

# New gridded operational products at Slovak Hydrometeorological Institute

Juraj Holec<sup>1</sup> - Lívia Labudová<sup>1</sup> - Katarína Mikulová<sup>1</sup> - Jakub Ridzoň<sup>2</sup> - Dušan Štefánik<sup>1</sup> - Miroslav Trnka<sup>3</sup> - Lenka Bartošová<sup>3</sup> - Jan Bálek<sup>3</sup>

<sup>1</sup> Slovak Hydrometeorological Institute, Jeséniova 17, 82101 Bratislava

<sup>2</sup> Slovak Hydrometeorological Institute, Regional branch in Banská Bystrica, Zelená 5, 97404 Banská Bystrica

<sup>3</sup> Global Change Research Institute CAS (CzechGlobe), Bělidla 986/4a, 603 00 Brno

## New gridded climatological maps

New gridded climatological maps were added into operation at Slovak Hydrometeorological Institute (SHMÚ) during March 2025. They comprise the following products: **Minimum, Maximum, Mean daily air temperature [°C], Daily precipitation sum [mm] and Daily sum of potential evapotranspiration [mm]**. These are computed on daily basis using high-performance computer (HPC) and are available around 9:00 UTC. The temperature maps are created using method of Frei (2014) which is suitable for areas with complex orography since it has been originally used for territories of Switzerland and Austria. Precipitation map is created using two step interpolation procedure. In this case the computation combines background monthly normal precipitation fields created by kriging with external drift (KED) and daily field created by Inverse Distance Weighting (IDW) method. Daily sum of potential evapotranspiration is derived from aforementioned maps using Hargreaves method (Hargreaves & Samani, 1982).

Fig. 1: Demonstration of gridded minimum daily air temperature during temperature inversion in December 2025

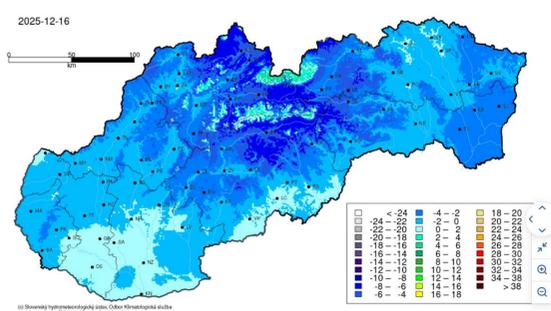


Fig. 2: Gridded daily precipitation sum

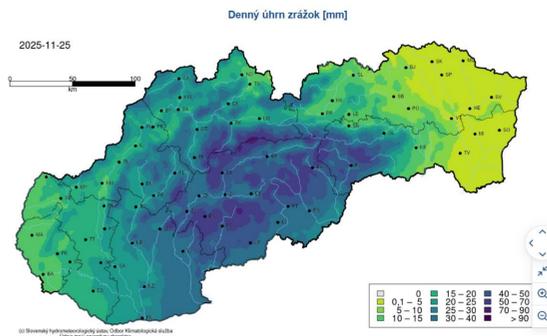
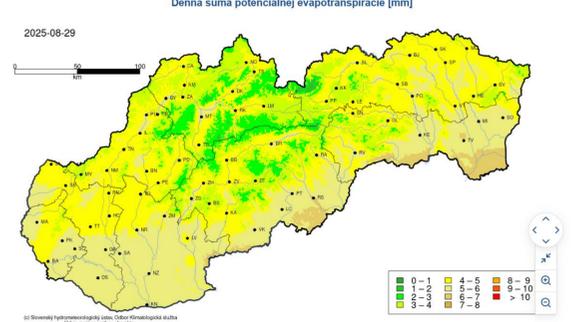


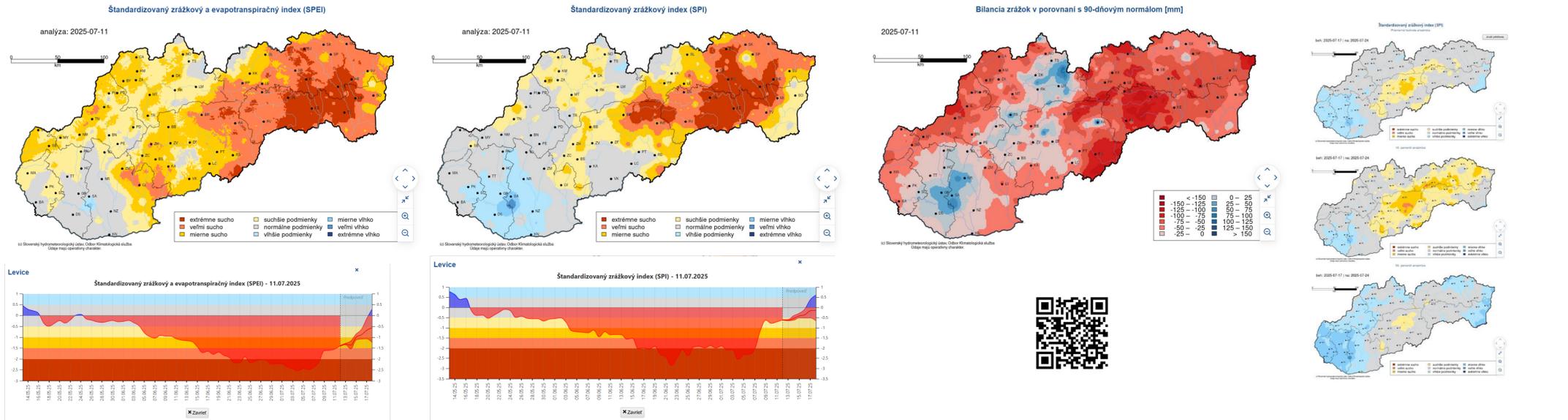
Fig. 3: Daily sum of potential evapotranspiration during a tropical day in August 2025



## New gridded drought monitoring maps

In consequence to climatological maps, drought monitoring products were added to operation during June 2025. Following products were created: Standardized precipitation-evapotranspiration index (SPEI), Standardized Precipitation Index (SPI), both for 30 day period, Precipitation balance in comparison with normal of 90 day precipitation sum, Percentage difference of precipitation in comparison with normal of 90 day precipitation sum and duration of drought. SPEI and SPI indices include a 7-day forecast based on A-LAEF (days 1-3) and ECMWF models (days 4-7). Instead of a deterministic forecast, an ensemble forecast was used, showing the mean, 10th, and 90th percentiles of the ensemble to illustrate the forecast uncertainty.

Figs. 4-8: SPEI (left side) and SPI (in the middle) indices and precipitation balance (right side) showing variability of meteorological drought across Slovakia in July 2025, below the graphs with SPEI and SPI history and ensemble forecast for town Levice

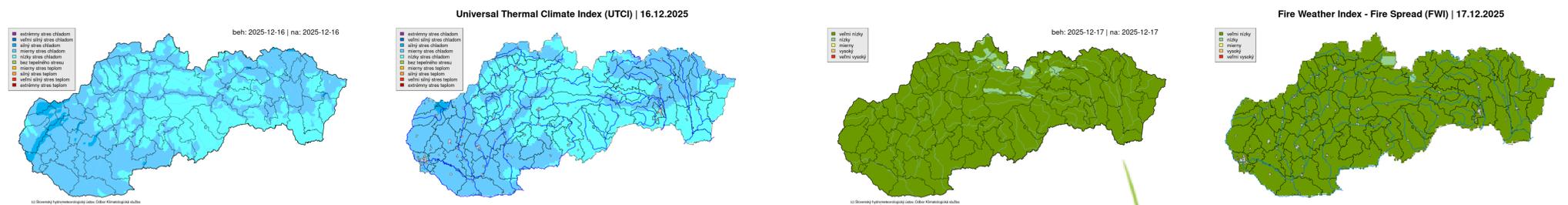


## New bioclimatological and fire risk maps

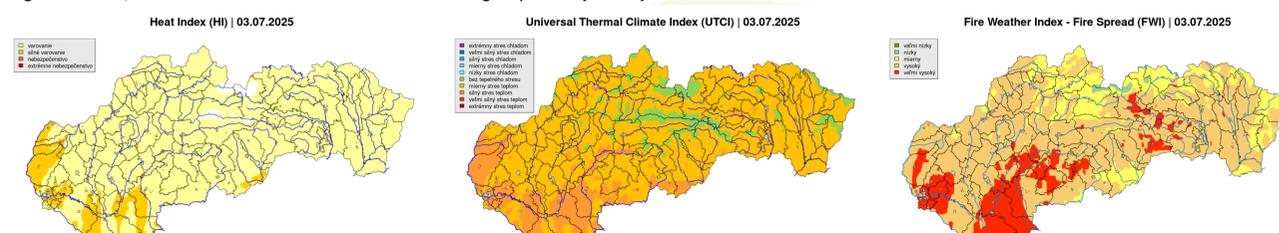
Third part of new products represents new bioclimatological products, namely Universal Thermal Comfort index (UTCI) and Heat index (HI) and Fire risk products, namely Fire Weather Index (FWI) and Fuel moisture index (FMI). These products have 7 day forecast as well, based on Aladin model with 2 km resolution (day 1-3) and ECMWF model (day 4-7).

Figs. 10-11: Comparison of new UTCI computed by SHMÚ using NWP model Aladin with 2 km resolution (left side) and by Czechglobe using NWP model ECMWF (right side). Better resolution with more detailed orography is reflected on left picture (e.g. Malé Karpaty Mts. in south-western part of area with very strong cold stress).

Figs. 12-13: Comparison of new FWI computed by SHMÚ using NWP model Aladin with 2 km resolution (left side) and computed by Czechglobe using NWP model ECMWF (right side). Better resolution with more detailed orography is reflected on left picture with areas above temperature inversion with moderate fire risk.



Figs. 14-16: HI, UTCI and FWI based on ECMWF model during tropical day in July 2025



References:  
 Frei, C. (2014). Interpolation of temperature in a mountainous region using nonlinear profiles and non-Euclidean distances. *International Journal of Climatology*, 34(5).  
 Hargreaves, G. H., & Samani, Z. A. (1982). Estimating potential evapotranspiration. *Journal of the irrigation and Drainage Division*, 108(3), 225-230.