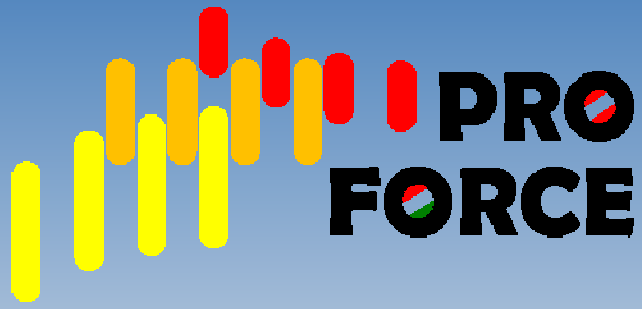
Seamless Probabilistic Forecasts for Civil Protection



Yong Wang, Clemens Wastl, Martin Suklitsch, Andre Simon, Mihaly Szűcs

ZAMG and HMS

EWGALM/SRNWP, 2015

ZAMG

OMSZ

Co-financed by the EU

European Commission

An EU project

Project aim

Weather service and civil protection agency work together on:

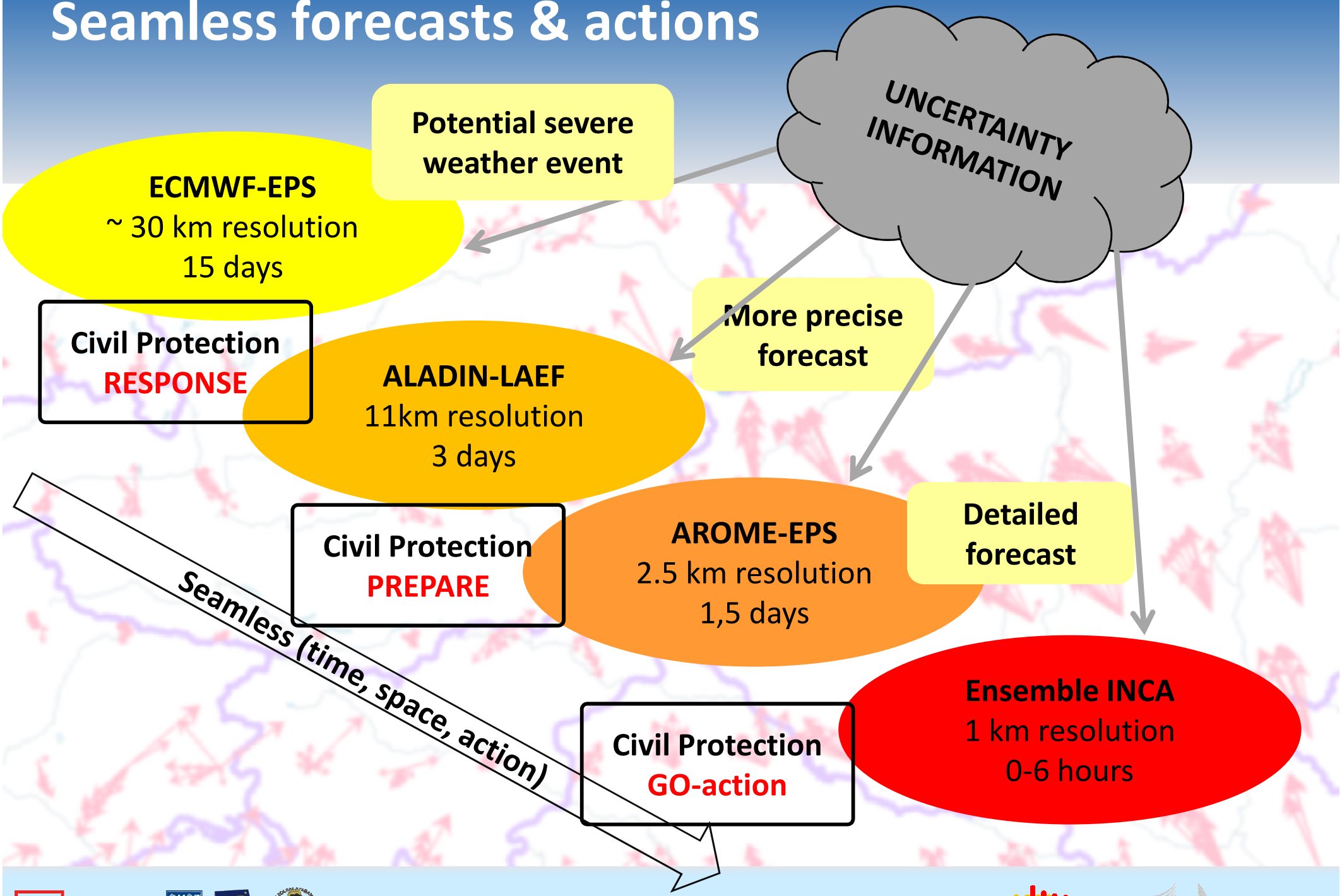
An innovative seamless probabilistic forecasting system in time (week to hour) and space (30km to 1km) tailored to civil protection

ZAMG

OMSZ

European Commission

Seamless forecasts & actions



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Webpage: www.echo-proforce.eu

PRO FORCE Bridging of Probabilistic Forecasts and Civil Protection

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The Tulln Training Sessions

Details
Published: 13 May 2015

Thanks to our colleagues of the Civil Protection authorities in Tulln we had a very...

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Evaluation results

Details
Published: 26 March 2015

At the end of the midterm meeting in Budapest a short evaluation of the meeting...

Read more >>

Midterm meeting in Budapest (updated)

Details
Published: 20 February 2015

On 27 and 28 January, 2015 the PROFORCE midterm meeting took place at the Hungarian...

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Legal notice

PRO FORCE

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Hello, Zentralanstalt für Meteorologie und Geodynamik!

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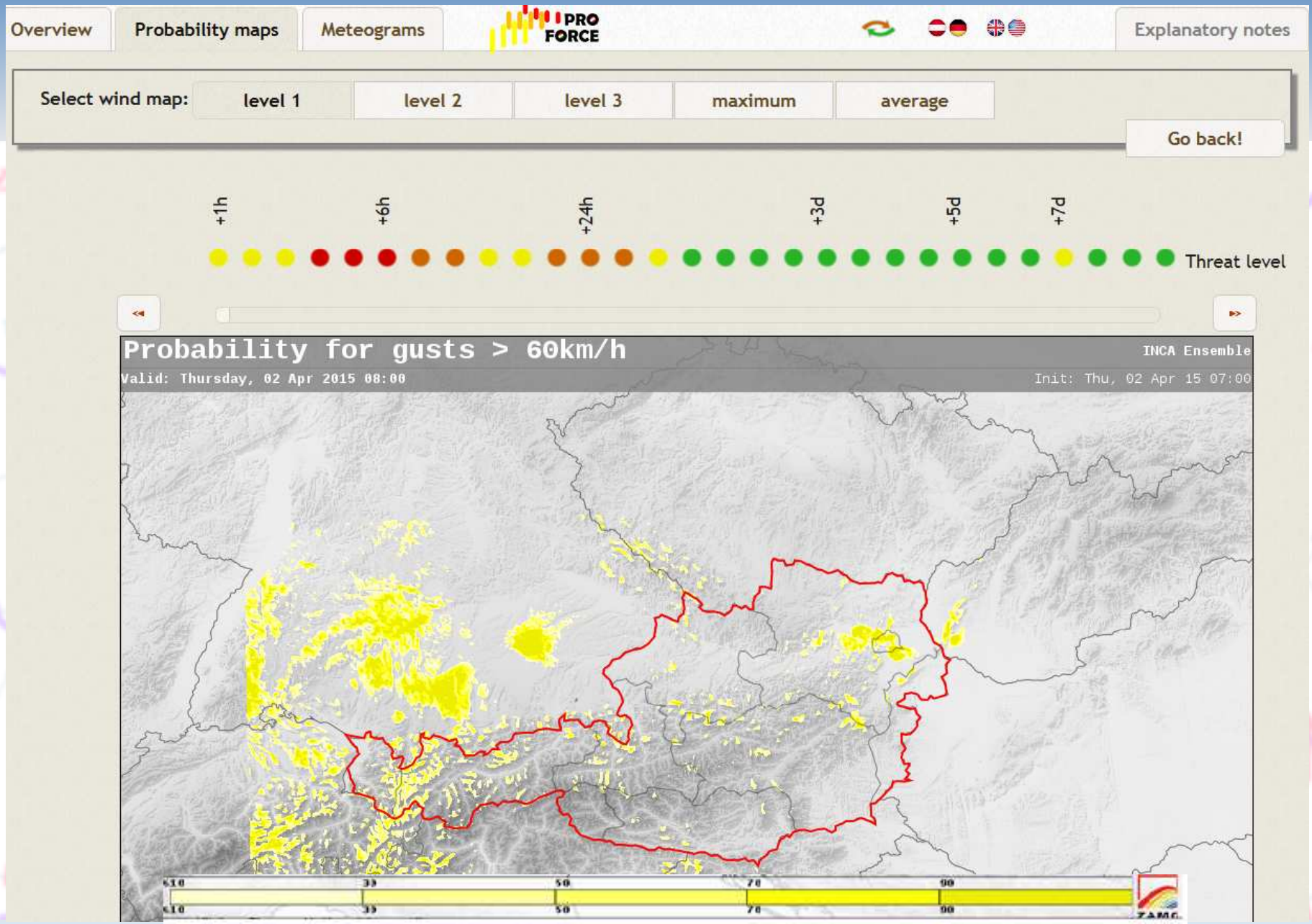
Webportal


Overview
Probability maps
Meteograms
PRO FORCE
Explanatory notes
Select wind map:
level 1
level 2
level 3
maximum
average
Go back!
+1h
+6h
+24h
+3d
+5d
+7d
Threat level
Probability for gusts > 60km/h
INCA Ensemble
Valid: Thursday, 02 Apr 2015 08:00
Init: Thu, 02 Apr 15 07:00

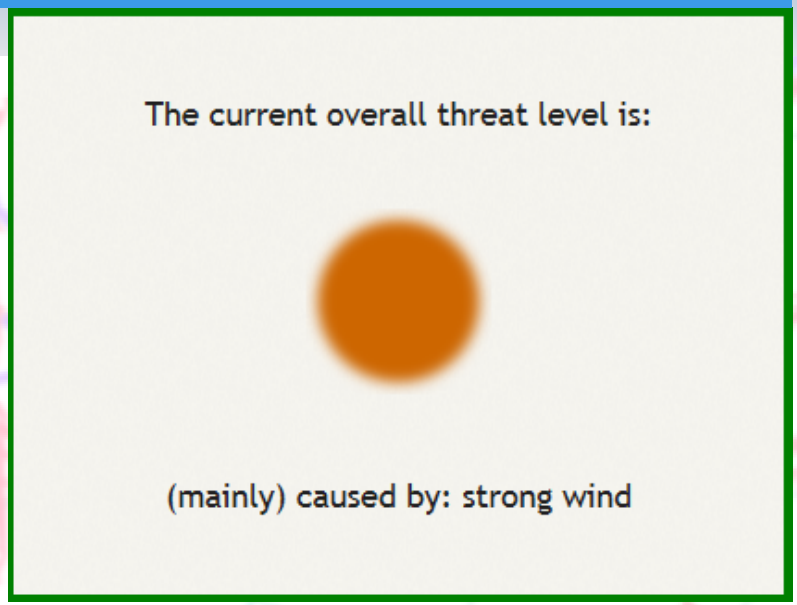
Threat by impact!

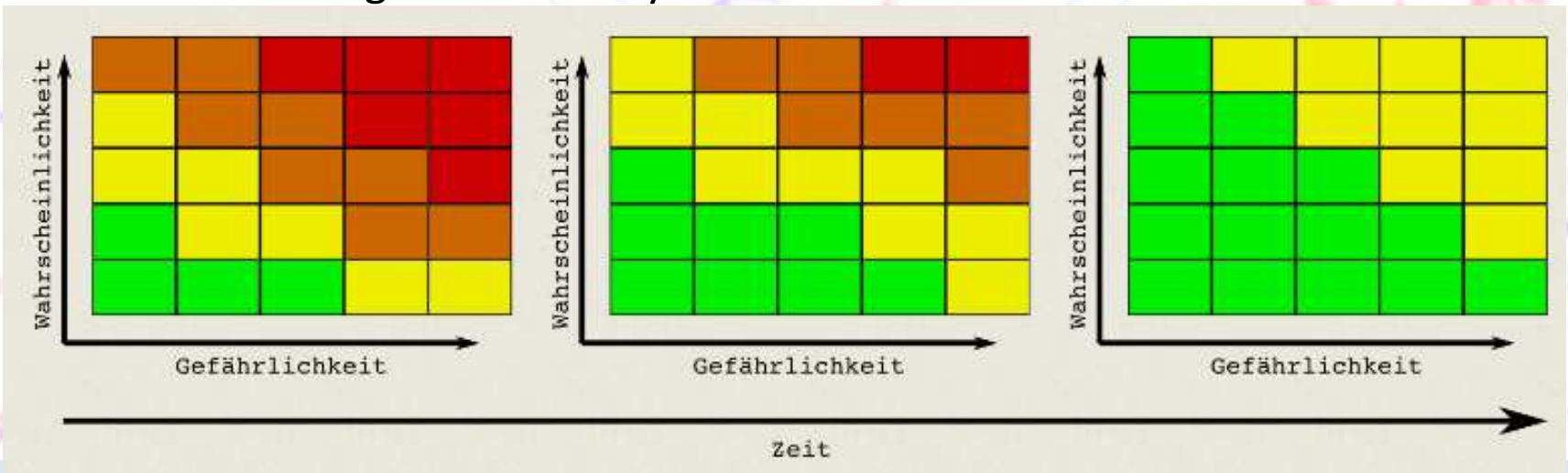
Threat level:

- Combination of probability and impact
- 3 warning levels: yellow, orange, red
- Also the forecast time plays a role:

  The farther into the future the more severe a potential event has to be to reach threat level
- General decay of forecast quality with increasing lead time is acknowledged in that way

Impact definded by Civil Protection!



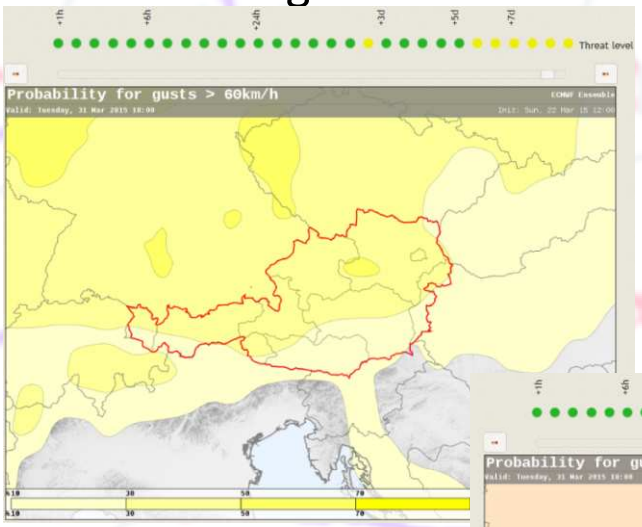


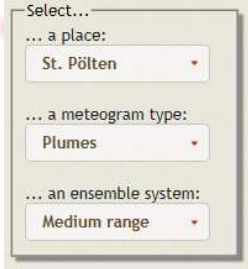
Case studies

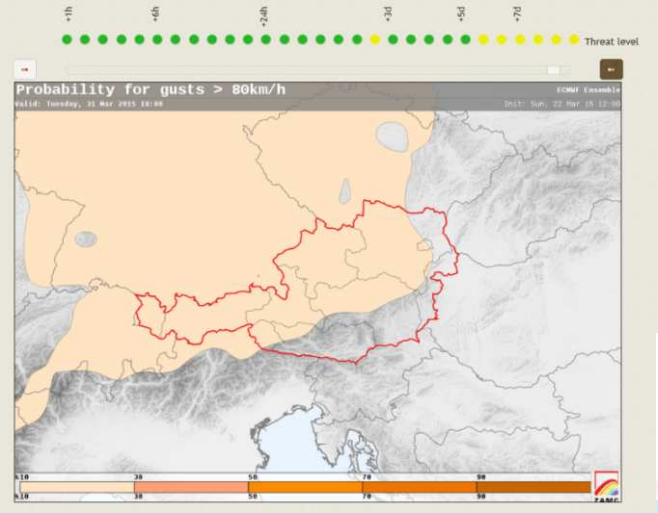
- **Storm Niklas March 30 – April 2 2015**

10 days before the event: ECMWF-EPS

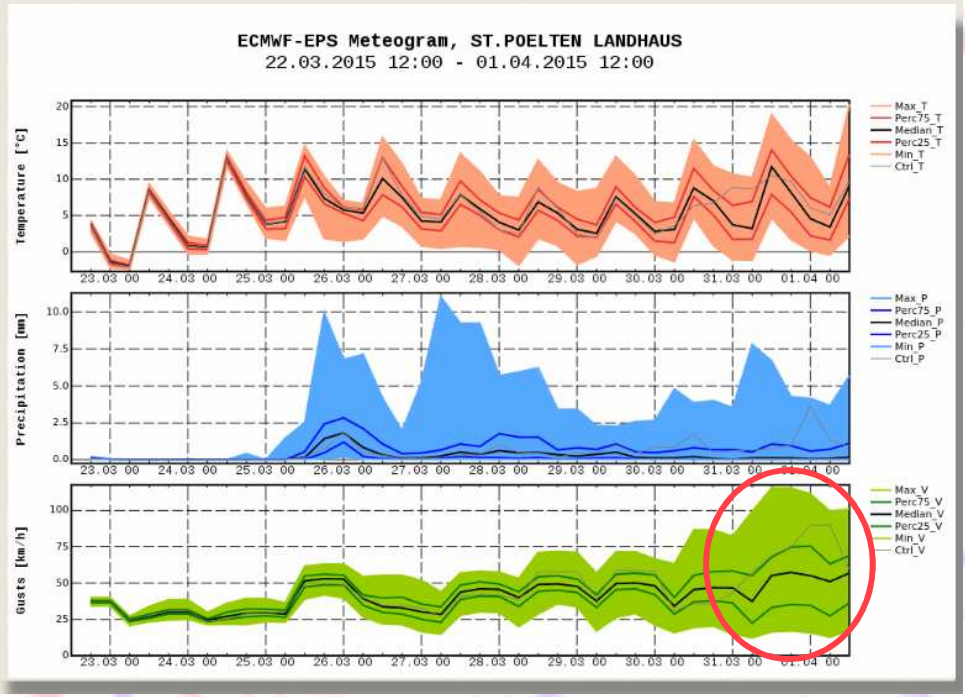
First signals of a heavy storm event are already visible - first awareness actions in the forecasting centres.







ECMWF forecast for Tuesday March 31, 18 UTC (Init. 2015032212 UTC). Probability of gusts > 60km/h (up) and > 80km/h (right).



ECMWF Meteogram for the capital city of St. Pölten (Init. 2015032212 UTC). Some members exceed the 100km/h threshold for this location.

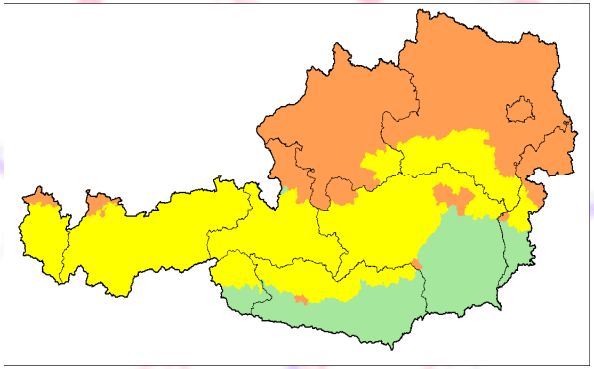
Case studies

- **Storm Niklas March 30 – April 2 2015**

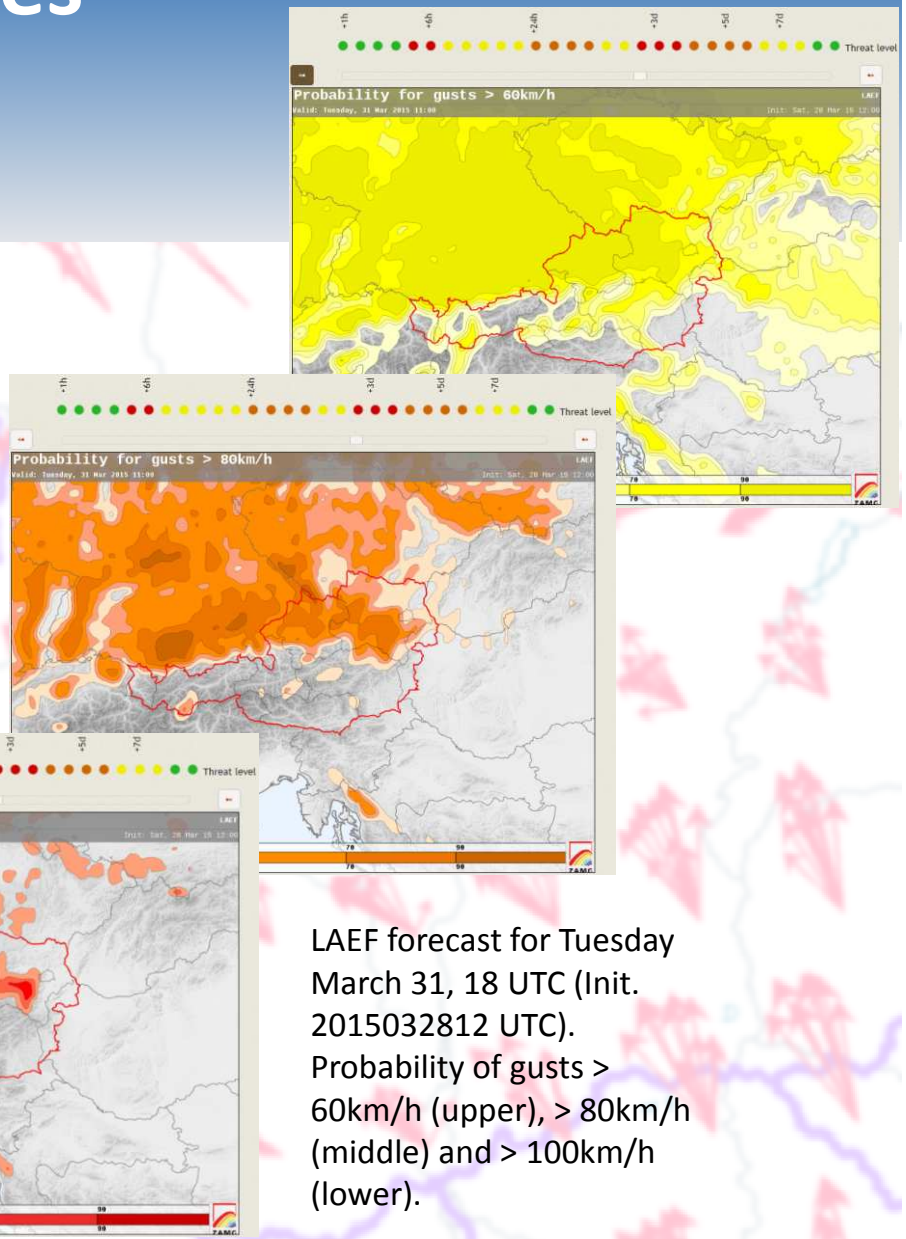
3 days before the event: LAEF

LAEF with a horizontal resolution of 11km includes more orographic details and confirms the forecast of ECMWF-EPS.

CP receives first official warnings – warning level was upgraded to orange. Local authorities are informed, first preparation actions are launched.



Official warning of ZAMG issued on March 27 12 UTC. Warning level was upgraded to orange (annuality < 3 times a year).



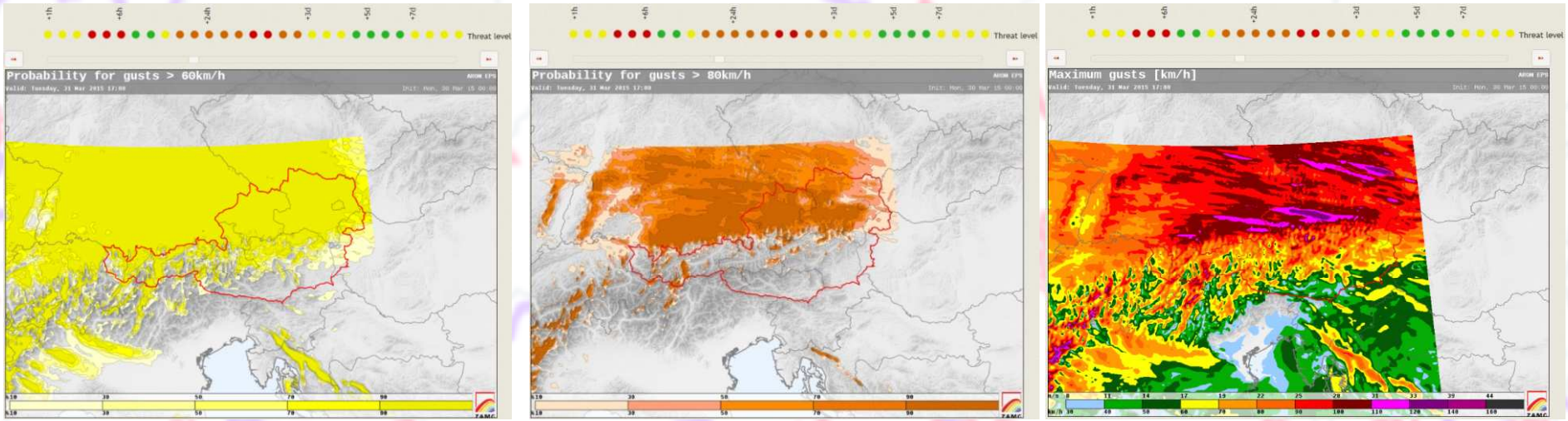
LAEF forecast for Tuesday March 31, 18 UTC (Init. 2015032812 UTC). Probability of gusts > 60km/h (upper), > 80km/h (middle) and > 100km/h (lower).

Case studies

- **Storm Niklas March 30 – April 2 2015**

1 day before the event: AROME-EPS

Convection permitting EPS system AROME with 2.5km resolution and 48 hours forecasting range. Warning level orange was extended in time, basic warning was increased to 100km/h for the western parts of Lower Austria - final preparedness and prevention actions in CP are launched.



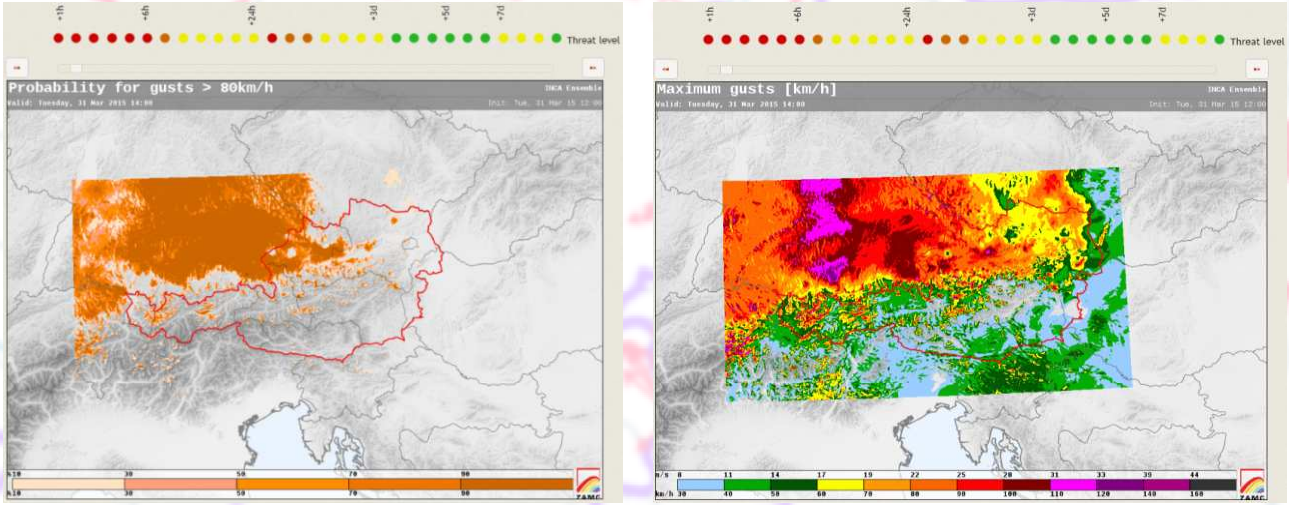
AROME-EPS forecast for Tuesday March 31, 17 UTC (Init. 2015033015 UTC). Probability of gusts > 60km/h (left), > 80km/h (middle) and Ensemble max. wind speed (right).

Case studies

- **Storm Niklas March 30 – April 2 2015**

Nowcasting: Ensemble-INCA

1km resolution, 12h forecasting range, 15min update interval.Warning level orange was extended in time, basic warning was increased to 100km/h for the western parts of Lower Austria - final preparedness and prevention actions in CP are launched.



Ensemble-INCA forecast for Tuesday March 31, 14 UTC (Init. 2015033112 UTC). Probability of gusts > 80km/h (left) and Ensemble max. wind speed (right).

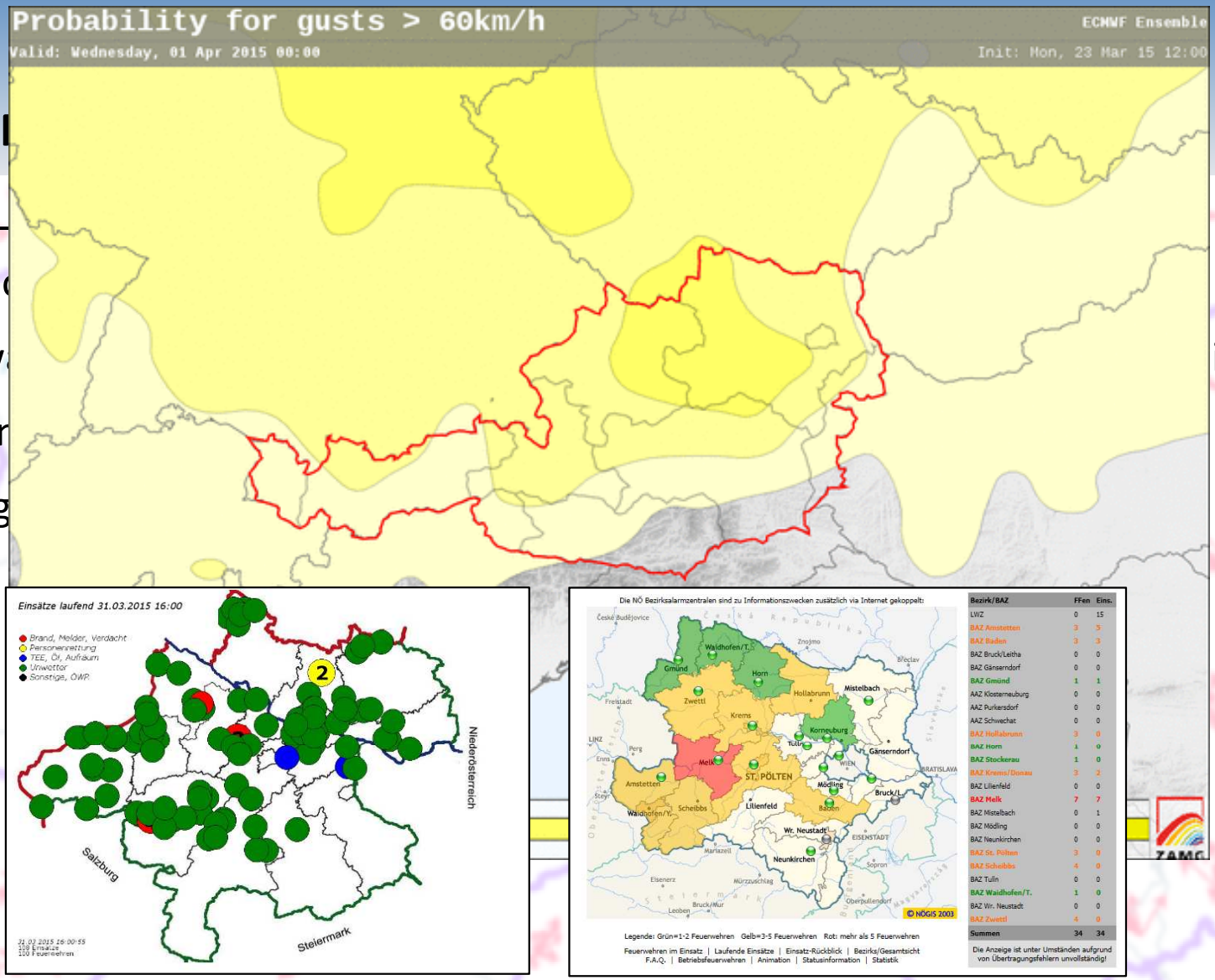
Case studies

- **Storm I**

Feedback

- Very goo
- First awa
- Additior
- Very hig

inistic)



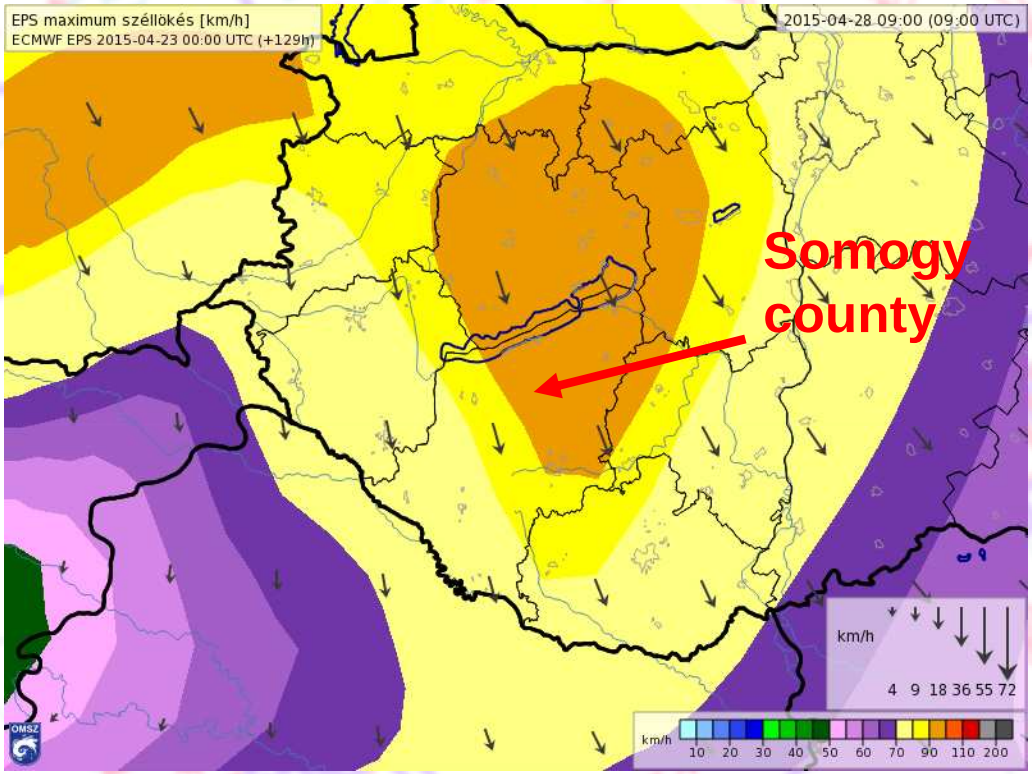
Map of Upper Austria (left) and Lower Austria (middle) with marked operations due to strong wind. A comparison with the seamless forecast of the event (probability of exceeding 60km/h) shows the very high correspondence between operations and forecast.

A severe windstorm over Hungary

6 days before the event

(Tuesday, 28 April 2015)

Maximum gust
(can exceed 90 km/h)



ECMWF-EPS:

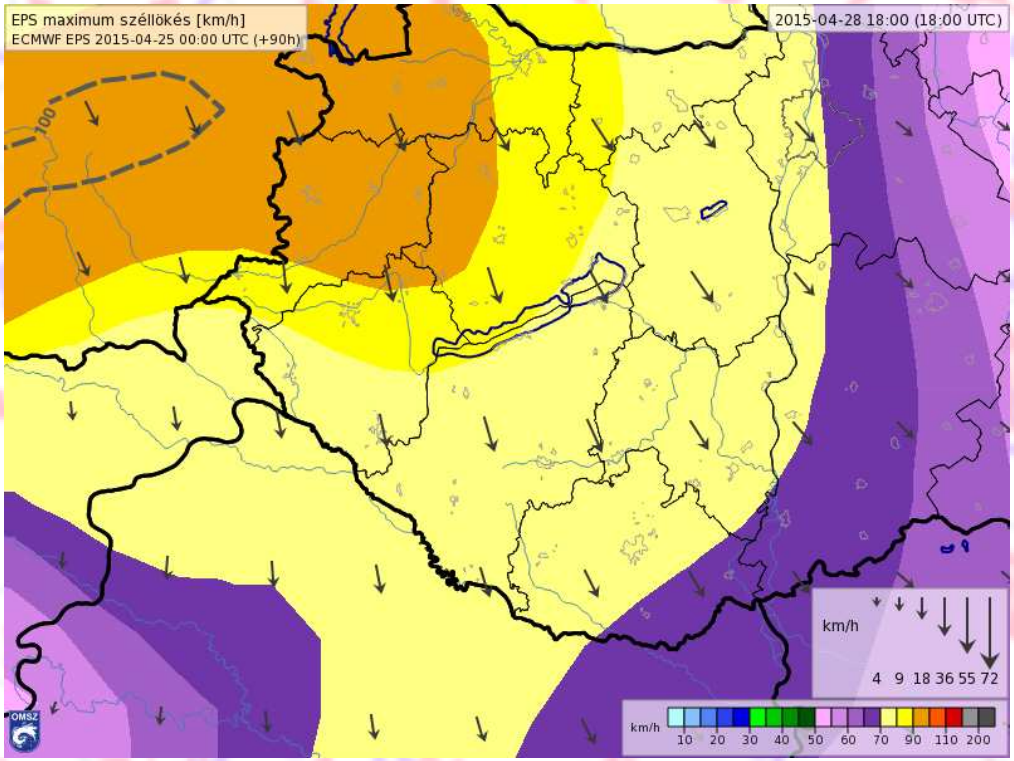
1. Windstorm from NW
2. In the morning (peak at 09 UTC),
3. North of the county (Lake Balaton)
4. probability: 20-30% over 70km/h

A severe windstorm over Hungary

4 days before the event

(Tuesday, 28 April 2015)

Maximum gust
(70-80 km/h)



ECMWF-EPS:

Change!

- **In the evening (peak at 18 UTC)!**
- **probability: 50-60% over 70km/h!**
- **Intensity weaker!**

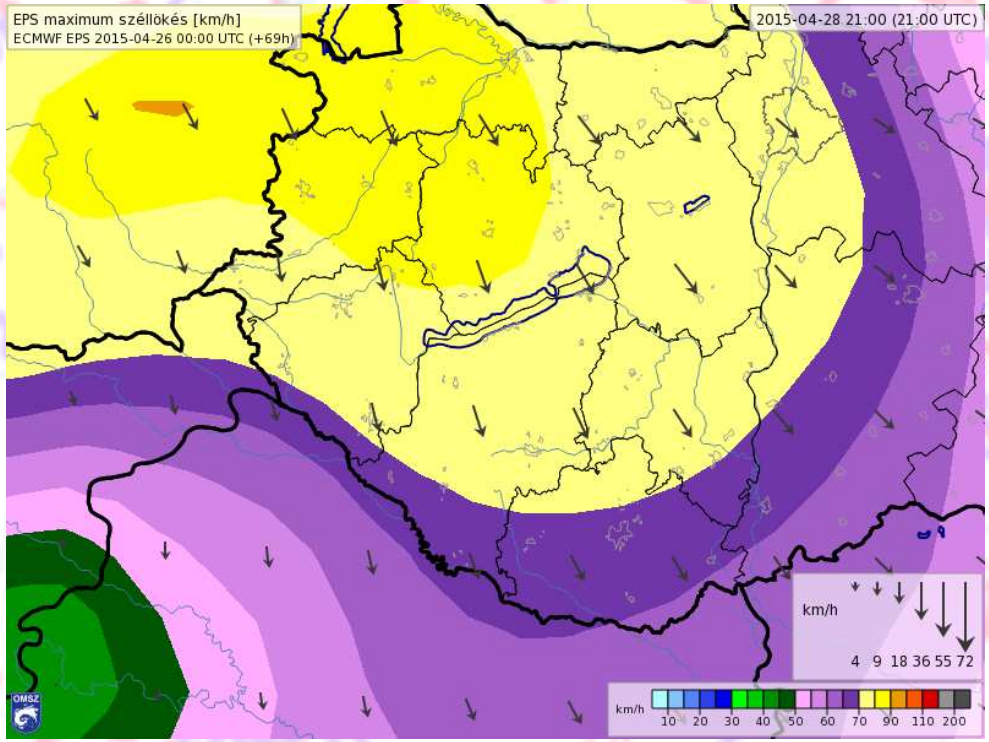
A severe windstorm over Hungary

3 days before the event
(Tuesday, 28 April 2015)

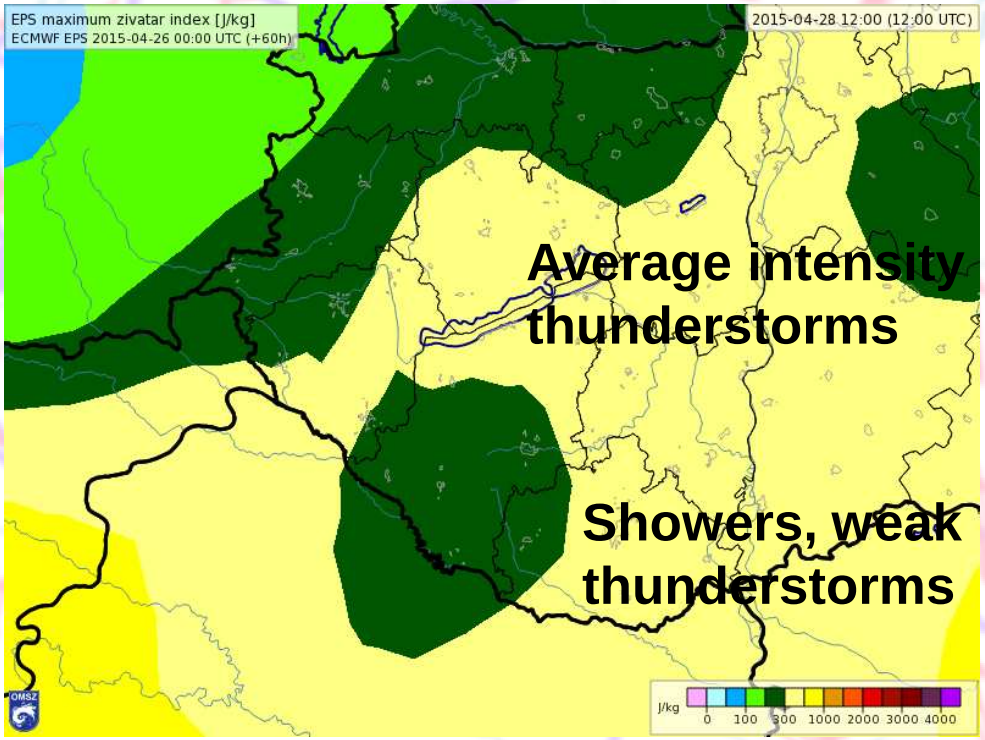
ECMWF-EPS:

- **Probability: 40% over 70km/h! No probability for 90km/h.**
- **Intensity even weaker!**
- **Weak thunderstorm!**

Maximum gust
(70-80 km/h)



EPS Maximum for thunderstorm index



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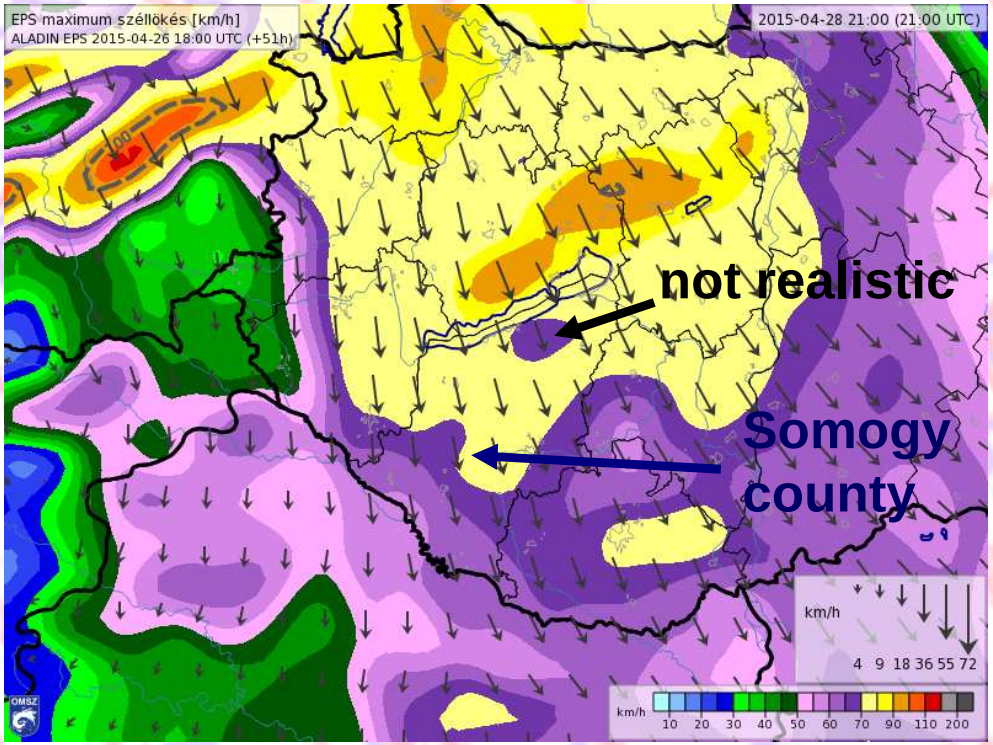
A severe windstorm over Hungary

1 days before the event

(Tuesday, 28 April 2015)

Maximum gust
(70 km/h)



ALADIN-EPS:

Change!

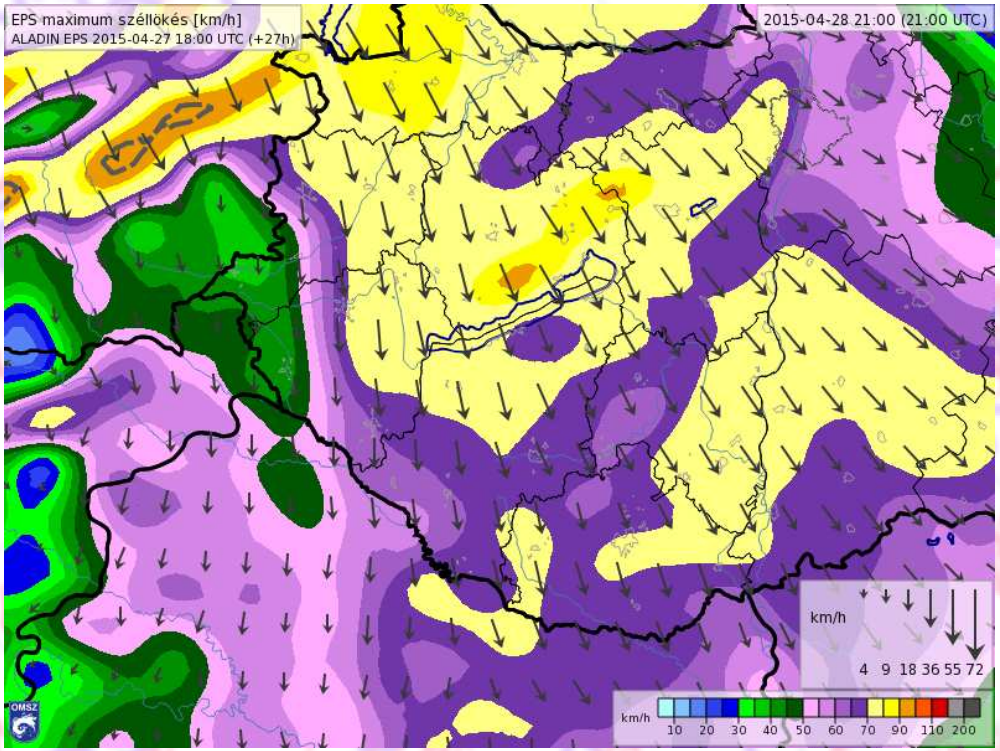
- **peak at 21 UTC!**
- **probability: 50% over 70km/h, but no > 90 km/h**
- **Intensity weaker!**
- **Shower, thunderstorm possible**

A severe windstorm over Hungary

The day of the event, in the morning

(Tuesday, 28 April 2015)

Maximum gust
(70 km/h)

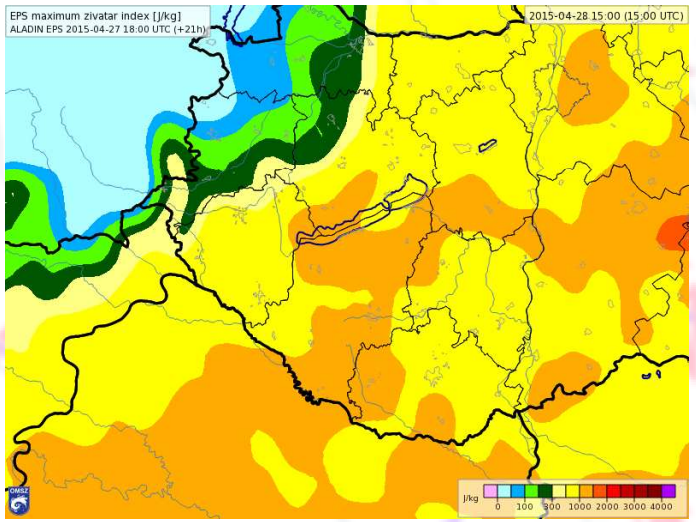


ALADIN-EPS:

No important change! The maximum gust even a bit weaker.

Thunderstorm possible, weak to normal!

EPS Maximum for thunderstorm index



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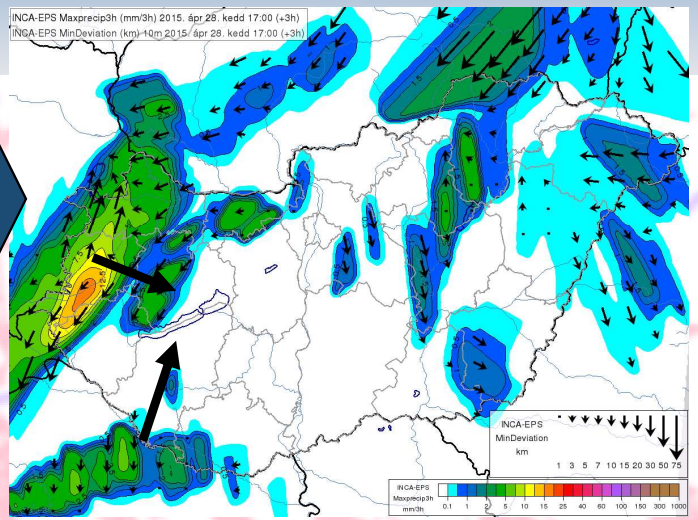
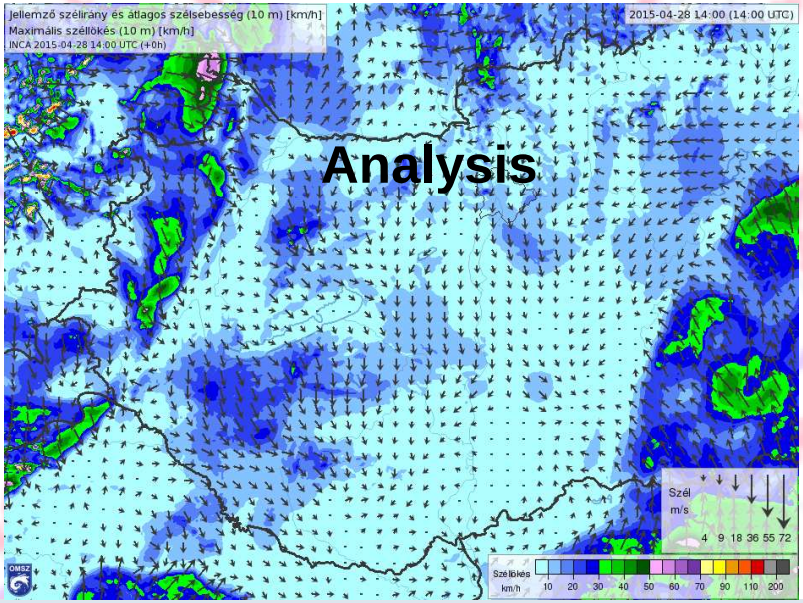
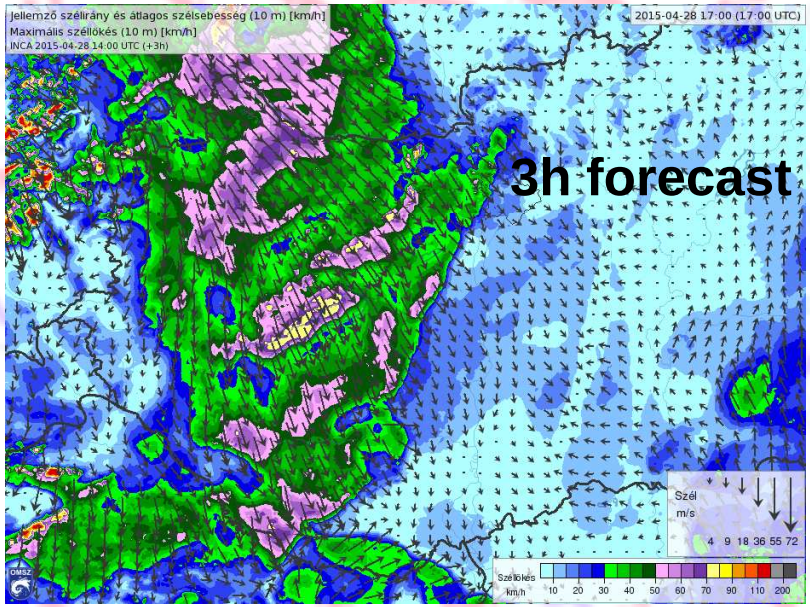
The event – 1400 UTC
(Tuesday, 28 April 2015)

INCA-EPS 3h nowcasts: Frontal precipitation approaching the area of Balaton, convective pre-frontal cells coming **from south**



INCA EPS Wind analysis and nowcast:
The wind will reach gale intensity at Balaton within 3h





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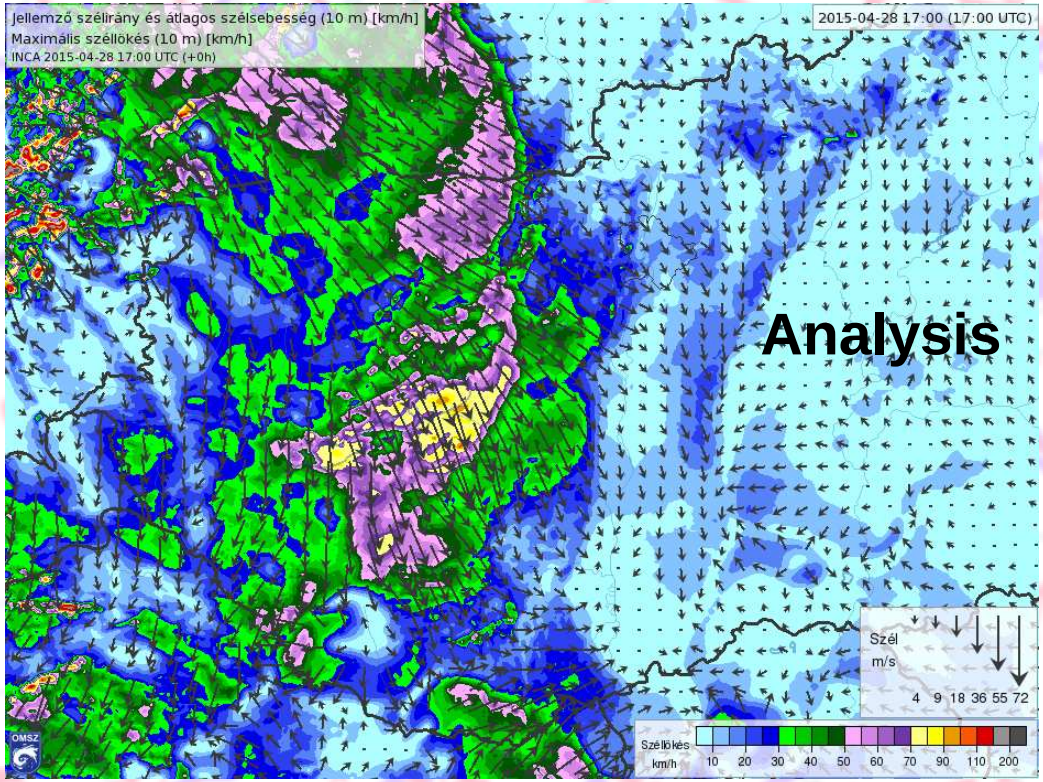
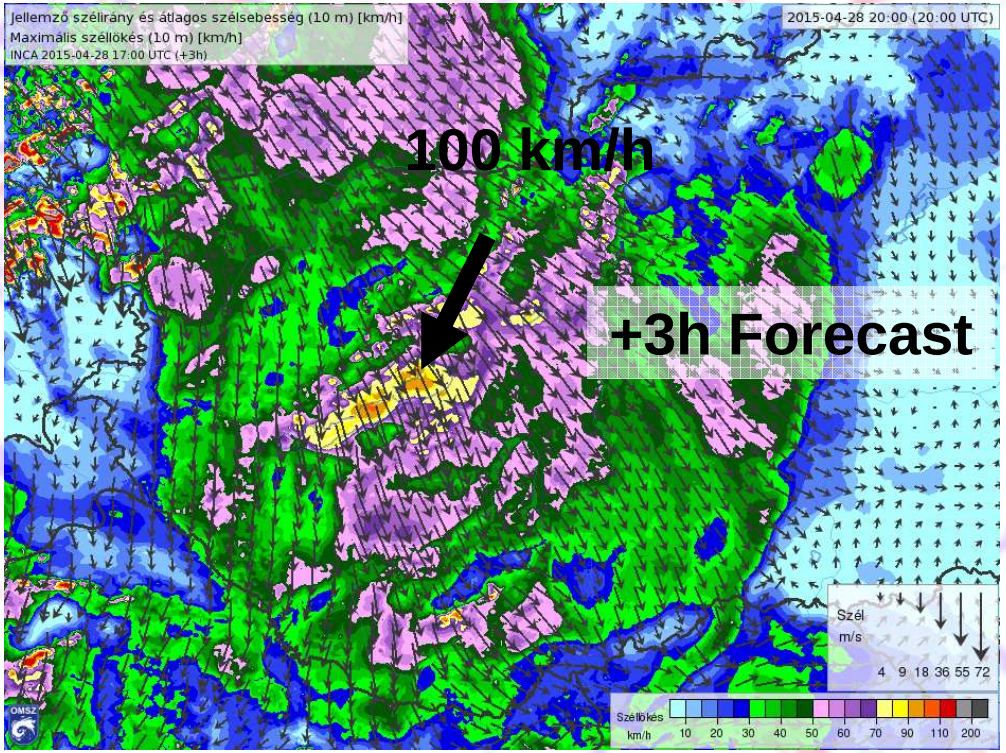
Caution! Day of the event – 1700 UTC (Tuesday, 28 April 2015)

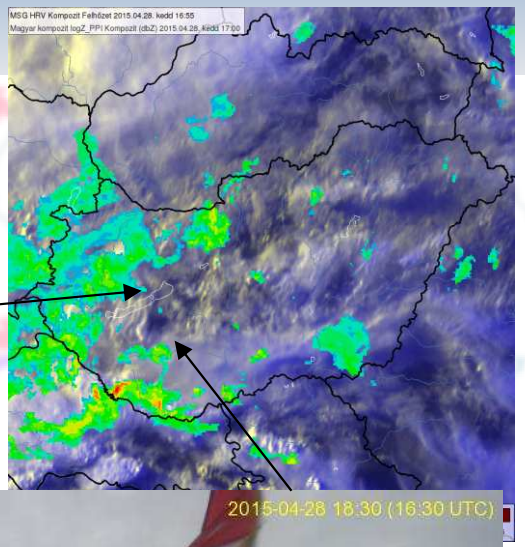
Wind analysis and nowcast: The wind already turned at Balaton and intensified (70-90 km/h gusts) as planned. But the INCA nowcasts indicate that **the wind can reach 100 km/h as well**. This was **not** forecast by ECMWF and ALADIN-EPS !!!





The event – 1700 UTC
(Tuesday, 28 April 2015)

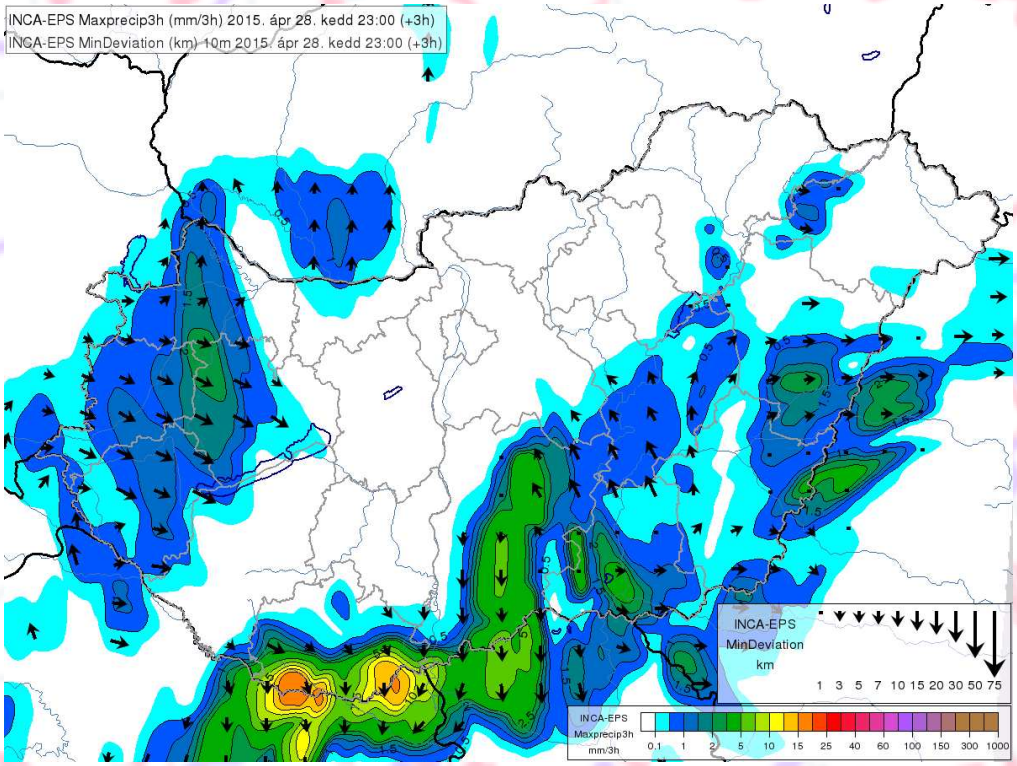
Observations confirmed! Windstorm at Balaton is already strong, the front reached the inner part of the County as well. The stable cold air inhibits convection. Heavy cells are only at the south.



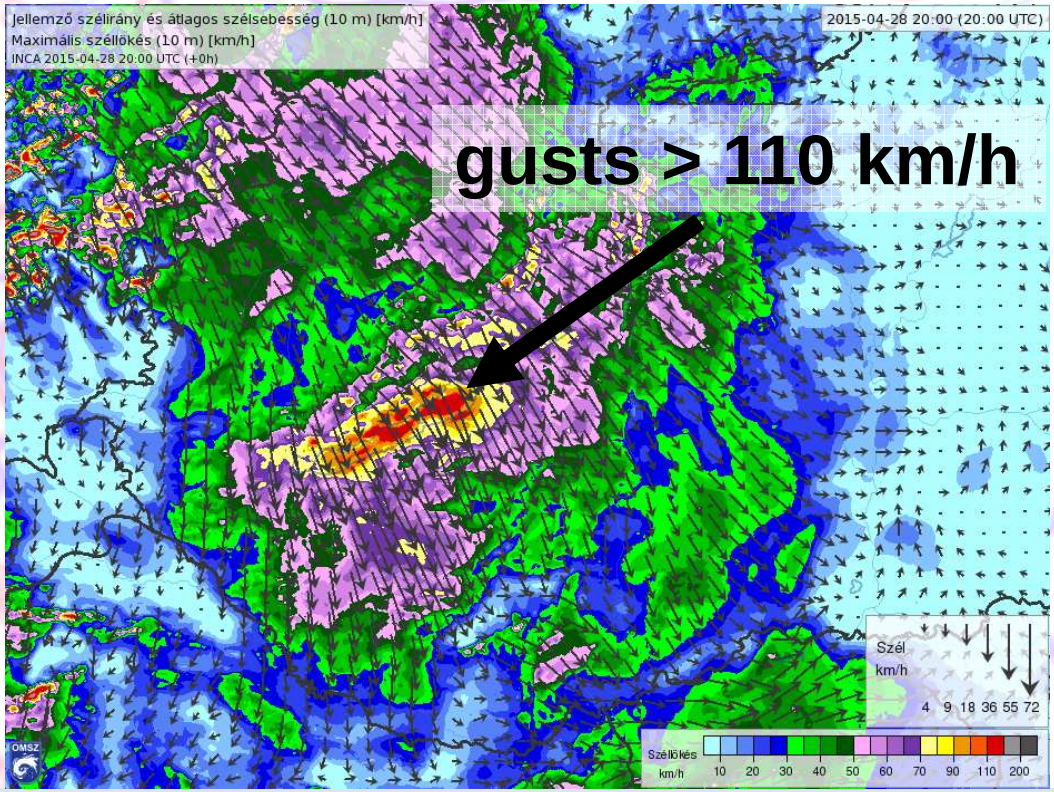
The event – 2000 UTC (Tuesday, 28 April 2015)

INCA-EPS 3h precipitation nowcasts: Heavy precipitation is aready out of the Somogy County. But the gale at Balaton further intensified!!!
But INCA can sometimes overestimate the gust speed. We might verify it ...

EPS INCA – maximum precipitation



INCA wind analysis



The event – 2000 UTC

(Tuesday, 28 April 2015)

IMPACT, after the event
(Wednesday, 29 April 2015)

Impact of : Damaged power lines on the railway at Balaton, buildings, ships in the harbour of Siófok. About 17 rescue actions required.

Summary and Follow up

In the frame of PROFORCE, 4 weather and civil protection partners from Austria and Hungary have worked together on:

An innovative seamless probabilistic forecasting system in time and space tailored to civil protection, for:

- improvements in the accuracy and timeliness of severe weather warnings
- improved preparedness and decision making procedures in civil protection agencies
- cooperation between weather and civil protection authorities
- transnational cooperation on warning

Adaptation of the developed system for further use in other European countries and in other application area


THANK YOU
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mahalo
kitos
cheers
hvala
toda
gracias
grassie
thank you
danki
grazie
welalin
mahalo
danki
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merci
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