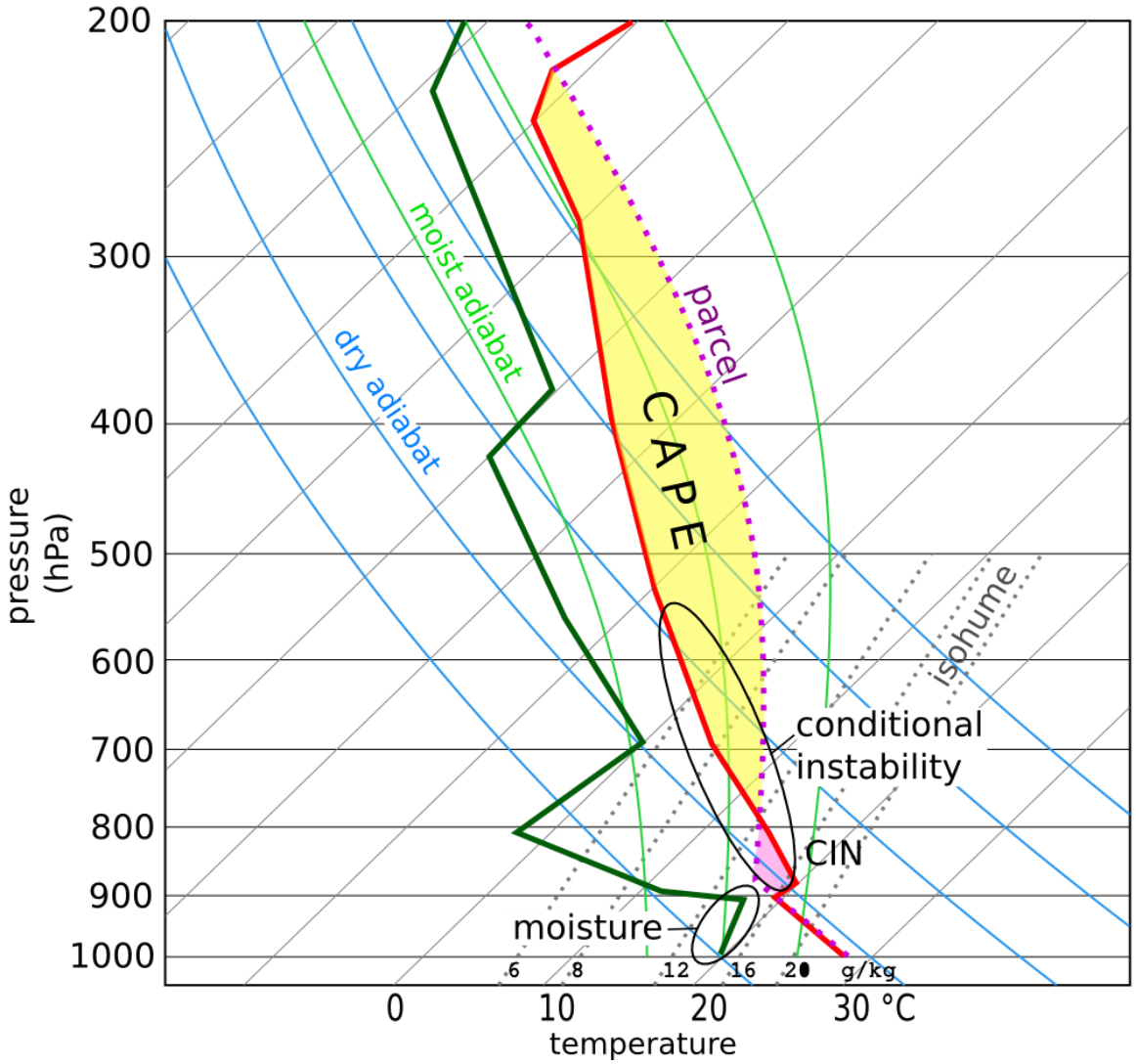
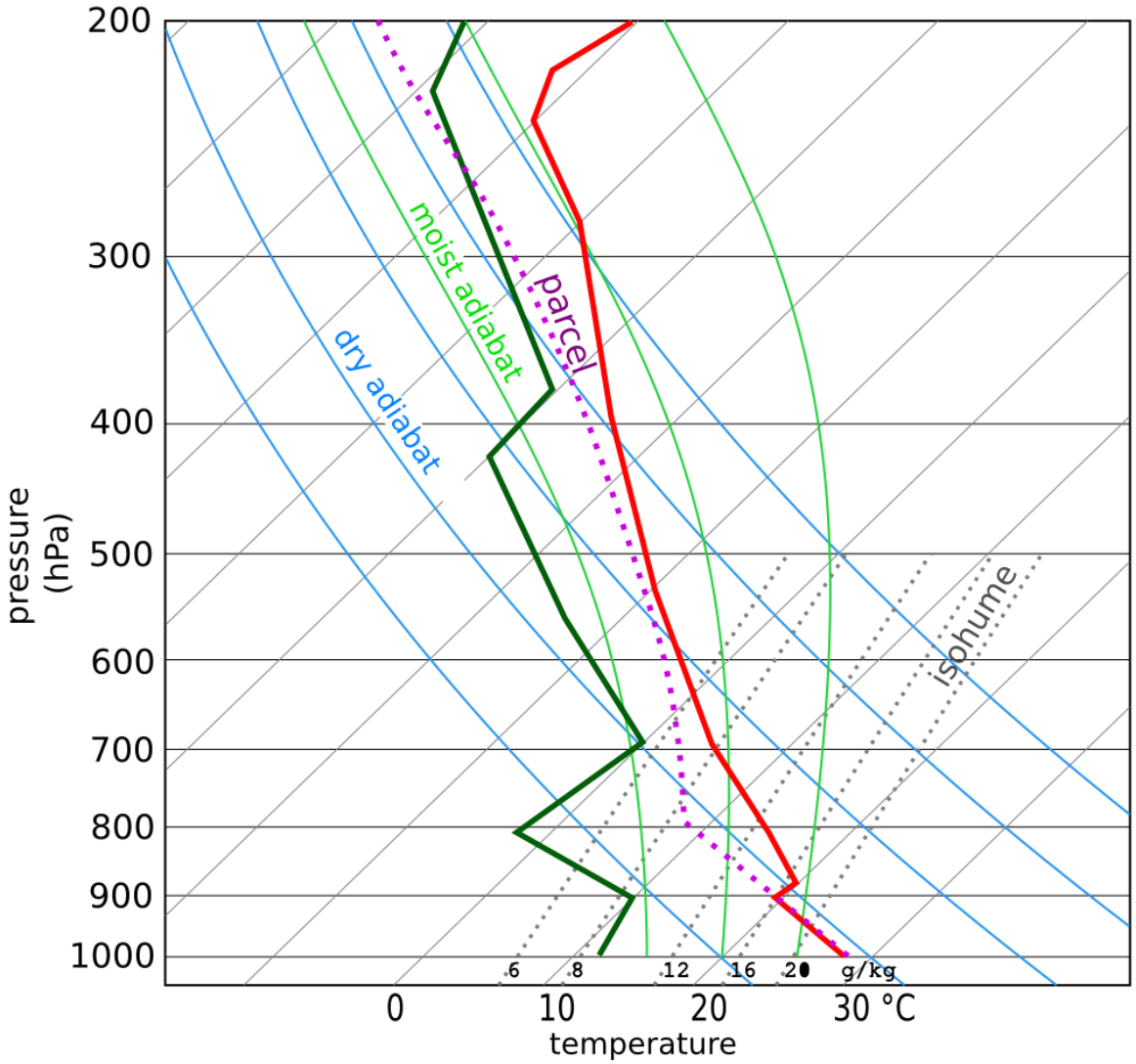


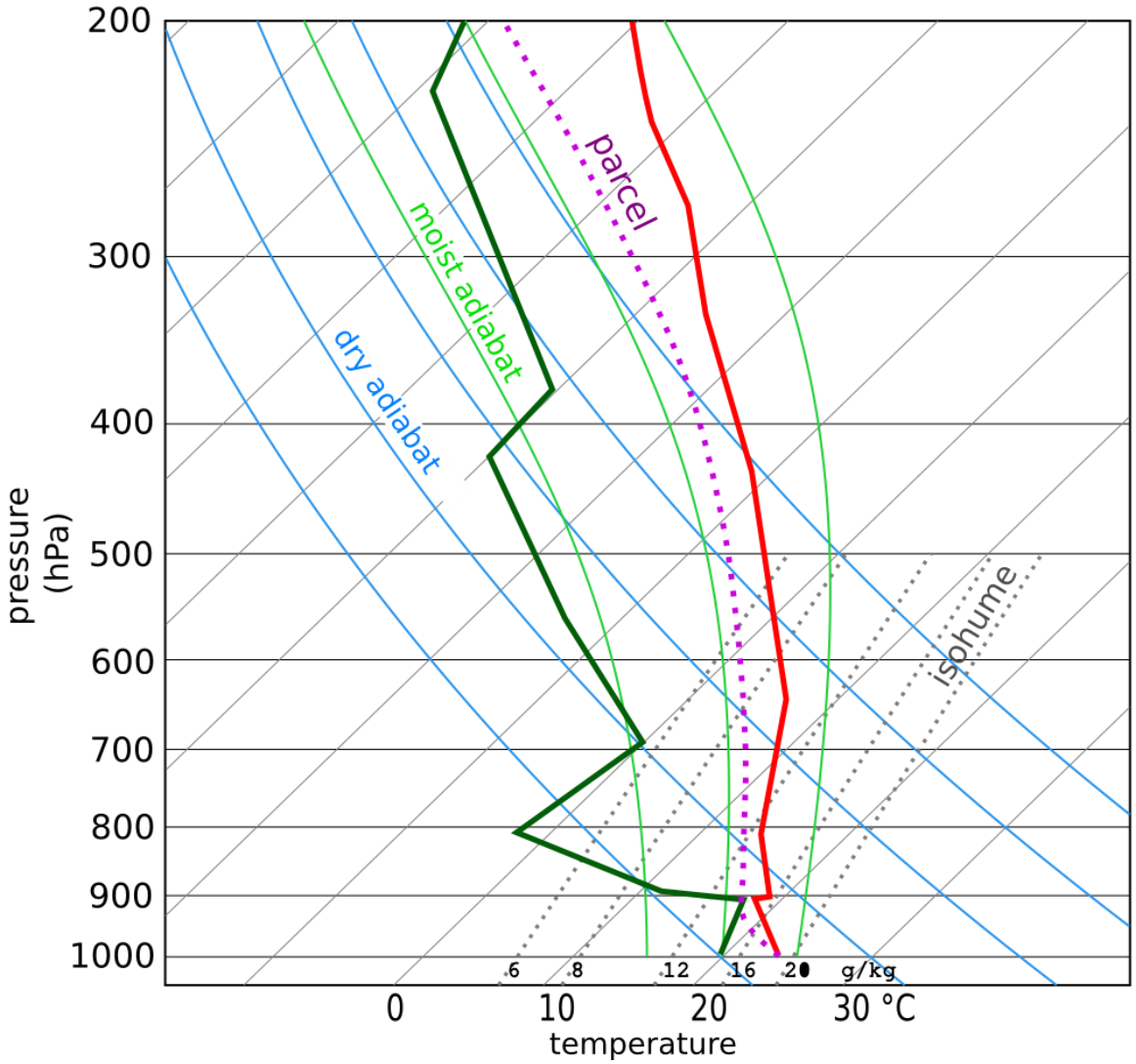
Buoyancy

No moisture:
no CAPE



Buoyancy

No lapse rates:
no CAPE either

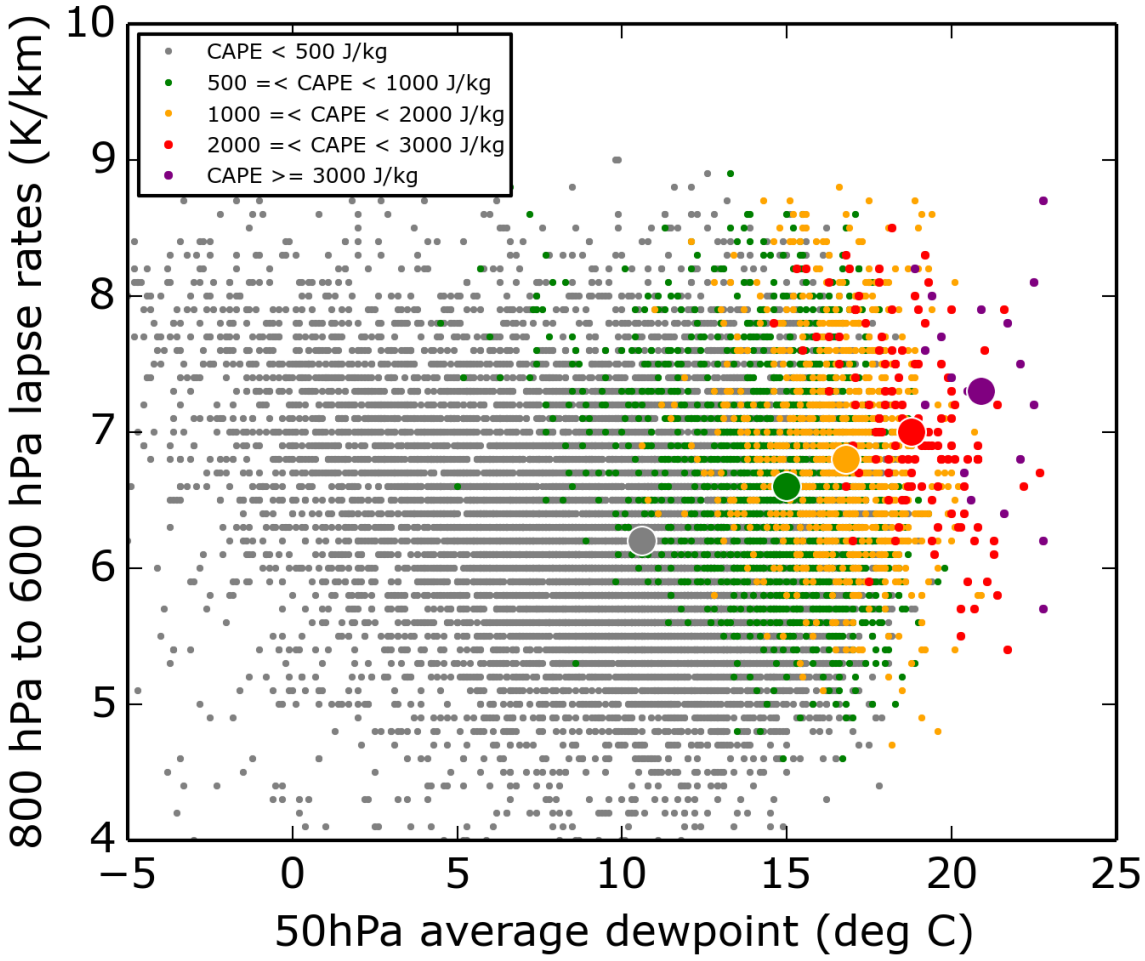


CAPE vs moisture and lapse rates

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:

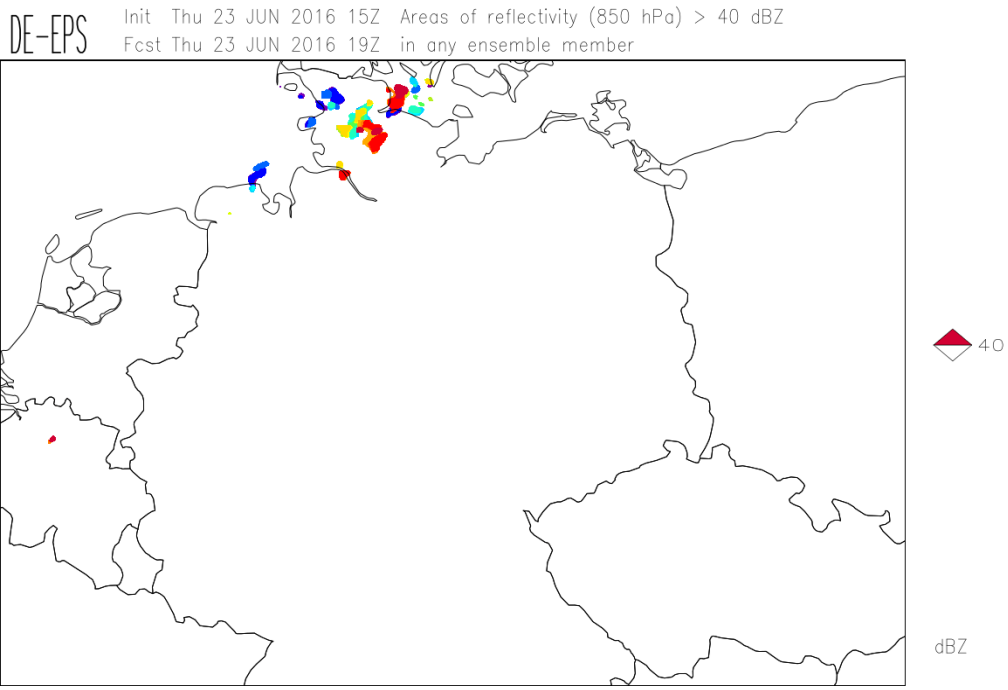
- conserved in geostrophic flow, travelling with *low to mid-level winds*
- modified slowly(!) by large-scale ascent and subsidence
- and rapidly by diabatic processes (heating)

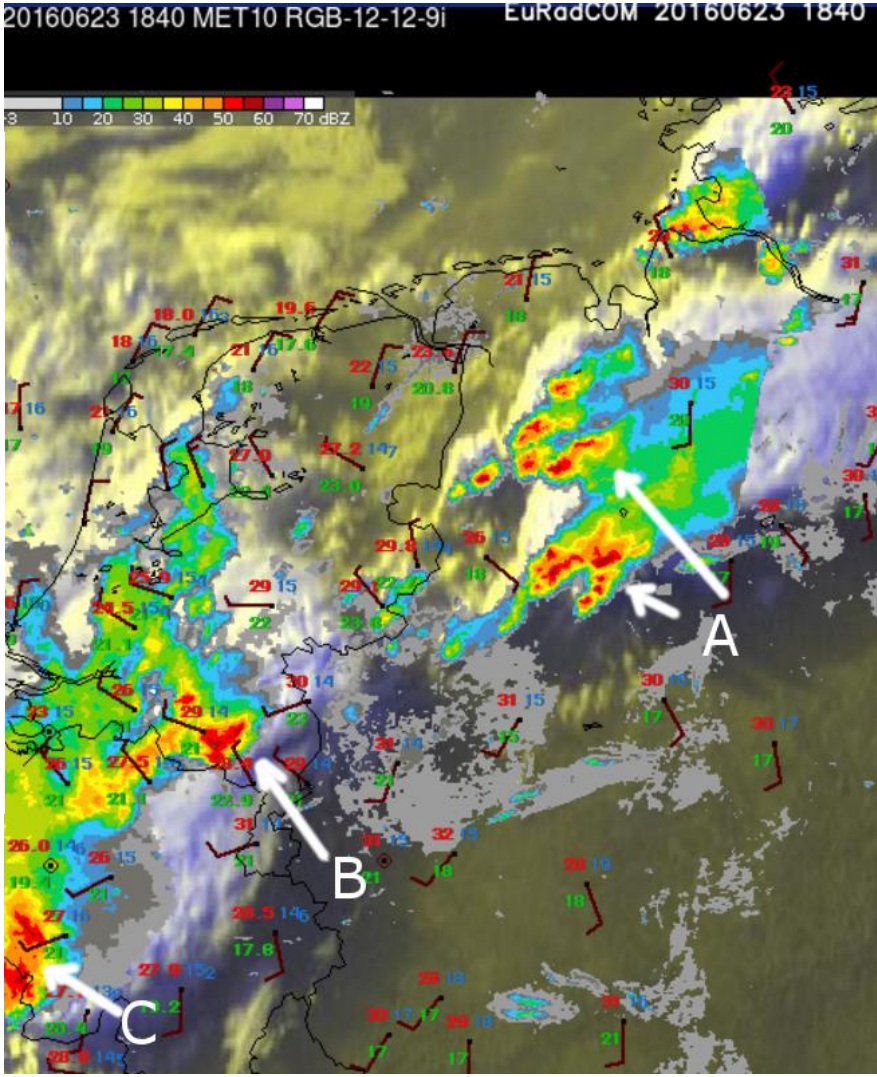
In contrast: **CAPE**, in model output just suddenly pops up.

ESSL Testbed

NWP: COSMO-DE-EPS

Case 23 June 2016

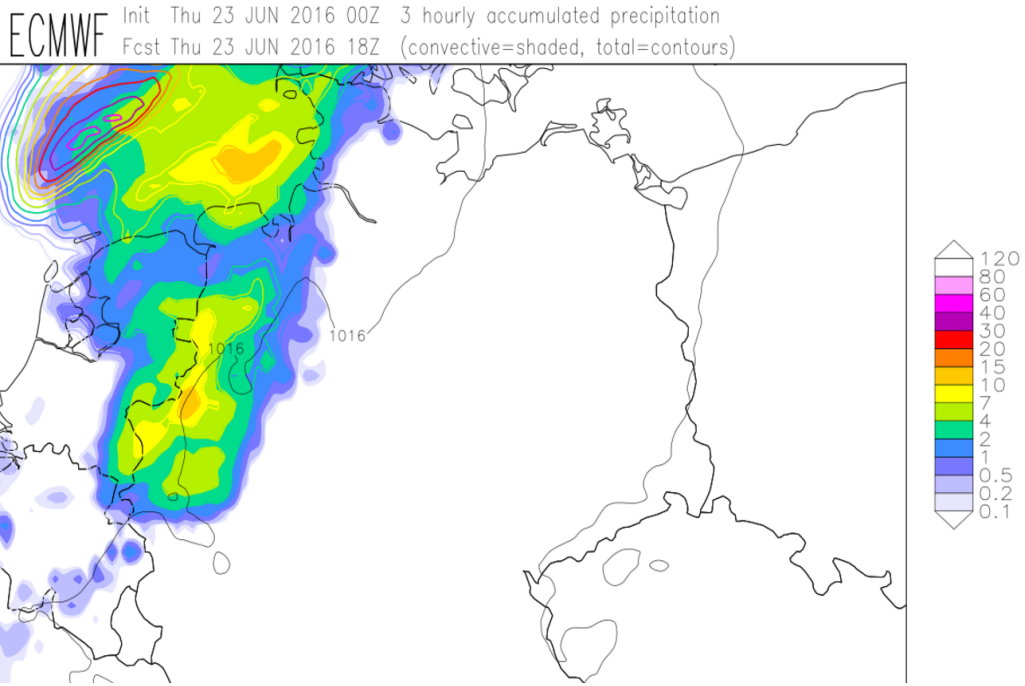


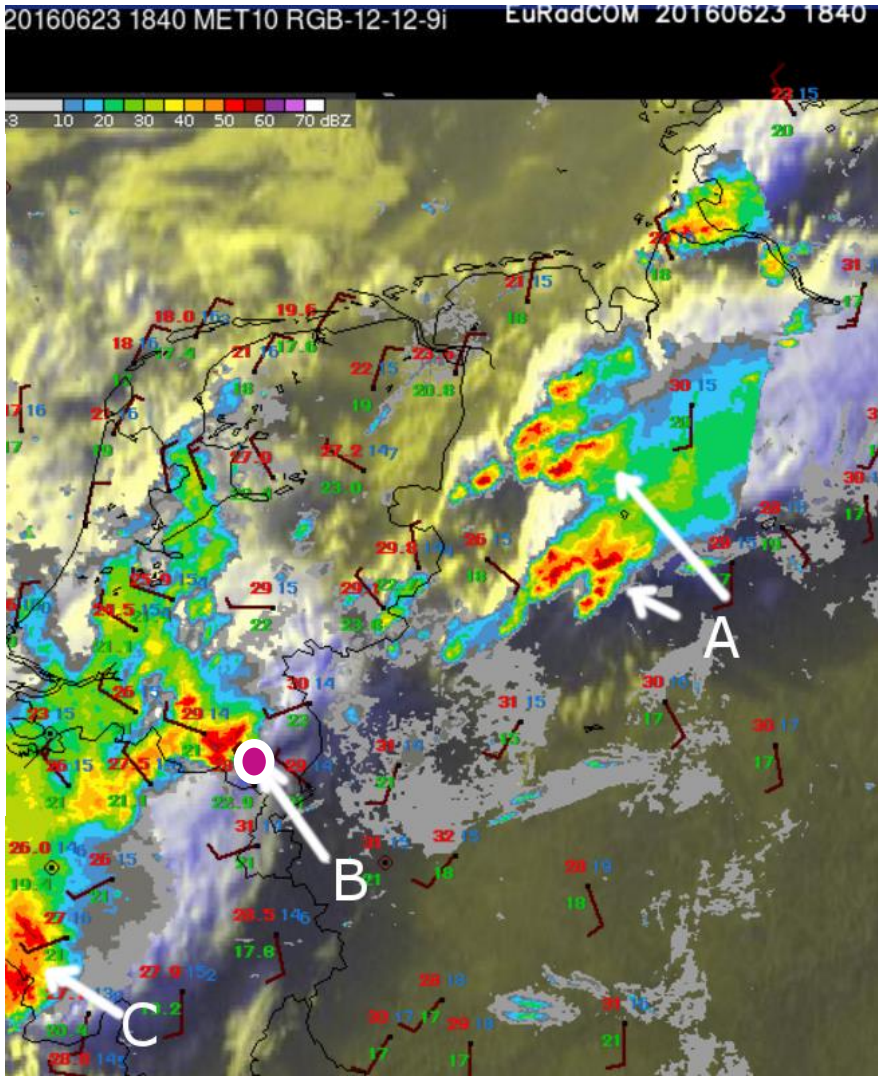


ESSL Testbed

NWP: ECMWF

Case 23 June 2016



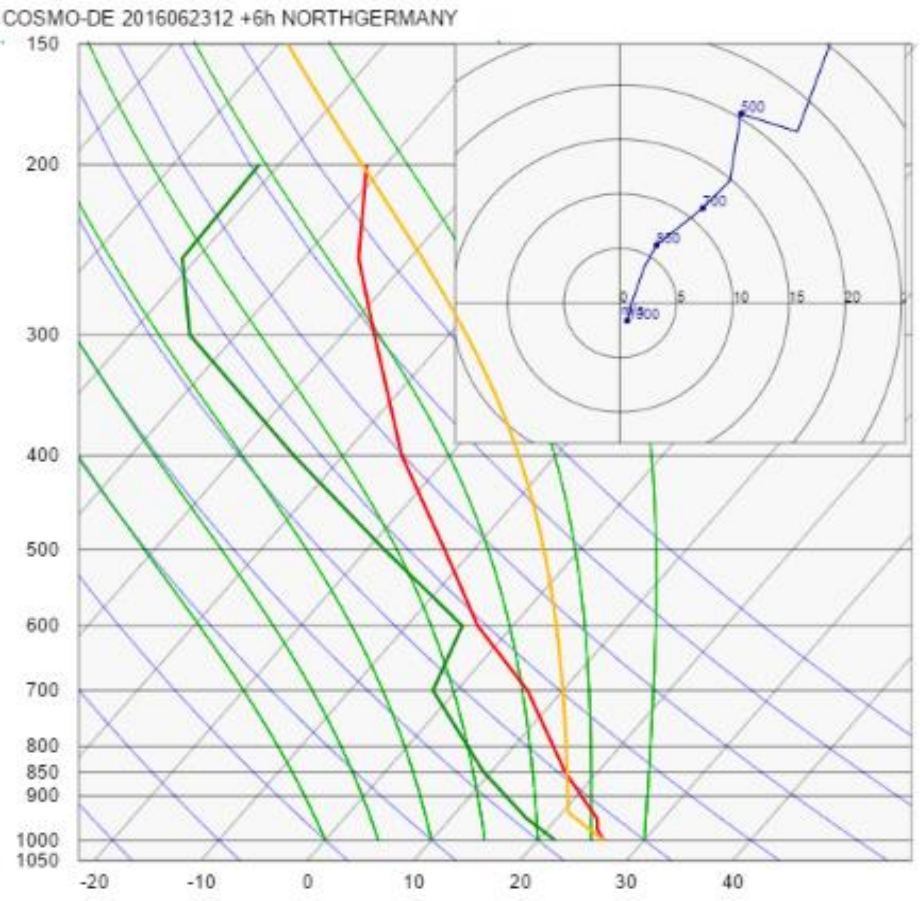


ESSL Testbed

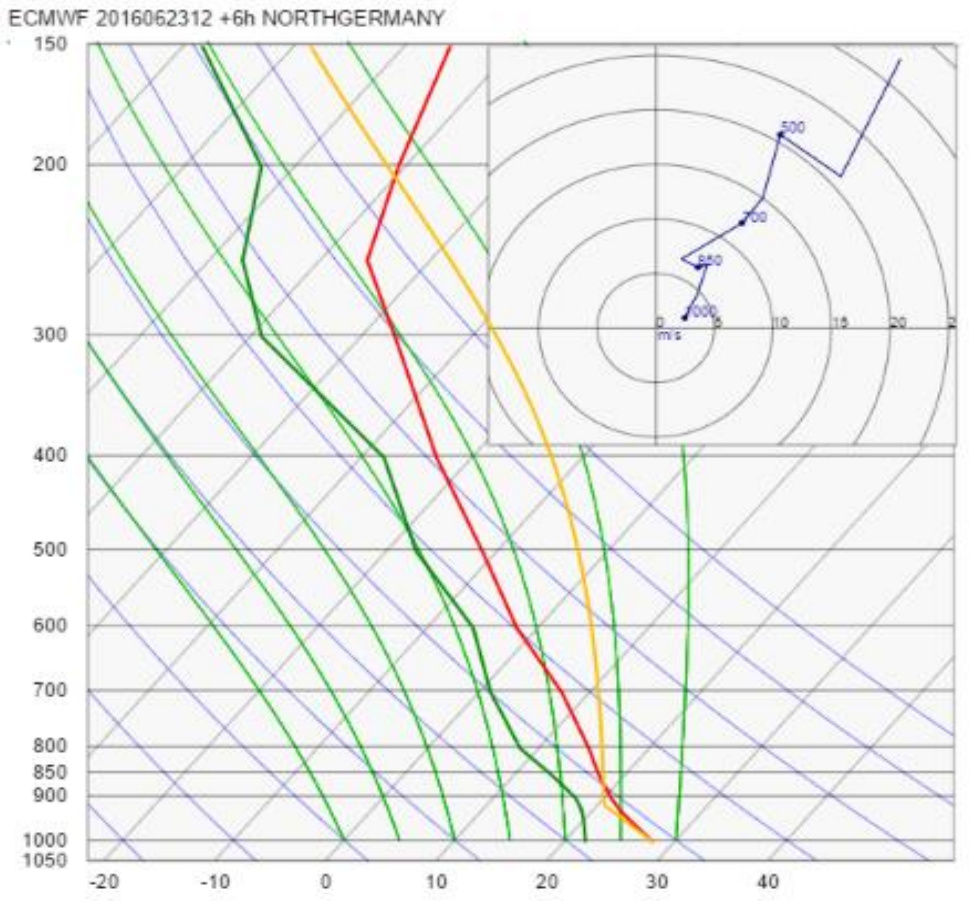
COSMO model evaluation

Case 23 June 2016

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



COSMO-DE



ECMWF

ESSL Testbed

COSMO model evaluation

Case 23 June 2016

MODEL SOUNDINGS at 18 UTC (12 UTC+06)
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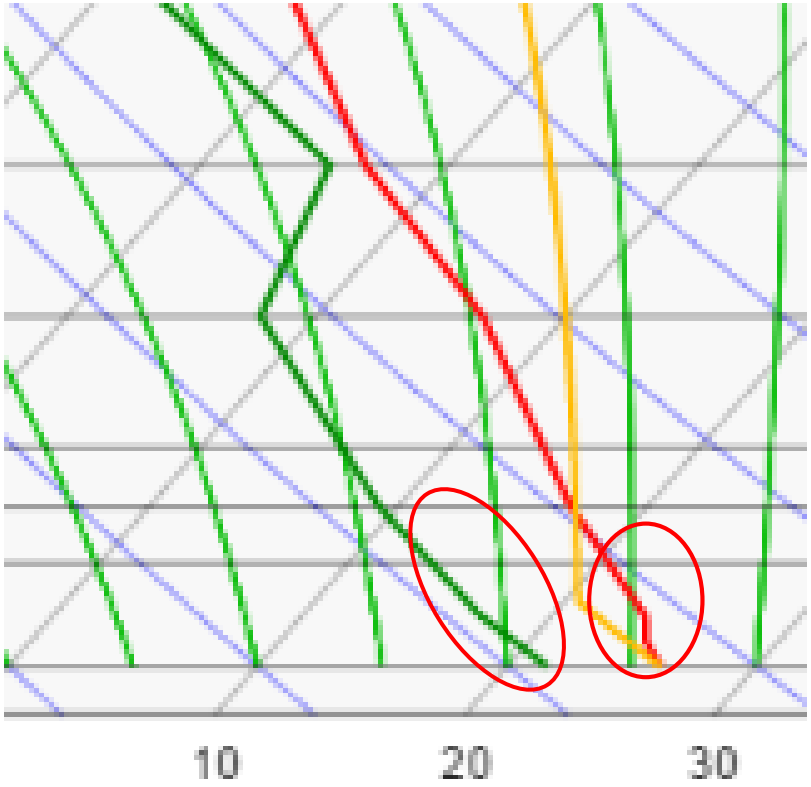
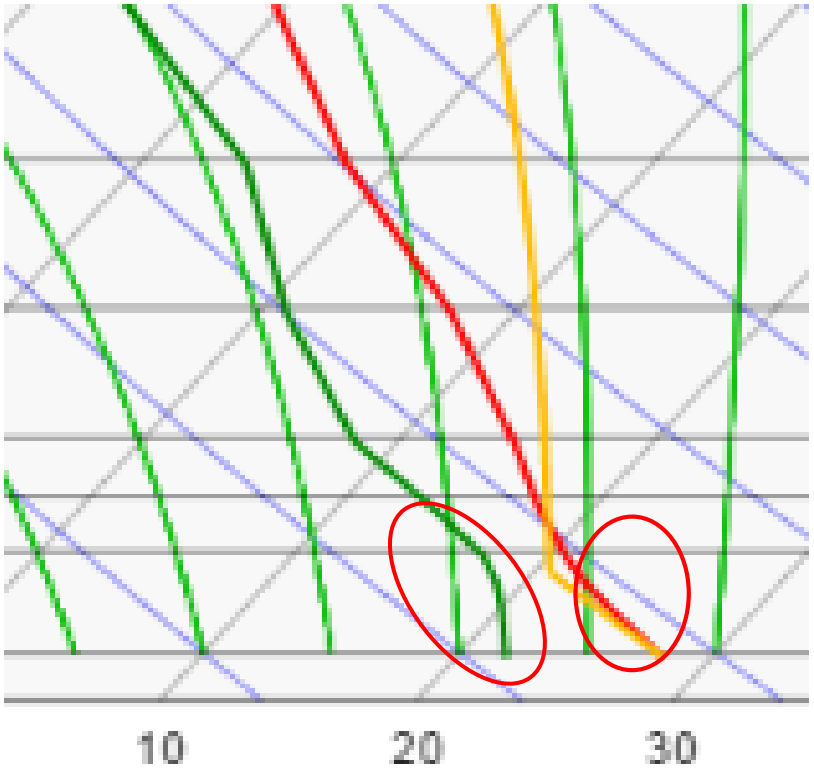


COSMO-DE



ECMWF

ESSL Testbed

ESSL Testbed Data Interface

Please open:
weather.essl.org/testbed

Username:
testbed

Password:
2016neustadt

ESSL Testbed

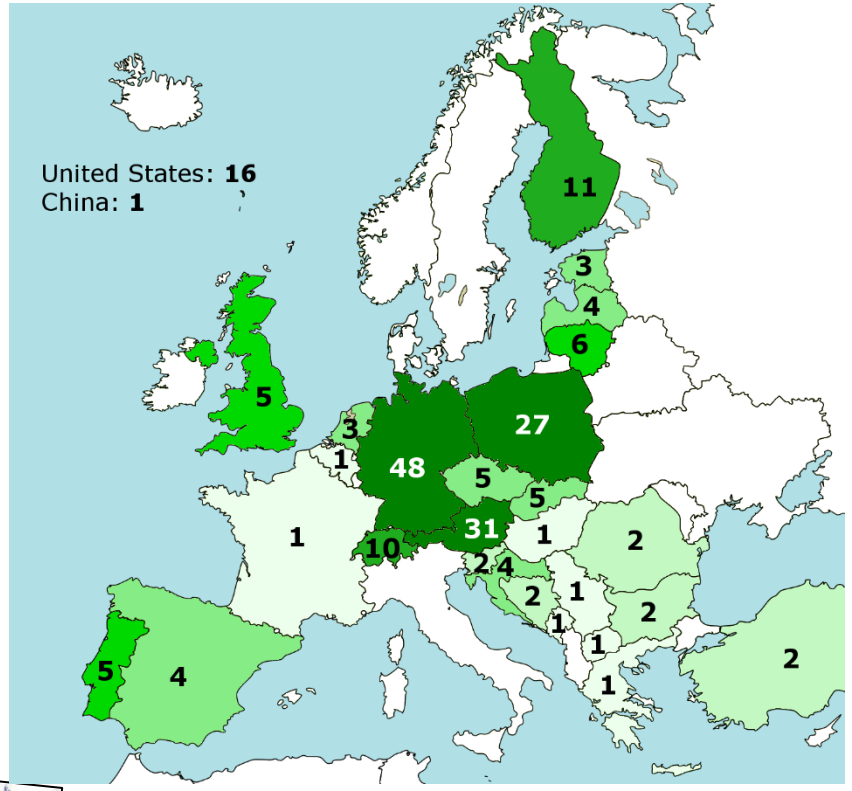
Exercise

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

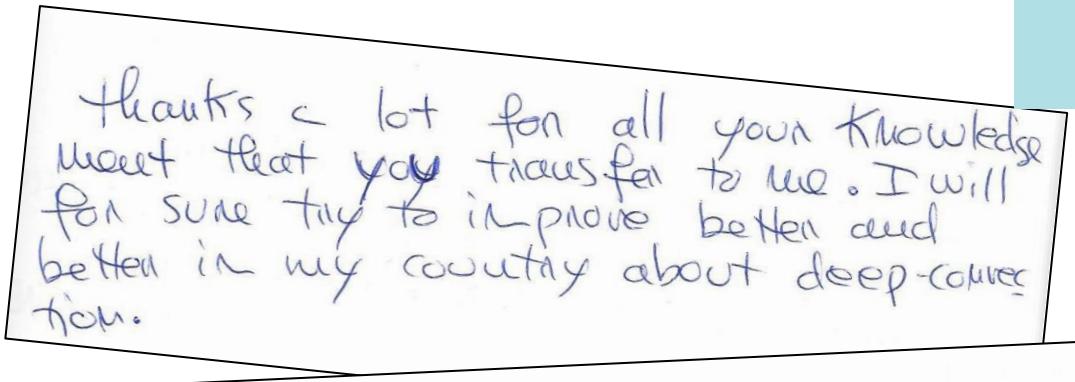
ESSL Testbed

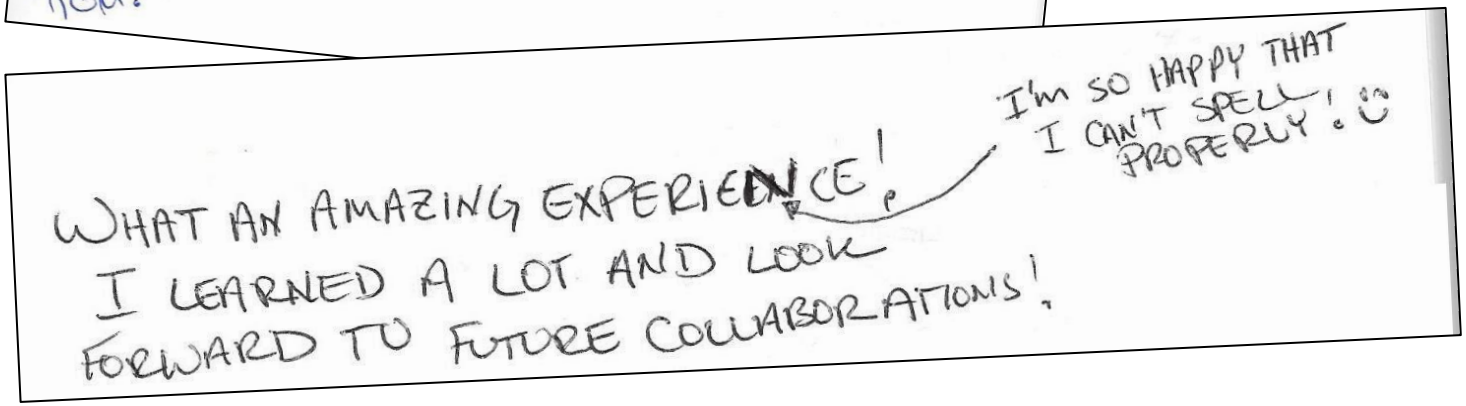
ESSL Testbed

- 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)





ESSL Testbed

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

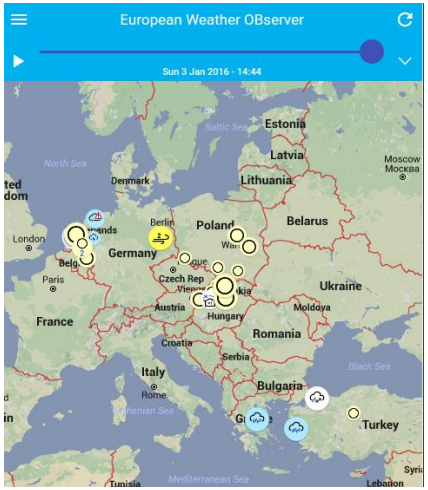
Group photos 2016:

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.

European Conference on Severe Storms

in cooperation with:

DHMZ

ECSS2017
European Conference on Severe Storms
18-22 September 2017
in Pula, Croatia
Registration open; abstract submission has closed.

BONUS SLIDES...

ESSL Testbed

Nowcasting at the Testbed

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

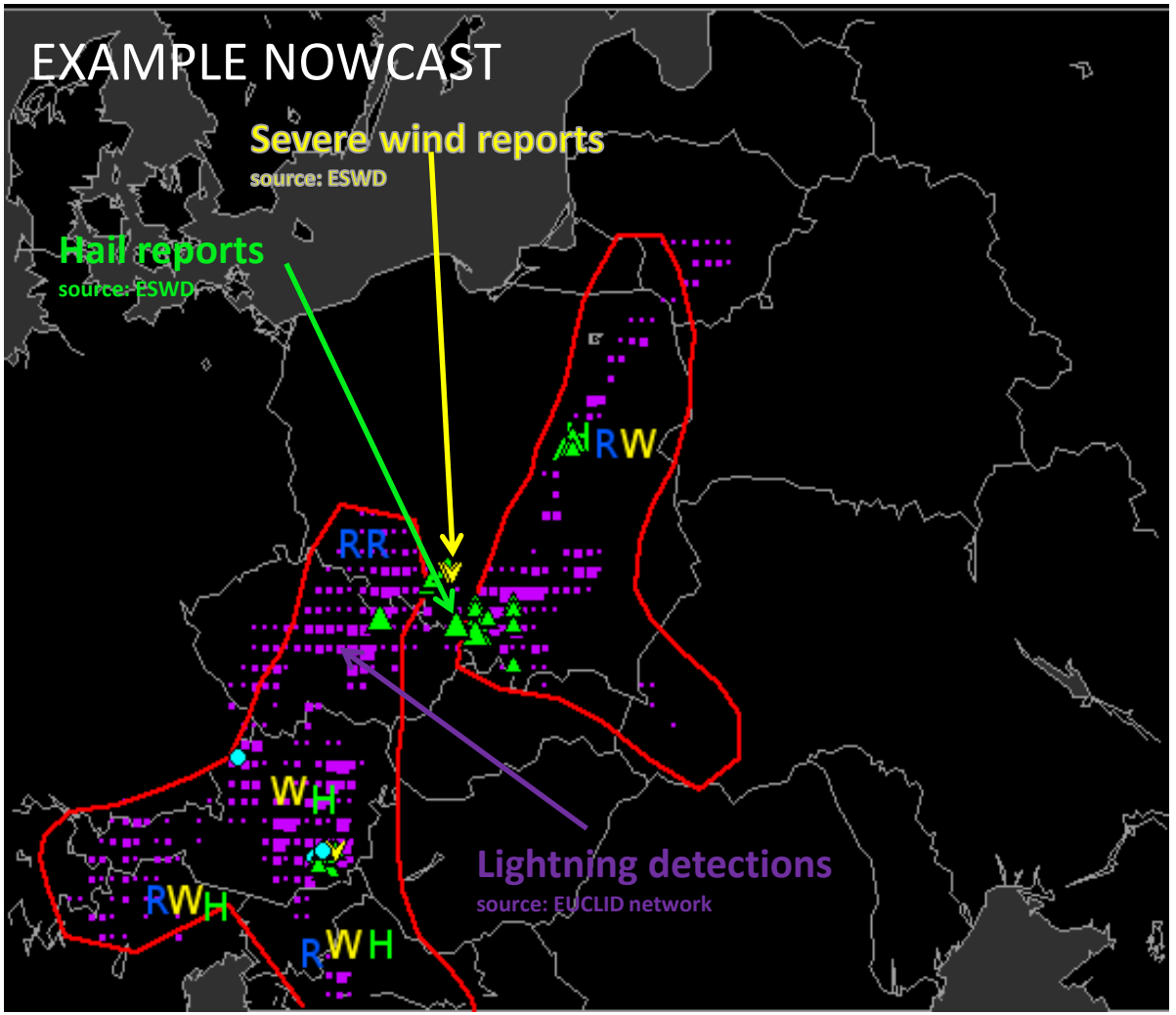
Activity:

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: Rain, Hail, Wind, or Tornadoes.

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



ESSL Testbed

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

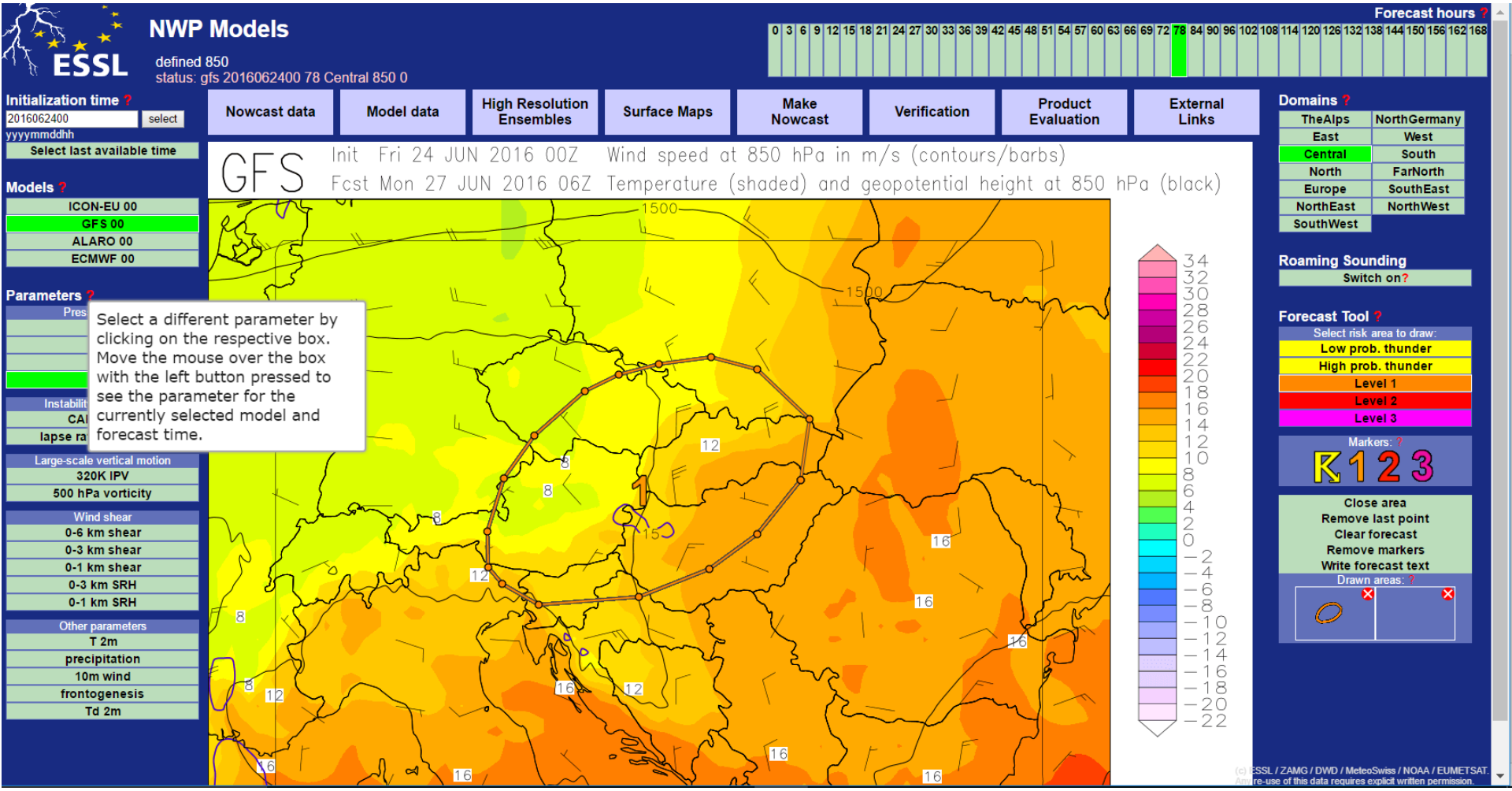
DWD radar products 2013 - …

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

- OPERA composite 2013

ESSL Testbed

Data display



ESSL Testbed

Data display

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

Observations
Surface Observations

Severe Weather Reports	
last 3 hours	coming hour

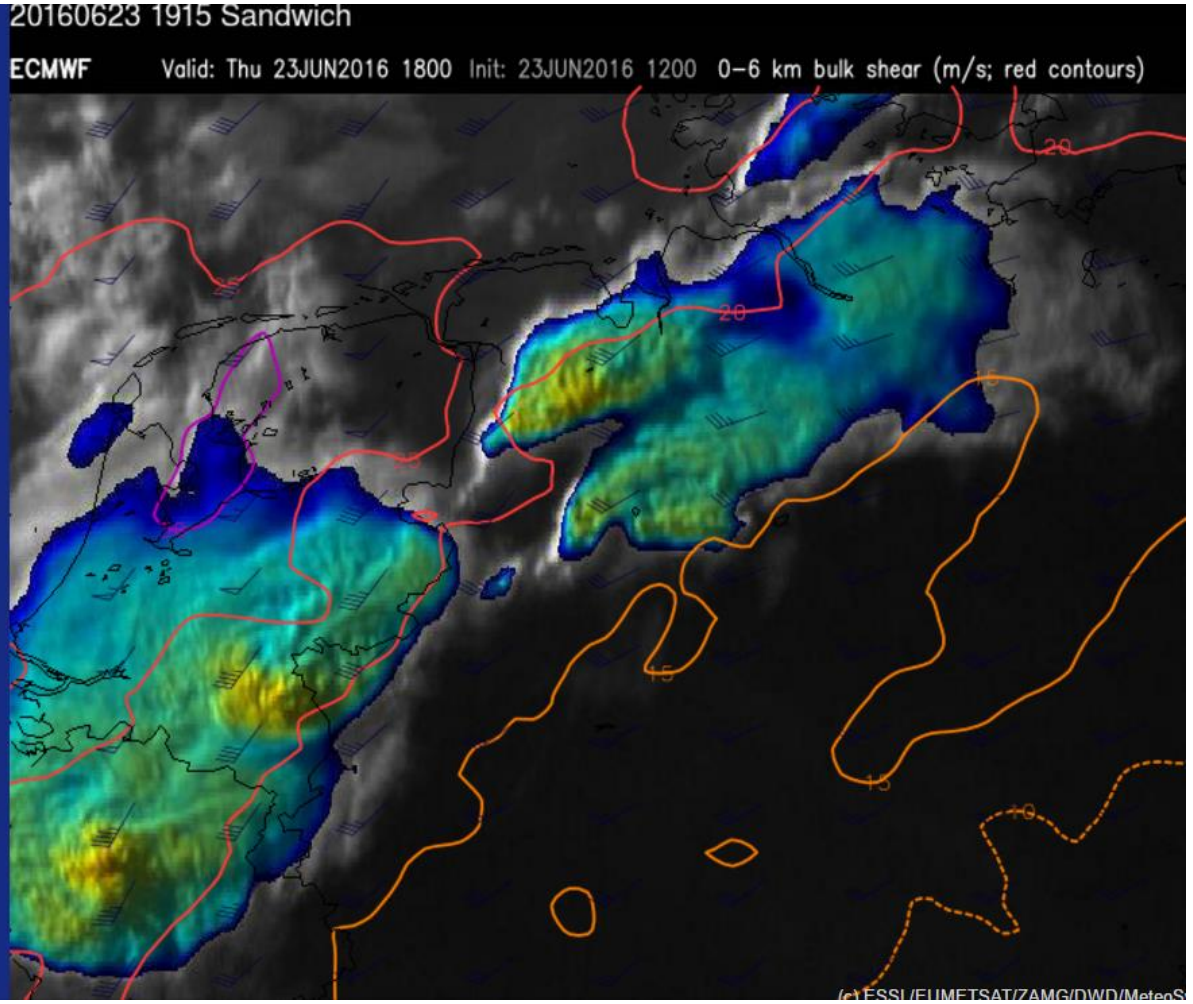
VAISALA GLD 360 lightning		
Flashes	Density	History

Mesocyclone Detection (D)		
All	Intensity ≥ 2	Features ≥ 2

NowcastMIX (D)	
Classic Version	WarnApp

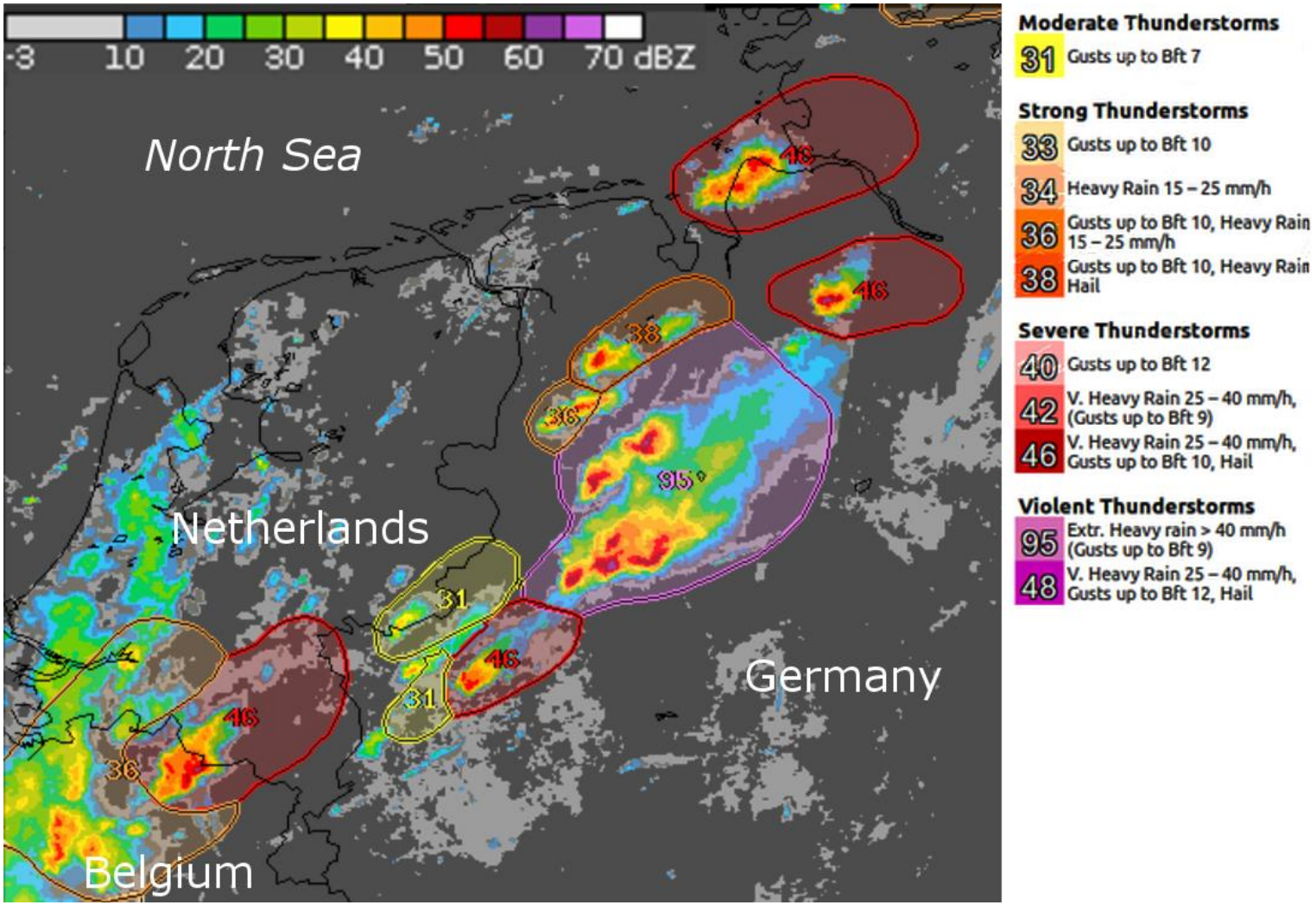
Radar Reflectivity Composites
Western Europe (EuRadCom)
OPERA Max. reflectivity
OPERA Rain Rate

DWD Radar Products (D)	
Low-level rotation	- track
Mid-level rotation	- track
VIL	- track
VII	- track



ESSL Testbed

NowcastMIX



Moderate Thunderstorms

31 Gusts up to Bft 7

Strong Thunderstorms

33 Gusts up to Bft 10

34 Heavy Rain 15 – 25 mm/h

36 Gusts up to Bft 10, Heavy Rain 15 – 25 mm/h

38 Gusts up to Bft 10, Heavy Rain Hail

Severe Thunderstorms

40 Gusts up to Bft 12

42 V. Heavy Rain 25 – 40 mm/h, (Gusts up to Bft 9)

46 V. Heavy Rain 25 – 40 mm/h, Gusts up to Bft 10, Hail

Violent Thunderstorms

95 Extr. Heavy rain > 40 mm/h (Gusts up to Bft 9)

48 V. Heavy Rain 25 – 40 mm/h, Gusts up to Bft 12, Hail

ESSL Testbed

NowcastMIX
Rotation and VIL-track

16 June 2016 1445 UTC

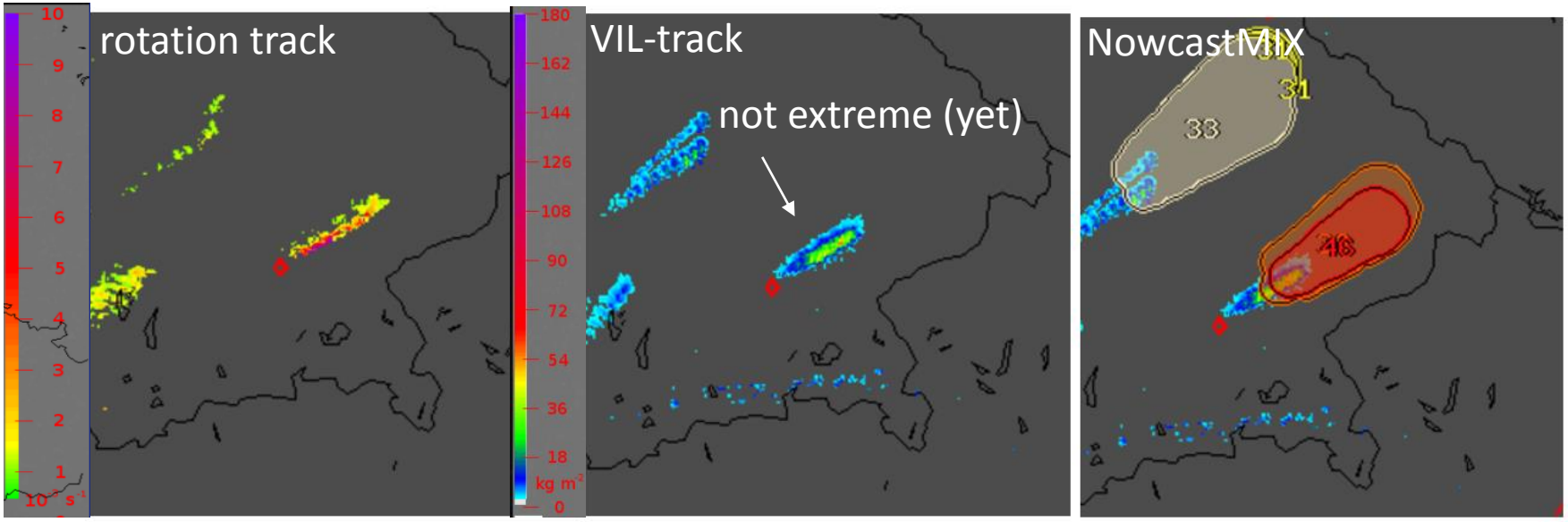
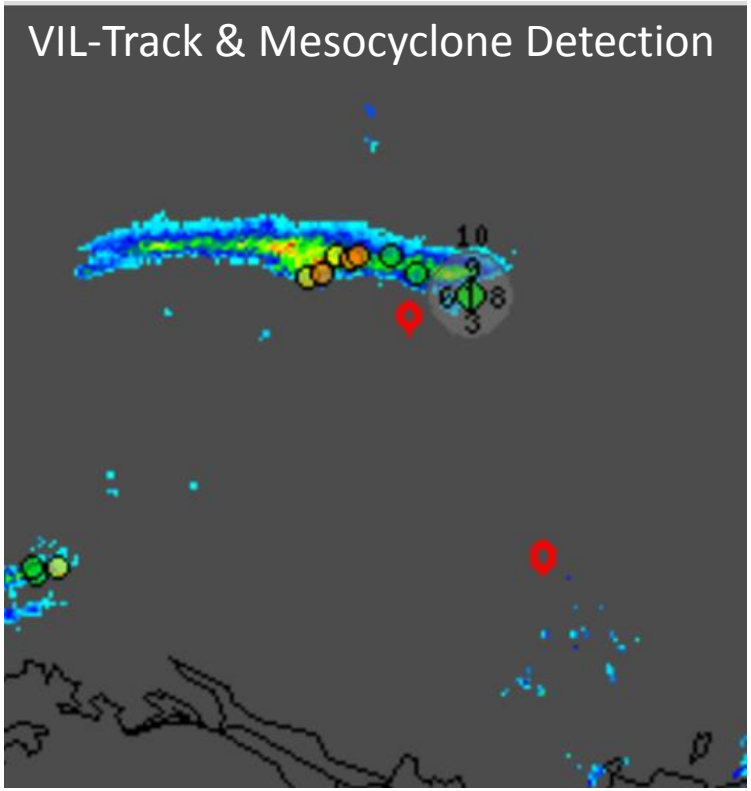


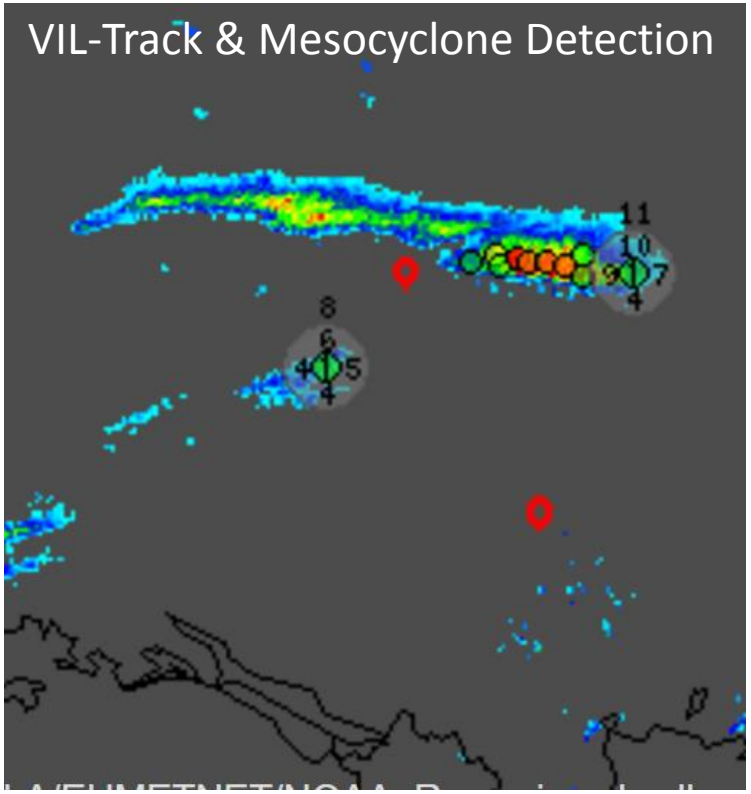
Fig. 3. 16 June 2016 1445 UTC. First 46 warning issued by WarnApp NowcastMIX was quite late, considering the strong mid-level rotation track (left) and the modest VIL (centre).

ESSL Testbed

Mesocyclone Detection Algorithm

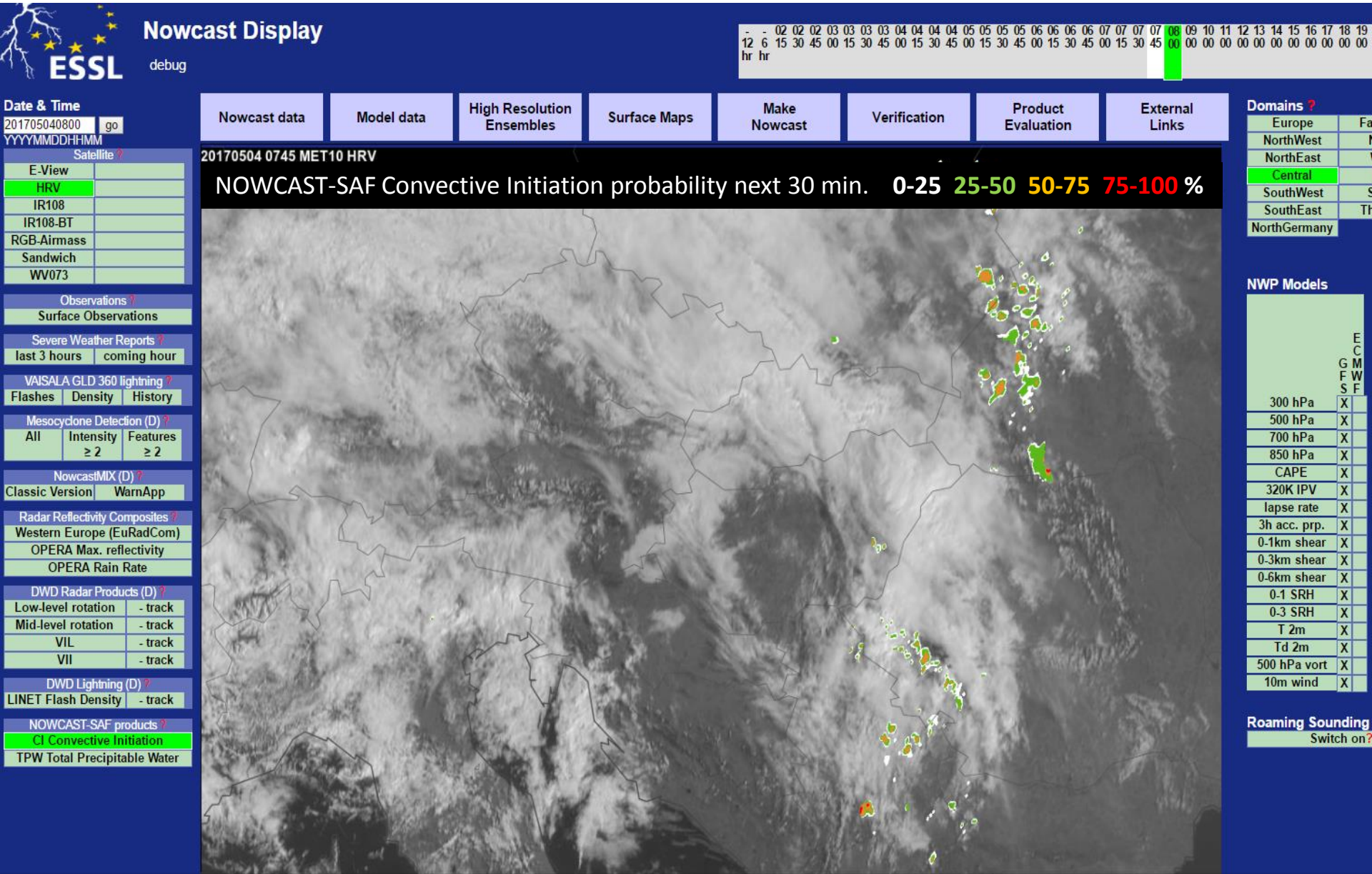
- Overall performance





- good detections, not many self-evident false alarms

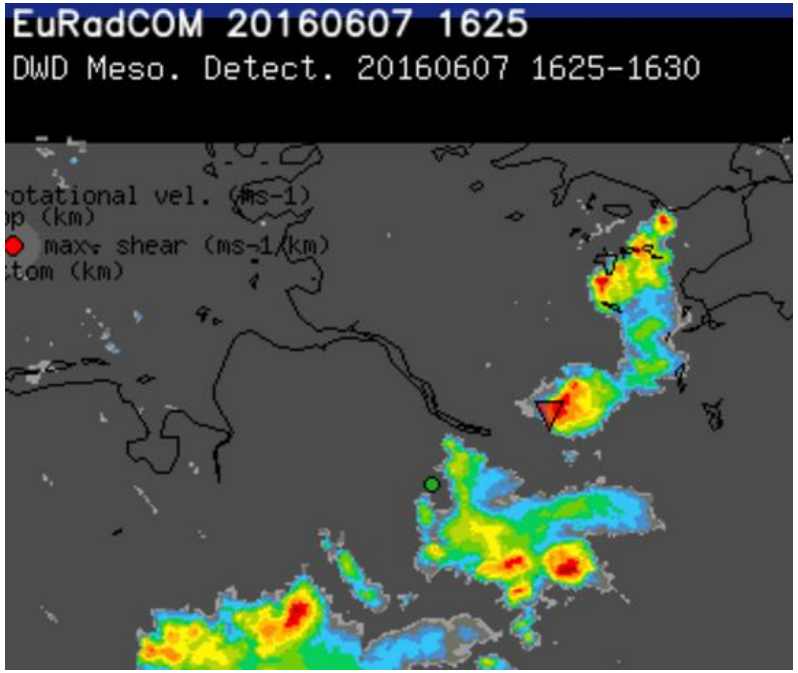
Nowcast Display

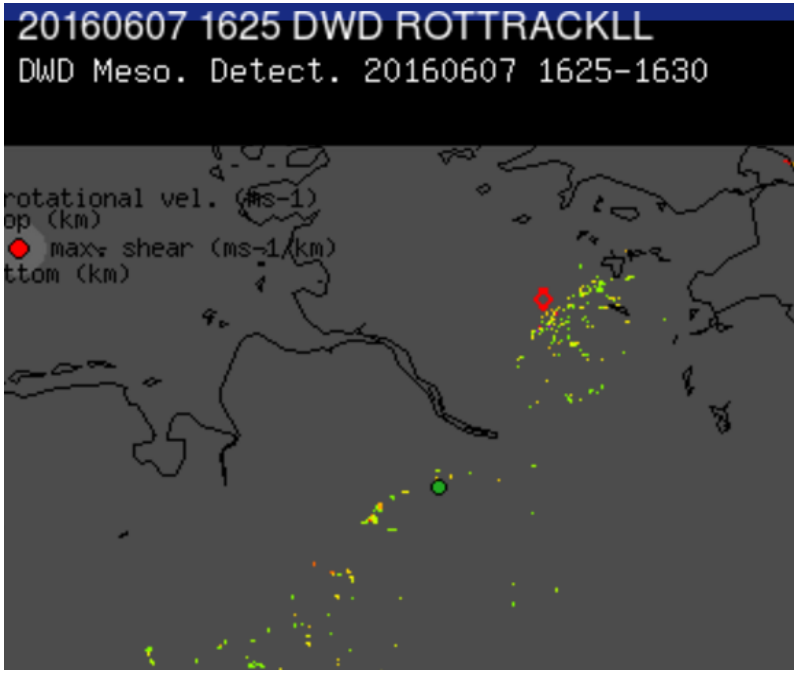


VIL/VII- and Rotation-Track products

Evaluation focus points:

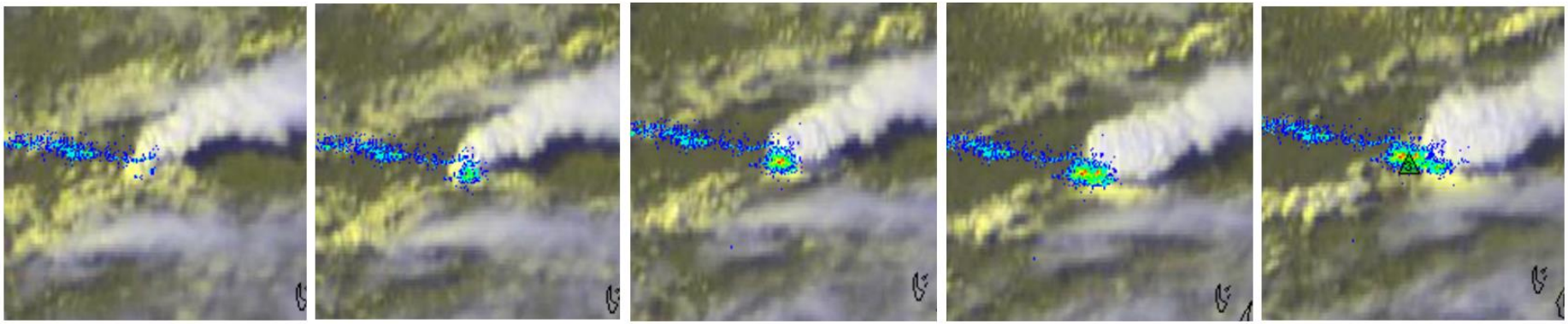
- Rotation track performance
  - product not suited for detecting non-mesocyclonic tornadoes
- reminder: it worked well on 13 May 2015 ☺





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 seems 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**