



Cold wave in Slovakia in October 2015

using ECMWF EPS and ALADIN LAEF

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Content

- ALADIN LAEF
- Orography in Slovakia
 - Typical cold advection over Slovakia
- Case study
 - ECMWF EPS
 - ALADIN LAEF
 - Limited Area Ensemble Forecast



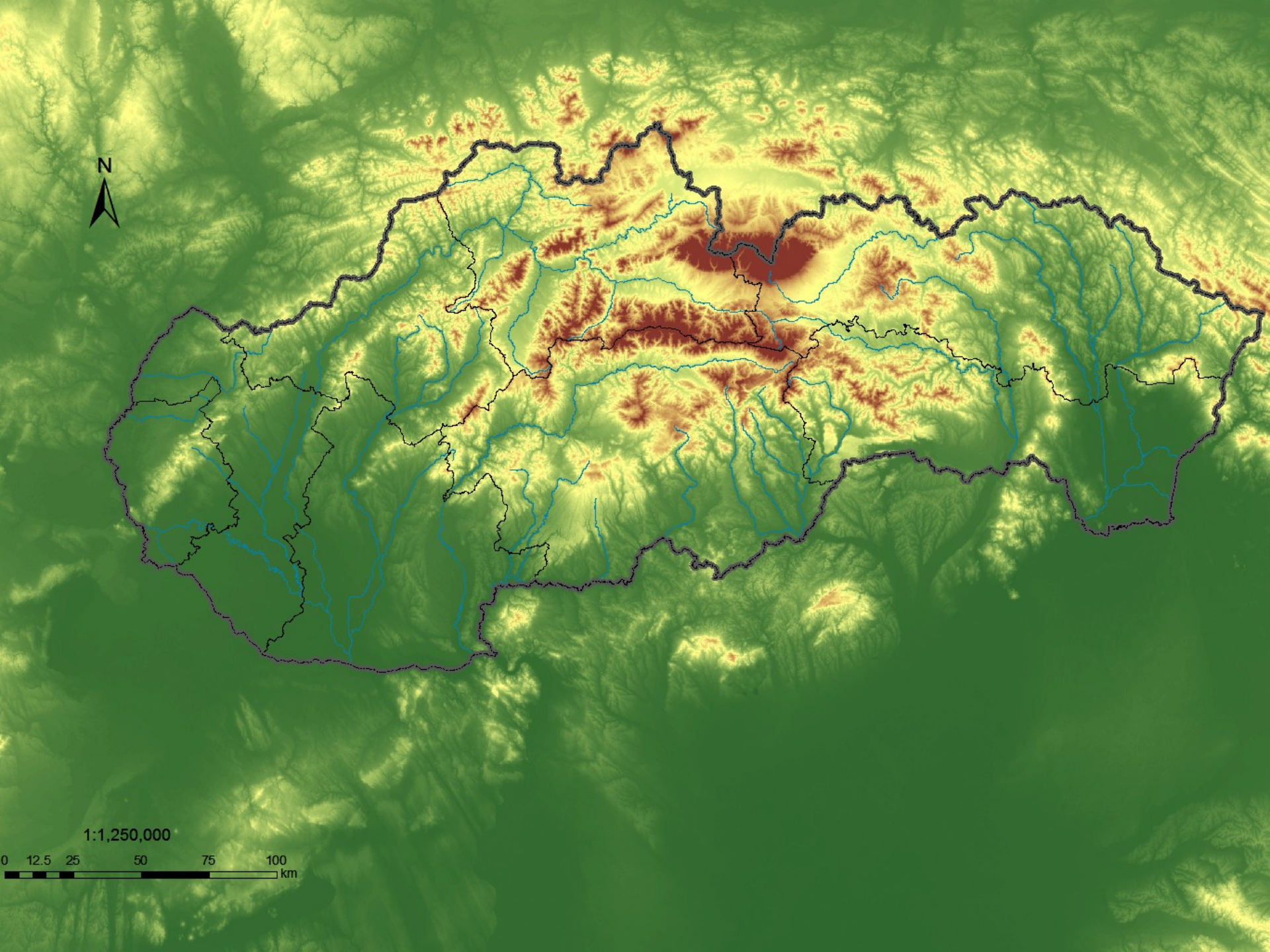
ALADIN LAEF

- 16 members + control run
- 10,9 km horizontal resolution
- 45 vertical levels
- 00 and 12 UTC runs up to +72h
- lagged ECMWF-EPS coupling (by 12h) – first 16 members, but with current assimilation (+ perturbation) T2m, RH2m

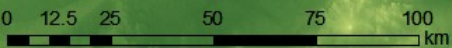


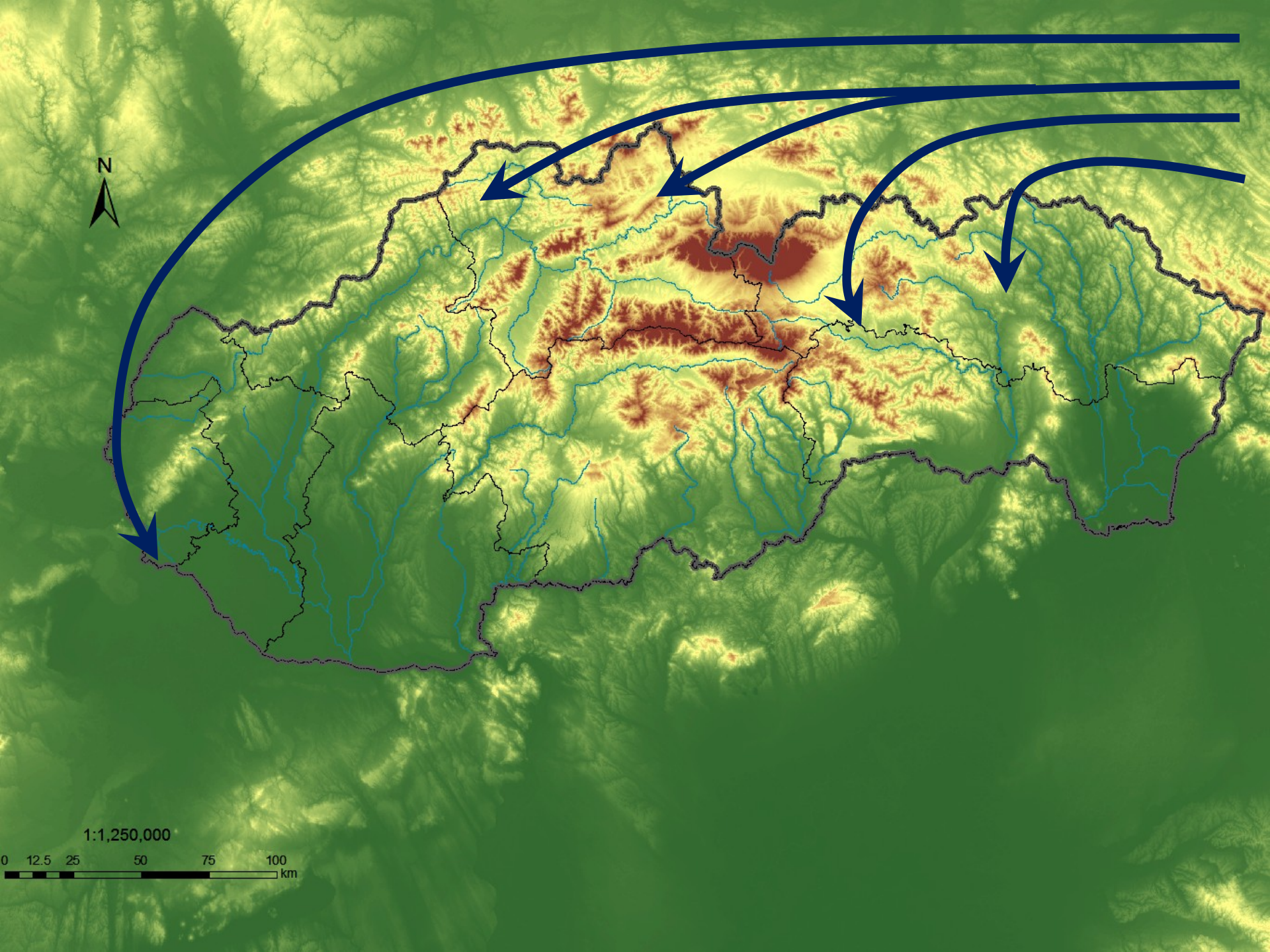
Cold air over Slovakia

- Cold advection is typically shallow
=> big influence of mountains



1:1,250,000

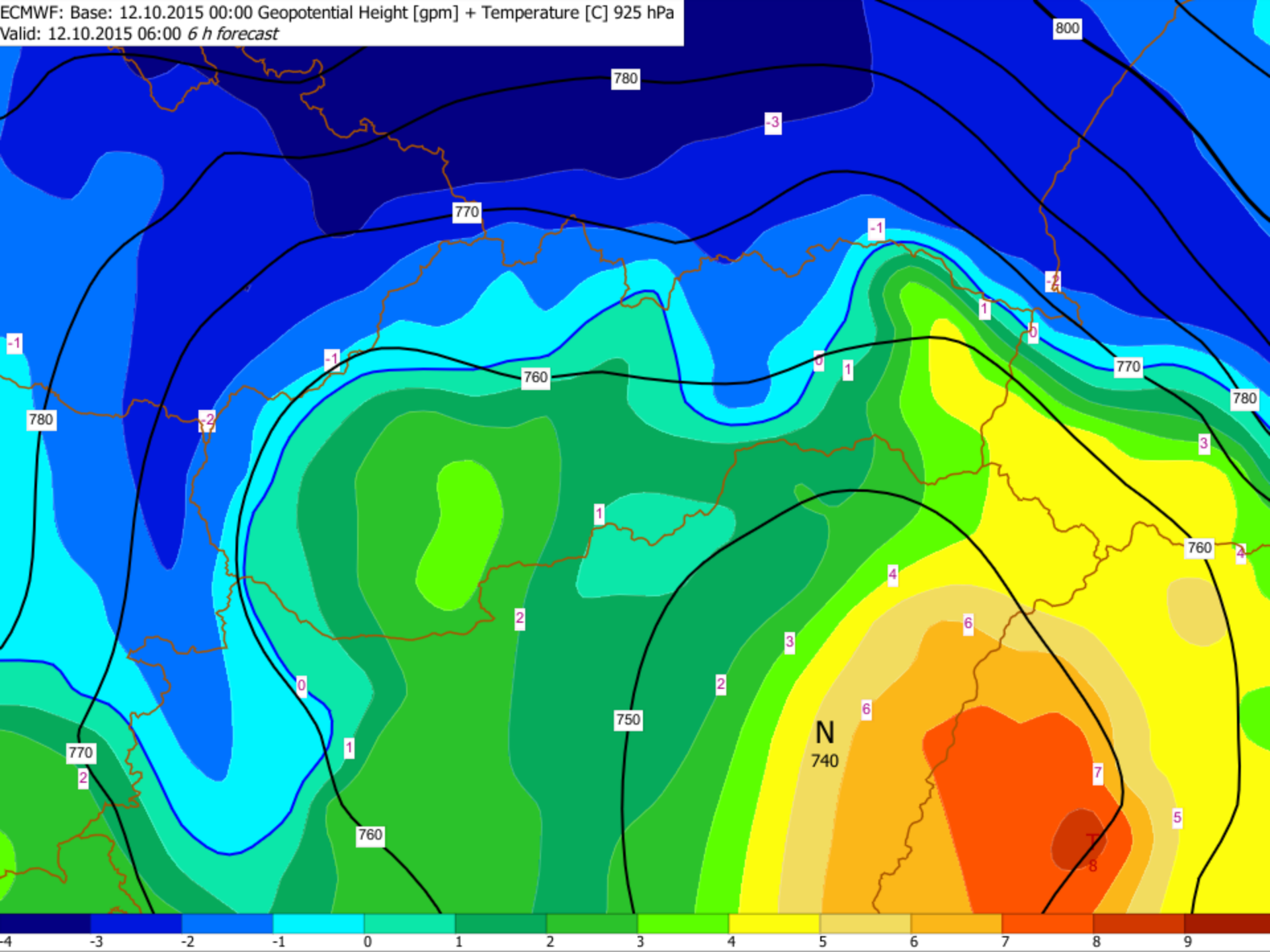




N

1:1,250,000

0 12.5 25 50 75 100 km





Forecasting the case of 12-13 October

- EPS ECMWF
 - 3-12/10/2015
- ALADIN LEAF
 - 10-12/10/2015

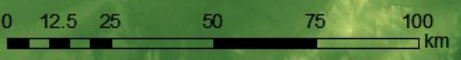


• **Poprad**

Tmax + Precipitation 12.10.
(cloudy, weak wind, humid air)

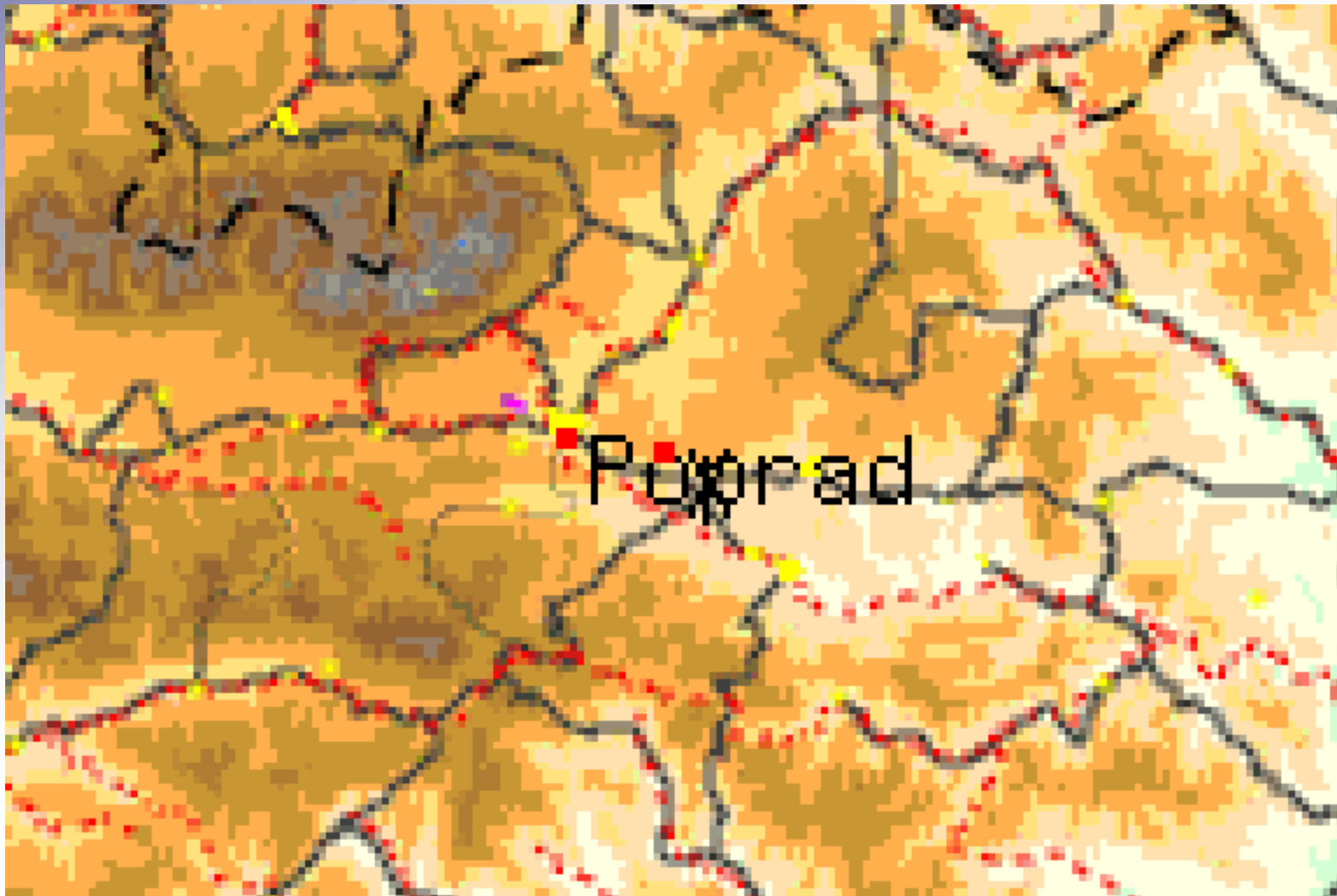
☹️ **precipitation only from ECMWF**

1:1,250,000



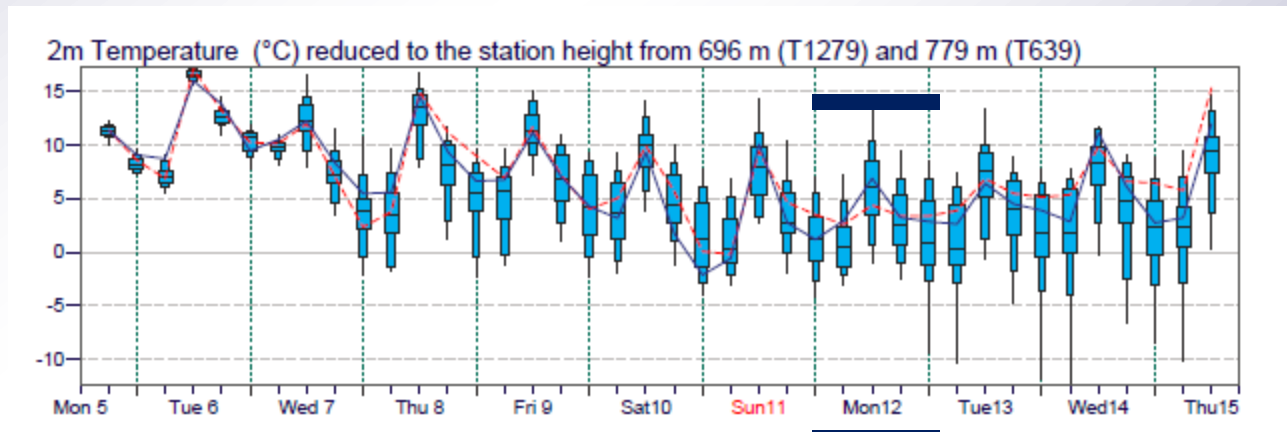
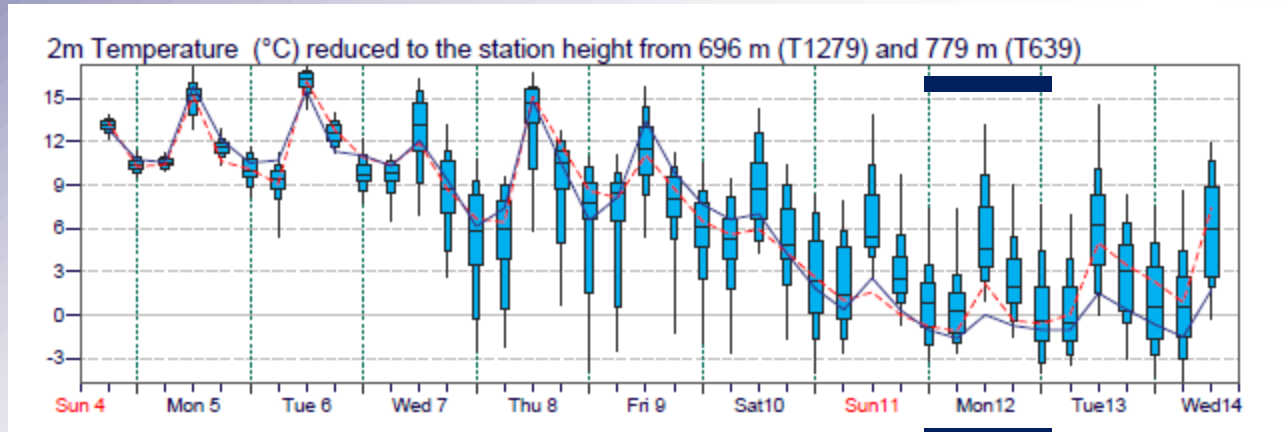


EPS ECMWF – Poprad – grid point



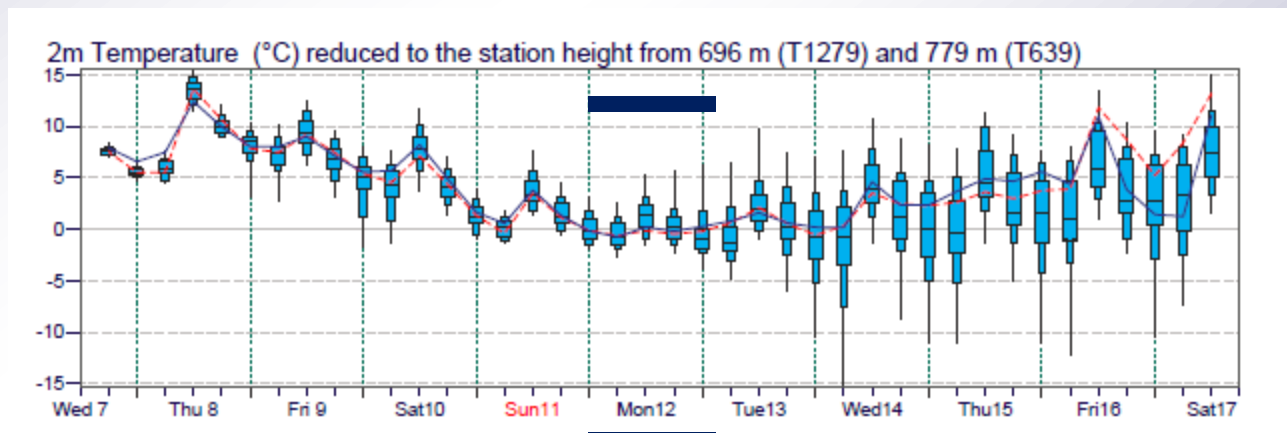
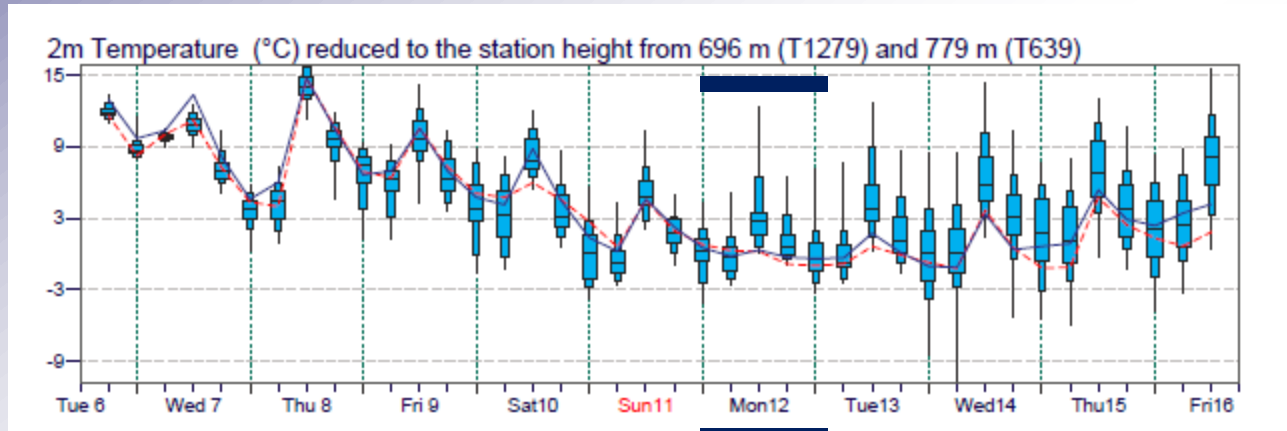


EPS ECMWF - Poprad





EPS ECMWF - Poprad





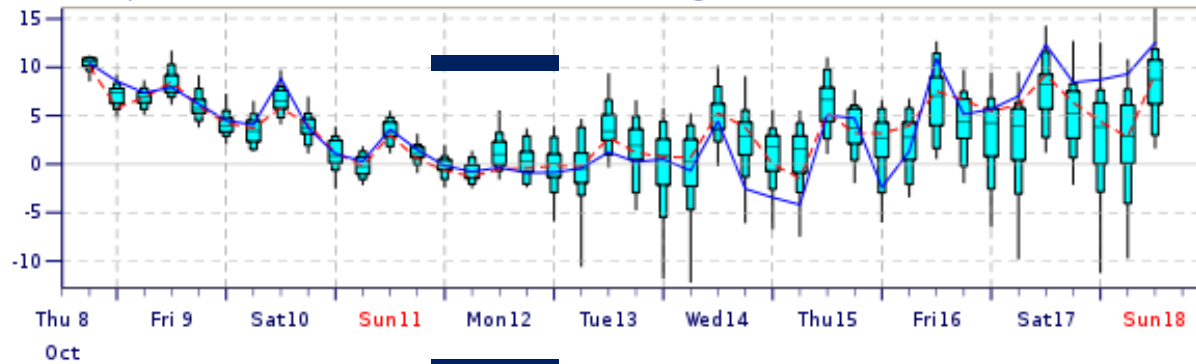
EPS ECMWF - Poprad

ENS Meteogram

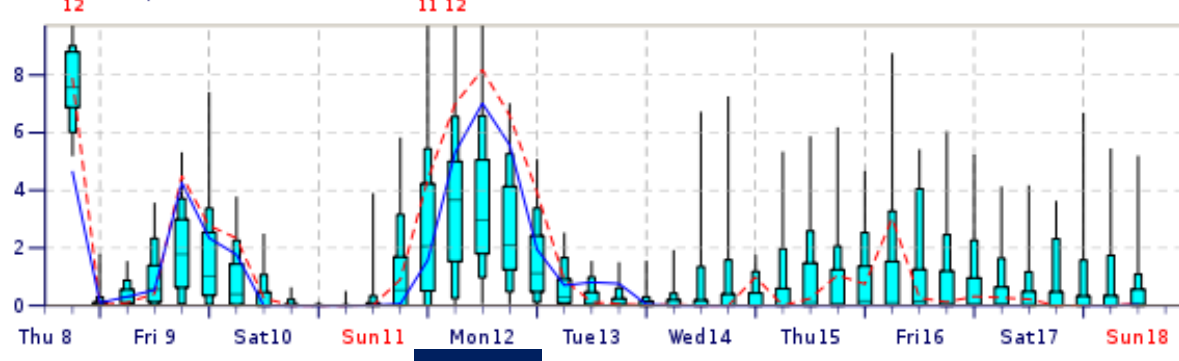
Poprad, Slovakia 49.04°N 20.42°E (EPS land point) 687 m

High Resolution Forecast and ENS Distribution Thursday 8 October 2015 12 UTC

2m Temperature(°C) reduced to 687 m (station height) from 696 m (T1279) and 779 m (T639)



Total Precipitation (mm/6h)



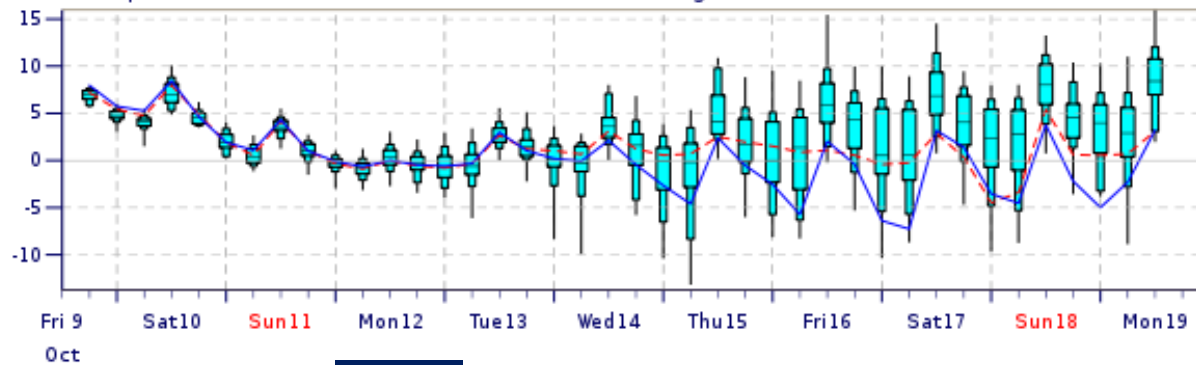
EPS ECMWF - Poprad

ENS Meteogram

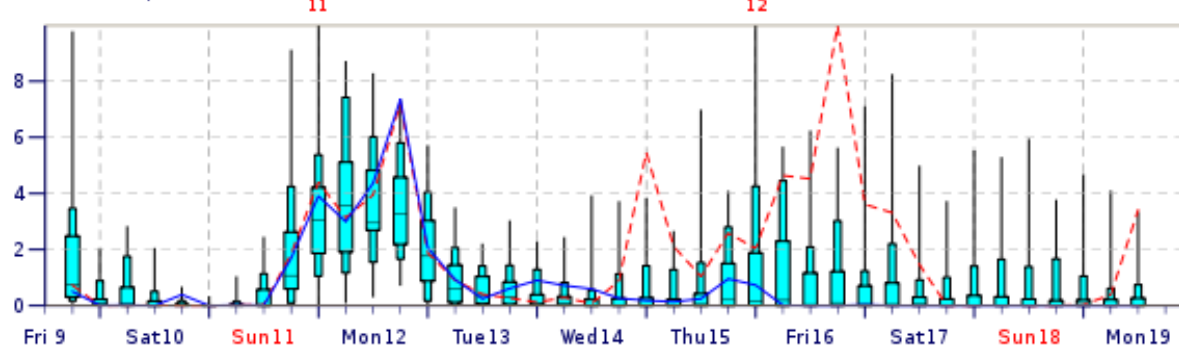
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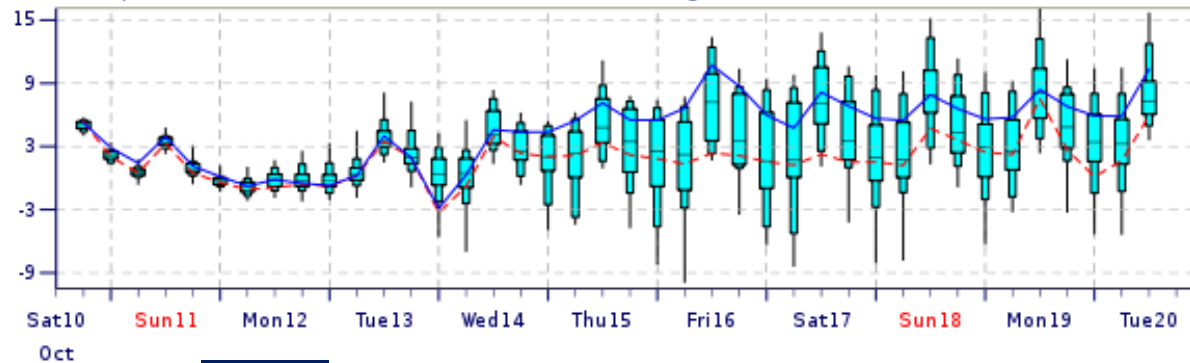
EPS ECMWF - Poprad

ENS Meteogram

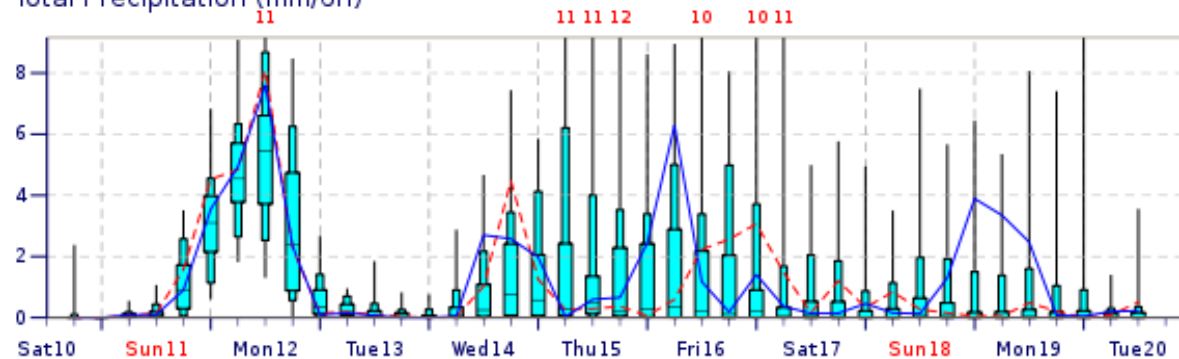
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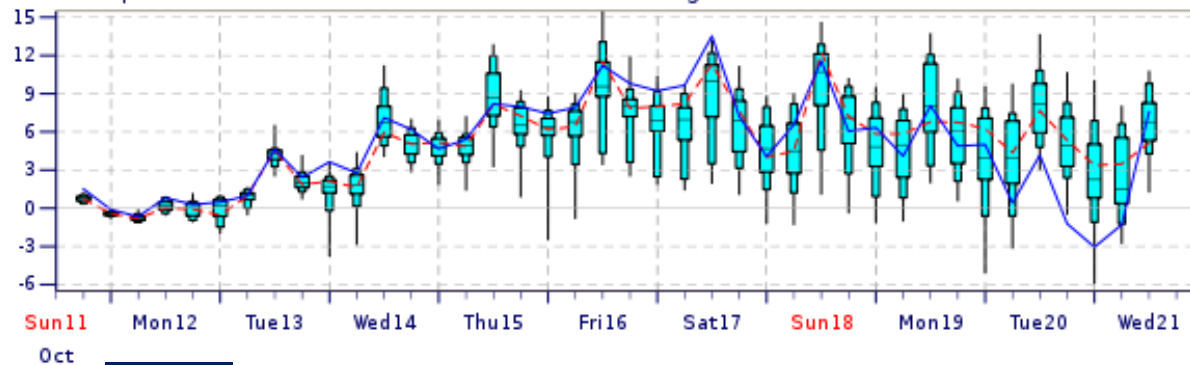
EPS ECMWF - Poprad

ENS Meteogram

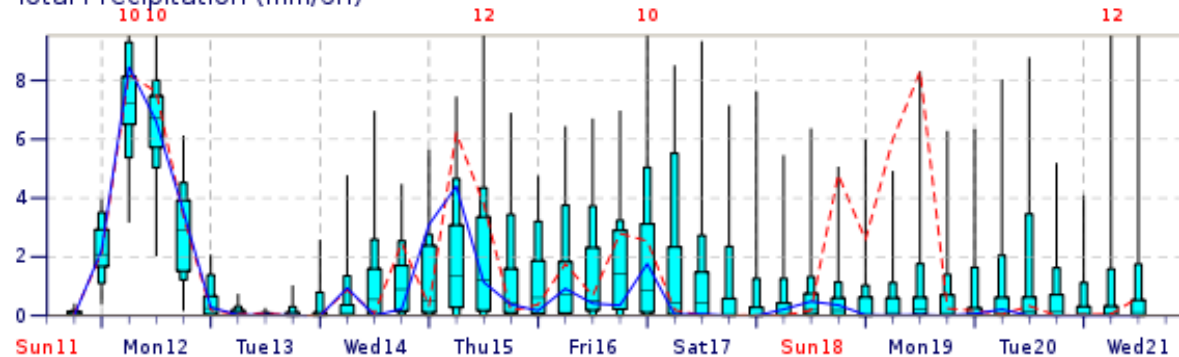
Poprad, Slovakia 49.04°N 20.42°E (EPS land point) 687 m

High Resolution Forecast and ENS Distribution Sunday 11 October 2015 12 UTC

2m Temperature(°C) reduced to 687 m (station height) from 696 m (T1279) and 779 m (T639)



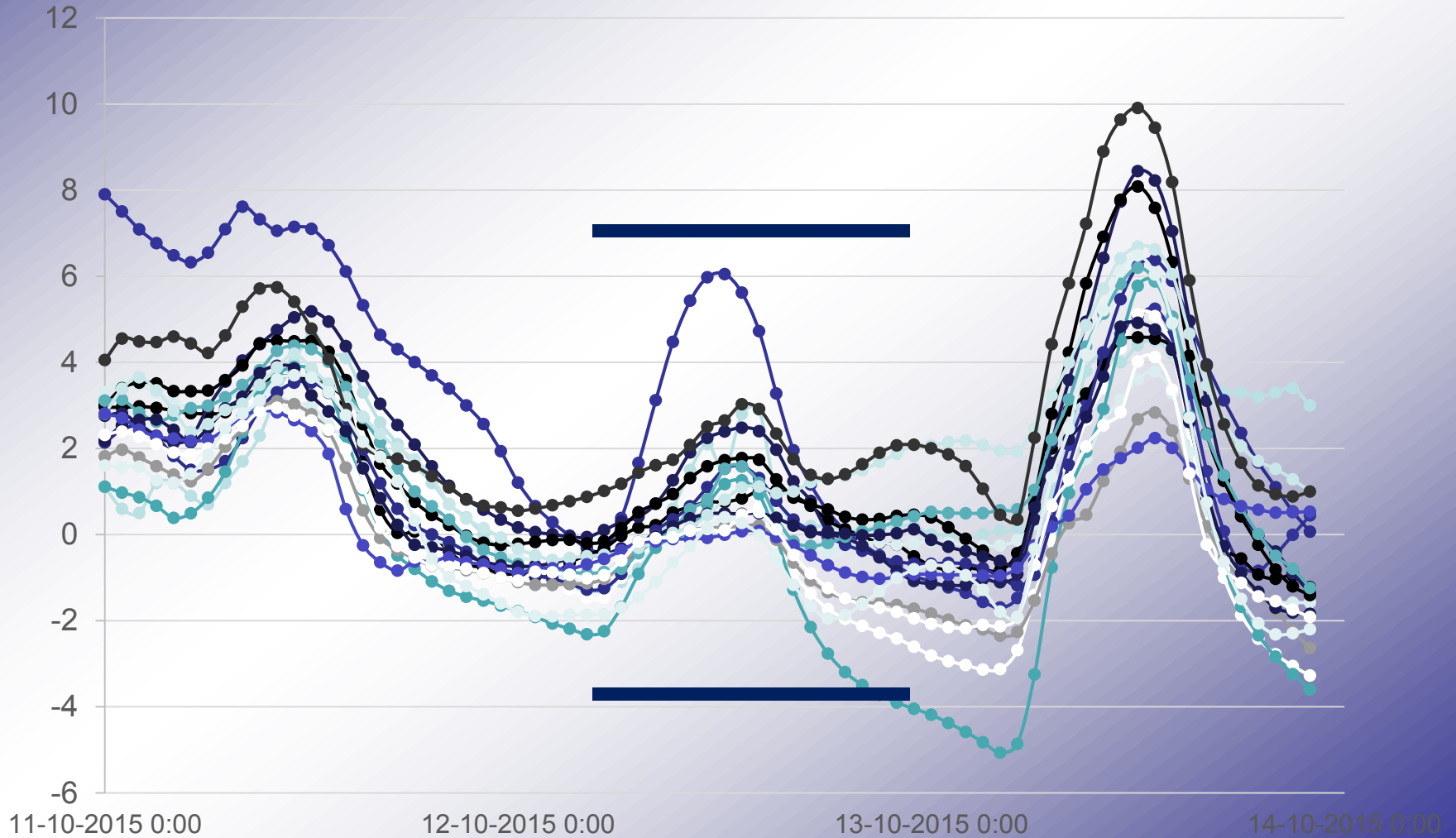
Total Precipitation (mm/6h)





LAEF - Poprad

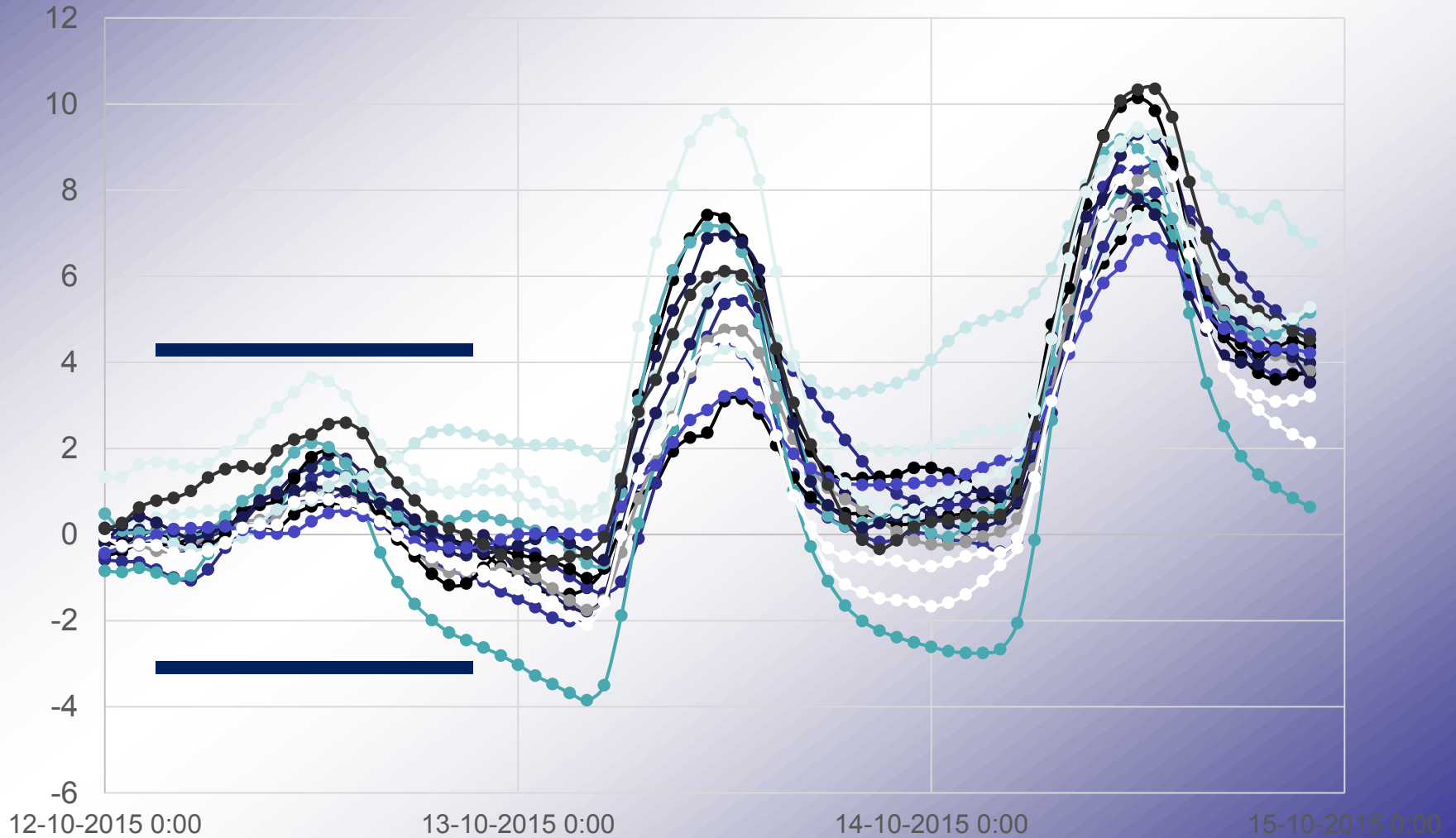
Poprad RCLACE LAEF 2015-10-11 00:00





LAEF - Poprad

Poprad RCLACE LAEF 2015-10-12 00:00



17 mm / 12 hours till 12:00 UTC

More than 10 cm snow

Tmax 2,8 °C





Kuchyňa

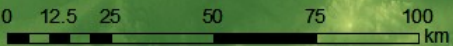


Bratislava

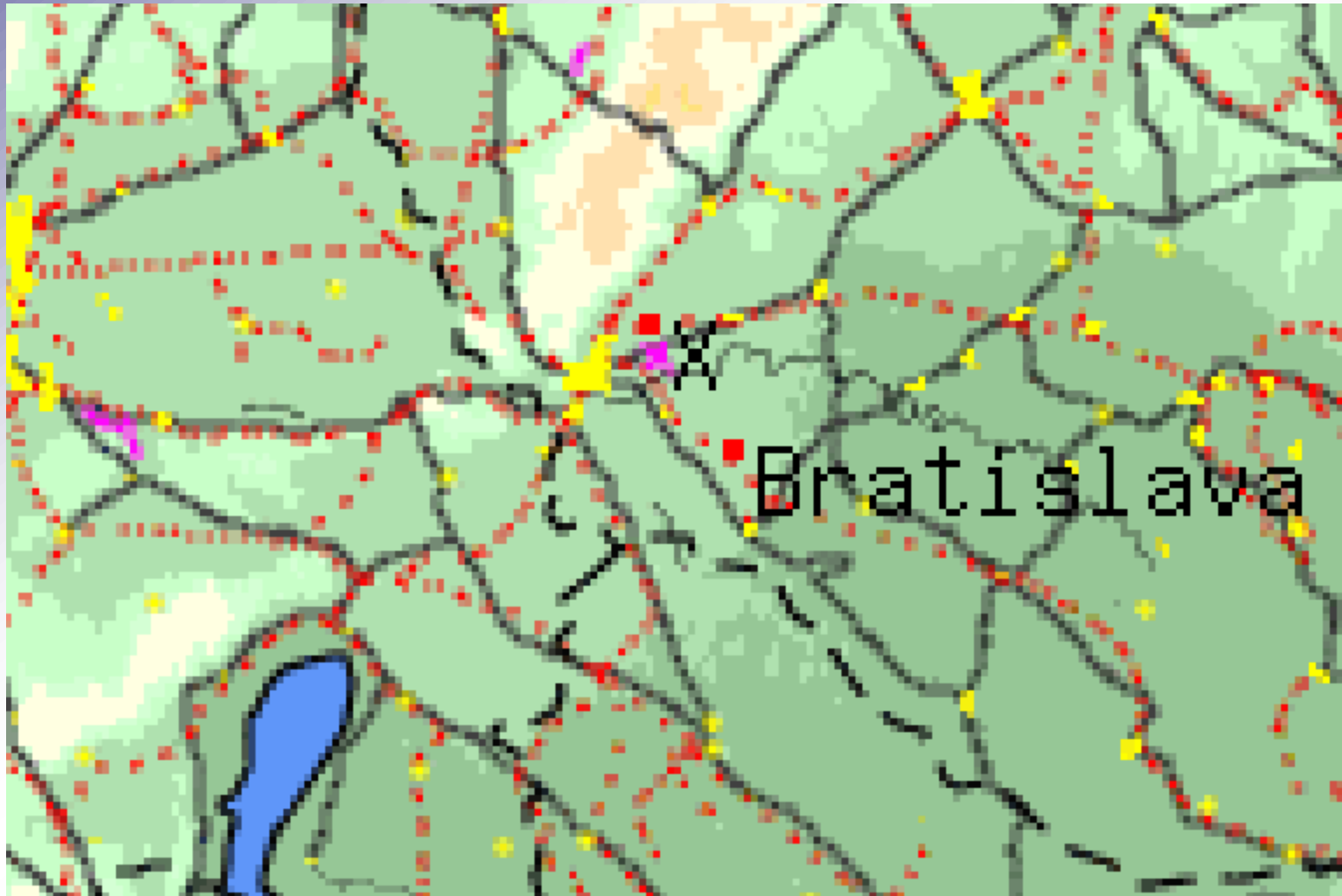
Tmin 13.10.

(clear sky, weak/no wind, dry air)

1:1,250,000



EPS ECMWF - Bratislava



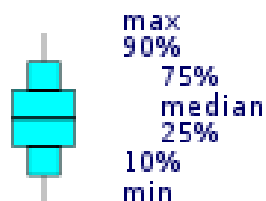
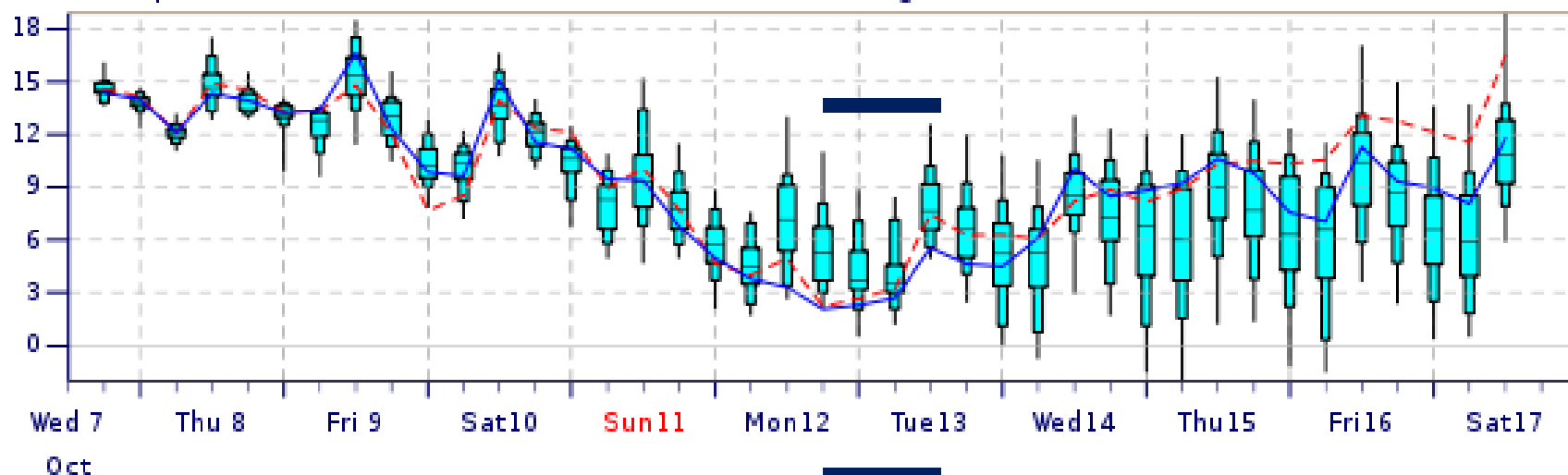
EPS ECMWF - Bratislava

ENS Meteogram

Bratislava, Slovakia 48.2°N 17.2°E (EPS land point) 132 m

High Resolution Forecast and ENS Distribution Wednesday 7 October 2015 12 UTC

2m Temperature(°C) reduced to 132 m (station height) from 196 m (T1279) and 196 m (T639)



ENS Control(31 km) High Resolution (16 km)

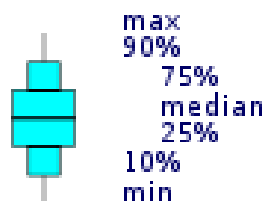
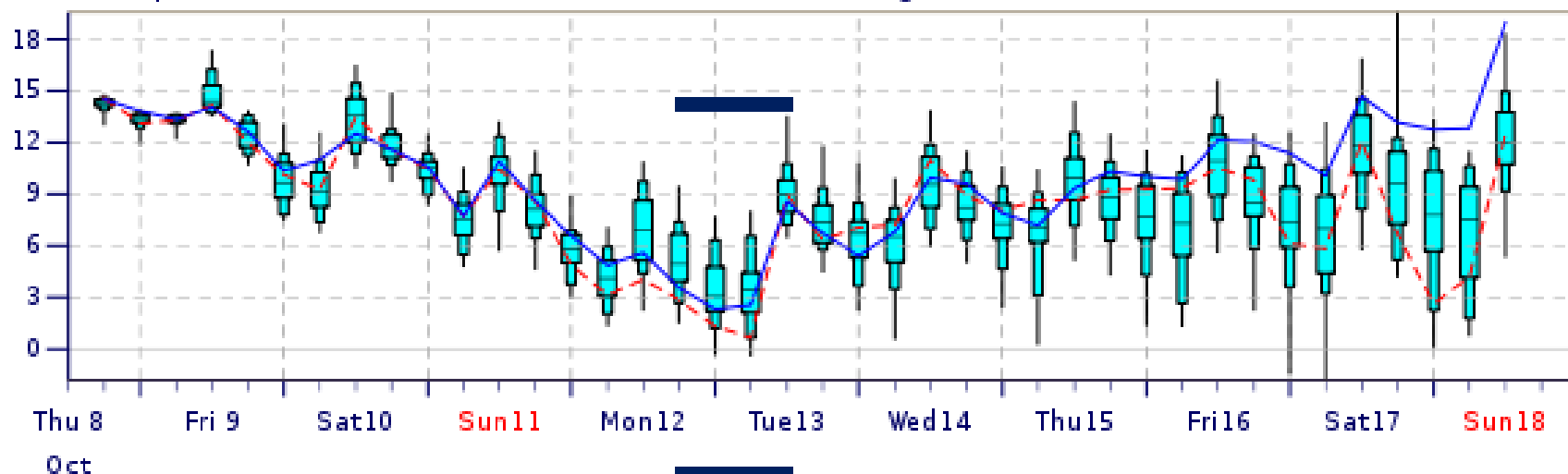
EPS ECMWF - Bratislava

ENS Meteogram

Bratislava, Slovakia 48.2°N 17.2°E (EPS land point) 132 m

High Resolution Forecast and ENS Distribution Thursday 8 October 2015 12 UTC

2m Temperature(°C) reduced to 132 m (station height) from 196 m (T1279) and 196 m (T639)



ENS Control(31 km) High Resolution (16 km)



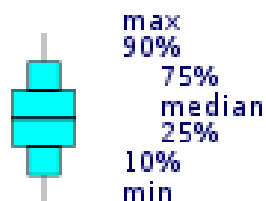
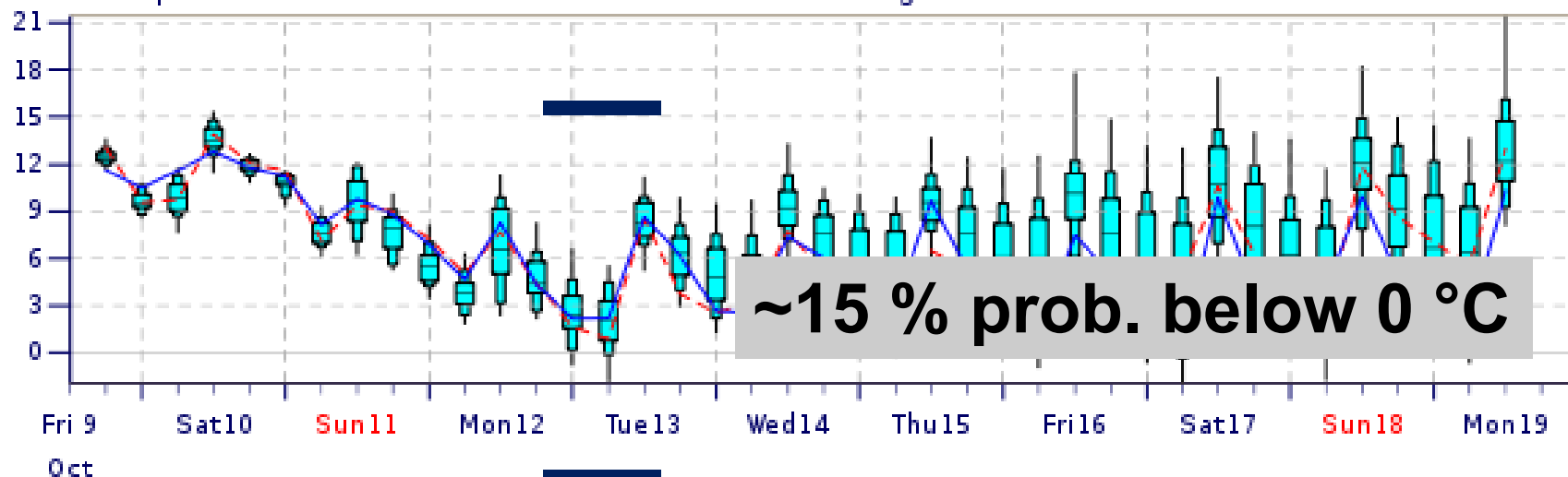
EPS ECMWF - Bratislava

ENS Meteogram

Bratislava, Slovakia 48.2°N 17.2°E (EPS land point) 132 m

High Resolution Forecast and ENS Distribution Friday 9 October 2015 12 UTC

2m Temperature(°C) reduced to 132 m (station height) from 196 m (T1279) and 196 m (T639)



ENS Control(31 km) High Resolution (16 km)

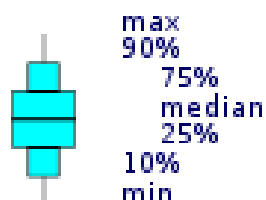
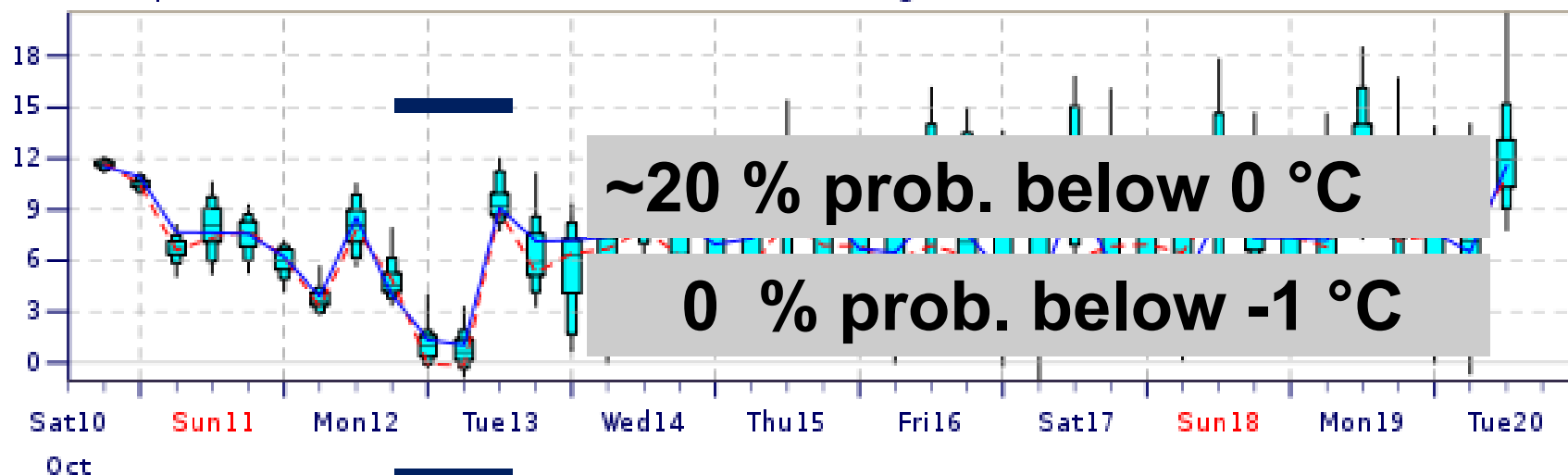
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High Resolution Forecast and ENS Distribution Saturday 10 October 2015 12 UTC

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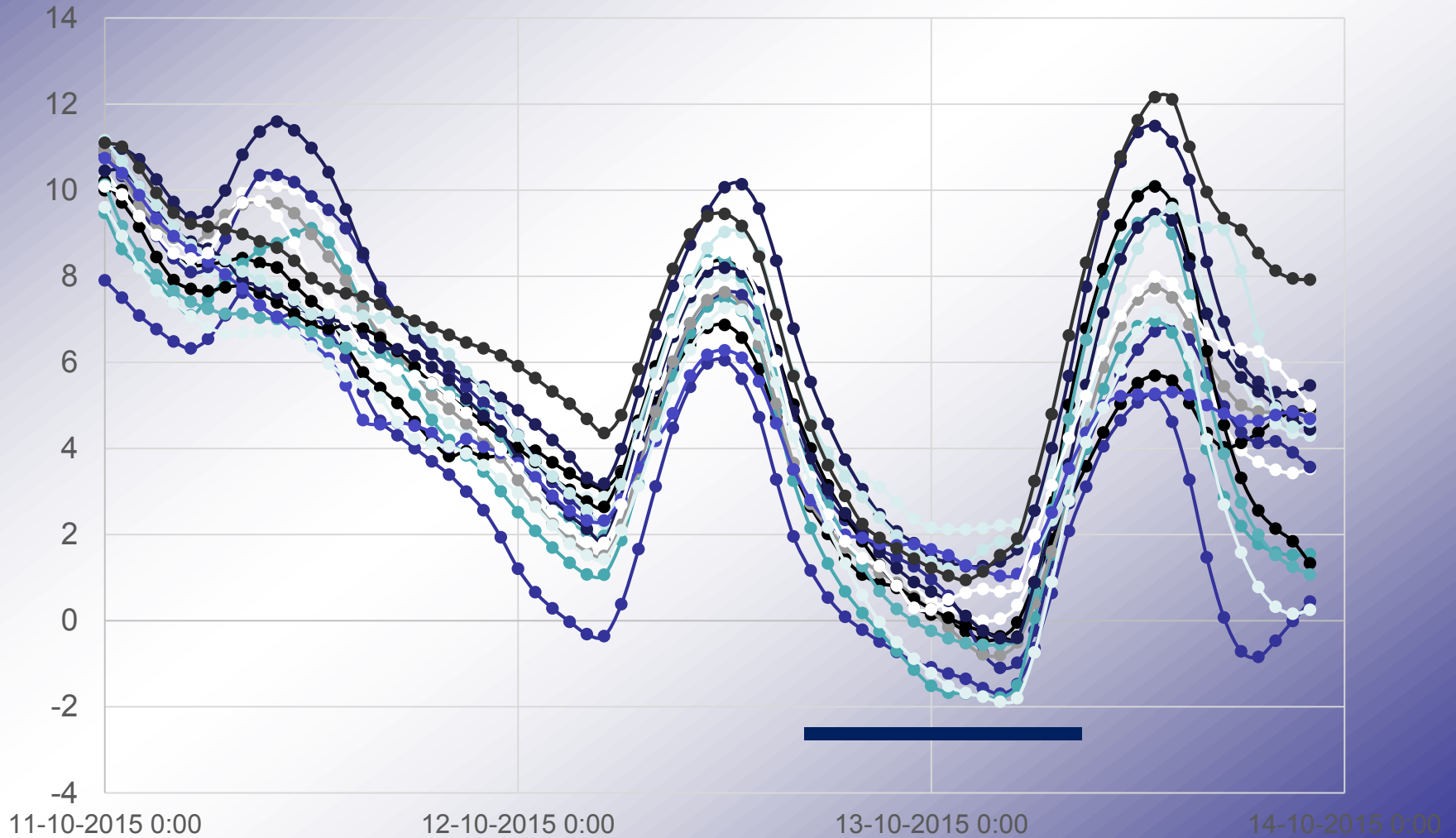


ENS Control(31 km) High Resolution (16 km)



LAEF - Bratislava

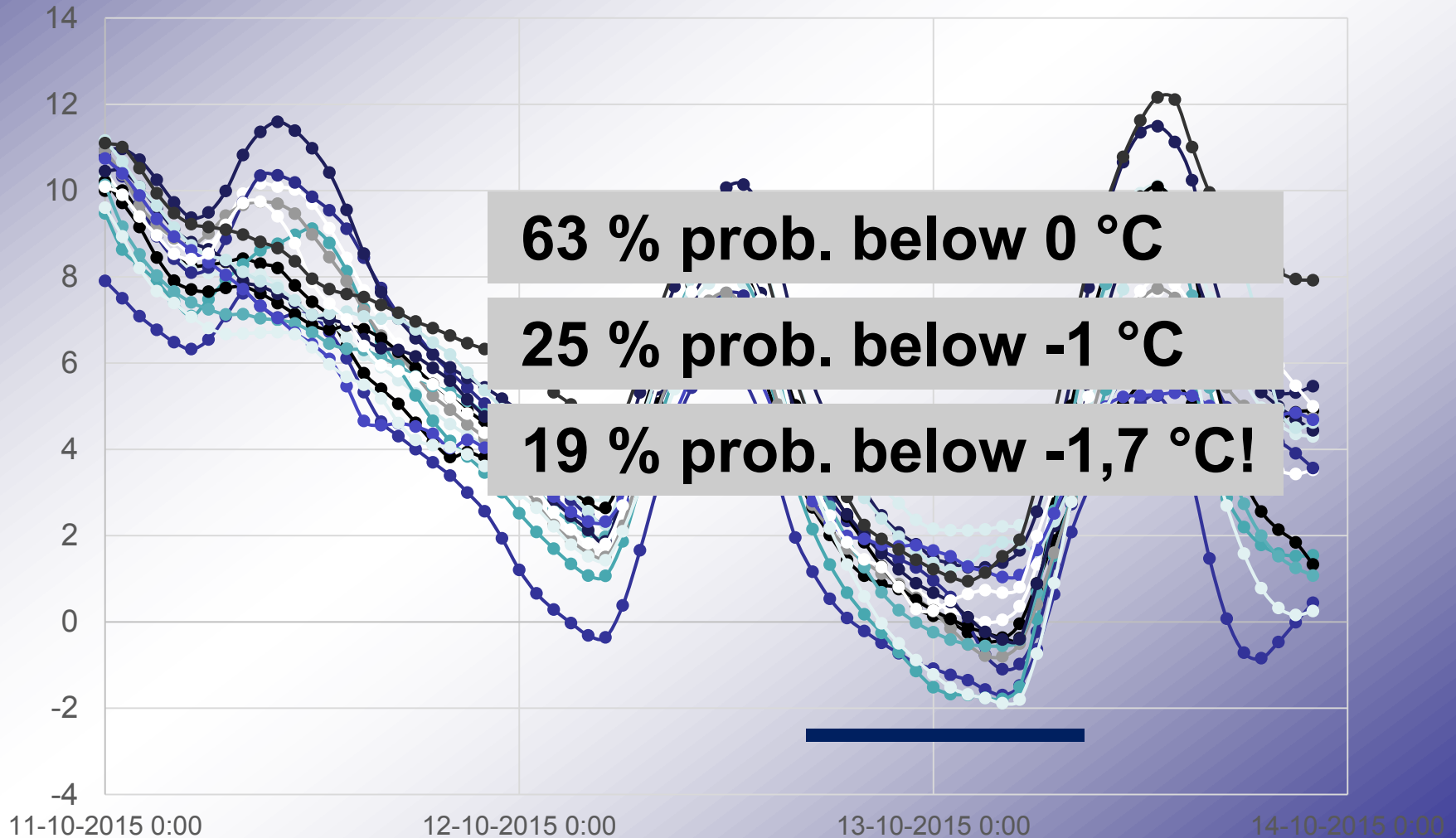
Bratislava RCLACE LAEF 2015-10-11 00:00





LAEF - Bratislava

Bratislava RCLACE LAEF 2015-10-11 00:00





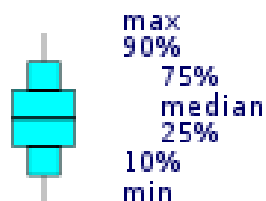
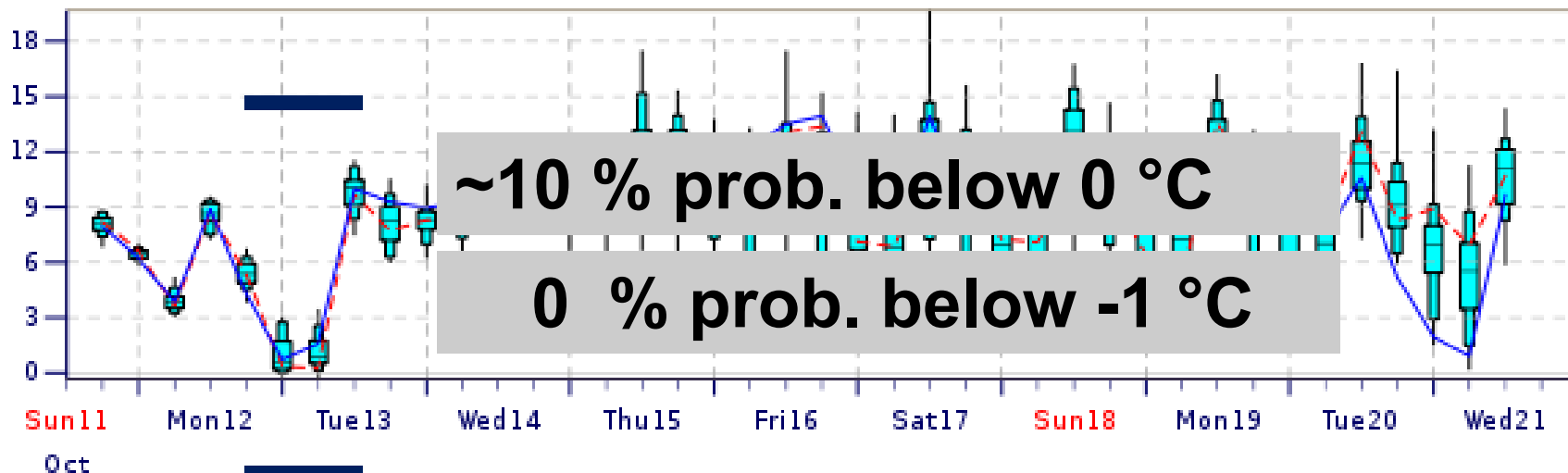
EPS ECMWF - Bratislava

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High Resolution Forecast and ENS Distribution Sunday 11 October 2015 12 UTC

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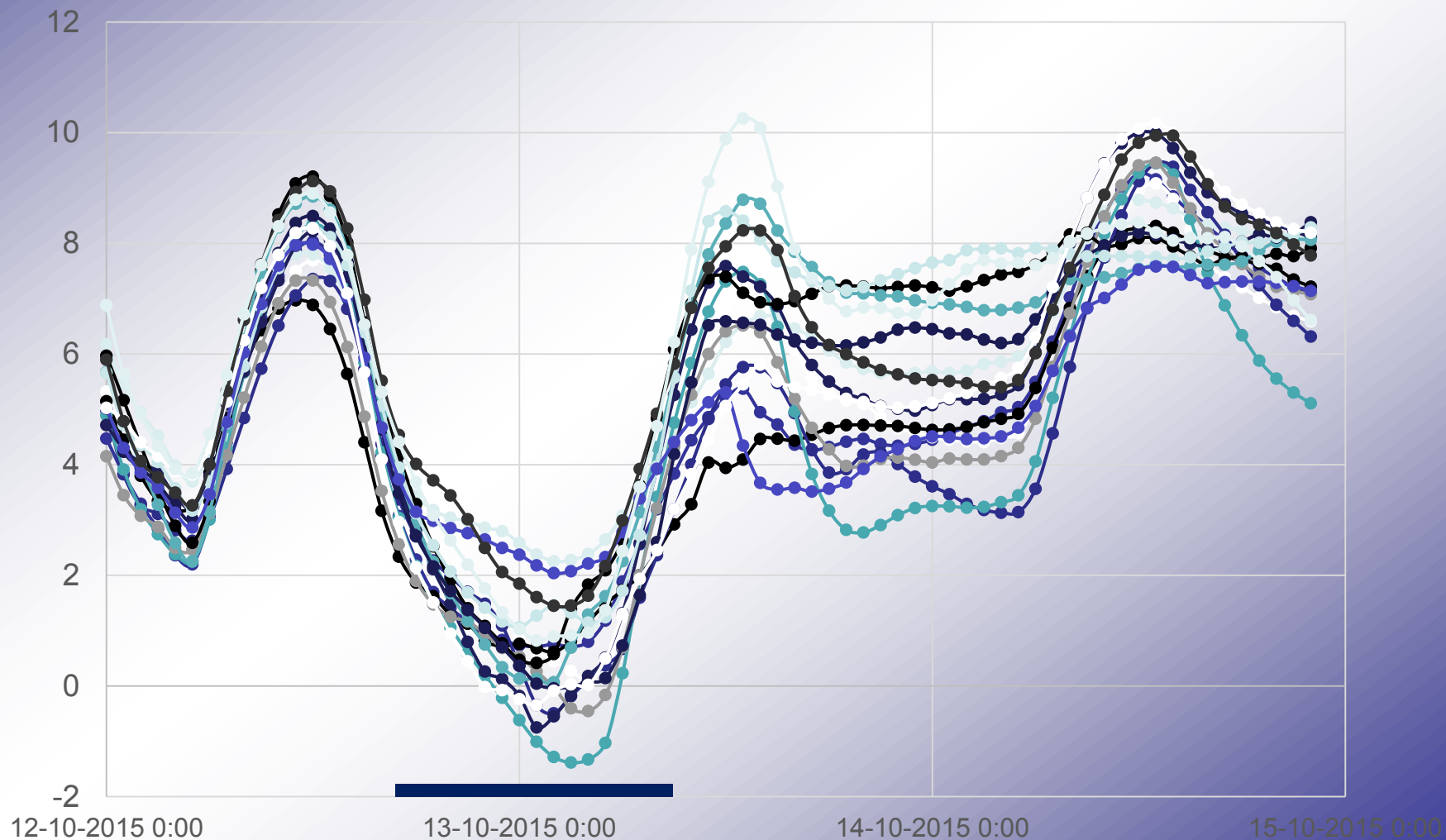


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LAEF - Bratislava

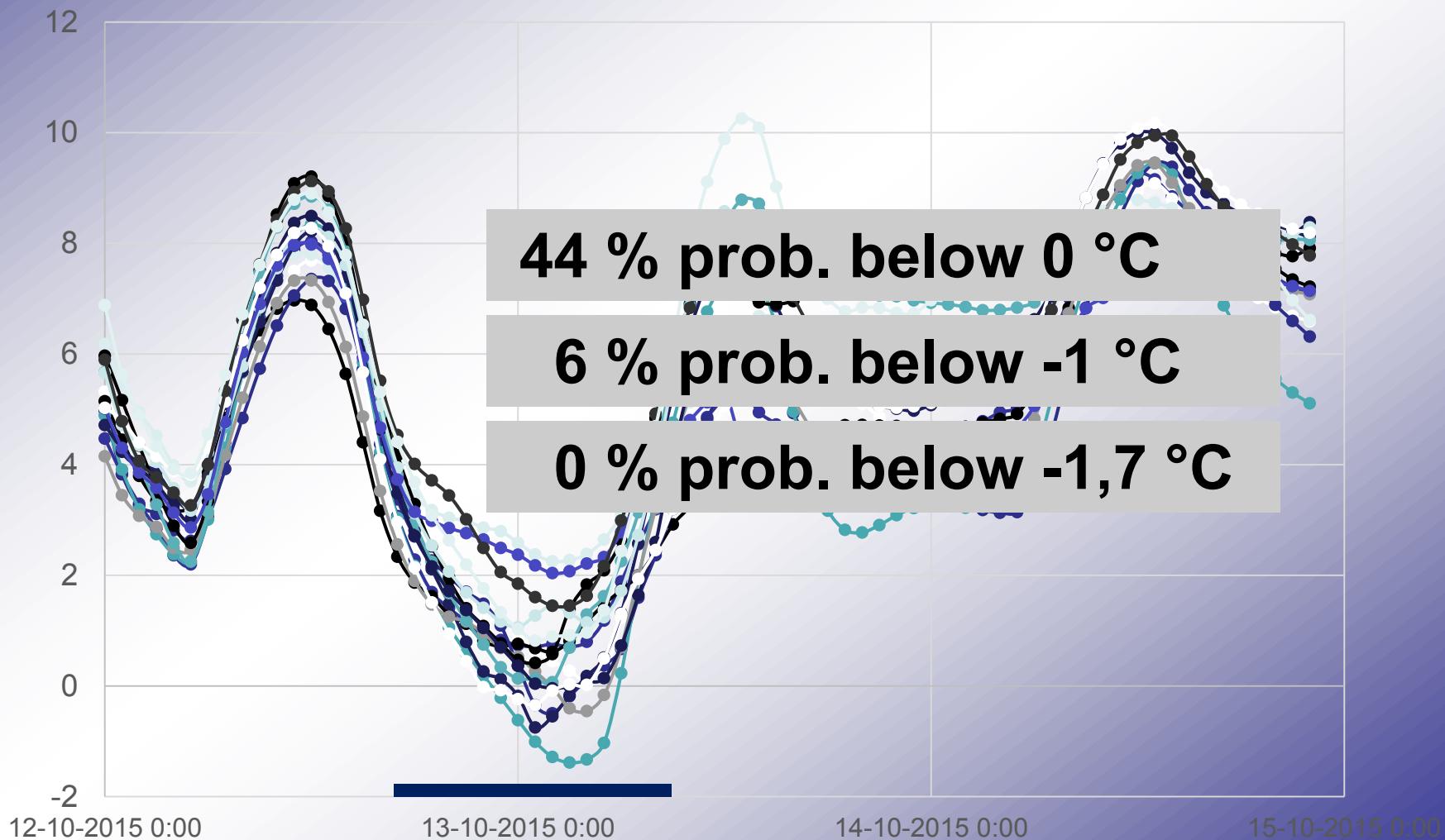
Bratislava RCLACE LAEF 2015-10-12 00:00





LAEF - Bratislava

Bratislava RCLACE LAEF 2015-10-12 00:00



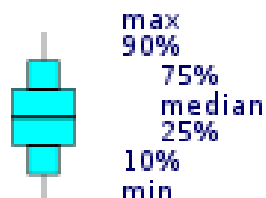
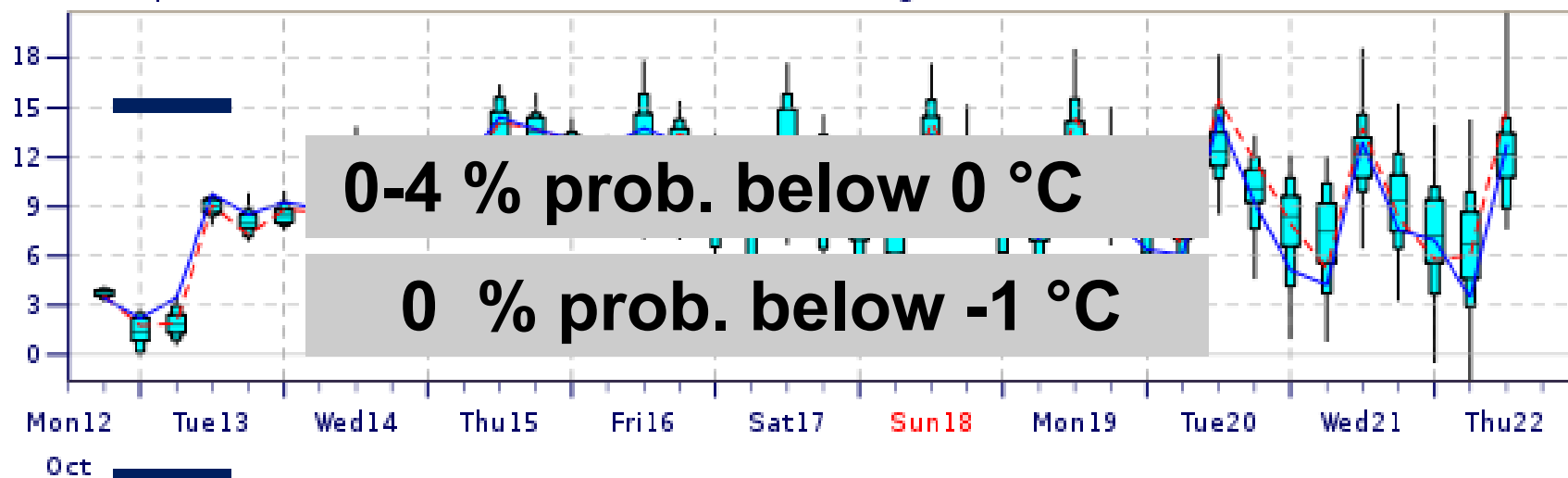
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High Resolution Forecast and ENS Distribution Monday 12 October 2015 12 UTC

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ENS Control(31 km) High Resolution (16 km)



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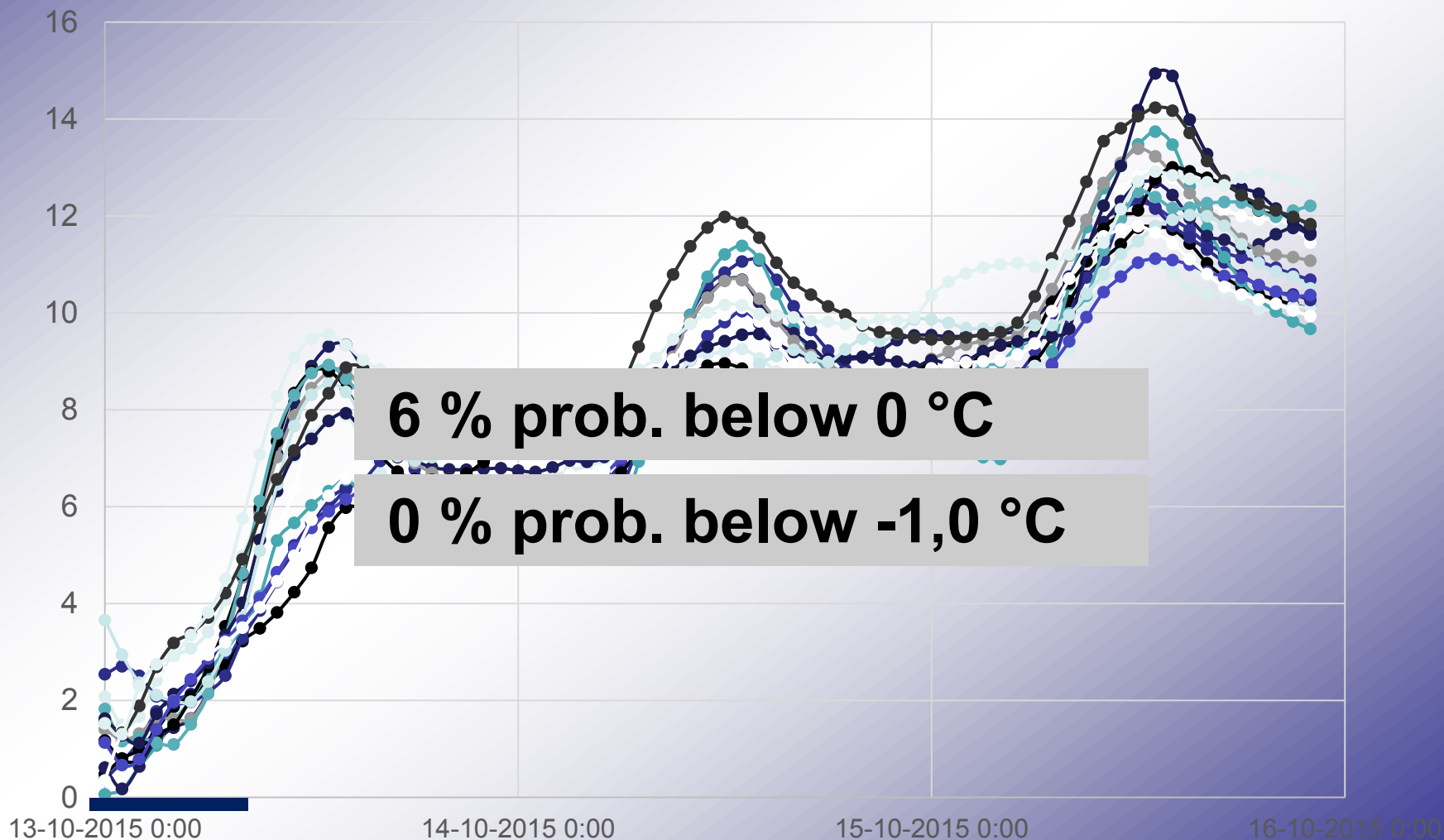
Bratislava RCLACE LAEF 2015-10-13 00:00



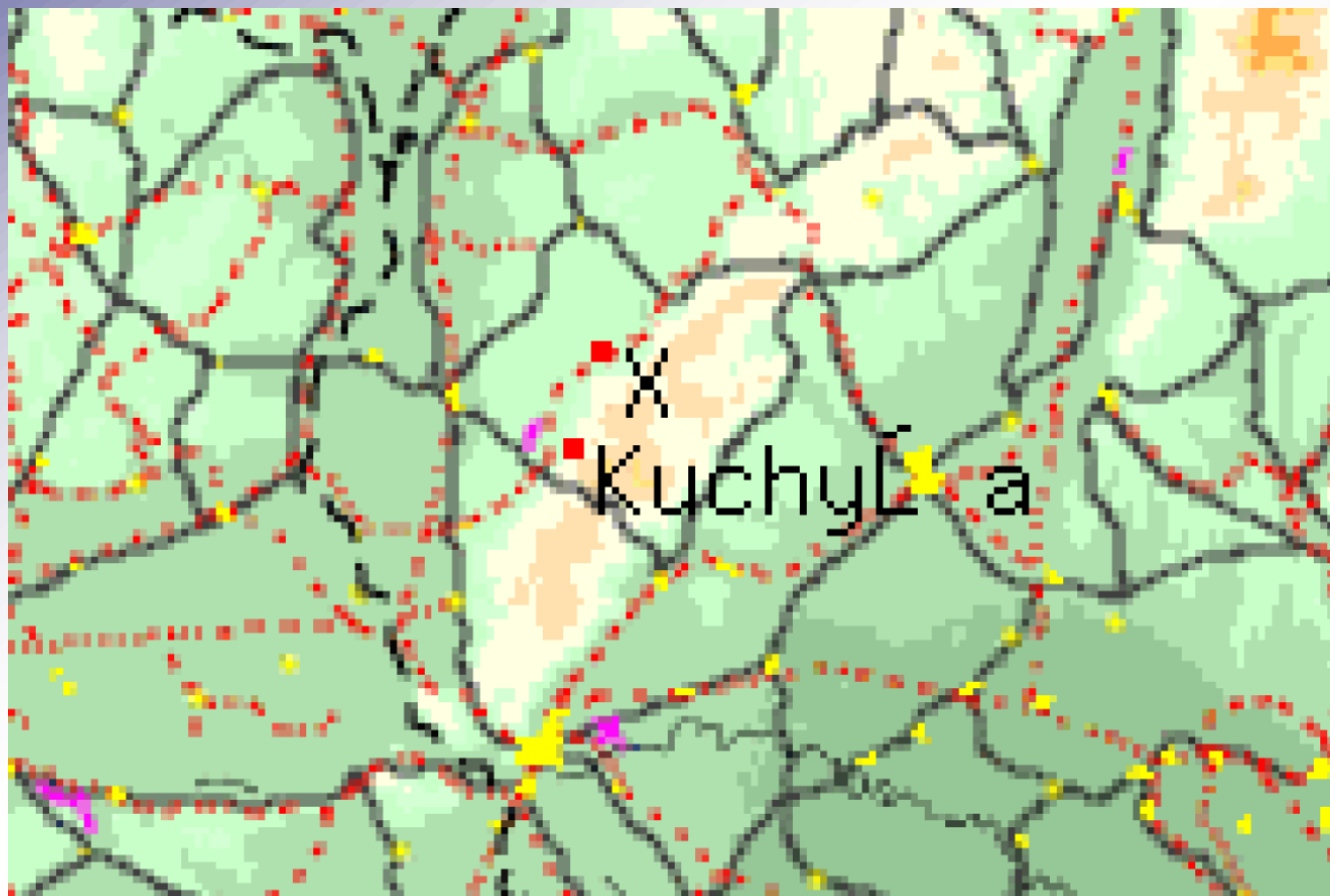


EPS LAEF - Bratislava

Bratislava RCLACE LAEF 2015-10-13 00:00



EPS ECMWF – Kuchyňa – grid point



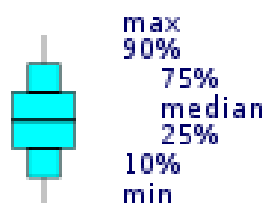
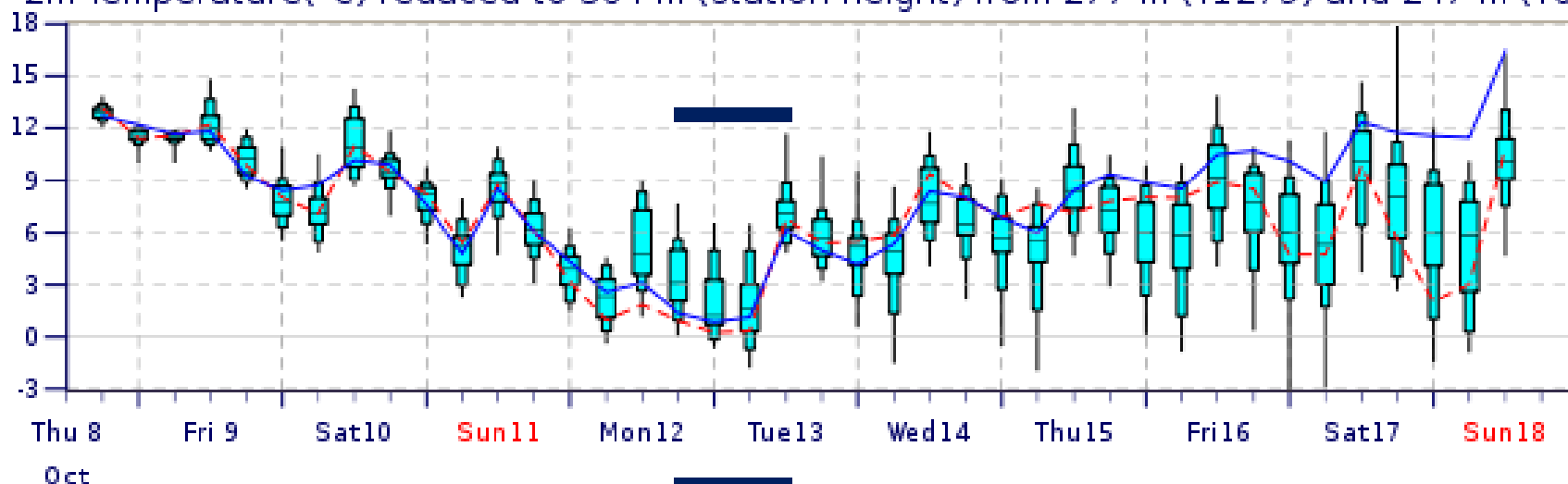
EPS ECMWF - Kuchyňa

ENS Meteogram

Kuchyňa, Slovakia 48.48°N 17.2°E (EPS land point) 364 m

High Resolution Forecast and ENS Distribution Thursday 8 October 2015 12 UTC

2m Temperature(°C) reduced to 364 m (station height) from 277 m (T1279) and 247 m (T639)



ENS Control(31 km) High Resolution (16 km)

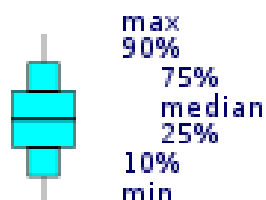
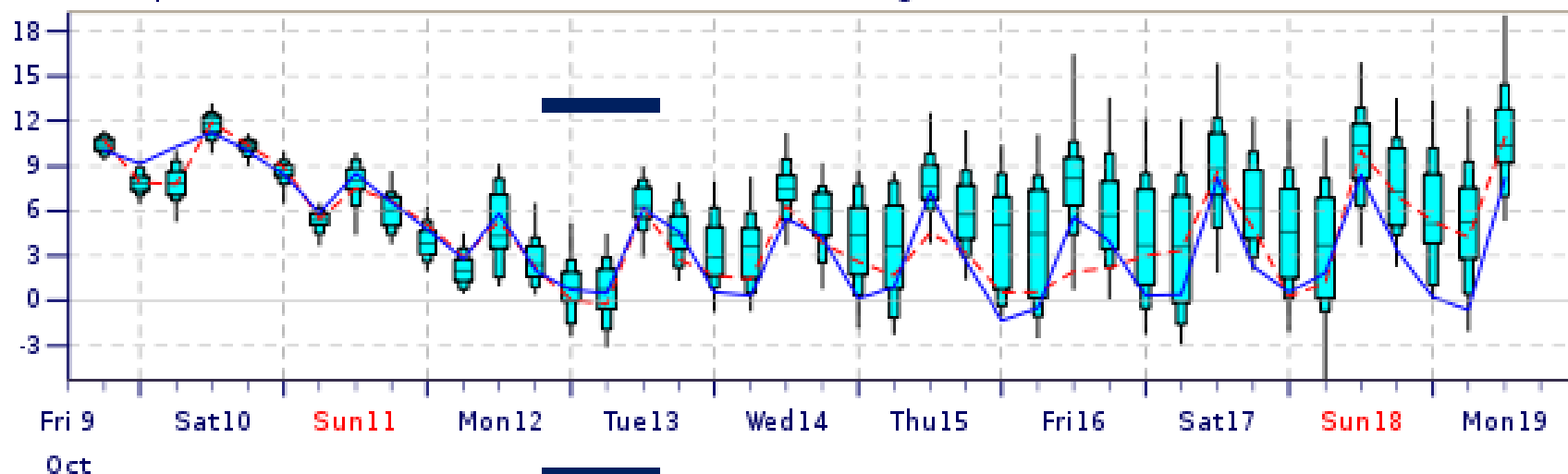
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Kuchyňa, Slovakia 48.48°N 17.2°E (EPS land point) 364 m

High Resolution Forecast and ENS Distribution Friday 9 October 2015 12 UTC

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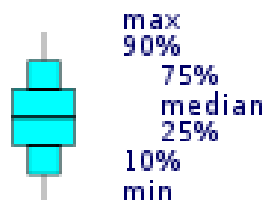
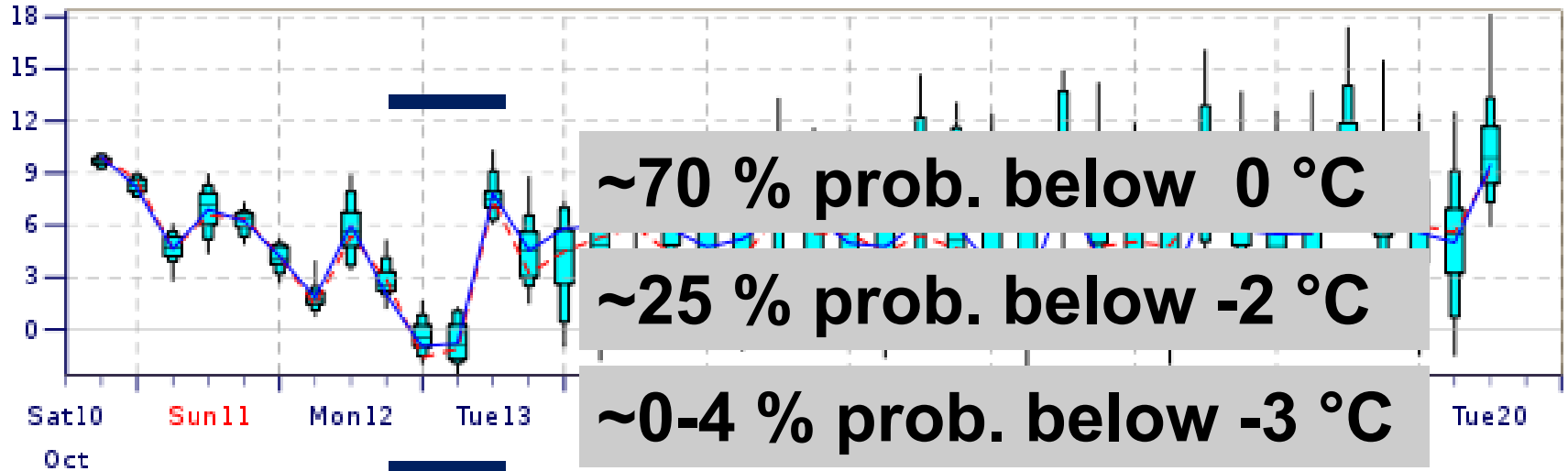
EPS ECMWF - Kuchyňa

ENS Meteogram

Kuchyňa, Slovakia 48.48°N 17.2°E (EPS land point) 364 m

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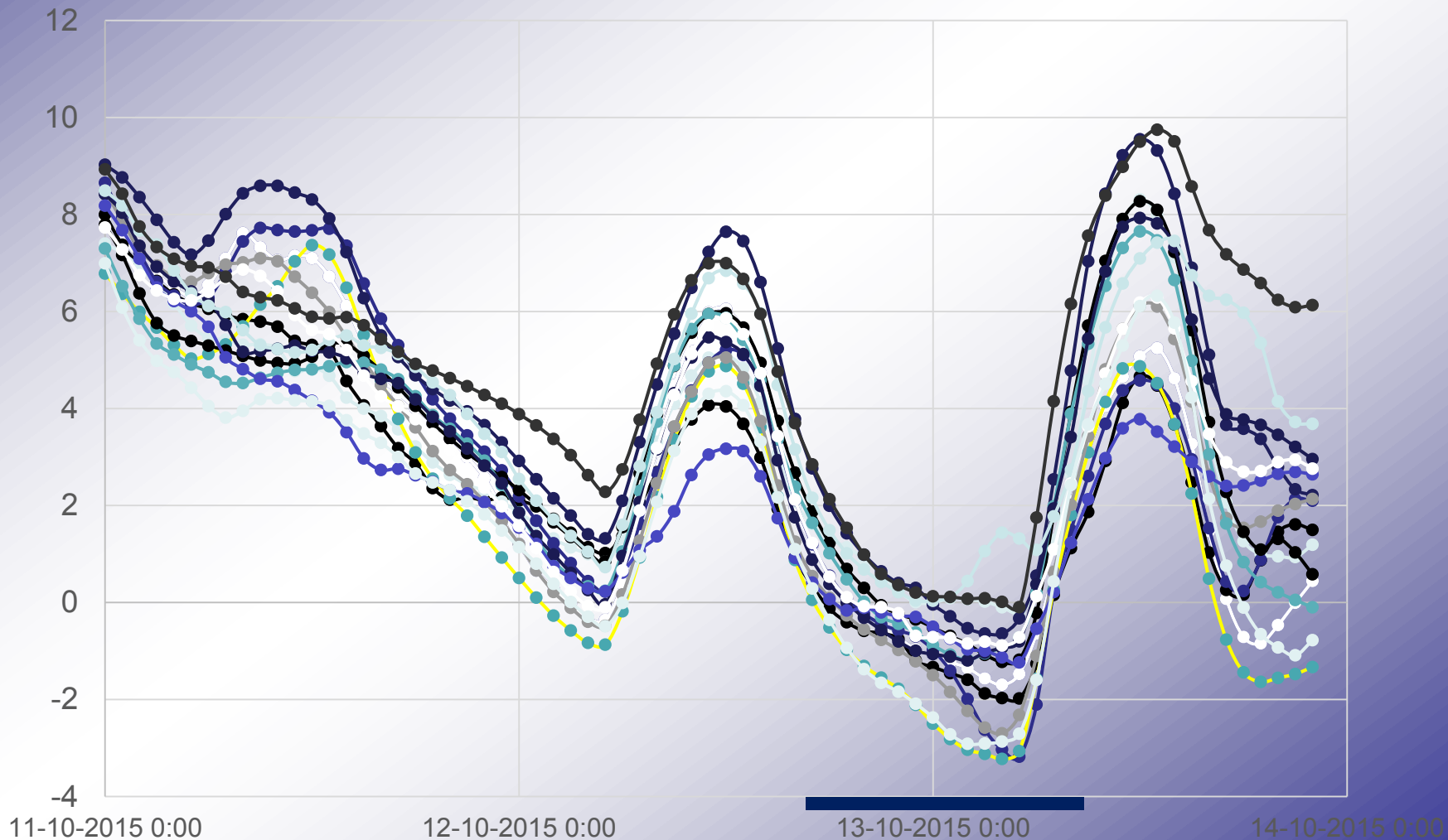


ENS Control(31 km) High Resolution (16 km)



LAEF - Kuchyňa

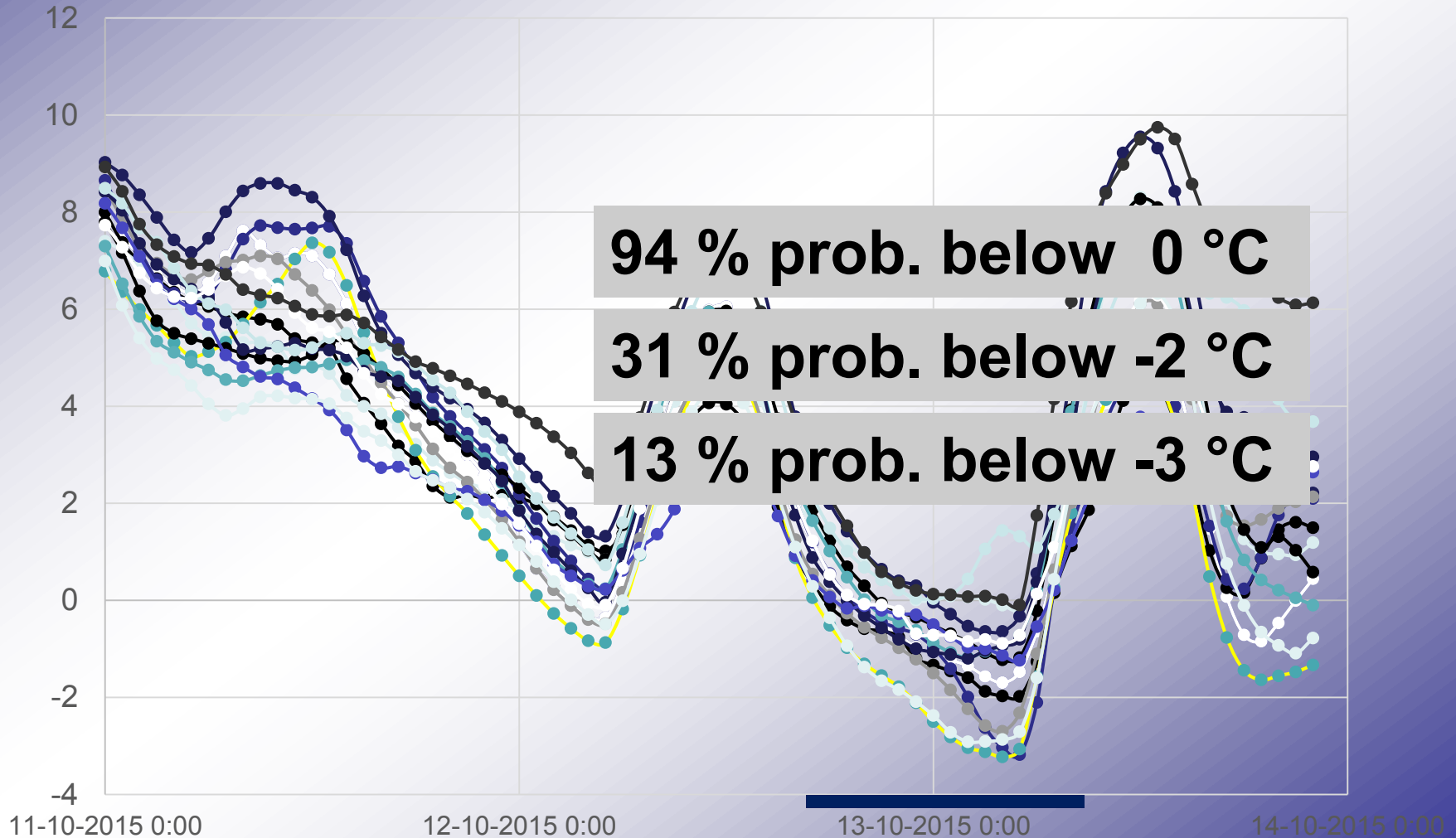
Kuchyna RCLACE LAEF 2015-10-11 00:00





LAEF - Kuchyňa

Kuchyna RCLACE LAEF 2015-10-11 00:00



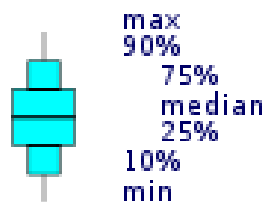
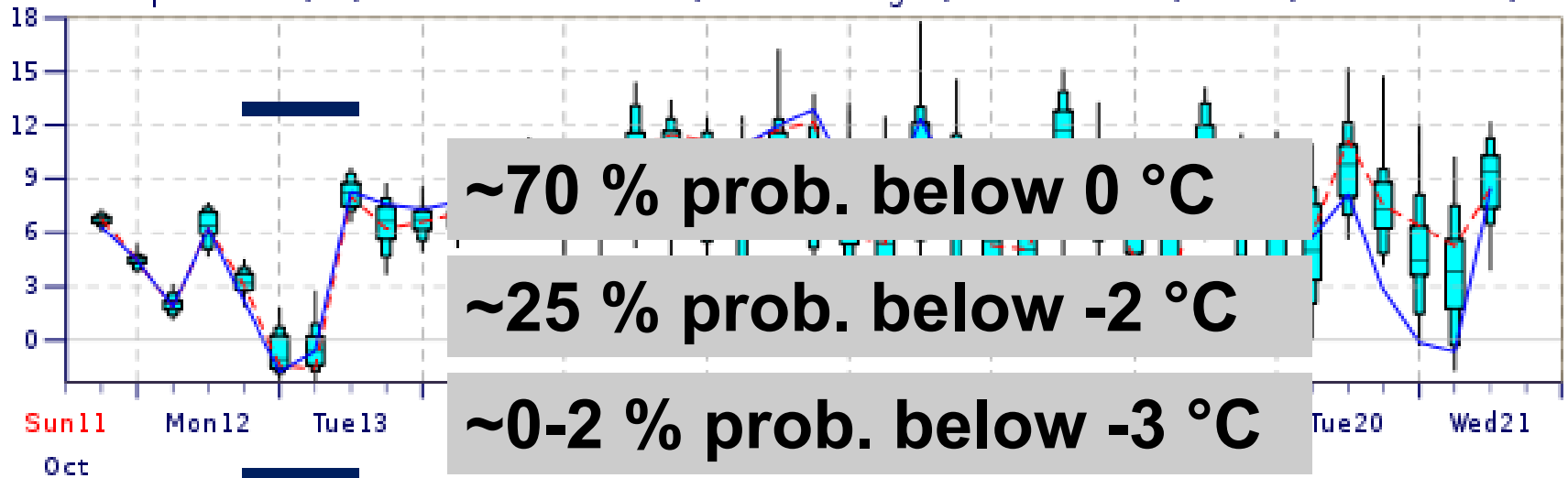
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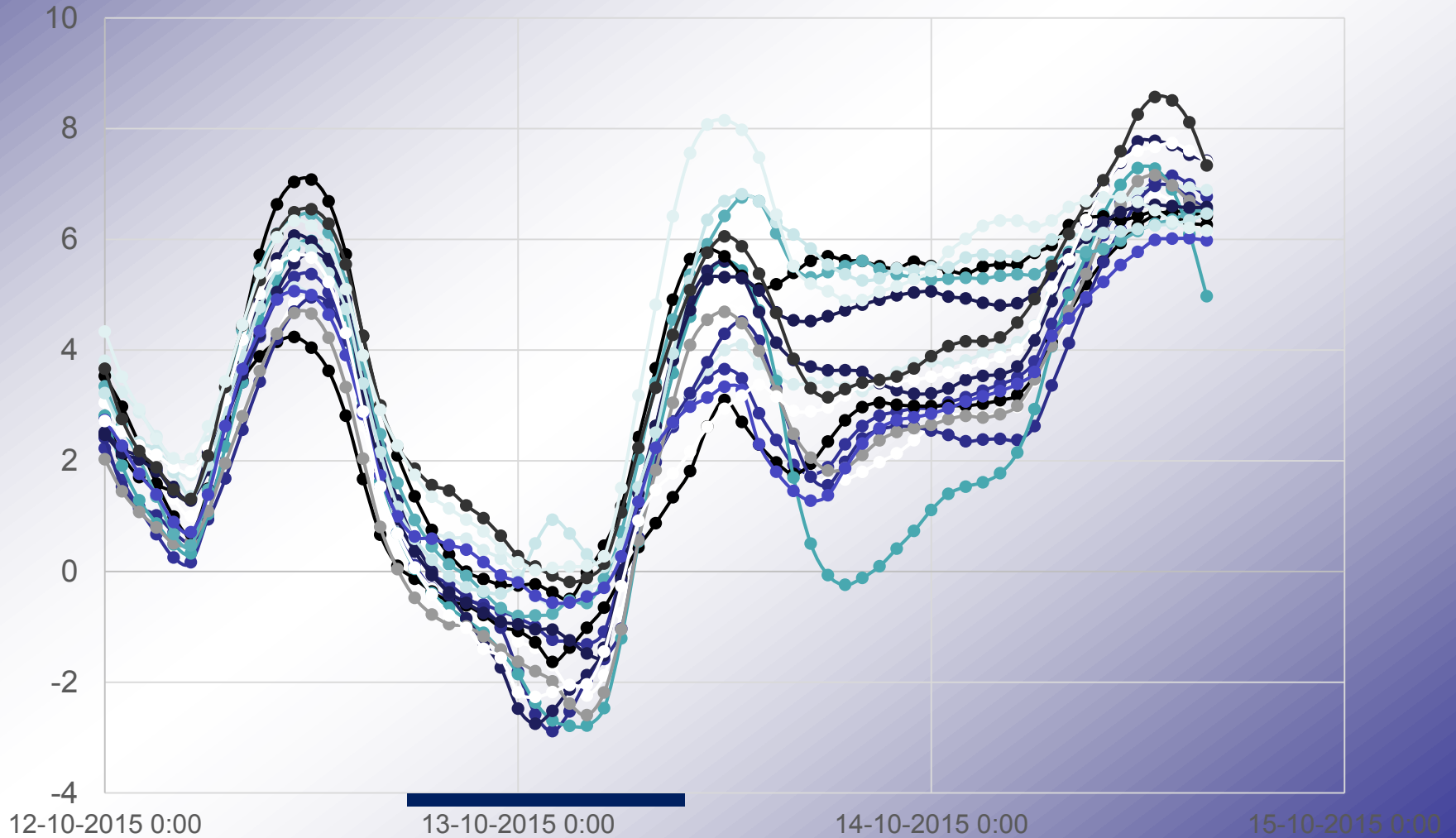


ENS Control(31 km) High Resolution (16 km)



LAEF - Kuchyňa

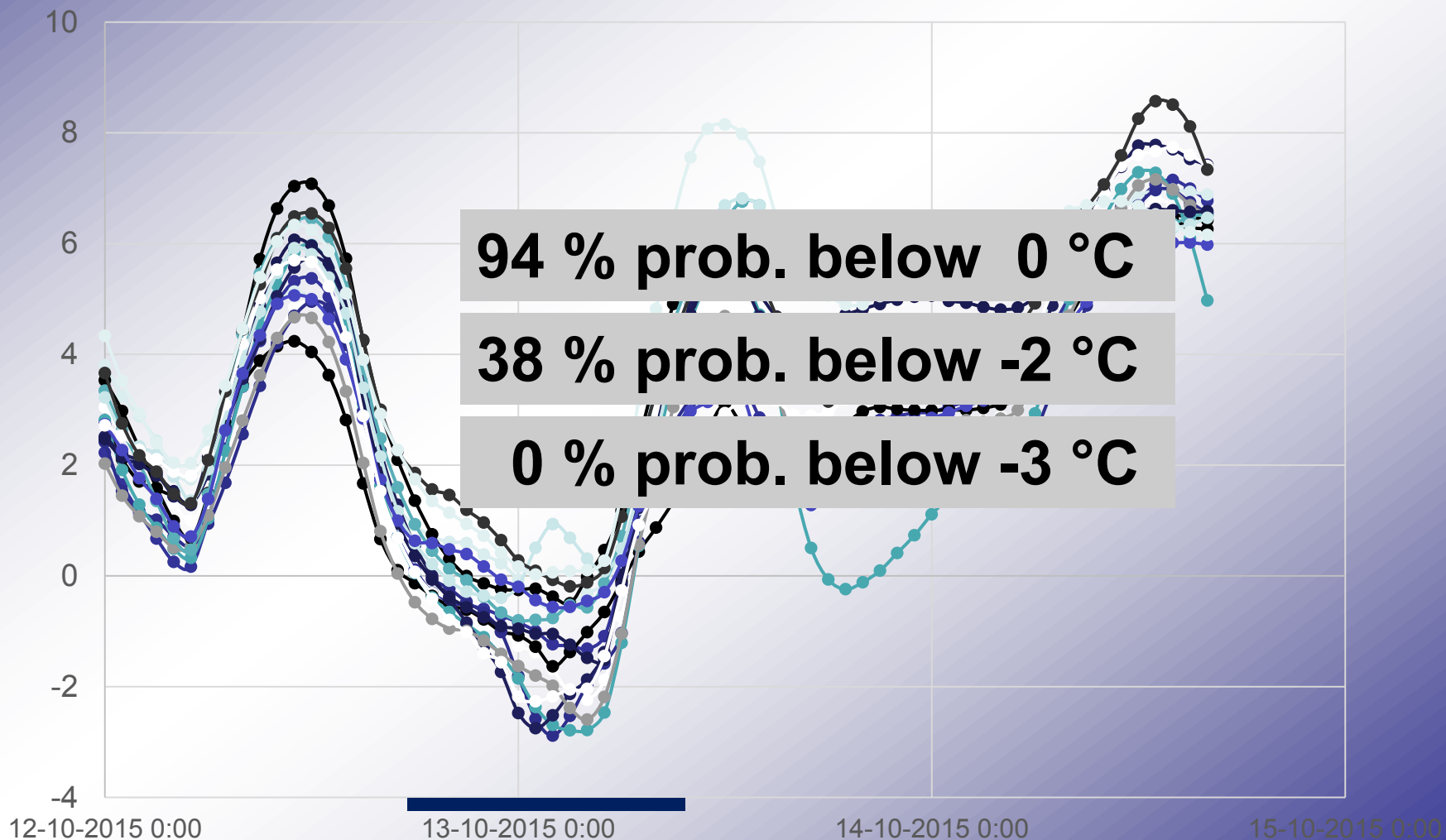
Kuchyňa RCLACE LAEF 2015-10-12 00:00





LAEF - Kuchyňa

Kuchyna RCLACE LAEF 2015-10-12 00:00



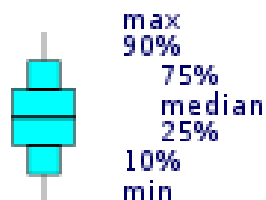
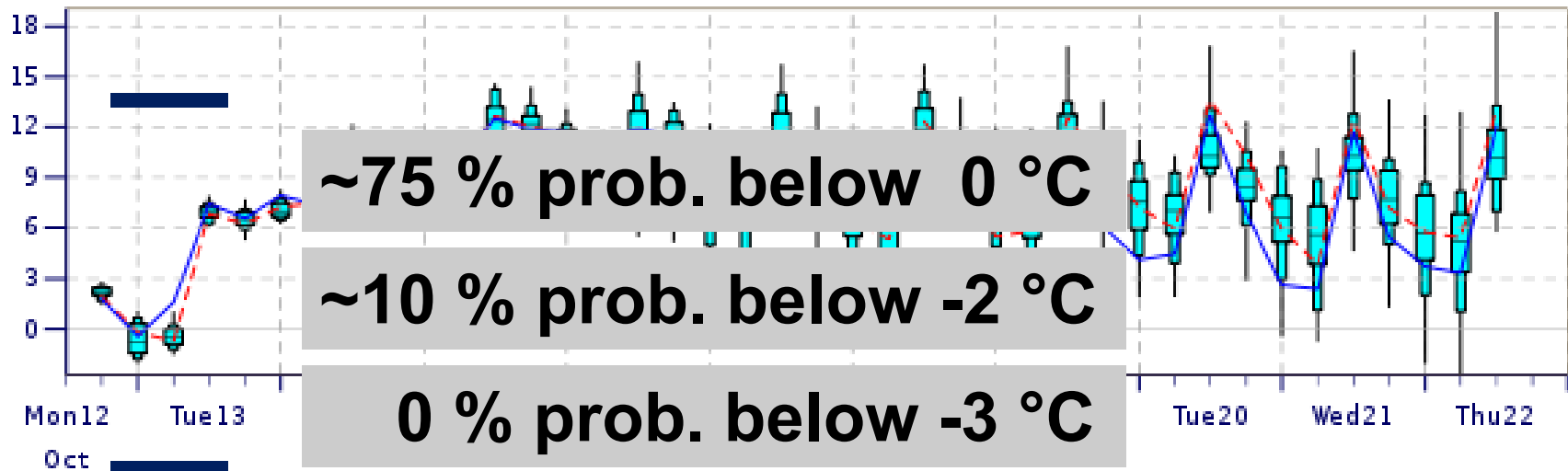
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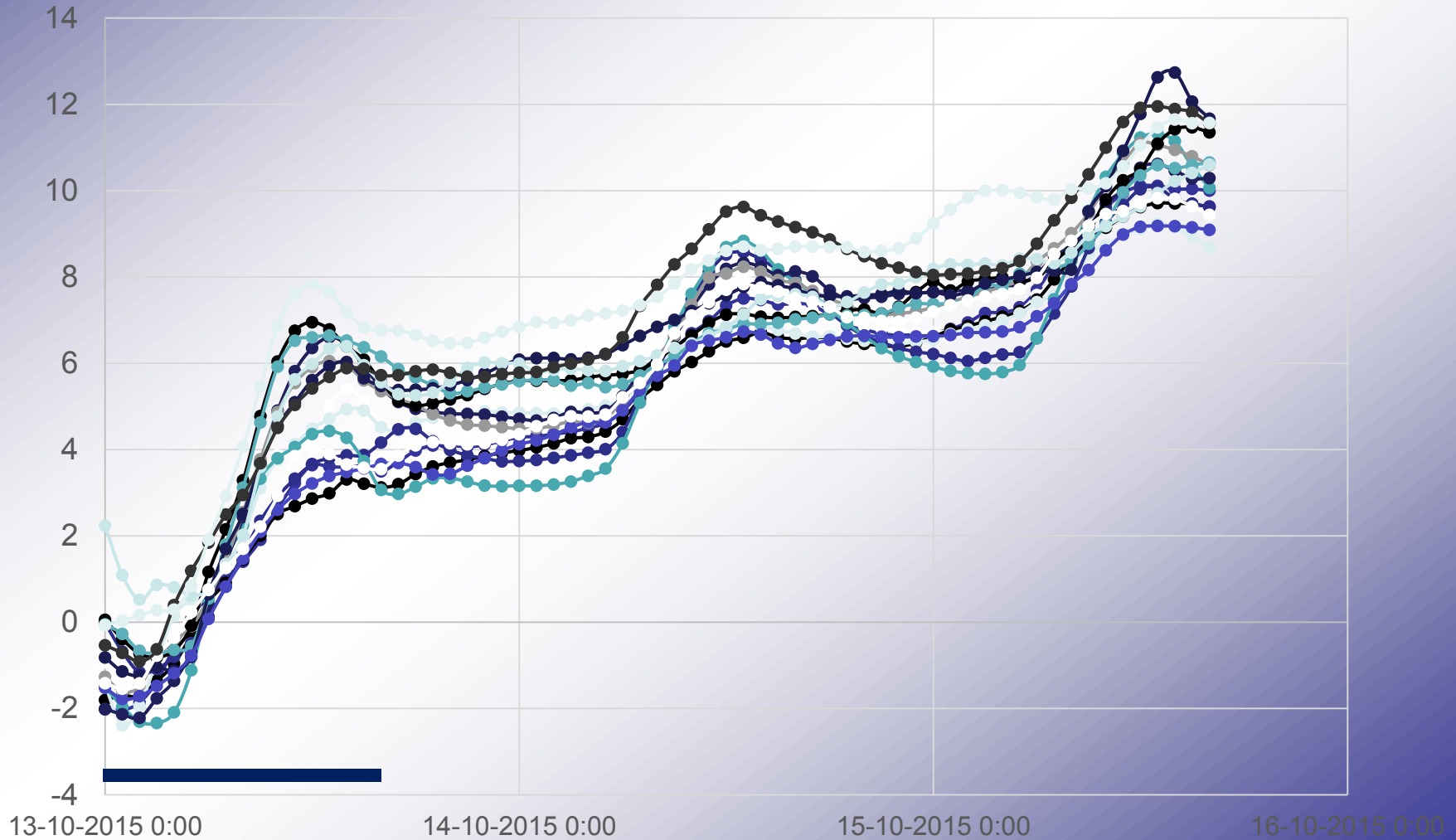


ENS Control(31 km) High Resolution (16 km)



LAEF - Kuchyňa

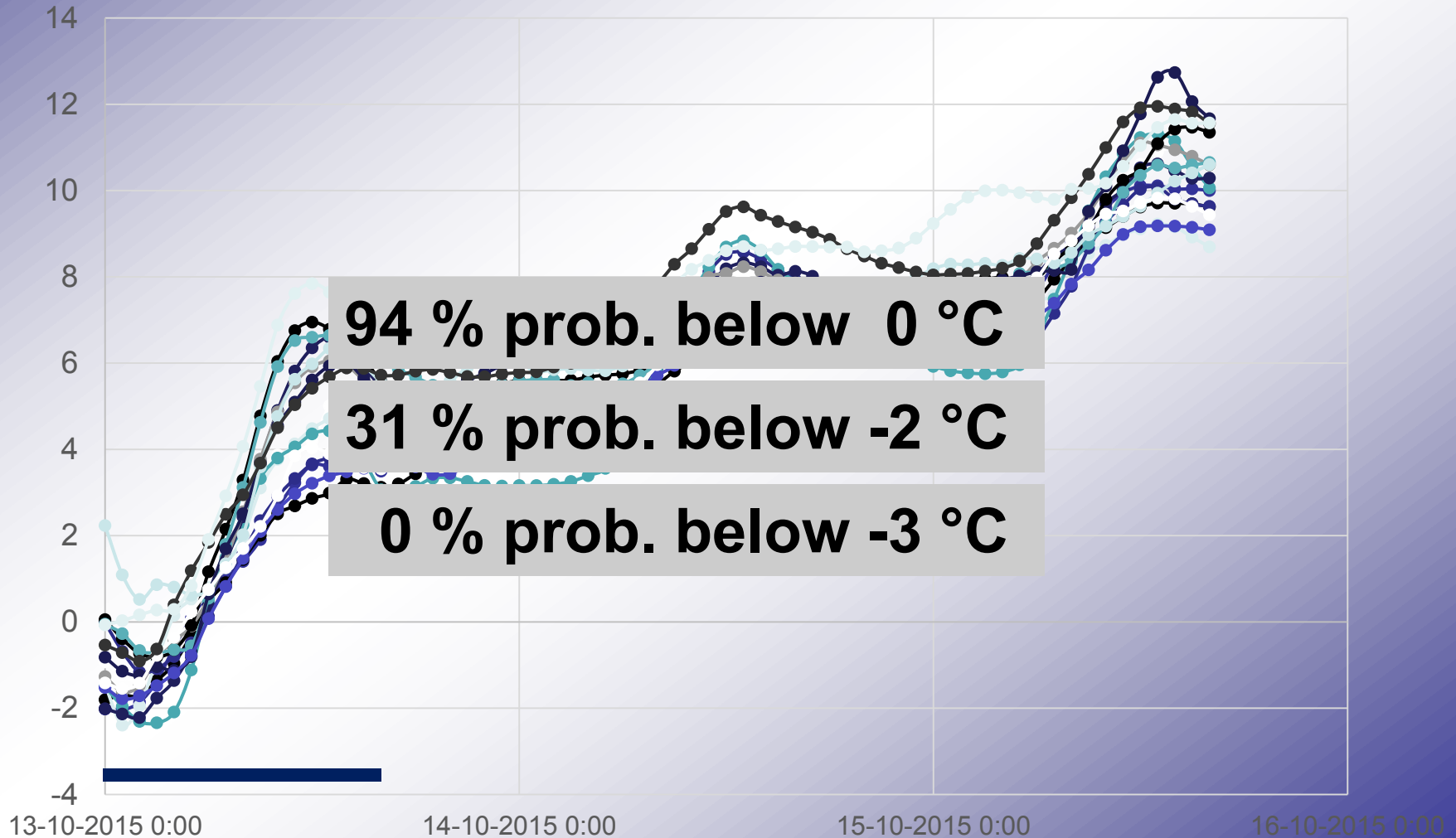
Kuchyňa RCLACE LAEF 2015-10-13 00:00





LAEF - Kuchyňa

Kuchyna RCLACE LAEF 2015-10-13 00:00





Summary

Bratislava

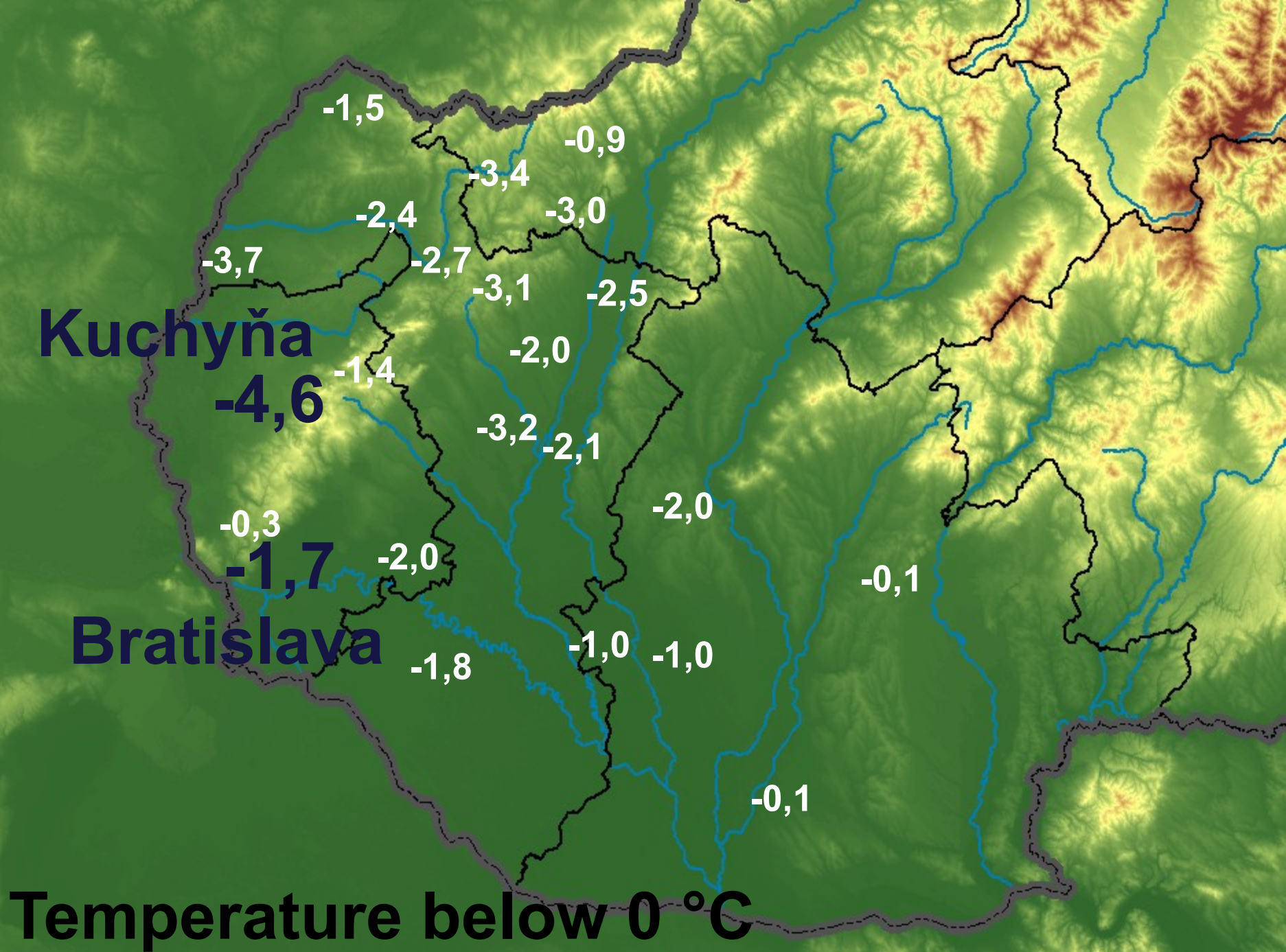
ECMWF	Probability of T below		
	0 °C	-1 °C	-1,5 °C
10 Oct	20%	0%	0%
11 Oct	10%	0%	0%
12 Oct	0-4%	0%	0%

LAEF	Probability of T below		
	0 °C	-1 °C	-1,5 °C
10 Oct	63%	25%	19%
11 Oct	44%	6%	0%
12 Oct	6%	0%	0%

Kuchyňa

ECMWF	Probability of T below		
	0 °C	-2 °C	-3 °C
10 Oct	70%	25%	0-4%
11 Oct	70%	25%	0-2%
12 Oct	75%	10%	0%

LAEF	Probability of T below		
	0 °C	-2 °C	-3 °C
10 Oct	94%	31%	13%
11 Oct	94%	38%	0%
12 Oct	94%	31%	0%





Results

- ✓ Kuchyňa colder than Bratislava
- ✓ LAEF better than ECMWF EPS
 - Expected
- × Overestimated temperature
 - main (estimated) problem = soil type
 - Kuchyňa is in region with partly sandy soil
 - caused particularly by model resolution
- × Last runs were not the best



Conclusion

- ECMWF EPS
 - unusual/severe situations only rarely captured in ensemble more than 5 days ahead of the event
- LAEF
 - Definitely better results
 - better resolution (orography)
 - other perturbations
- Meteorologists are still needed = they better know local conditions



Thank you for your attention

miroslav.singer@gmail.com

