

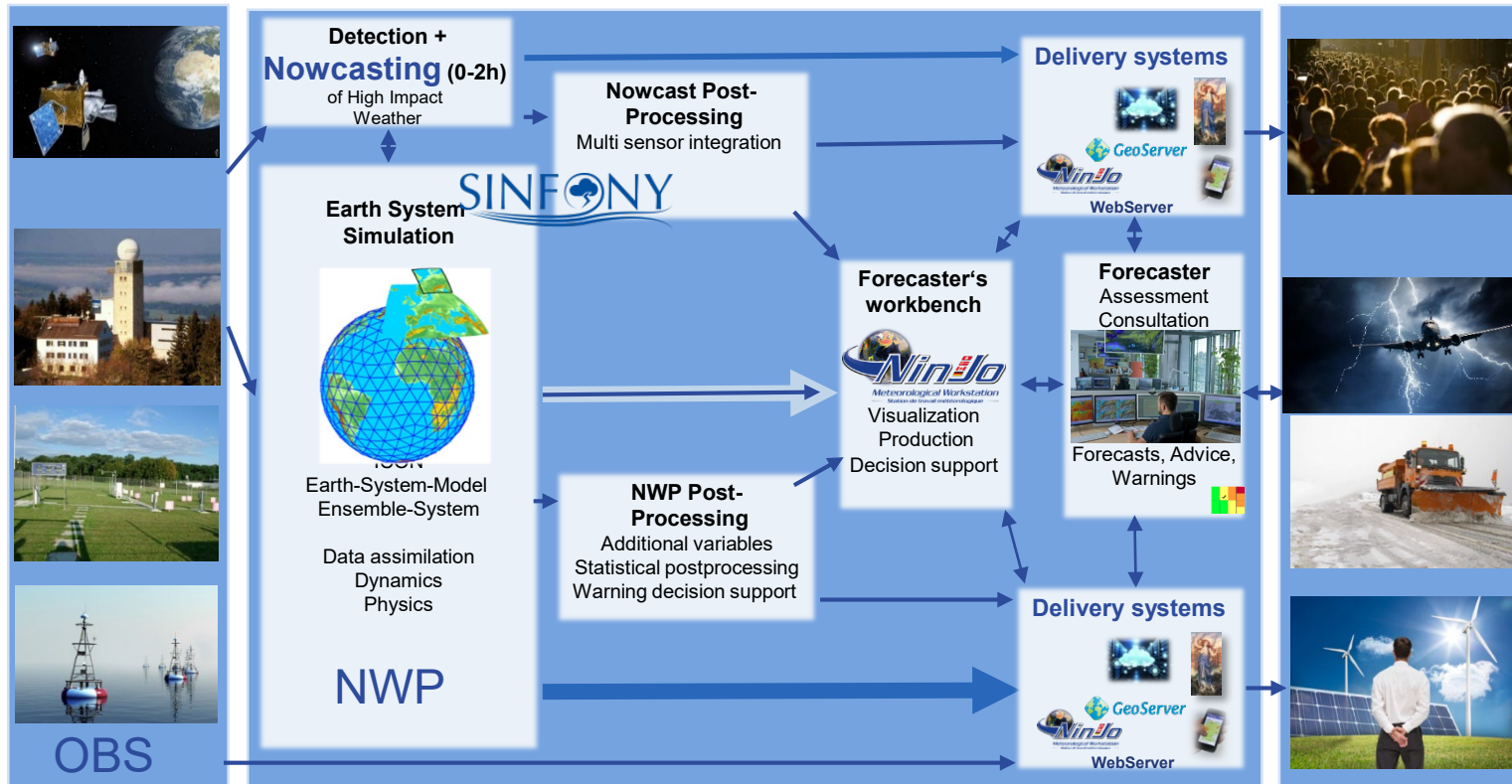
# Use of numerical weather prediction in operational forecasting and warning services



Franz Molé  
Head of

DWD Forecast and Advisory Centre

# Value Chain for our services at DWD

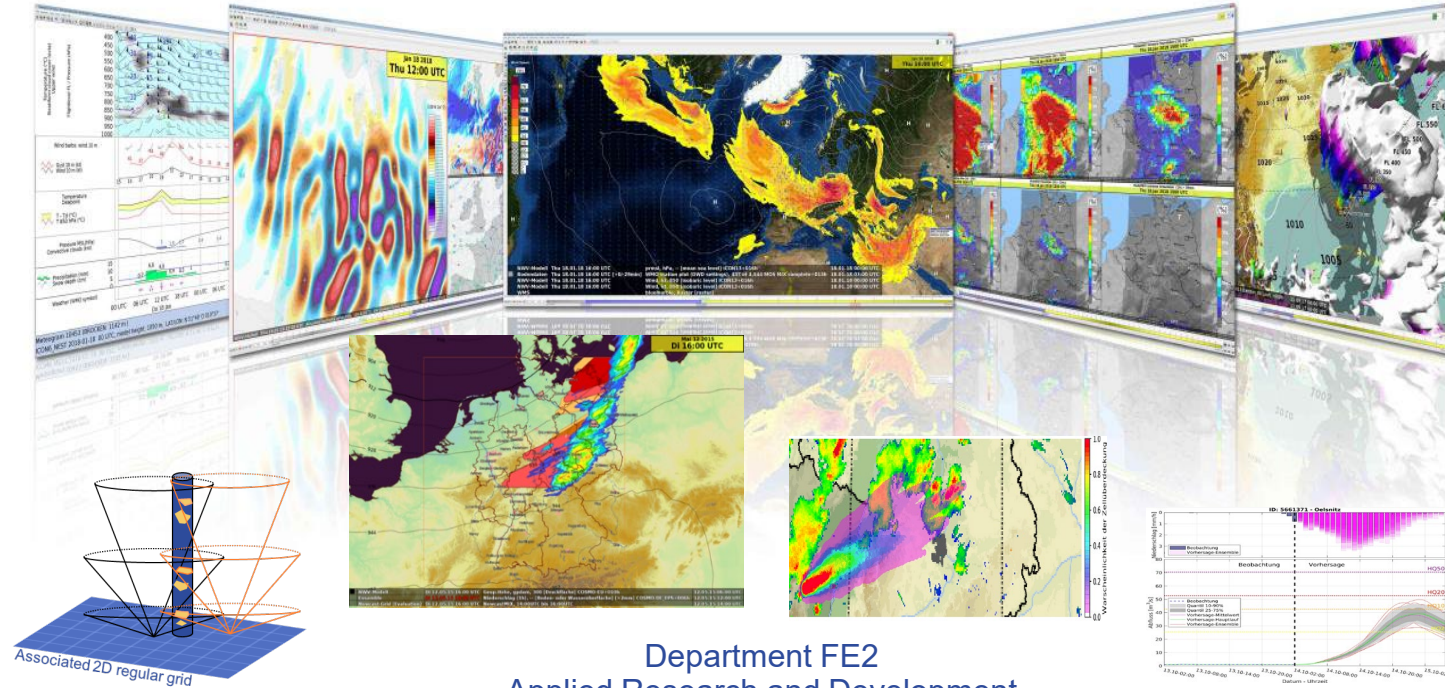


# we are forecasting and issuing warnings with

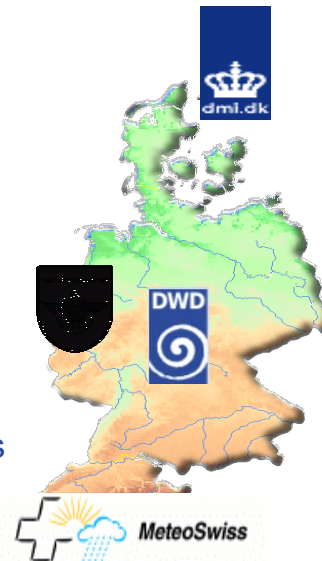
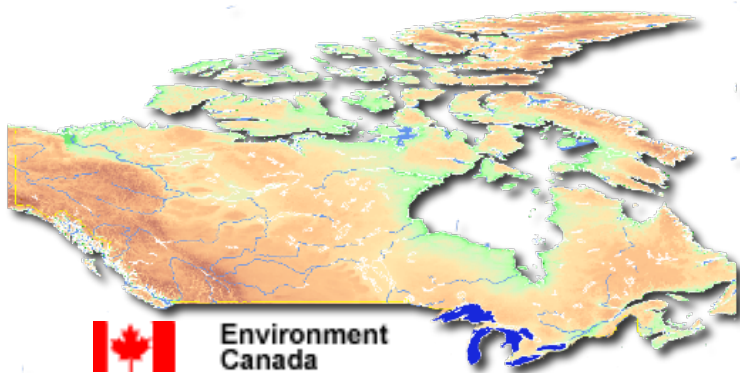
Deutscher Wetterdienst  
Wetter und Klima aus einer Hand



## Meteorological Workstation and much more



Department FE2  
Applied Research and Development  
Dirk Heizenreder



- International collaboration by 5 Met Services
- Official Agreement signed in 2006
- Joint Development and Maintenance



EMS

European Meteorological Society

04/05/2018

## EMS Technology Award 2018 for the operational meteorological workstation NinJo

– The EMS Technology Award for significant technology achievements and innovations in the field of meteorology and earth observation

The European Meteorological Society (EMS) has chosen the international *NinJo* Consortium that developed the *NinJo* operational meteorological workstation to receive the EMS Technology Achievement Award 2018.

**Datenfeldauswahl**

Auswahl von GRIB-Datenfeldern

Modell	Modelllauf	Vorhersagezeitpunkt	Einstellungen
AROME_HD	Letzter Lauf	14.06.23 06:00	Auswahl aufheben
DWD-CWAM	Letzter 12H Lauf	14.06.23 12:00	
DWD-EWAM	Letzter 6H Lauf	14.06.23 18:00	Aktualisieren
DWD-GWAM	Letzter 3H Lauf	15.06.23 00:00	
ECMWF16_DWDSAT	Letzter 00 Lauf	15.06.23 06:00	Auswahl aufheben
ECMWF_Globe	Letzter 12 Lauf	15.06.23 12:00	
EZMW-GLO	21.06.23 06:00	15.06.23 18:00	Aktualisieren
EZMW-MED	21.06.23 05:00	15.06.23 00:00	
GFS_0250_GL	21.06.23 04:00	16.06.23 00:00	Auswahl aufheben
GFS_0250_NAE	21.06.23 03:00	16.06.23 06:00	
ICON-D2 (mf00051)	21.06.23 02:00	16.06.23 12:00	Aktualisieren
ICON-D2	21.06.23 01:00	16.06.23 18:00	
ICON-D2	21.06.23 00:00	17.06.23 00:00	Auswahl aufheben
ICON13	20.06.23 21:00	17.06.23 06:00	
ICON13_NAE	20.06.23 18:00	17.06.23 12:00	Aktualisieren
ICON6_NEST	20.06.23 15:00	17.06.23 18:00	
ICON6_NEST	20.06.23 12:00	17.06.23 18:00	

Elemente	Niveau
Luftdruck (MSL)	1000 [Druckfläche]
Geopotentielle Höhe	995 [Druckfläche]
Wind	977 [Druckfläche]
Windböen	975 [Druckfläche]
Wetter	960 [Druckfläche]
Temperatur	950 [Druckfläche]
Taupunkt	... [Druckfläche]
Relative Feuchte	... [Druckfläche]
Theta Ae	... [Druckfläche]
Vertikalbewegung OMEGA	... [Druckfläche]
Niederschlag (01h)	892 [Druckfläche]
Niederschlag (03h)	875 [Druckfläche]
Niederschlag (06h)	859 [Druckfläche]
Niederschlag (12h)	850 [Druckfläche]
Niederschlag (24h)	...

## Direct Model Outputs

**Datenfeldauswahl...**

Datenfeld	Modell	Modelllauf	Vorhersagezeitpunkt	Einstellungen
	COSMO_LEPS	Letzter Lauf	20.06.23 07:00	Auswahl aufheben
	ECMWF_EPS	Letzter 12H Lauf	20.06.23 08:00	
	ICON-D2_EPS	Letzter 6H Lauf	20.06.23 09:00	Aktualisieren
	ICON-D2_EPS_22km	Letzter 3H Lauf	20.06.23 10:00	
	ICON-EU_EPS	Letzter 00 Lauf	20.06.23 11:00	Auswahl aufheben
	ICON_EPS	Letzter 12 Lauf	20.06.23 12:00	
		21.06.23 03:00	20.06.23 13:00	Aktualisieren
		21.06.23 00:00	20.06.23 14:00	
		20.06.23 21:00	20.06.23 15:00	Auswahl aufheben
		20.06.23 18:00	20.06.23 16:00	

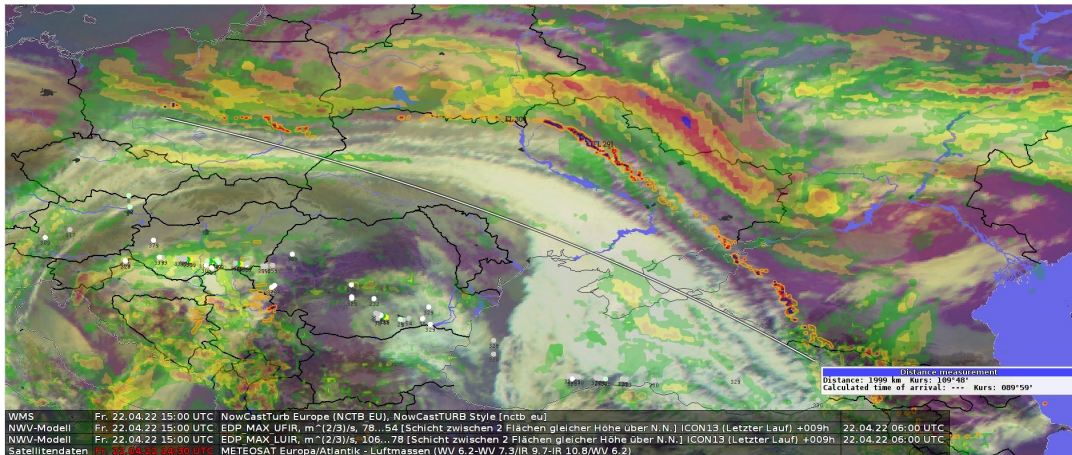
  

Elemente	Niveau
Bedeckungsgrad, tiefe Bewölkung	1...7 [Schicht zwischen 2 Flächen gleicher Tiefe im Boden]
CAPE	10 [Höhe über Grund]
CAPE (24h)	2 [Höhe über Grund]
CAPE (24h) (EFI, SOT)	250 [Druckfläche]
CAPE Shear (24h) (EFI, SOT)	40...80 [Schicht zwischen 2 Druckflächen]
Cloud cover	0...40 [Schicht zwischen 2 Druckflächen]
Erbodentemperatur (12h), Minimum	500 [Druckfläche]
Erbodentemperatur (24h), Minimum	800 [Druckfläche]
Erbodentemperatur, Minimum, (12h)	850 [Druckfläche]
...	[Boden, oder Wasseroberfläche]

## Ensemble Data Layer

# Applications for aviation customers

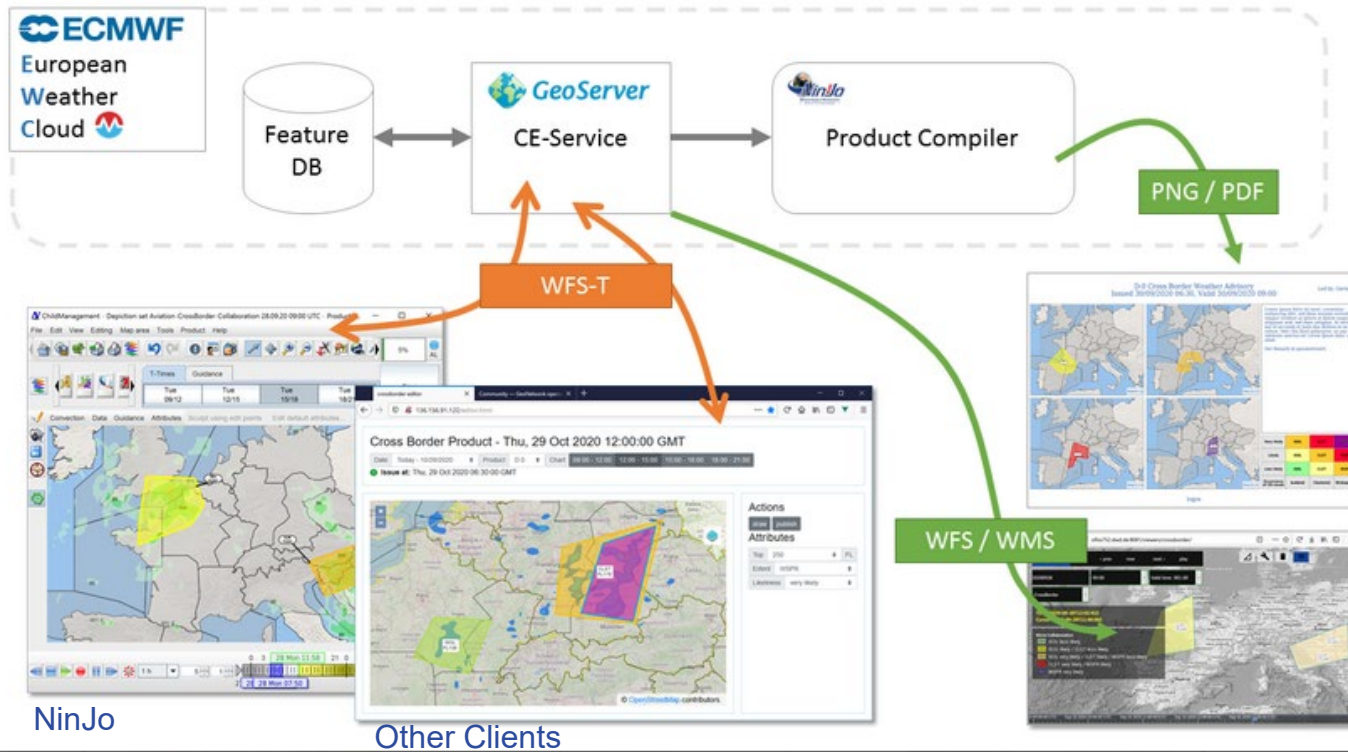
- AutoMETAR
- Detection of turbulence and convection
- ADWICE, AutoTAF



Nowcast-TURB (Polygone)+ ICON-EDP,  
A.Barleben(WV24) R. Müller (FE23)

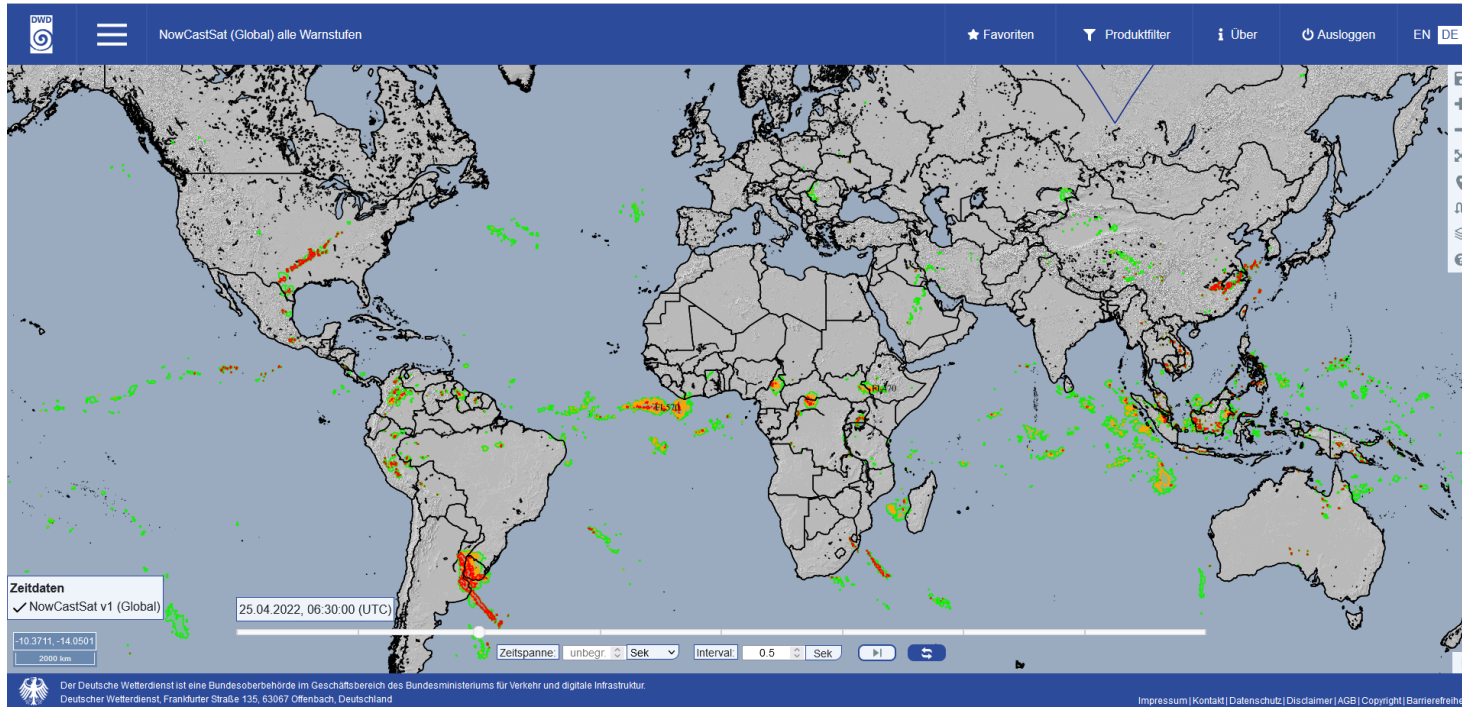
# EUFOCS (European CrossBorder Projekt)

NinJo - development of tools to support efficient weather advice





# Example – global status of convection (WebGIS/DWD)



## NowCastSat-Aviation (NCS-A) 25.04.2022, 06:30:

# Cockpit of the Lufthansa (eRouteManual/LSY)

Lufthansa flight over China during the trial phase in 2021.

Operational at Lufthansa in the cockpits for long distance Flights since May 2022.

Situational awareness:  
Area beyond waypoint PADNO (outside the onboard radar) is free of sev thunderstorms.



Bordradar<sub>10</sub>

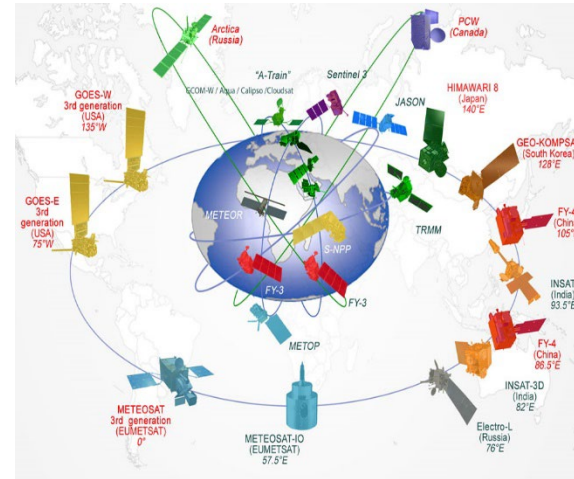
Electronic-Flight-Bag

Matthias Jerg, Axel Barleben, DWD



## Input data:

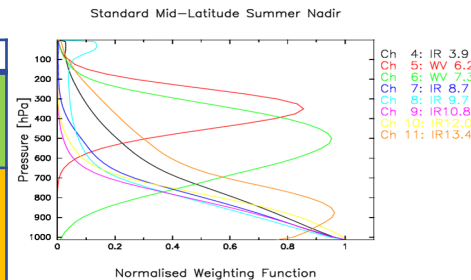
- ➔ Measurements from geostationary SAT: MSG, -IODC, HIMAWARI, GOES-16/17
- ➔ Global lightning data Vaisala GmbH.
- ➔ NWP (ICON) data for filtering to reduce FAR.



## Result of the NowCastSat-Aviation (NCS-A):

- severity of convection
- cloud top
- Nowcasting up to +2h using “Optical Flow”

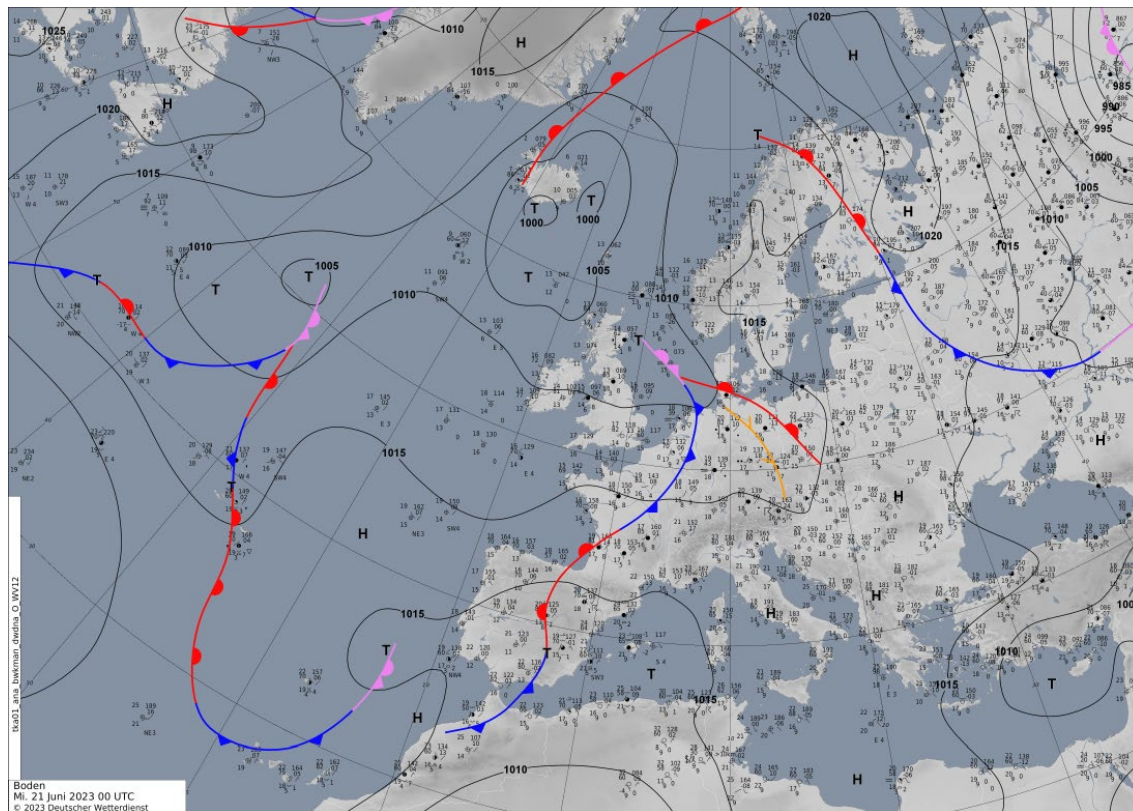
convection	property	threshold
Light	shallow convection or lightning	$BT_{wv062} - BT_{wv073} > -1$ and $KO < 2$ or lightning_20min
Moderate	mature deep convection or overshooting top	$BT_{wv062} - BT_{wv073} > 0.7$ or $BT_{wv062} - BT_{ir108} > 2$ and $KO < 2$
severe	lightning	lightning_20min



# Current Severe Weather Situation

Analysis Chart  
produced within NinJo

Today 00 UTC

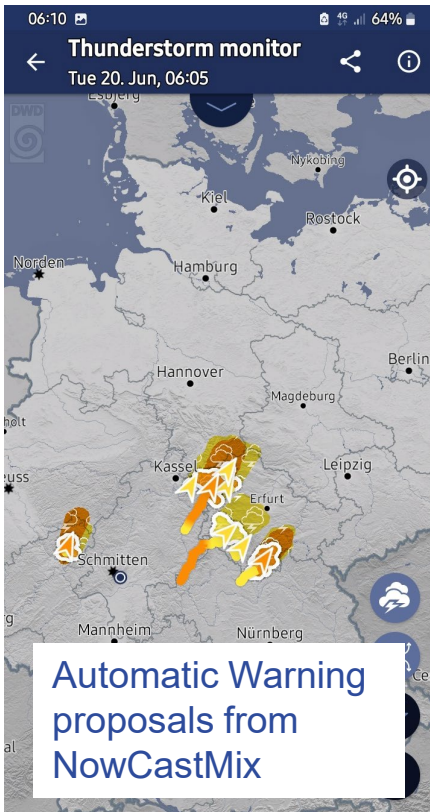


# Current Severe Weather Situation

Products for general public within the DWD WarnWeather APP yesterday morning



# Products within the DWD APP WarnWeather

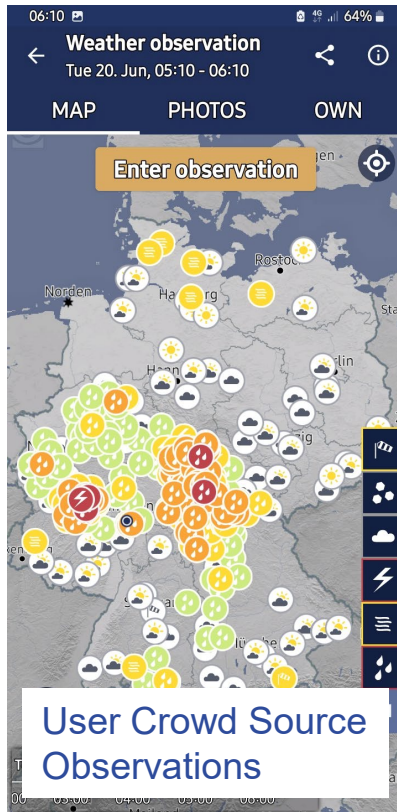


06:10 49% 64%

### Thunderstorm monitor

Tue 20. Jun, 06:05

Automatic Warning proposals from NowCastMix



06:10 49% 64%

### Weather observation

Tue 20. Jun, 05:10 - 06:10

MAP PHOTOS OWN

Enter observation

User Crowd Source Observations



06:13 49% 64%

### Offenburg am Ma...

WARNING WEATHER

Tue, 20. Jun 11:00 - 19:00

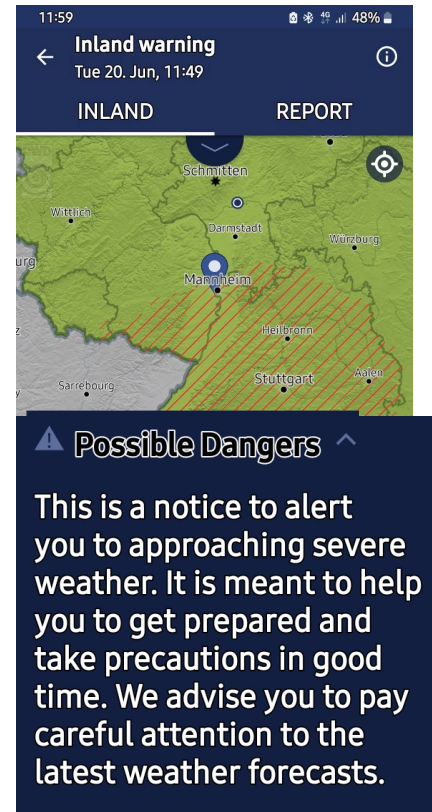
The expected weather will bring a situation of strong heat stress. (Level 1 of 3)  
Height range: < 200 m

Possible Dangers

#### Trend of warning

Thunderstorm	Green	Yellow	Orange	Red
Storm	Green	Yellow	Orange	Red
Rain	Green	Yellow	Orange	Red
Heat	Green	Yellow	Orange	Red

Warning Trend for Offenburg



11:59 48%

### Inland warning

Tue 20. Jun, 11:49

INLAND REPORT

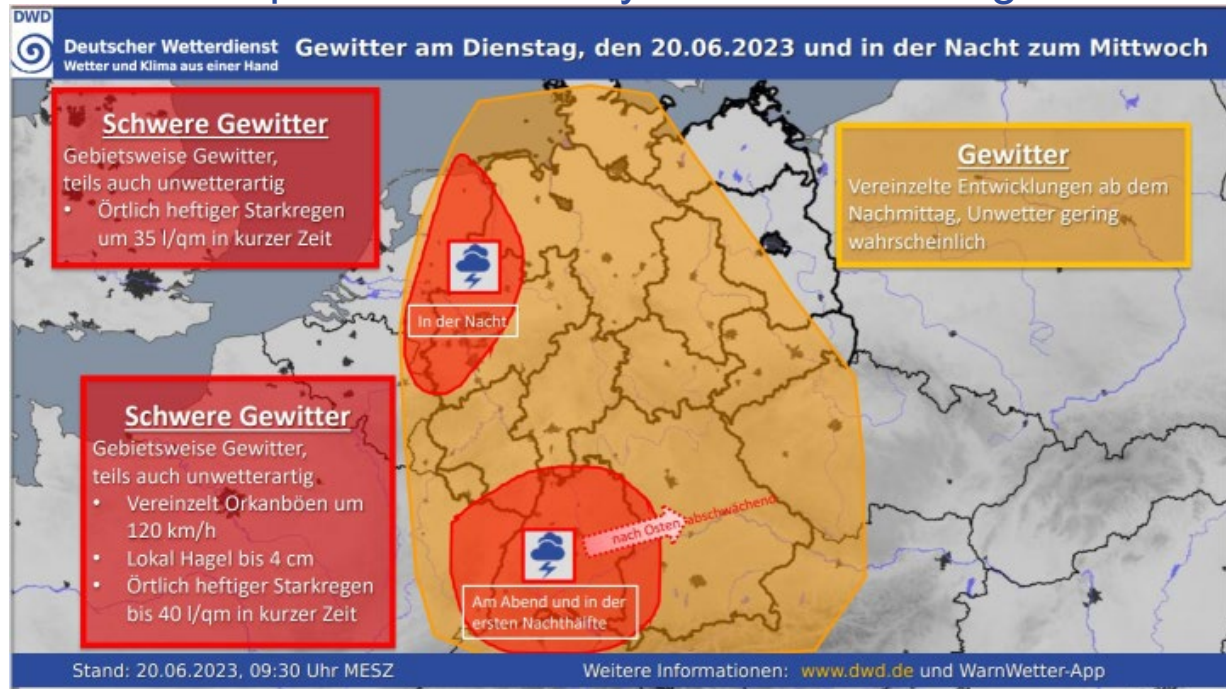
Possible Dangers

This is a notice to alert you to approaching severe weather. It is meant to help you to get prepared and take precautions in good time. We advise you to pay careful attention to the latest weather forecasts.

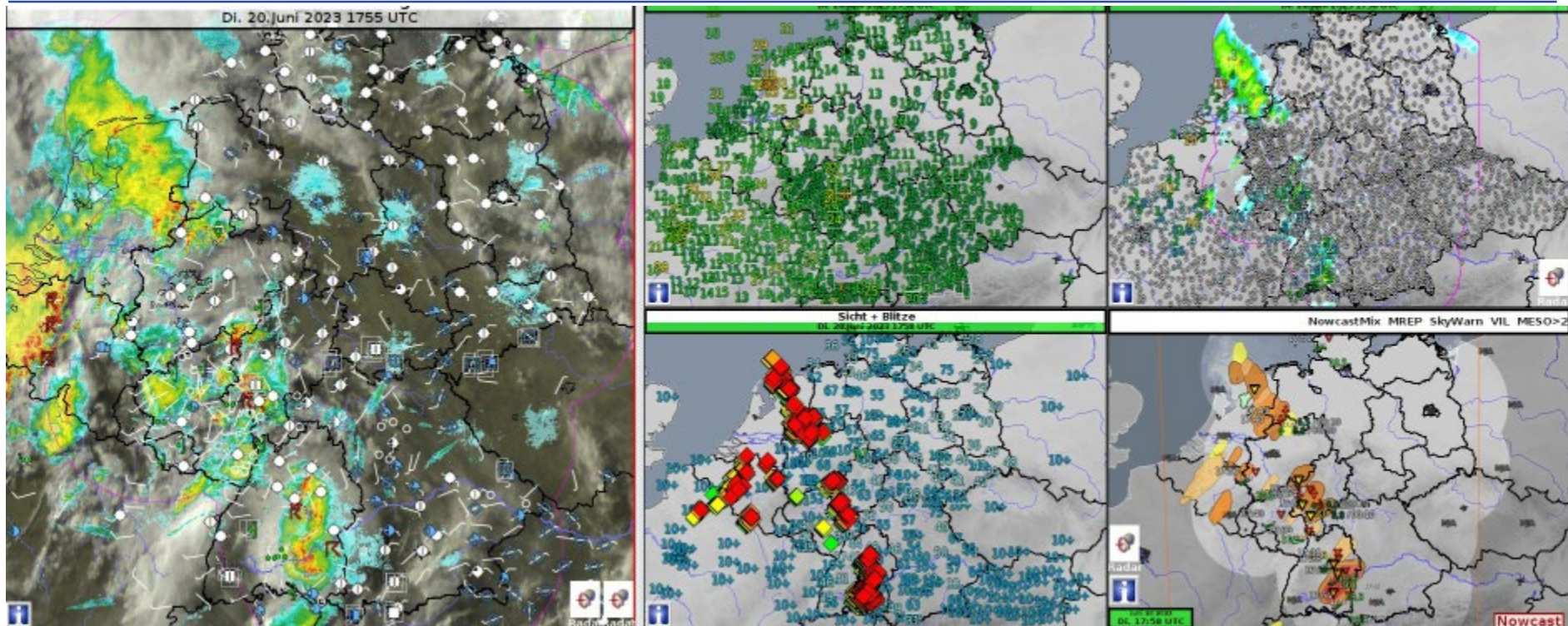


# Current Severe Weather Situation

## Situation Map issued Tuesday until this morning for Civil Protection



# Current Severe Weather Situation



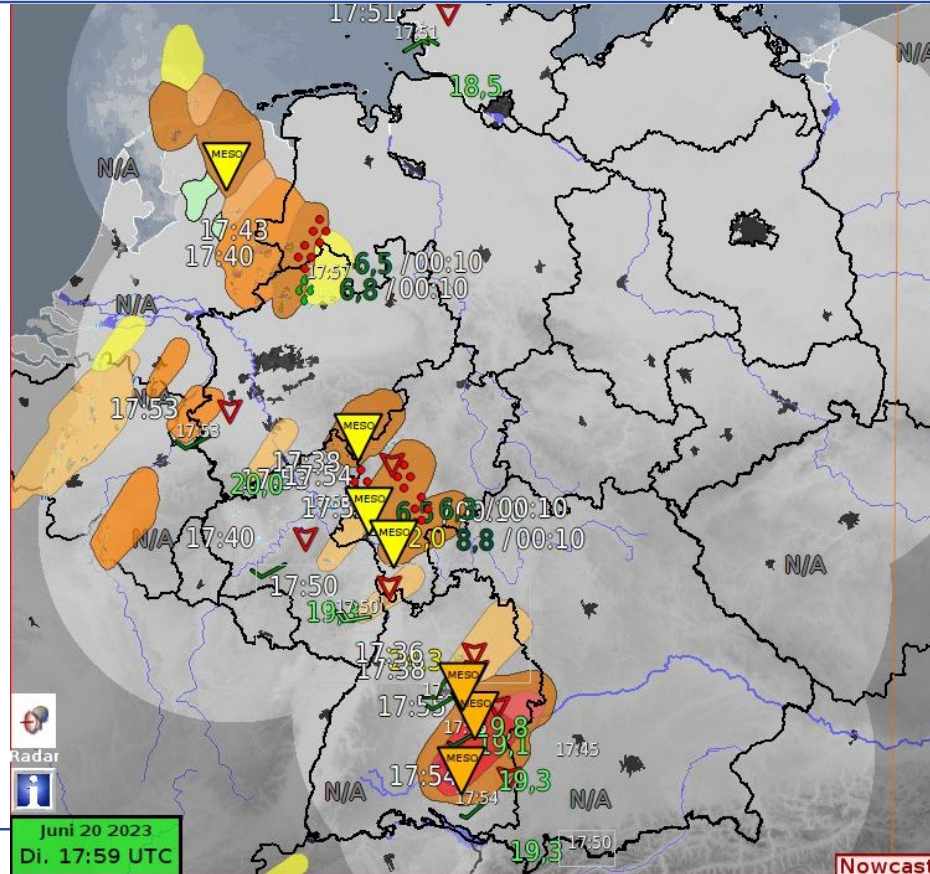
Monitoring Tue 17:55 UTC Weather, Gusts, Lightning, Prec1h, NowCastMix





# Current Severe Weather Situation

Monitoring Tue 17:59  
UTC NowCastMix  
Mesocyclone Warnings

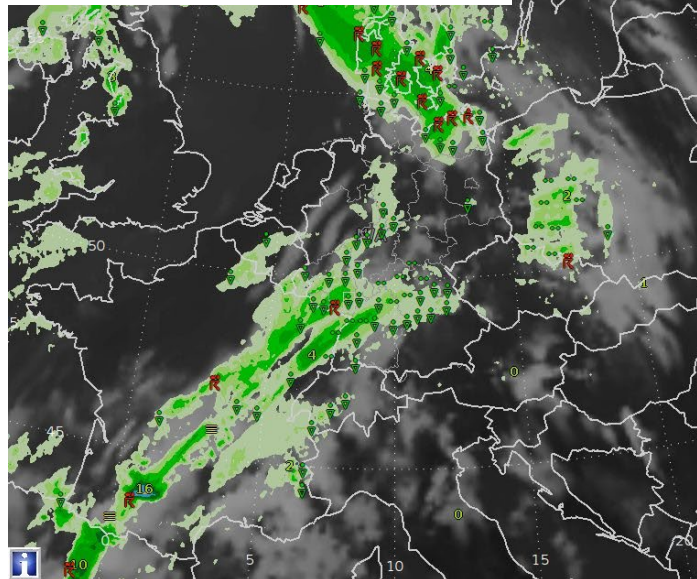


# Current Severe Weather Situation

Simulated situation from ICON-EU (Tue 12 run) for today 9 UTC

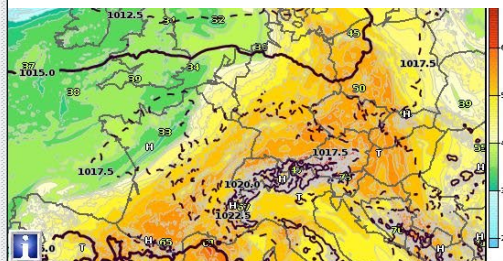
Sat, Radar, ww  
Mi. 21.Juni 2023 0900 UTC

RR3h, Weather + Satsim IR



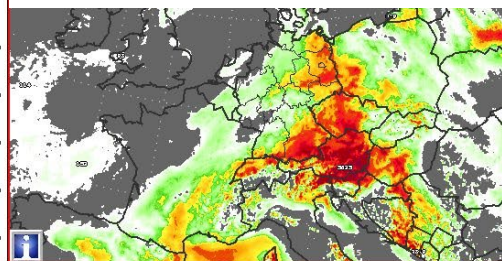
ICON6\_NEST ThetaAe850, Bodendruck + Tendenz  
Mi. 21.Juni 2023 0900 UTC

Airmass + Surface Pressure



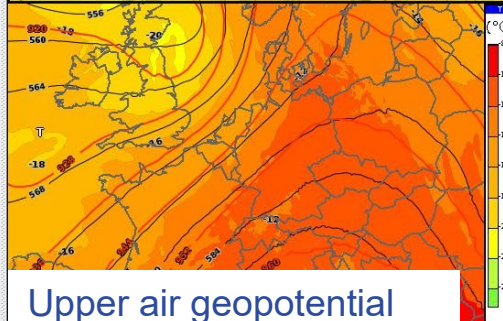
Cape ML und Totals Totals  
Mi. 21.Juni 2023 0900 UTC

Available convective energy



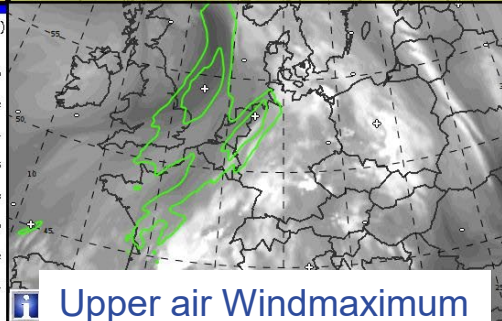
ICON6\_NEST Temp + Geopot500, Geopot 300  
Mi. 21.Juni 2023 0900 UTC

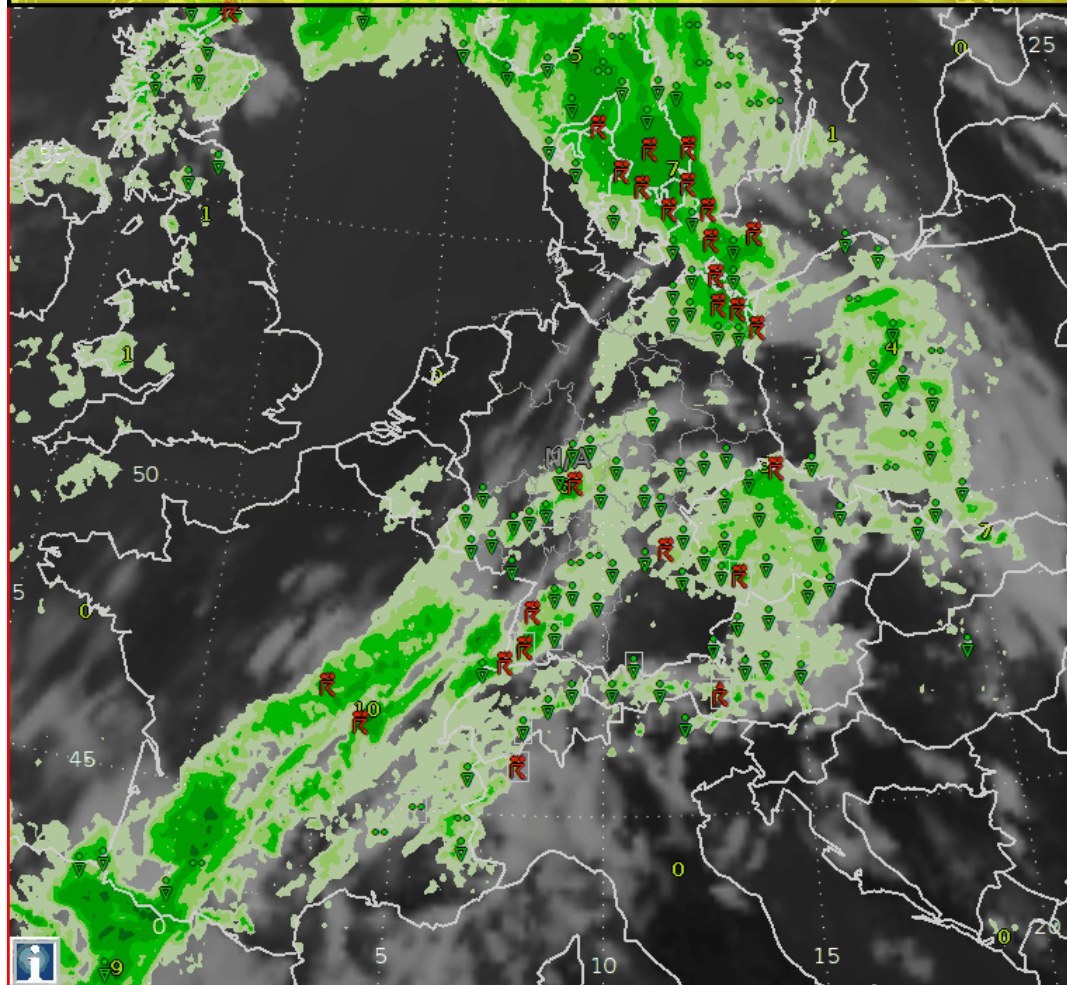
Upper air geopotential  
and Temperature



WV, Jst 300 + Blitze  
Mi. 21.Juni 2023 0900 UTC

Upper air Windmaximum  
and Water Vapor Satsim

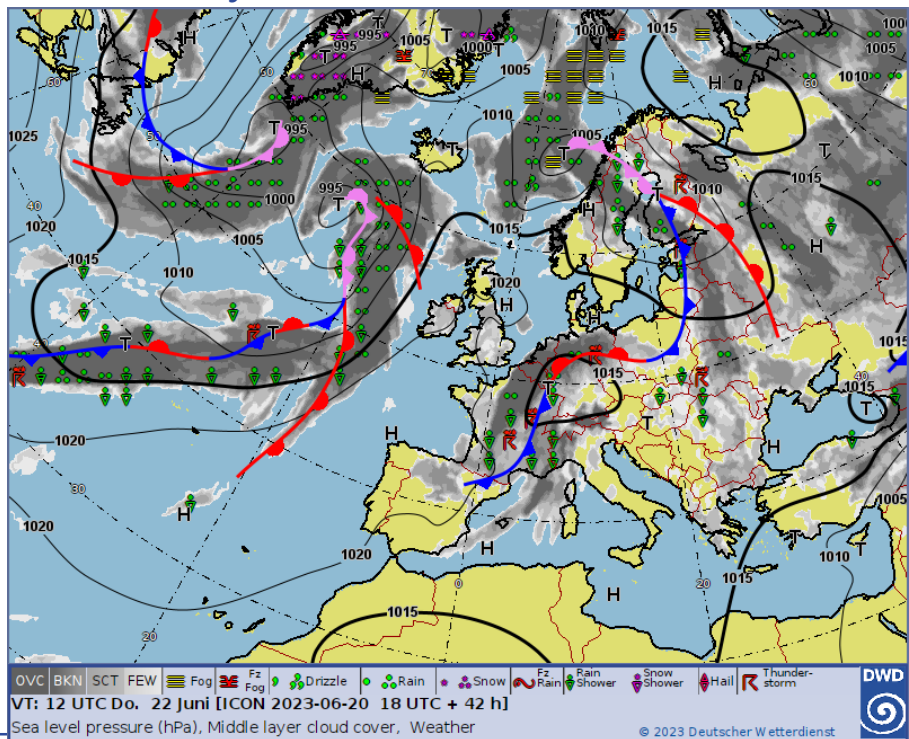




RR3h, Weather + Satsim IR  
Loop from today 12 until Friday  
00 UTC  
simulated from ICON-EU (Tue  
12 run)

# Severe Weather Situation Thursday

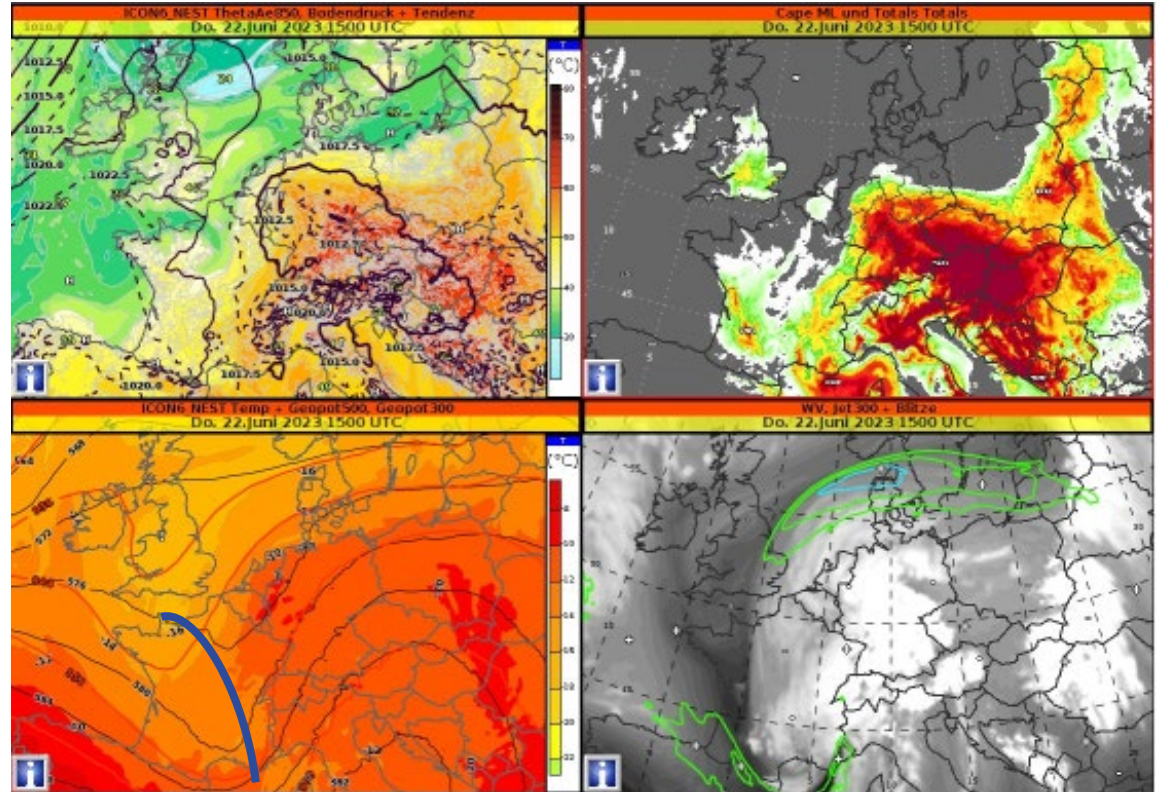
Forecast for Thursday 12 UTC from ICON with surface fronts produced via NinJo



# Severe Weather Situation Thursday

ICON-EU (Tue 12) forecast  
for Thursday 15 UTC

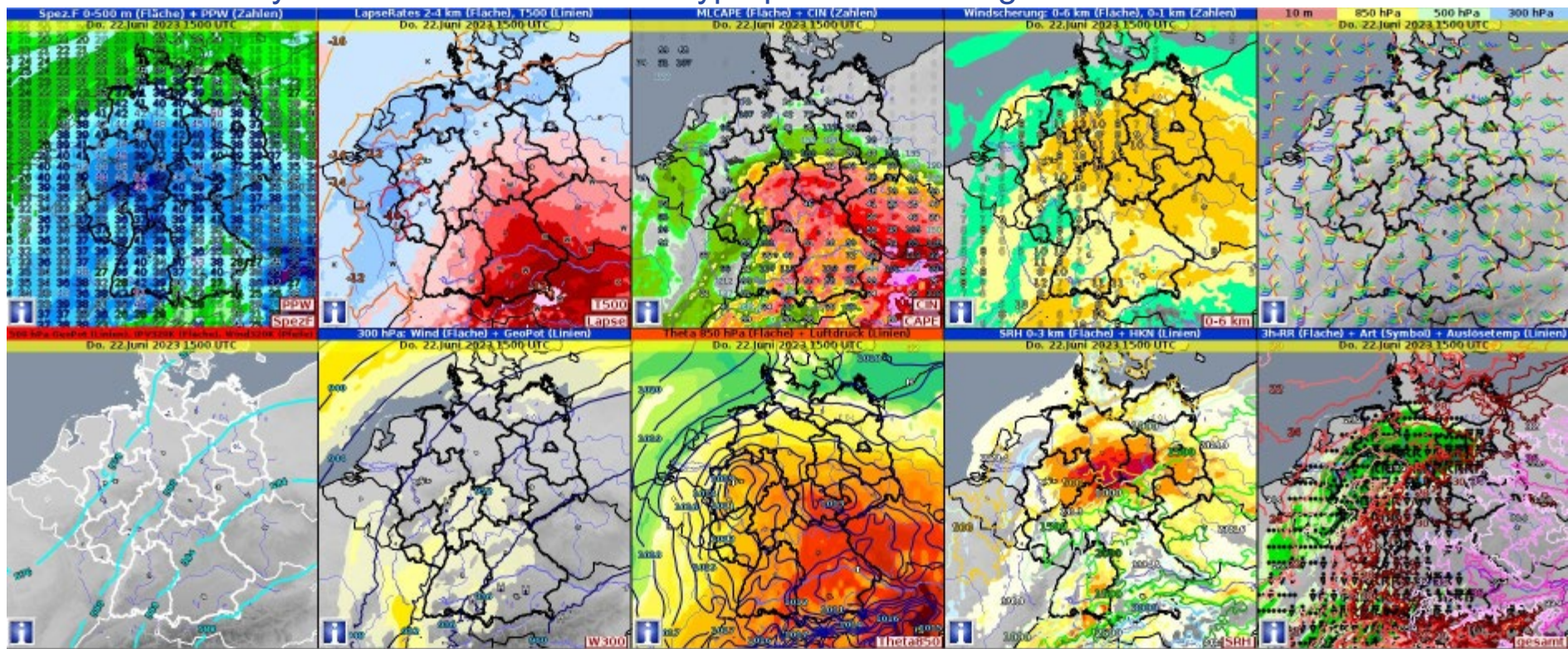
Extreme Instability with  
CAPE ~4000 J/kg ahead of  
a trough approaching from  
SW



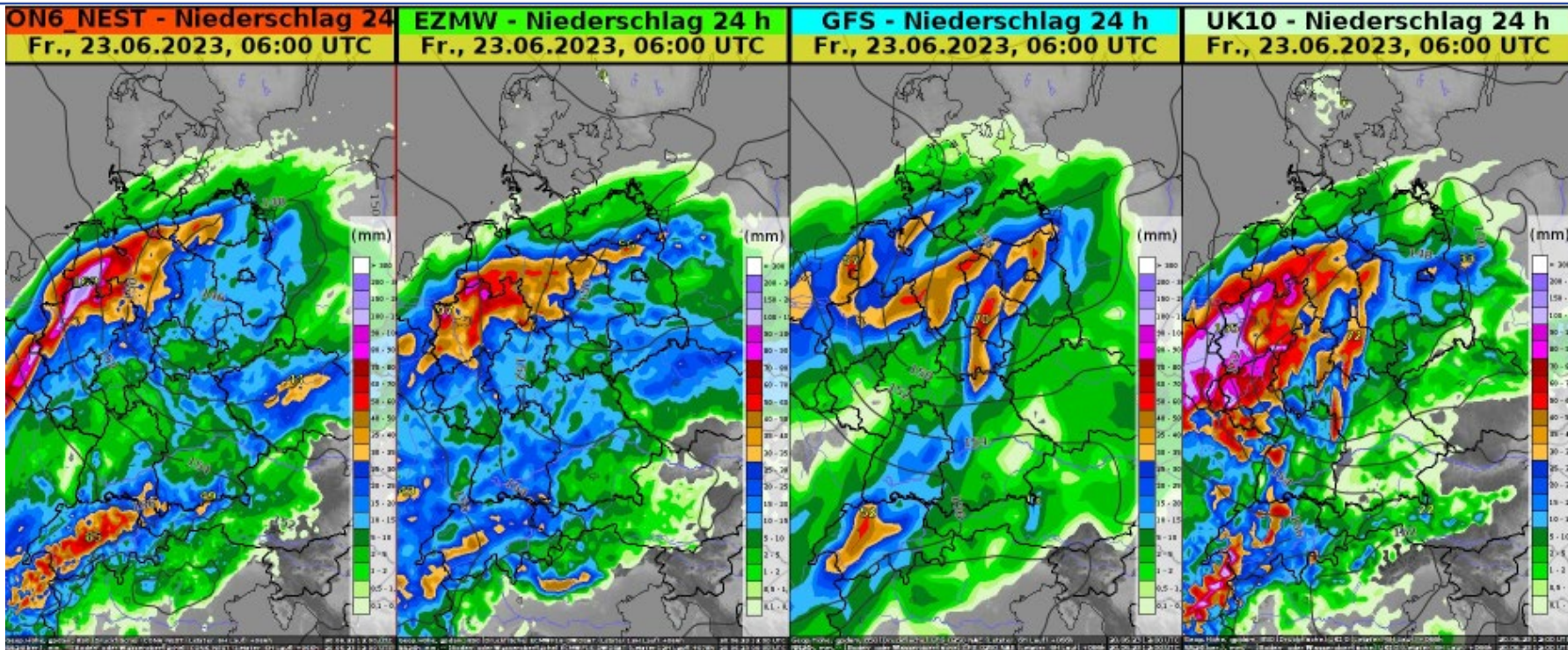
# Severe Weather Situation Thursday

ICON-D2 (Tue 12) forecast for Thursday 15 UTC

Fields necessary to calculate tunderstorm type potential for large hail hurricane force and tornados



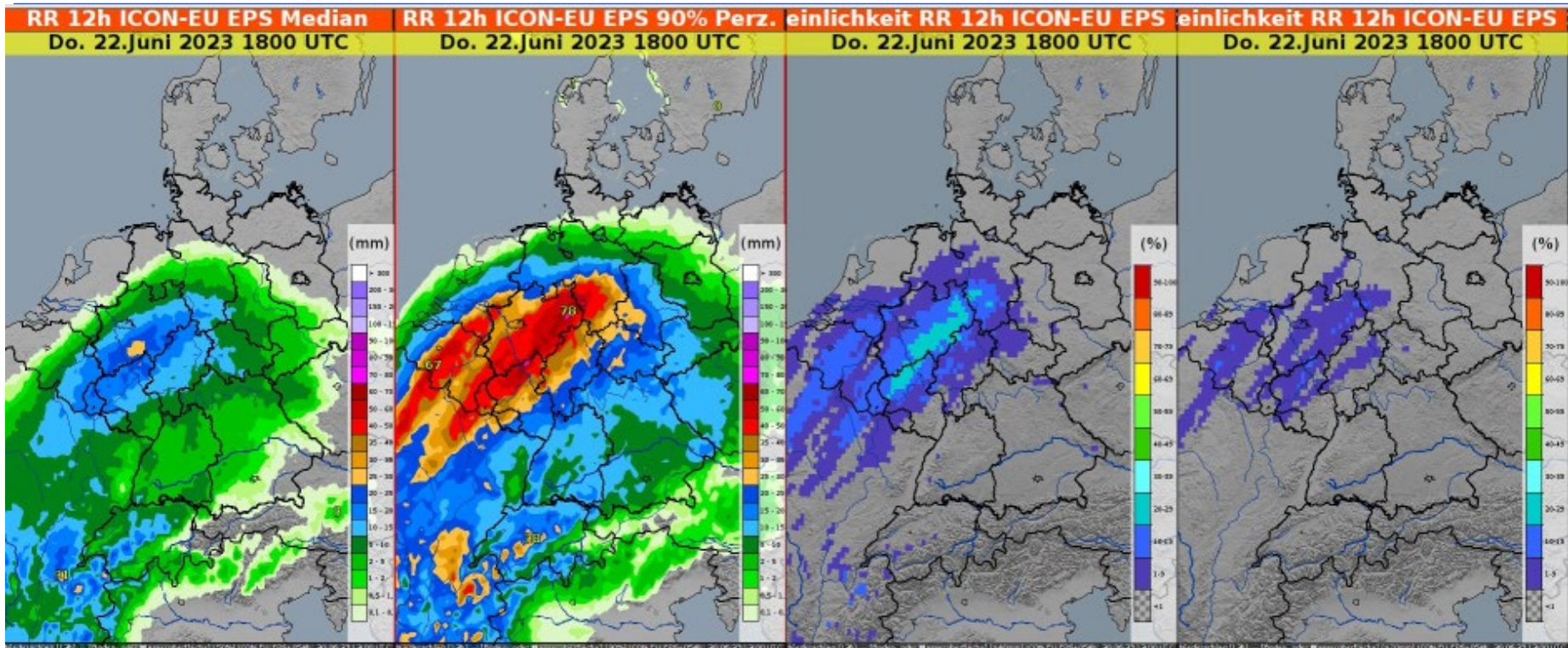
# Severe Weather Situation Thursday



RR24h Do00 - Fr00 NWP Comparison (DWD, EZMW, GFS, MetOffice) pink: > 100 mm



# Severe Weather Situation Thursday

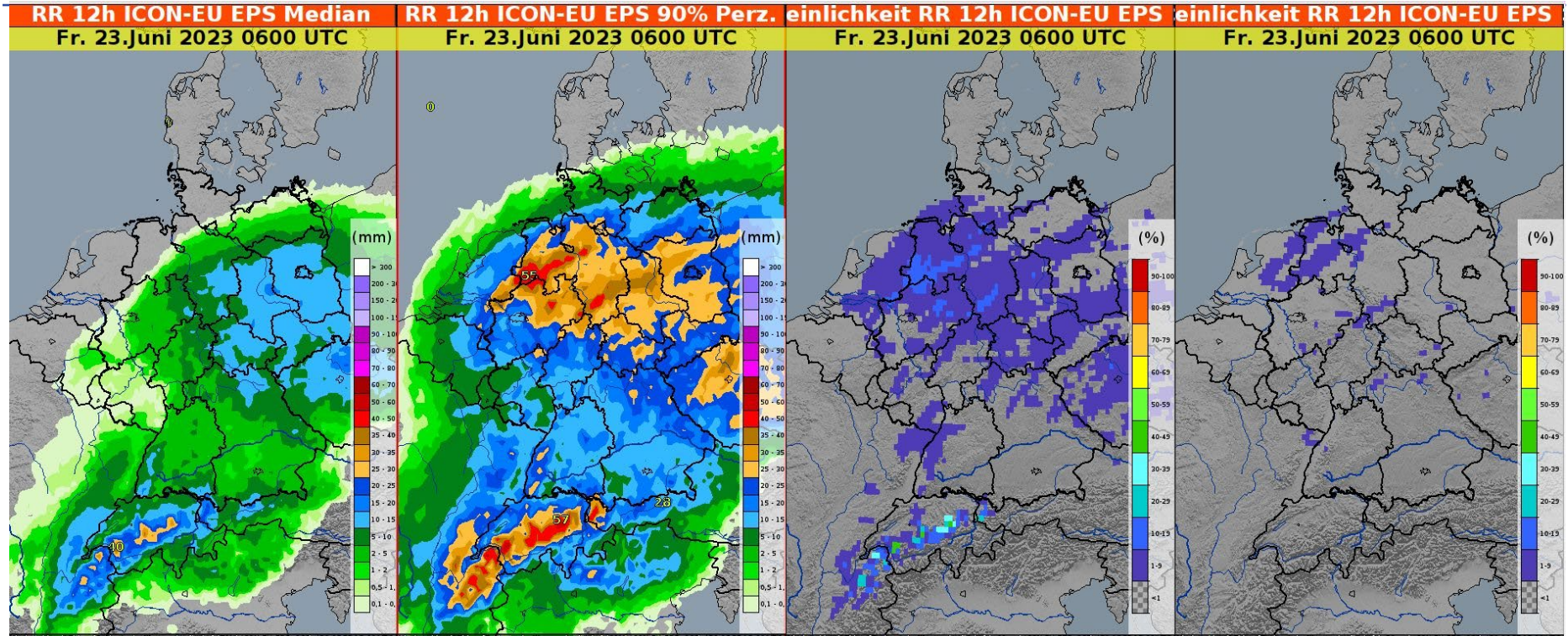


RR12 Icon EU EPS Do 18 UTC mean, 90% Perz, Prob for Severe, Prob extreme Prec.





# Severe Weather Situation Thursday



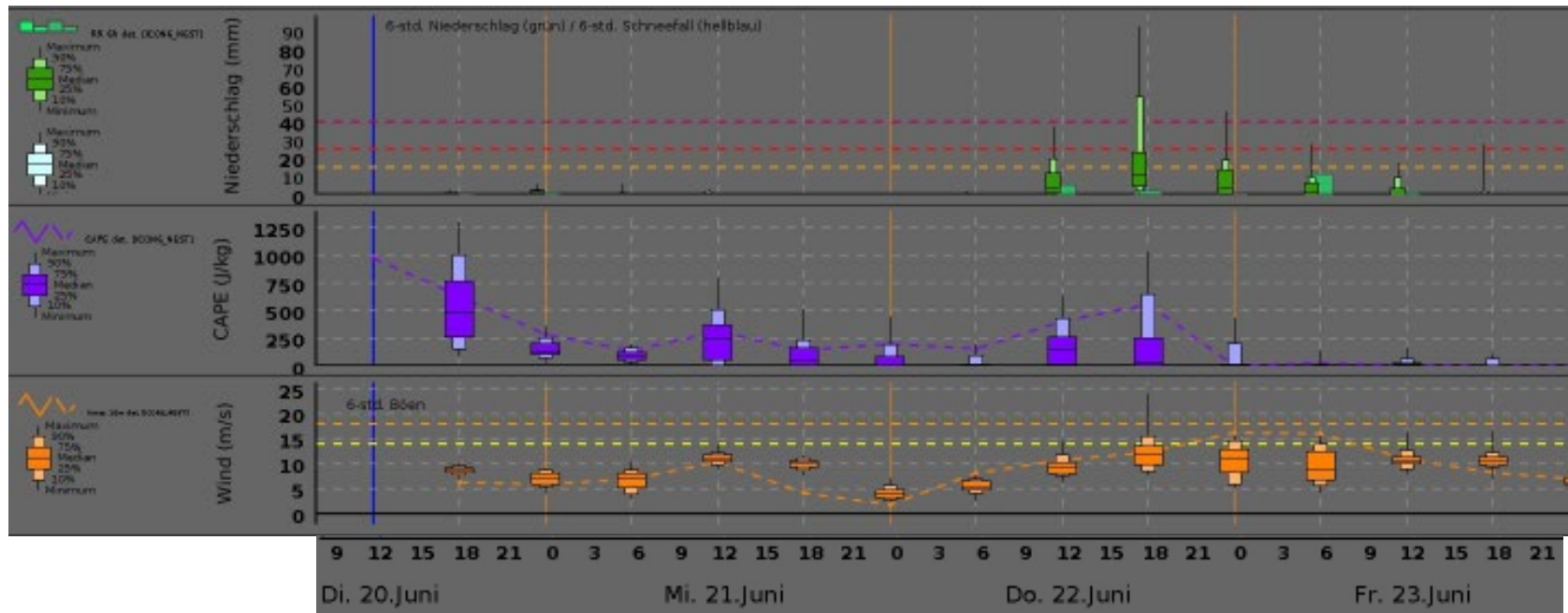
RR12 Icon EU EPS Fr 06 UTC, mean, 90% Perz, Prob for Severe, Prob extreme Prec.



# Severe Weather Situation Thursday

## Icon EU EPS Meteogram Di 12 – Fr 21 UTC for Offenbach

Precip.



**Thank you very much  
for your attention!**

**Any questions?**

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**+49(0)6980622600**