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Date: 15/05/2024 10:03:59

Green Book 2024 - aka Use and verification of ECMWF products in the Member and Co-operating States

Fields marked with * are mandatory.

Introduction

Welcome to ECMWF new "Green Book" online submission system (aka "Use and verification of ECMWF products in the Member and Co-operating States")

This time we have two options for completion:

- Filling out the online questionnaire below (new for this year based on feedback from the Meteorological Representatives meeting in November 2023)
- Producing a single report offline (as done in previous years), and emailing the report as detailed in Section 1.

Both methods ask the same questions, however the questionnaire method requires no formatting and aims to make analysis of all responses easier. The questionnaire option also allows you to part-complete, and save your entries to come back to later (using the "Save as Draft" button in the top right corner of this page). Note that the EUSurvey page will timeout after 60 minutes of no activity, responses are usually saved however to be sure please "Save as Draft" to avoid losing responses.

The deadline for all submissions is 23:59UTC on Wednesday 15th May 2024

A summary of responses will be presented at UEF2024 with a summary report available in the ECMWF Publications library in due course.

Section 1: Background - please fully complete

* **1.1 Which Country is your submission for?**

LT - Lithuania

* **1.2 Please provide your name(s)**

Inga Grigorjanc, Kristina Kryžanauskienė, Izolda Marcinonienė

* **1.3 Please provide your organisation**

Lithuanian Hydrometeorology Service under Ministry of Environment

* **1.4 Please select your preferred submission method:**

- ○ Producing a single report offline
- ◉ Online questionnaire

Online questionnaire

Please answer the following questions, and illustrate your answers, where appropriate, by also uploading clearly annotated images with image/figure numbers (max 1MB per file). More questions or options may appear, depending on answers to particular questions. Mandatory questions are marked with a '*'. Free text boxes appear to have a 5000 character limit (if your answers are longer than this please email them to Becky and they will manually added), answers don't need to fit the box size given, the boxes expand.

Responses to the questionnaire can be saved and returned to at a later date before submitting. To do this click the 'Save as Draft' button on the left, this will provide you with a link which you can return to to continue /complete your submission.

Section 2: Summary of major highlights

* **Please detail major highlights since January 2022**

You may wish to complete this section at the end, after completing all others**.**

No significant changes. The ECMWF products are used intensively in everyday work at LHMS. ECMWF model output data are integrated in forecaster's workstation and is considered the main data source for medium or extended range weather forecasts. For short-range forecasts we mostly use HARMONIE-AROME model. This local limited area Lithuania tailored NWP model uses boundary conditions from ECMWF.

Section 3: Forecast products

3.1. Please outline what direct use you make of standard ECMWF model products (on ecCharts / OpenCharts / own workstation), for operational duties, in the following 4 categories (noting that new AI model output should be dealt with separately, via question 3.4).

* **a) Medium Range (e.g. for high impact weather forecasting)**

Medium-range HRES forecast is used daily. ECMWF data is visualized in forecaster's workstations – Visual Weather (IBL) and Messir Vision (Corobor). In addition, ecCharts are used for the basic overview of synoptic situation and as a backup source of information in case forecaster's workstation fails to work. The choice of products depends on the situation. Especially we pay attention to the situation on AT500 hPa, TA and divergence field. If we expect sharp change in temperature, wind or precipitation, we use EFI products. For short range forecast the vertical profile product is useful. Sometimes we compare vertical profile forecast and sounding data to be sure they are trusty. Simulated images and some AI products are analysed time to time. Also, ecCharts are used for probability products, as well as meteograms of geopotential height, temperature and humidity at different levels, 500-1000 thickness maps, vorticity, divergence, indices, MUCAPE, multi-parameter EFI.
In general, ecCharts are used with various products combinations, it differs a little bit depending on the season. In many compositions are base products, e.g. low/medium/high cloudiness, total precipitation rate and precipitation accumulation, mean sea level pressure, wind, geopotential height, visibility, temperature and other products. In a warm season more convective parameters are added, e.g. lightning flash density, vertical profiles products; in a cold season precipitation type, freezing rain accumulation, snow cover products are used.

*** b) Extended Range (monthly)**

Extended Range (monthly) forecasts are not used on a daily basis, but these are the products which are used most often: temperature and precipitation weekly mean anomalies, meteograms, 500hPa height: weekly mean anomalies, weather regimes, Multiparam: weekly mean anomalies, sometimes verification products and 2 m temperature: probability distribution.

In LHMS Extended range - Weekly mean anomalies the product is used twice a week. A 4-week forecast is made on Fridays and updated on Tuesdays. ECMWF Weekly mean anomalies are presented as the deviation of that week from the last 20 years, but during forecasting we recalculate to the deviation from the standard climate norm period of 1991-2020. In the graphs, we present the forecasted weekly standard climate norm for the years 1991-2020 and the forecasted air temperature/precipitation. We also provide textual information about the expected air temperature and precipitation for the whole or half of the month.

*** c) Long Range (seasonal)**

LHMT doesn't issue Long Range (seasonal) forecast.

*** d) CAMS and Fire-related output (ecCharts mainly)**

LHMS doesn't use CAMS and Fire-related output.

3.2. ECMWF cycle 48r1 went live at the end of June 2023. Changes included a much higher resolution medium range ensemble, and much more frequent monthly forecasts.

* **a) Please describe any positive impacts of model cycle 48r1 for your service**

The data format for generating local products is preserved and input data can still be compacted with existing visualisation software.

If you have any annotated graph/diagram/plot that would help clarify your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

* **b) Please describe any negative impacts of model cycle 48r1 for your service**

No degradation was observed between IFS cycles.
Changes/discrepancies were observed in the visibility product during the winter/cold season when convective type mixed precipitation or snow-like precipitation falls: a strong decrease in visibility is given over or near the areas of moderate or low intensity precipitation, up to 100-500 meters, it is understood that this can be the case with intense precipitation, but at light precipitation should not be like this and according to observations, it has never been like this. Visibility is better defined for continuous precipitation.

If you have any annotated graph/diagram/plot that would help clarify your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

* **c) Have you noticed any systematic changes in forecast output since model cycle 48r1 was implemented?**

- ○ Yes
- ◉ No

* **3.3: Do you modify ECMWF model output to create 'derived fields' (e.g. post-processed output, regimes, probabilities).**

- ○ Yes
- ◉ No

* **3.4: Do you currently use Artificial Intelligence (AI) and/or Machine Learning (ML) techniques in your service, in conjunction with standard ECMWF model output?**

- ○ Yes
- ◉ No

* **3.5: Does your NMHS use ECMWF data for modelling purposes - e.g. by providing initial/boundary conditions for limited area model runs, or for hydrological models, or for dispersion models, etc...**

- ◉ Yes
- ○ No

Please describe these activities

ECMWF provides initial/boundary conditions (IFS) for local deterministic HARMONIE-AROME LAM. 3DVAR and CANARI are used for the data assimilation, including convective boundary observations and air sounding data. Model results are provided with a horizontal resolution of 2.5 km and a vertical resolution of 65 model levels. Forecasts are produced for 54 hours ahead and are updated every 3 hours (8 times per day).

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

* **3.6: In the last year or so ECMWF has made available, on ecCharts and OpenCharts, selected fields from AI models (e.g. Pangu Weather, AIFS). Were you aware of this?**

- ○ Yes
- ◉ No

* **a) What are your views on this initiative?**

No activities at this moment at LHMS, but there might be some plans in the future.

* **b) Do you currently use AI forecasts for operational purposes?**

- ○ Yes
- ◉ No

What would you need in order to use AI models in your forecast activities?

Lack of specialists able to work in this field at the moment.

Section 4: Verification

ECMWF does extensive verification of its products in the free atmosphere. However, our verification of surface parameters is more limited and can be constrained to only using synoptic observations. More detailed verification of these surface weather parameters by National Services is always valuable to us. We are most interested in results for the last 1 or 2 years. Also, any evidence you have of performance changes since the introduction of cycle 48r1 would be very valuable.

* **4.1 Do you routinely verify raw model output from ECMWF model(s) and/or other operational models /ensembles?**

- ◉ Yes

- ( ) No

Please describe your verification activities and show and discuss related scores in the the two lead-time categories shown below, including, where possible, comparisons with your own models /ensembles, and other models/ensembles.
Ideally focus on surface weather parameters in your own territory. Inclusion of conditional verification results is also strongly encouraged - e.g. stratification by a weather type - as these can provide very useful insights into model weaker points.

a) Short Range and Medium Range

Real time monitoring of 4 surface parameters, such as 2-meter air temperature (Fig., top left), mean sea level pressure (Fig., top right), mean wind speed (Fig., bottom left) and wind gusts (Fig., bottom right) at 33 meteorological stations (point to point verification). Observations (black solid line) are compared with local model (solid-coloured lines) and ECMWF forecasts (dashed coloured lines). No verification indices are calculated, these observations are for nowcasting purposes.

There are still large deviations (sometimes in opposite directions) between local LAM and ECMWF forecasts at coastal stations (the attached example is from the coastal station of Nida), and this has not changed with the introduction of the 48R1 cycle.

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

dc396adb-0893-438e-8a85-1e269ca654c9/Example_of_point-to-point_short_range_verification.png

b) Extended Range (Monthly) and Long Range (Seasonal)

A few years ago, LHMS performed a reliability analysis of the Extended range - Weekly mean anomalies forecast for individual weeks. Currently not applicable.

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

* **4.2 Do you routinely verify post-processed products and/or tailored products delivered to users?**
- ( ) Yes
- (•) No

* **4.3 Do you perform any subjective verification of forecasts?**
- ( ) Yes
- (•) No

4.4: Case Studies. Please describe and illustrate any case study verification you have undertaken. Examples of both good and bad model performance are welcome. Severe weather events (and non-events) are of particular interest to us.

a) Case Study 1 - Please describe the forecast(s) and what happened

22 severe weather phenomena have been registered in Lithuania in 2023 and one of them was extremely strong squall. All situations have been analysed and the quality of models' forecasts evaluated. ECMWF model showed better results comparing with others.

More detailed information:
• Wind gusts (local event on the seaboard) 18-02-2023 – ECMWF good forecast 144 h in advance;
• Frost 28-04–14-05-2023 – 240 h in advance;
• Frost 28-05-2023 – 156 h;
• Frost 31-05-2023 – 168 h;
• Frost 03–05-06-2023 – 216 h;
• Fire risk in the forests 07-06–05-07-2023 – 168 h;
• Very heavy rain (local event in the northern part) 18-06-2023 – 144 h;
• Waterspout over the Baltic Sea 31-07-2023 – 108 h;
• Severe thunderstorms including very heavy precipitation, large hail and squalls 05–08-08-2023 – 156 h (the forecast was already 216 h before, but it has been not good corrected a few times later);
• Heat wave 15–20-08-2023 –156 h;
• Severe thunderstorms including very large hail 30–31-08-2023 – 192 h
• Wind gusts/squall (locally in the SE part of Lithuania) 04-10-2023 – 144 h;
• Wind gusts (locally on the seaboard) 05-10-2023 – 144 h;
• Wind gusts (locally on the seaboard) 07-10-2023 – 96 h;
• Wind gusts (locally on the seaboard) 23-11-2023 – 72 h;

Severe thunderstorms including very heavy precipitation, large hail and very strong squalls in Lithuania on 5–8 of August 2023

In Lithuania, August was very warm and wet. During the month even seven severe weather events were registered and moistly of them developed due to tropical air influence. Two of these cases were Severe thunderstorms with powerful lightings, heavy or very heavy rains, strong squalls and large or very large hails. The most intensive thunderstorm lasted 4 days, from 5 to 8 of August. It started at day on 5th with powerful rain in the eastern and southern regions of Lithuania (16–49 mm). The convection intensification increased at night of 6th close to the Baltic Sea and due to tropical airmass influence it increased during the day and especially on 7th of August when the heaviest rain observed (80 mm/12 h) in the northeastern part of Lithuania. Under the lines of instability in the warm sector (temp at 850 hPa was 18–20 ℃) of southern cyclone very strong squalls (28–33.5 m/s) and large hail (2–9 cm) measured in many places. Synoptic analysis of the period 5–8 of August showed the typical situation for intensive convection to occur: cold waving front was over the Central Europe and the high pressure expanded over Russia and became as a barrier to move frontal system to the east. Thus, very warm and wet unstable tropical air made a significant damage in many places and especially in the northern region with more urbanized places which were touched by cold front in the afternoon of 7th: green houses, cars were damaged, electricity power lines cut by broken trees, roofs of buildings destroyed.

ECMWF forecast of synoptic situation and heavy rain was very good 2-3 days ahead (Fig.). Moreover, ECMWF predicted the start of dangerous synoptic situation even 156 h in advance. It is worth to mention that the first features of the powerful convection could be detected already 216 h in advance. Local model Harmonie predicted the sharp change of temperature very well 24 h in advance (Fig.).

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

0b66a780-2ed7-4fdd-be6b-0464e743bbbd/ECMWFtotal_precipitation_forecast__48_for_05-08-2023.png
2423285b-e158-4de3-b961-f5a1020dd01e/ECMWF_total_precipitation_forecast__72_h_for_06-08-2023.png
09c89f2f-e1ce-45e3-bd73-8900a4f9f930/Temperature_forecast_from_HARMONIE__24_h_for_07-08-2023.jpg

Case Study 1 is an example of:

- (●) Good model performance
- ( ) Bad model performance
- ( ) Mixed (good and bad) model performance
- ( ) Other (please describe above)

Add another Case Study?

- (●) Yes
- ( ) No

b) Case Study 2 - Please describe the forecast(s) and what happened

Powerful convection in Lithuania on 30–31 of August 2023
Intensive thunderstorm started in the morning on 30 of August and continued in the evening and even at night on 31st of August. Synoptic analysis of pressure on the sea level showed the narrow through with cold front. It connected two lows – one cyclone was standing over Scandinavia while another one approached the Baltic States from Balkans. The front was in parallel – south-north – upper flow and couldn't leave Lithuania rapidly as anticyclone over Russia blocked its motion to the east. Tropical air with very warm (14–19 ℃) and moist airmass on 850 hPa height reached the country. The warm sector of cyclone created convenient conditions to form a few lines of convergence. It was the main reason for very powerful convection and disastrous weather events to occur heavy rain (15–47 mm/4 h, very large hail (2–5 cm), squalls (up to 20 m /s) and lighting. Significant damage was done mainly in the southern and eastern parts of country: broken trees, electricity power lines cut, roofs of buildings destroyed.
ECMWF predicted the typical situation powerful convection to occur even 192 h before the event.

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

26e6665a-089e-40cf-836e-362611e29ad4
/Lightning_strikes_over_Lithuania_at_day_and_evening_on_30_of_August.jpg

Case Study 2 is an example of:

- (●) Good model performance
- ( ) Bad model performance
- ( ) Mixed (good and bad) model performance
- ( ) Other (please describe above)

Add a third Case Study?

- ( ) Yes
- (•) No

Section 5: Output Requests

5. Please describe, and illustrate if necessary, any particular requests you may have for new or modified ECMWF products.

a) Product request 1 - title / summary

Lapse rate in different layers, bulk wind share, hail products

Product request 1 - description of request

It would be beneficial to have „Lapse rate“ product in different layers, same as „Bulk wind shear“ product, and some product for hail probability or possible size.

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

Add another Product Request?

- (•) Yes
- ( ) No

b) Product request 2 - title / summary

Sounding forecasts

Product request 2 - description of request

Sounding forecast at least one week in advance.

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

Add a third Product Request?

- ○ Yes
- ◉ No

Section 6: References

6. Are there any recent internal or external publications that relate to the questions in this survey? Please list them including the respective link/s. For any publications that cannot be readily downloaded via a link please attach a copy below (or email Becky Hemingway (becky.hemingway@ecmwf.int) and Tim Hewson (timothy.hewson@ecmwf.int) if too large to upload here).

No publications.

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

Section 7: Additional comments and Feedback

7.1. Please use the box below if you have additional comments on topics that have not been covered in any of the questions above

find attached some more illustrations for Section 3

If you have any annotated graph/diagram/plot that would help support your answer to the previous question, please upload here.
File types: most accepted, File Size: max 1MB per file.

2b5d2556-f5b7-4dc2-90a2-17ba078a521c/3.1._a_Example_of_data_visualization.png
fa9380b3-15a4-4024-94f2-965822d685b4/3.1._b_Exampale_of_4_weeks_temperature_and_precipitation_forecast_visualization_at_LHMS_webpage.png

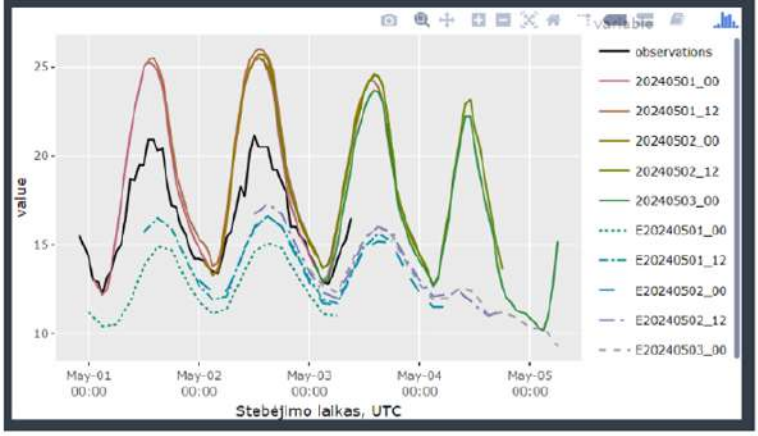
7.2. This is the first time we have used a survey style structure for Green Book submissions. You thoughts and feedback on this process are very welcome

Thank you for taking the time to complete your Green Book report. Your feedback and comments are very valuable to us!

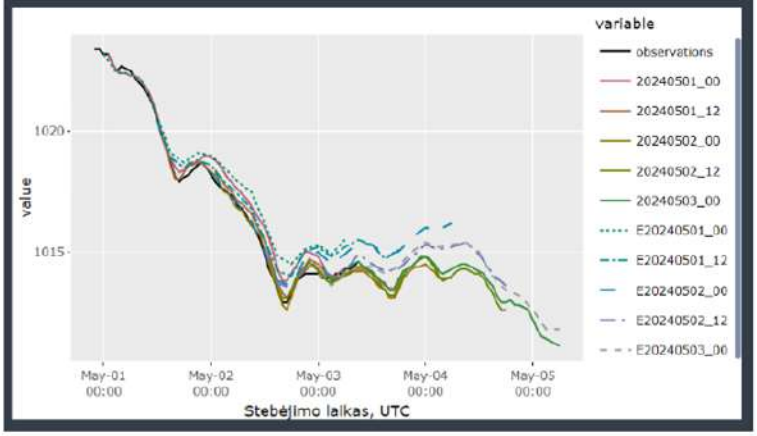
Contact

Contact Form

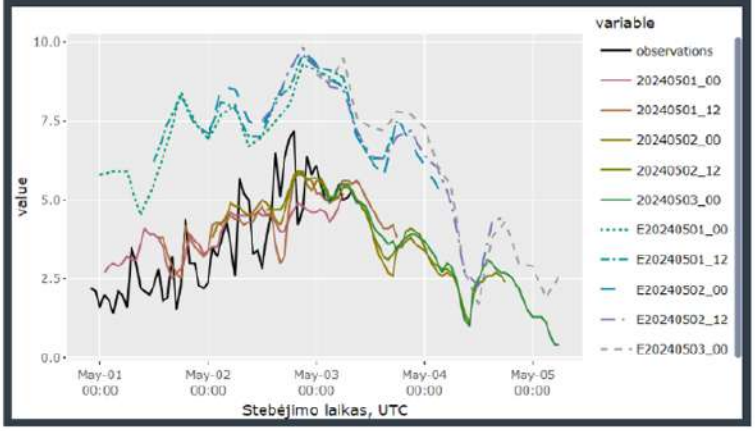
Oro temperatūra **2m air temperature, °C**



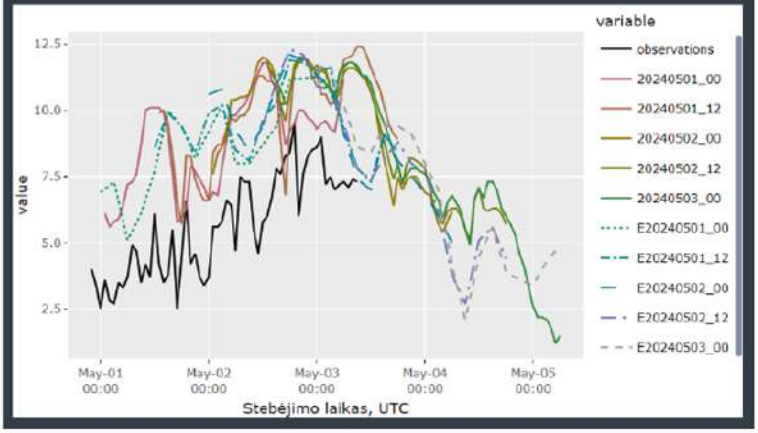
Atmosferos slėgis **Mean sea level pressure, hPa**

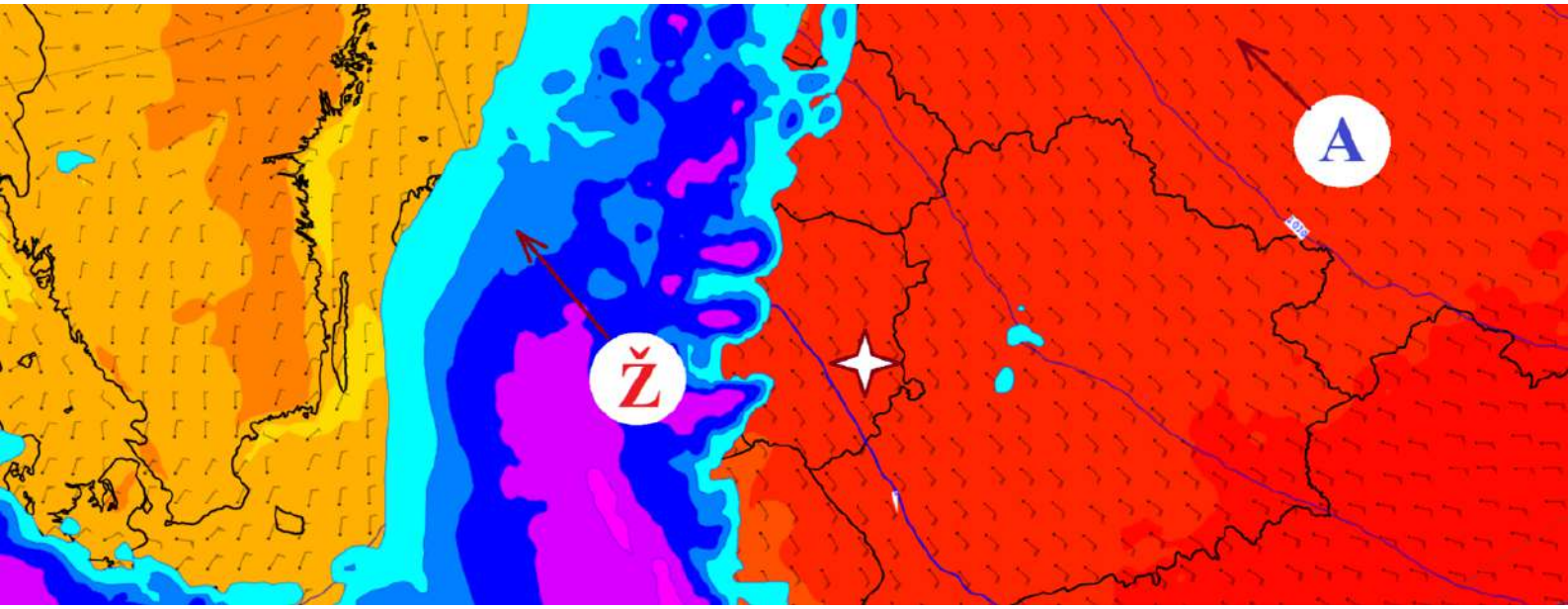


Vėjo greitis **Wind speed, m/s**



Vėjo gūsiai **Wind gusts, m/s**

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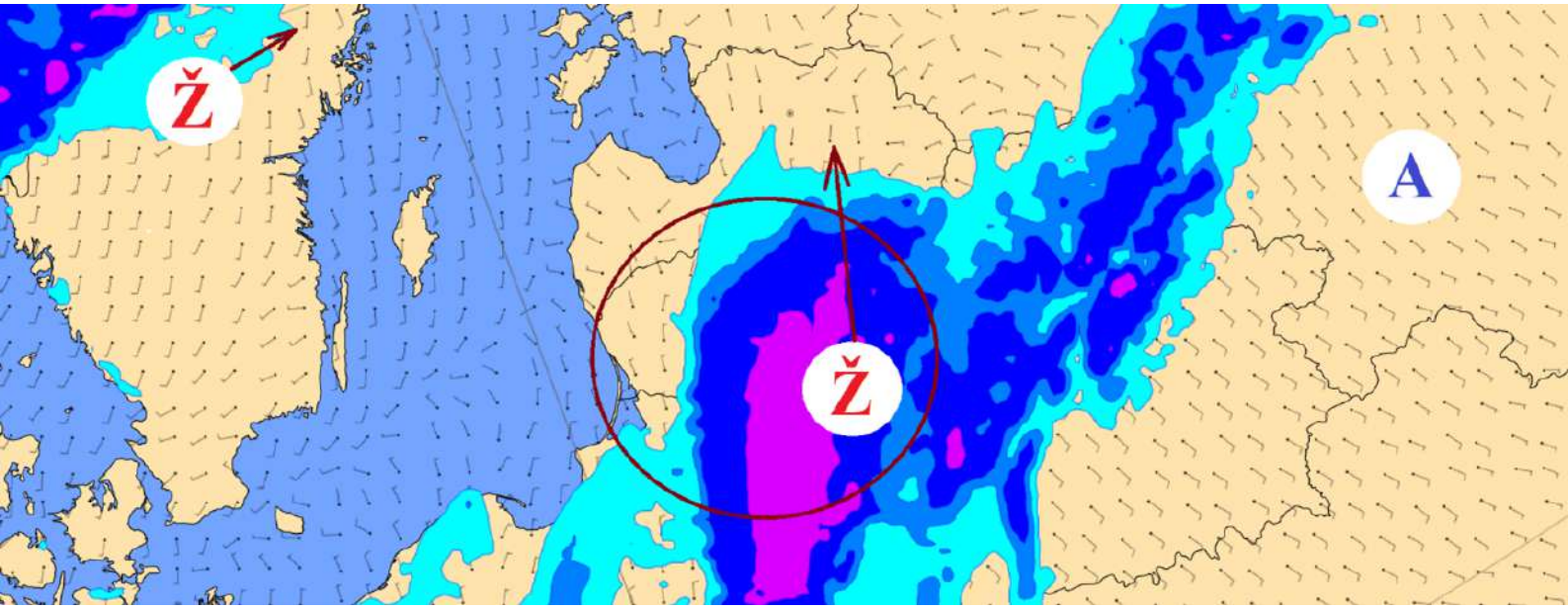
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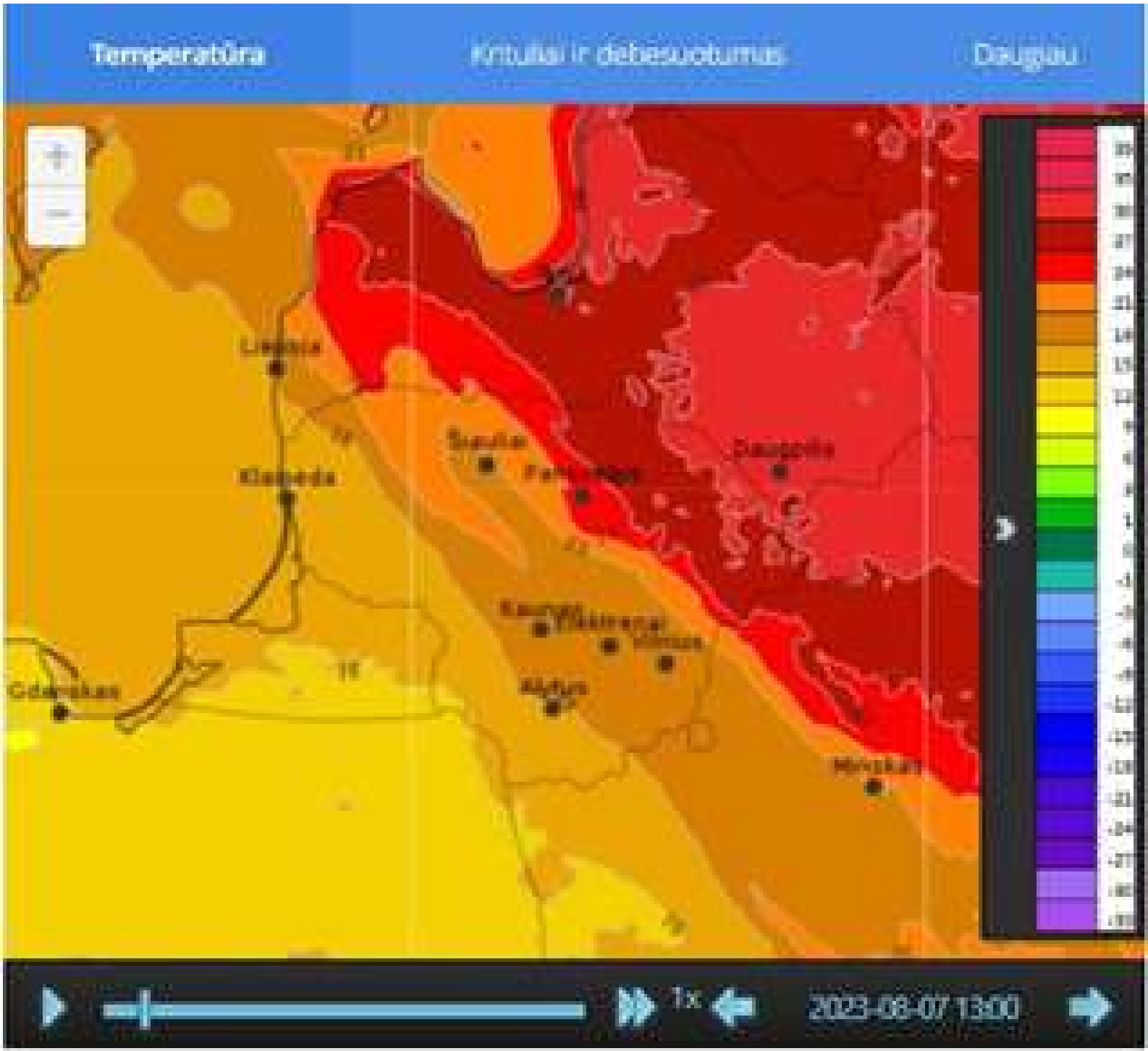
Temperatūra
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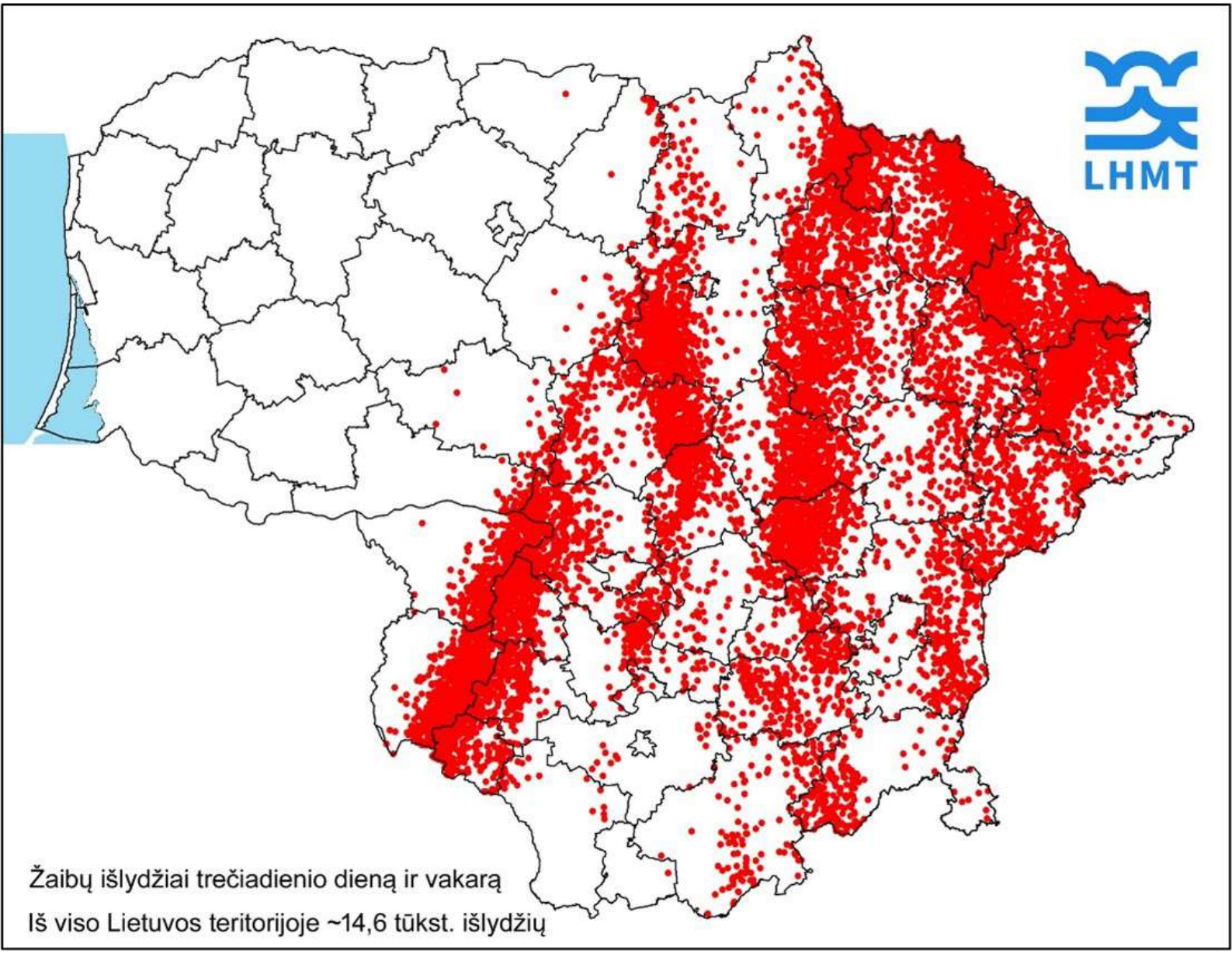
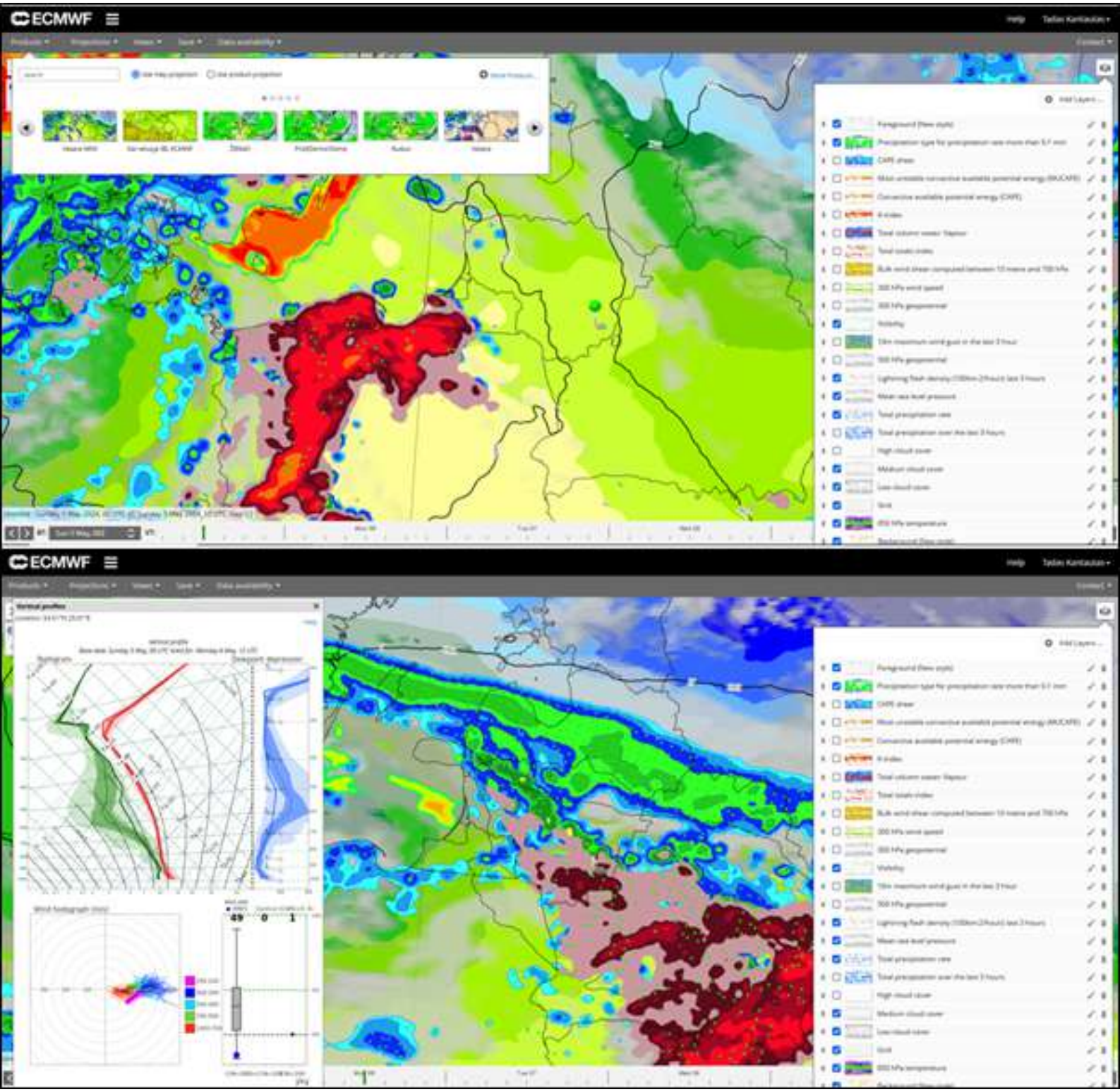


Žaibų išlydžiai trečiadienio dieną ir vakarą

Iš viso Lietuvos teritorijoje ~14,6 tūkst. išlydžių


ECMWF
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Precipitation type for precipitation rate more than 0.1 mm/h
CAPE shear
Most unstable convective available potential energy (MUCAPE)
Convective available potential energy (CAPE)
K-index
Total column water Vapour
Total totals index
Bulk wind shear: computed between 10 metres and 700 hPa
300 hPa wind speed
500 hPa geopotential
Visibility
10m maximum wind gust in the last 3 hour
500 hPa geopotential
Lightning flash density (100km-2/hour) last 3 hours
Mean sea level pressure
Total precipitation rate
Total precipitation over the last 3 hours
High cloud cover
Medium cloud cover
Low cloud cover
Grid
850 hPa temperature
Background (New style)

ECMWF
Help
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Products
Projections
Areas
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Data availability
Connect
Vertical profiles
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Foreground (New style)
Precipitation type for precipitation rate more than 0.1 mm/h
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Lightning flash density (100km-2/hour) last 3 hours
Mean sea level pressure
Total precipitation rate
Total precipitation over the last 3 hours
High cloud cover
Medium cloud cover
Low cloud cover
Grid
850 hPa temperature
Background (New style)

Ilgalaikė prognozė

Prognozuojama, kad *gegužės antroje pusėje* oro temperatūra iki 0.5 °C aukščiau normos, o kritulių kiekis iki 5 % didesnis nei SKN*.

*Pateikiama ekspertinė artimiausio mėnesio prognozė Lietuvoje**:*

- Gegužė: oro temperatūra iki 0.5 °C aukščiau normos, o kritulių kiekis iki 5 % mažesnis nei SKN (SKN: 12.5 °C ir 53 mm).

Prognozę sudarė Klimato ir tyrimų skyrius. Prognozė atnaujinta 2024-05-10

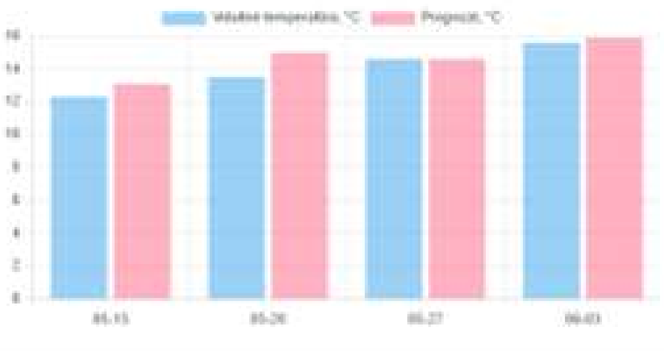
* SKN – [illegible] 1991–2020 [illegible] Lietuvoje

** [illegible]

*** [illegible] ECMWF [illegible]

[illegible]

Vidutinės oro temperatūros prognozė



Kritulių kiekio prognozė