

Operational suite

2 current configurations:

- ALADIN-HR4:** 4km, 73 levels, ALARO-0 phys.; CANARI+3D-Var with 3h cycle; 72h fcst.; LBCs: IFS-3h (lagged mode); 4 runs per day
- ALADIN-HRDA:** 2km, 32 levels, dynamical adaptation (DA) of wind; 72h fcst.; ICs/LBCs: ALADIN-HR4; 4 runs per day

2 future configurations:

- ALADIN-HR4:** 4km, 73 levels, ALARO-1 phys.; CANARI+3D-Var (3h cycle, ENS B-matrix); 72h fcst.; LBCs: IFS-3h (lagged mode); 4 runs per day
- ALADIN-HR2:** 2 km, 87 levels, ALARO-1 phys.; 72h fcst.; ICs: ALADIN-HR4 + DFI; LBCs: IFS-1h (lagged mode); 4 runs per day

Tuning of CY43T2-based e-suite

- improved standard deviation of screen-level temperature and cloudiness in winter (Fig. 1 and Fig. 2) and summer (not shown)
- decreased negative bias of temperature and its diurnal variation in winter (Fig. 1)
- decreased negative bias of cloudiness in winter (Fig. 2) and summer (not shown)

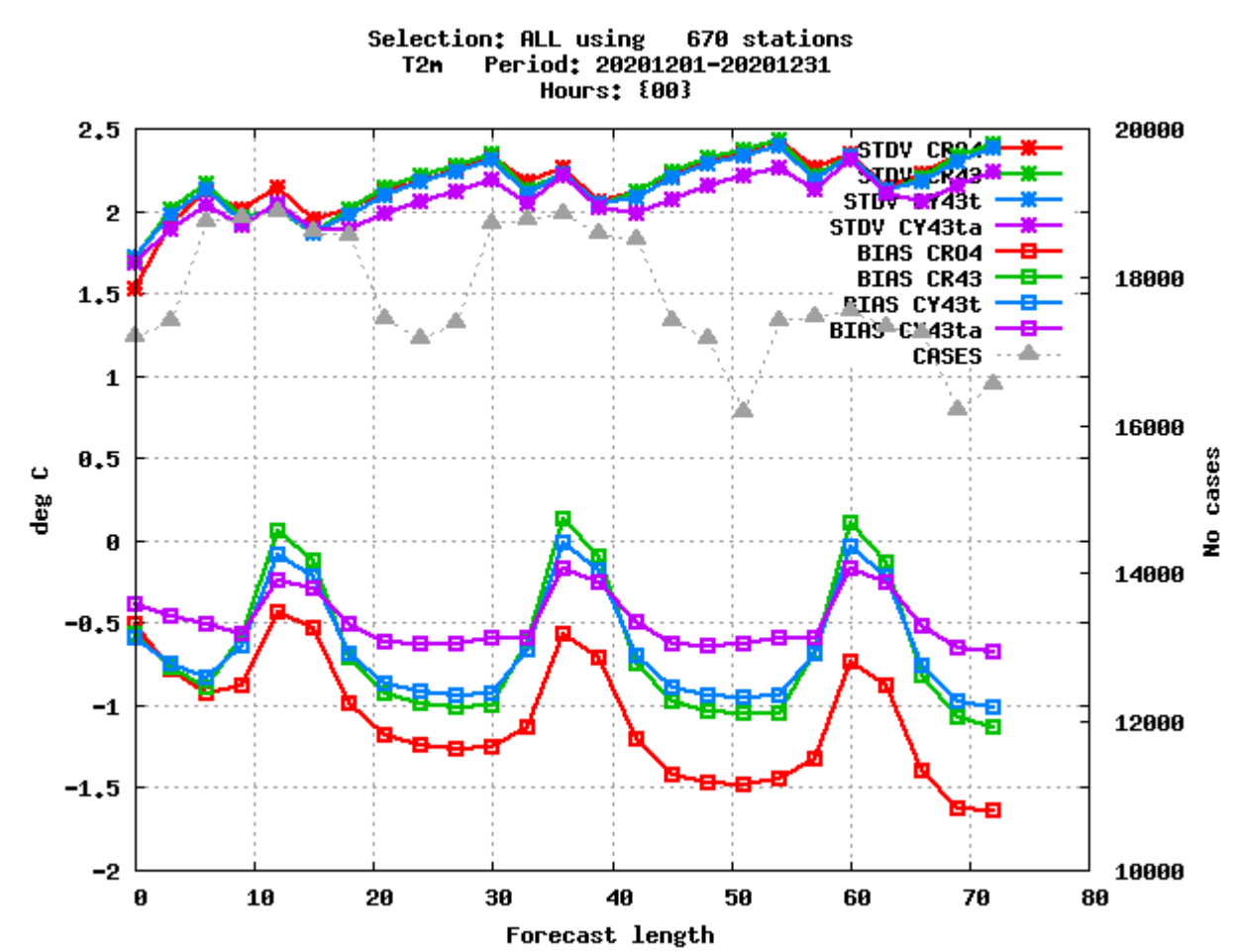


Fig. 1. BIAS and STD of screen-level temperature (SLT) for different model configurations during the period 1.12-31.12.2020. (CRO4 – CY38-based operational configuration, CR43 – CY43 e-suite, CY43t – tuned CY43t2 e-suite and CY43ta – CY43t with modified SLT interpolation and cycling)

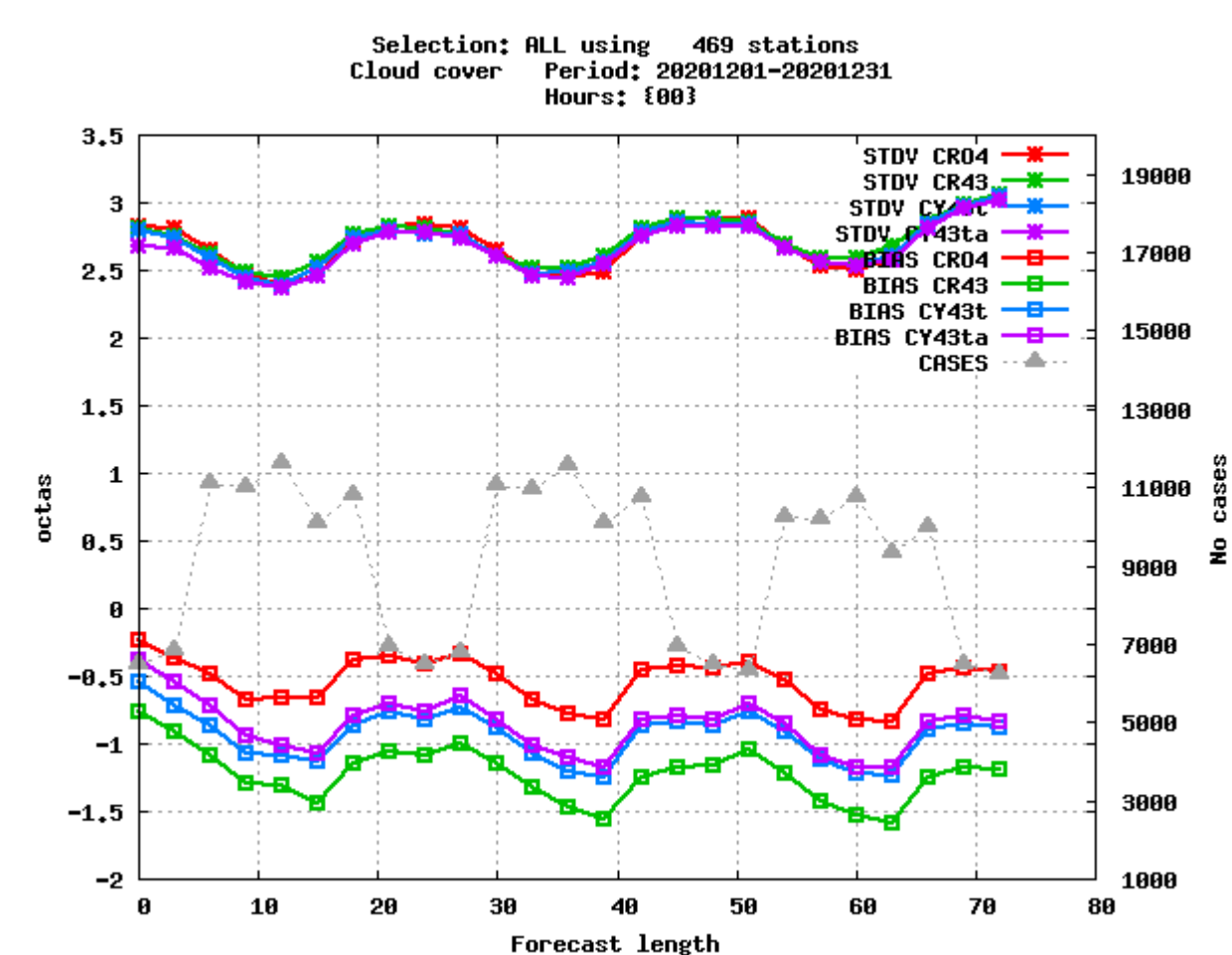


Fig. 2. BIAS and STD of cloudiness for different model configurations during the period 1.12-31.12.2020. (CRO4 – CY38-based operational configuration, CR43 – CY43 e-suite, CY43t – tuned CY43t2 e-suite and CY43ta – CY43t with modified interpolation of SLT and cycling)

Heat wave forecast – case study 8.7.2021.

- improved prediction of the heat wave peak at multiple locations (shown for Osijek and Zagreb, Fig. 3)
- possible cause of a temperature underestimation in CY38 is a false representation of cloudiness (Fig. 4)

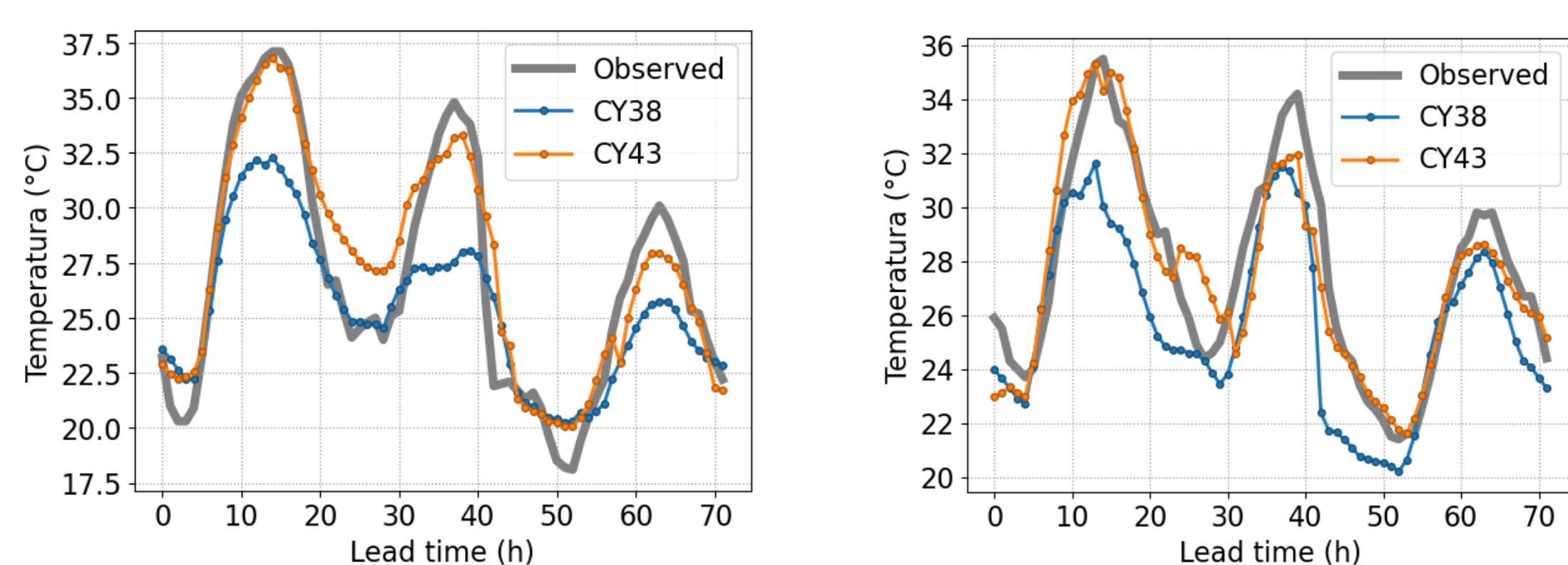


Fig. 3. Timeseries observed and modeled screen-level temperature for stations Osijek (left) and Zagreb (right), starting from 00 UTC on 8th July 2021 (blue – CY38-based operational configuration, orange – tuned CY43T2 e-suite)

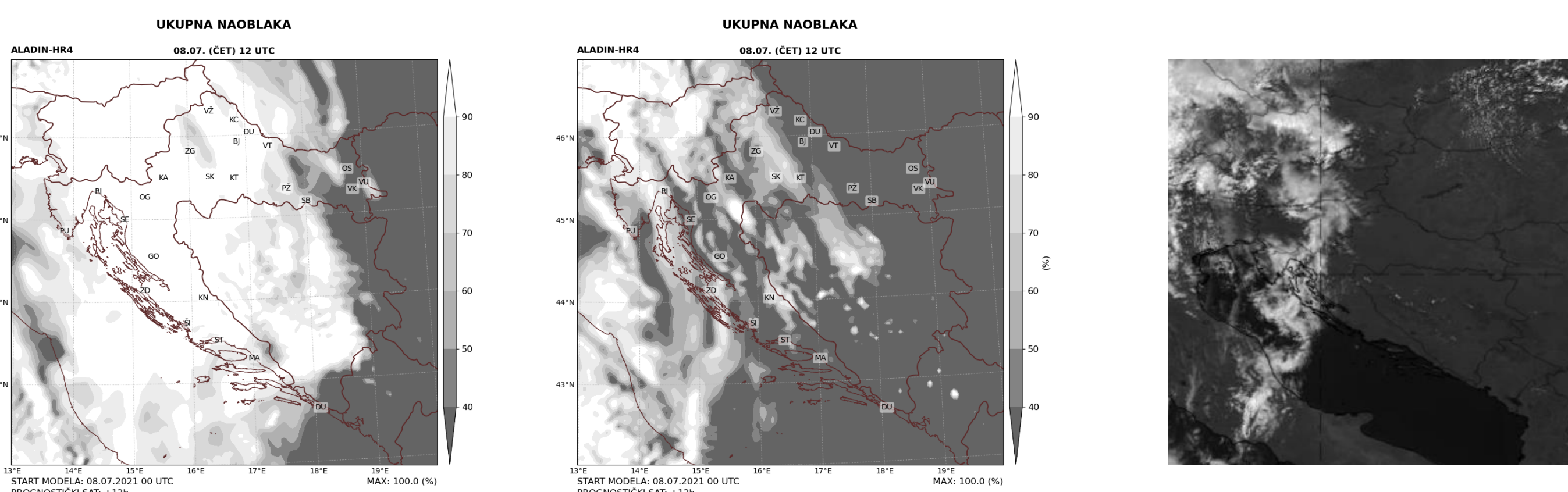


Fig. 4. Total cloudiness field from: i) CY38-based operational configuration (left), ii) tuned version of the CY43T2-based e-suite (middle), and iii) satellite data (right) at 12 UTC on 8th July 2021.

Tuning of CY43-based HR20 configuration

- improved forecast of wind (not shown) and wind gusts (Fig. 5; compared to DA)

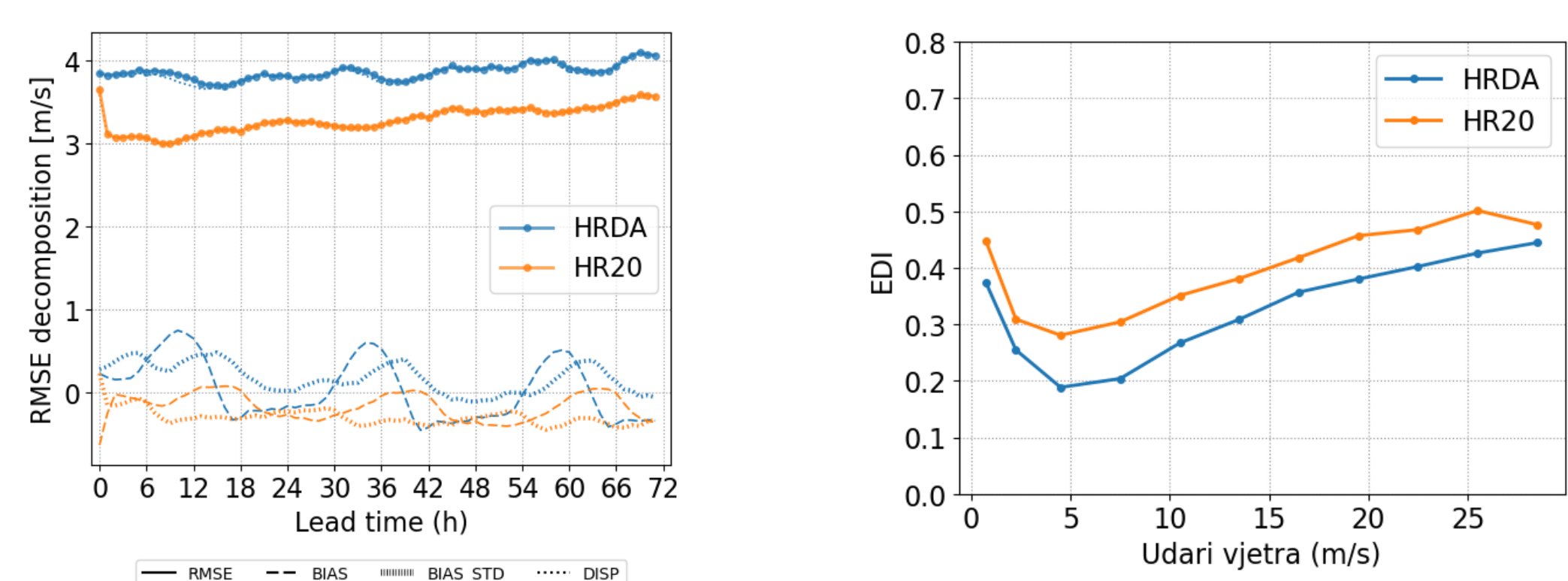


Fig. 5. RMSE decomposition (left) and EDI (right) for wind gusts within the period 1.1.2021-31.12.2021. for Croatian stations (blue – DA, orange – tuned CY43-based HR20 configuration)

Post-processing

Operational forecasts improvement

- upgrade of analog-based forecasts upon the raw NWP forecast of the temperature, wind speed, and wind gusts is obtained by applying:
 - a weighting procedure for determining the importance of each predictor variable
 - the statistical correction for the high (or low)-percentile events
- using more advanced variants of the analog-based forecast (AnEnT, AnEnK) leads to further improvements, especially for more extreme events

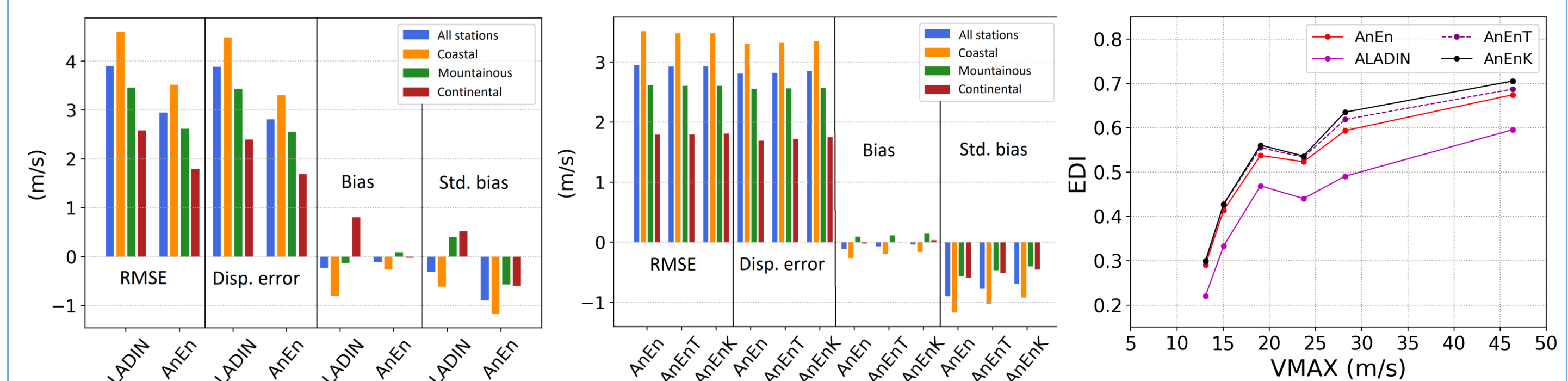


Fig. 6. The RMSE and members of RMSE decomposition for each group of stations and all stations (left, middle) for the 10-m wind gust for NWP and analog-based forecasts. Categorical verification measure EDI (right) calculated for all the wind gust forecasts for all stations.

The Kalman Filter research

- the optimization of the variance ratio r in the Kalman Filter (KF) algorithm is performed for four post-processed point-based forecasts of the wind speed and wind gust
- for the simplest one, the KF algorithm is applied to the time series of NWP forecasts. For the remaining forecasts, the KF is combined with the analog approach (KFAS, KFAN, KF-KFAS)
- the results differ, depending on the data: the optimal r -value shifts toward the larger values when analyzing more extreme events. Recommended r -values (0.01 or 0.001, depending on the forecast) show remarkable results for the overall data, as well as solid results for more extreme events

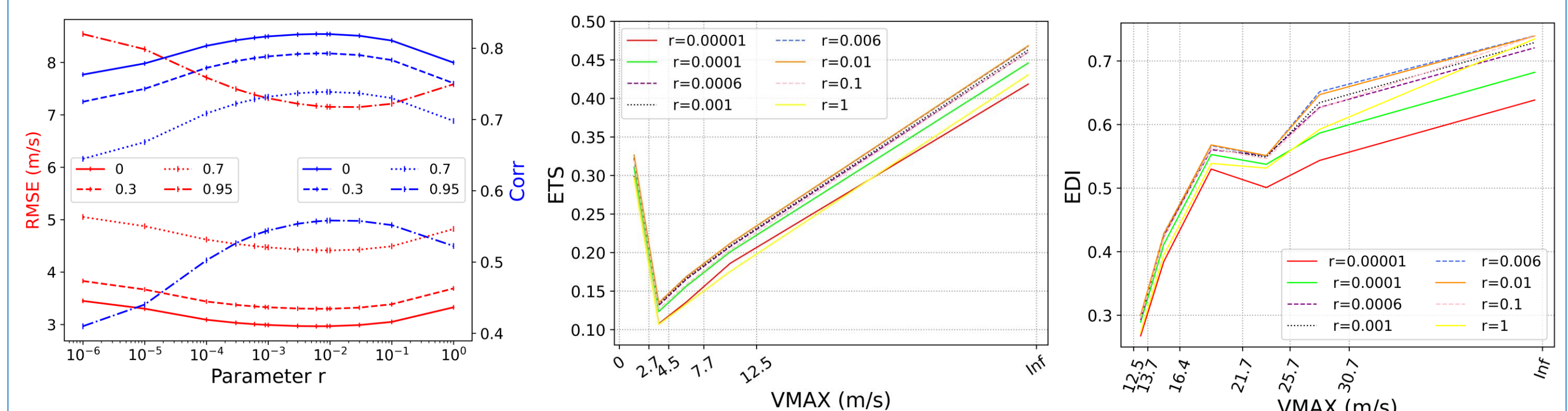


Fig. 7. The KFAS forecast of 10-m wind gust: The RMSE and correlation coefficient depending on the value of parameter r used, where the results include only the events for which observed values exceed the value of the percentile noted in the legend (left). Categorical verification measures ETS (middle) and EDI (right) calculated for all data using several values of the r parameter.

Universal Thermal Climate Index - UTCI

UTCI is a biometeorological index that represents the air temperature of the reference environment providing the same physiological response of reference person as the actual environment.

- the meteorological data used for the calculation of UTCI are hourly model values of air temperature, relative humidity, wind speed and mean radiant temperature from NWP model ALADIN-HR cy43
- 72h forecast of UTCI over local domain and point-based (Fig. 8) → still in the test phase

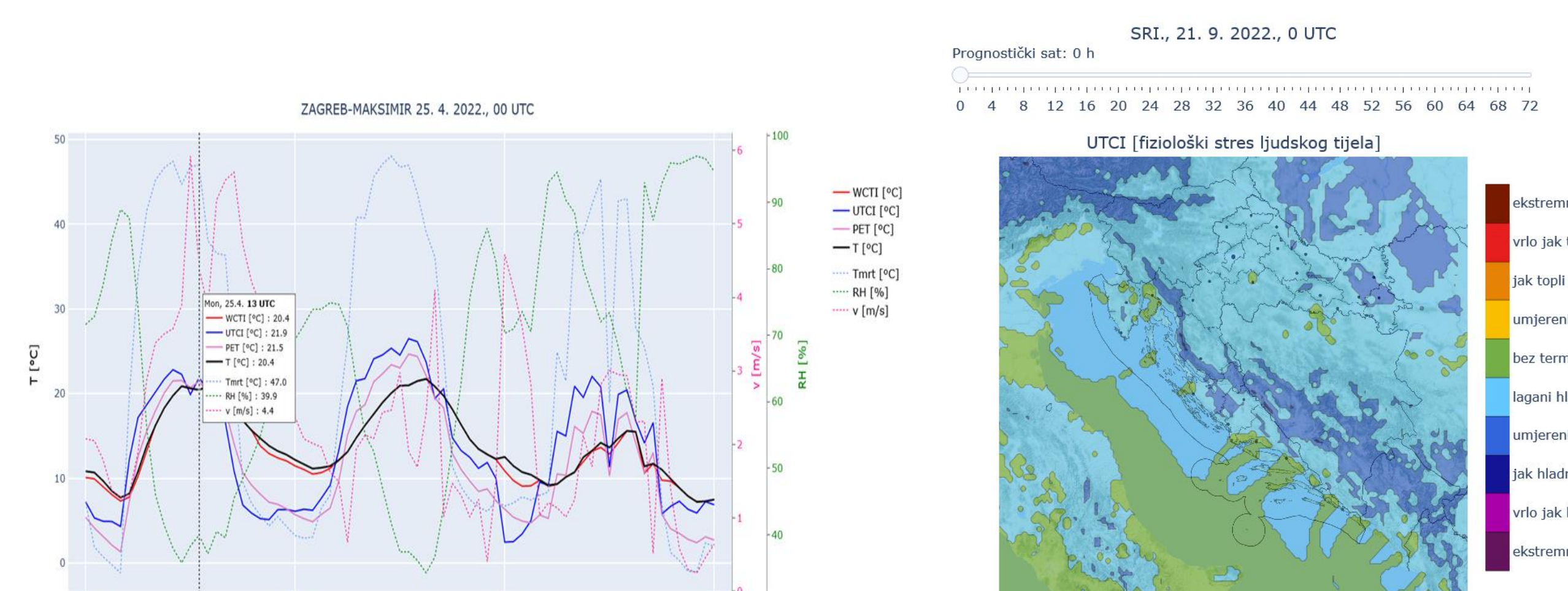


Fig. 8. 72-h forecast of UTCI: point-based (left) and over local domain (right).