Copernicus Emergency Management Service

What's New in EFAS Data Validation in Meteo DCC

EFAS Annual Meeting 2023

Presented by Carina-Denise Lemke and Zora Schirmeister

29 09 2023

Copernicus Europe's eyes on Earth

European Commission

Data Validation in Meteorological Data Collection Center

Emergency Management

- Meteo Data Collection Center checks incoming observation data using different quality checks, e.g.
  - Distance validation → time distance between two values, data availability
  - Min/max validation → values against min/max thresholds
  - Rate of change validation → rate of change between two values against max thresholds
  - Resulting quality flags decide whether data are used for MDCC products or not

Parameter	Min threshold	Max threshold	Unit
Cloud cover	0	9	octas
Evaporation	0	2 3 15	mm/15 min mm/hour mm/day
Relative air humidity	5	100	%
Solar radiation	0	1360 cos(lat)	W/m^2
Sunshine duration	0	astronomic max	min
Vapour pressure	0	35	hPa
Wind direction	0	360	°
Wind speed	0	45	m/s

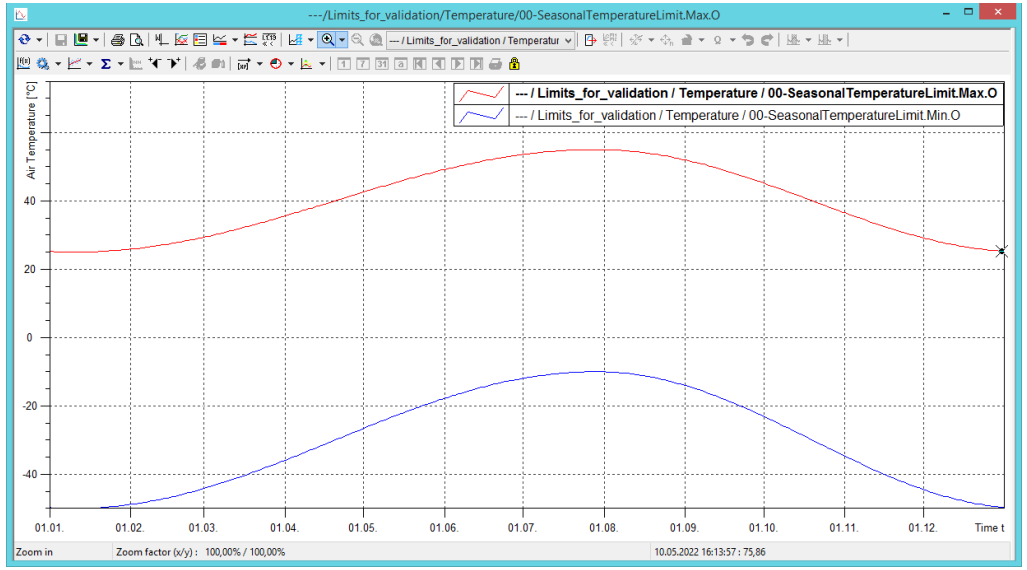
Example min/max thresholds

KISTERS
Deutscher Wetterdienst
Wetter und Klima aus einer Hand
DWD
Copernicus
Europe's eyes on Earth
European Commission

Data Validation in Meteorological Data Collection Center

Emergency Management

- Specific min/max validation rules
  - Seasonally varying thresholds for min/max temperature
  - Thresholds for precipitation totals
  - Thresholds are very tolerant to avoid excluding real extremes



Parameter	Min threshold	Max threshold	Unit
Precipitation	0	125	mm/15 min
Precipitation	0	200	mm/30 min
Precipitation	0	250	mm/60 min
Precipitation	0	350	mm/180 min
Precipitation	0	425	mm/360 min
Precipitation	0	475	mm/540 min
Precipitation	0	500	mm/720 min
Precipitation	0	525	mm/900 min
Precipitation	0	550	mm/1080 min
Precipitation	0	600	mm/1440 min

KISTERS Deutscher Wetterdienst Wetter und Klima aus einer Hand DWD Copernicus Europe's eyes on Earth European Commission

Data Validation in Meteorological Data Collection Center

Emergency Management

- Shortcomings
  - No geographical and few seasonal context:
    - Same thresholds for all stations in data base (e.g. North vs. South Europe)
    - No seasonal dependencies used for precipitation (e.g. ‚rain season' vs. ‚dry season')
  - Validation of individual time series
    - No information from neighboring stations

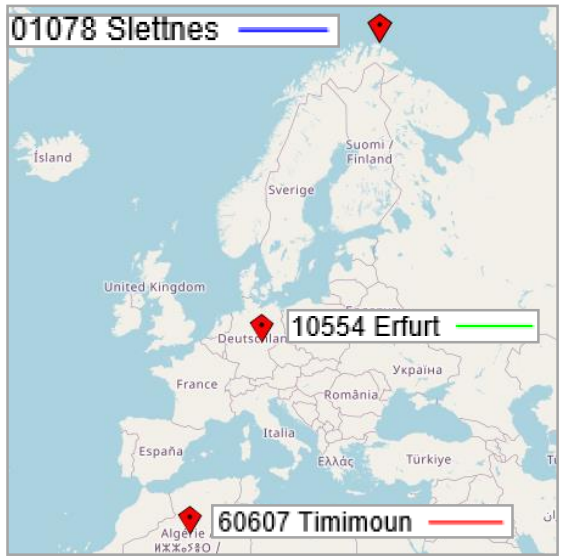
- Measures currently being setup
  - Introduction of climate zones and seasonally varying thresholds
  - Introduction of spatial comparison checks

KISTERS
Deutscher Wetterdienst
Wetter und Klima aus einer Hand
DWD
Copernicus
Europe's eyes on Earth
European Commission

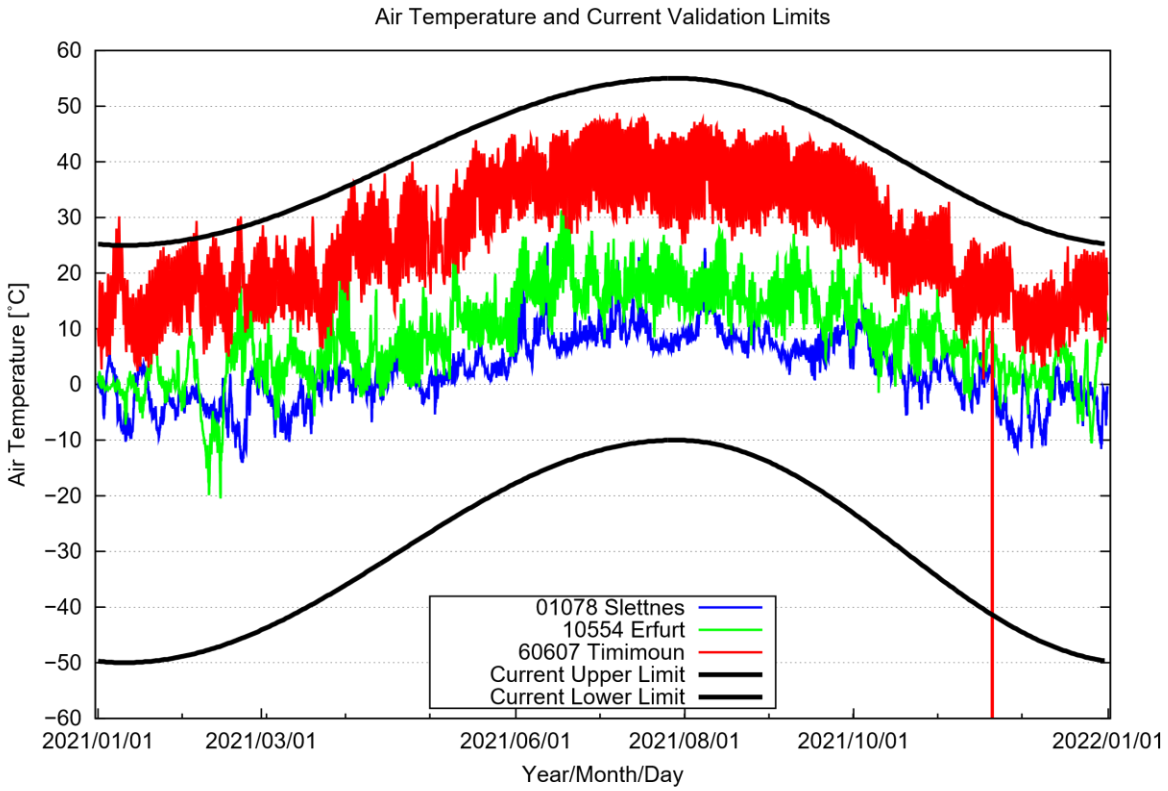
Meteo Data Validation: Thresholds by Climate Zone and Season

Emergency Management

- Introduction of climate zones and seasonally varying thresholds
  - Example: Air temperature



openstreetmap.de/



- Goal:
  - Adapt limits to local climate / Reduce limit range
  - Don‘t flag real extremes

KISTERS

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Copernicus
Europe's eyes on Earth

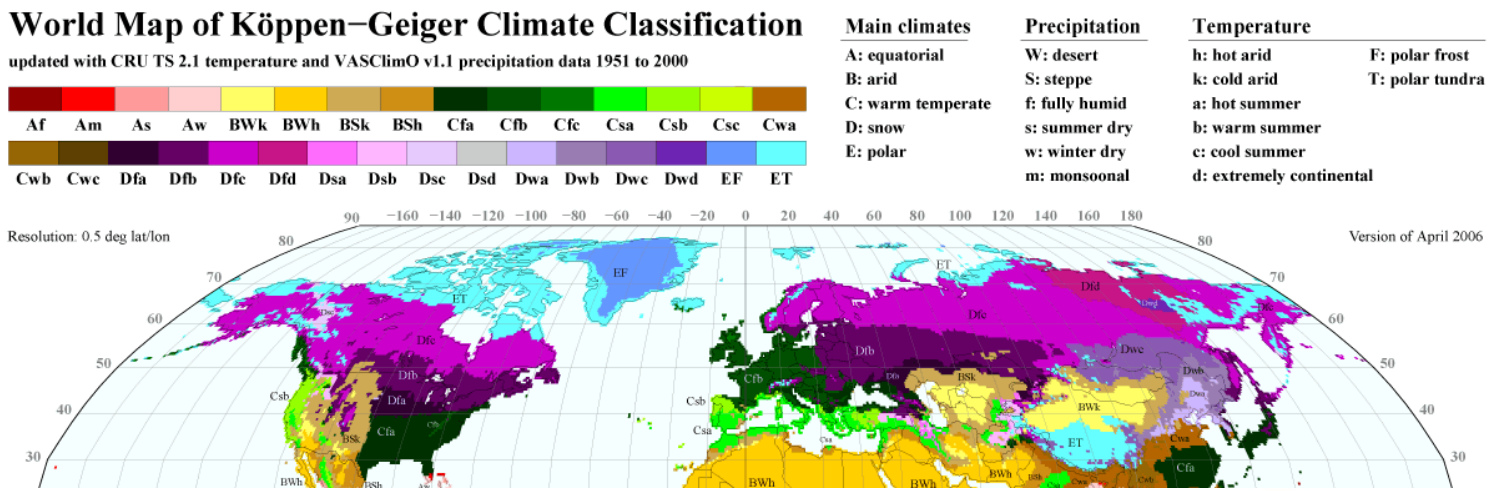
European Commission

www.efas.eu

Emergency Management

Meteo Data Validation: Thresholds by Climate Zone and Season

- Approach
  - Clever grouping of stations by similar geographical characteristics → using climate zones
  - Köppen-Geiger Climate Classification based on temperature and precipitation characteristics
  - Using data set provided by University of Veterinary Medicine, Vienna, based on CRU and GPCC data

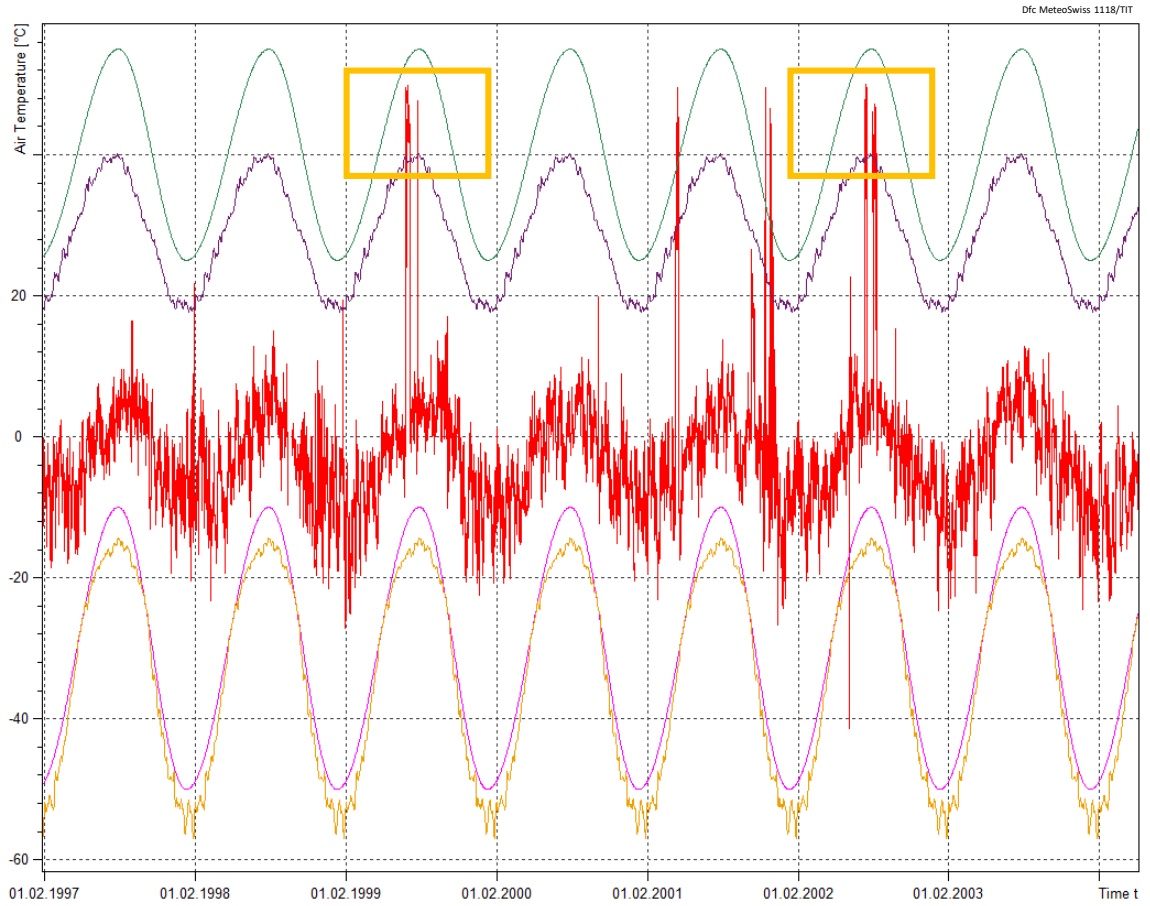


KISTERS Deutscher Wetterdienst Wetter und Klima aus einer Hand DWD Copernicus Europe's eyes on Earth European Commission

Meteo Data Validation: Thresholds by Climate Zone and Season

Emergency Management

- Definition of new thresholds
  - Group stations by climate zones and calculate thresholds for each group
    → adds regional dependency
  - Separate percentile for each day → adds seasonal dependency



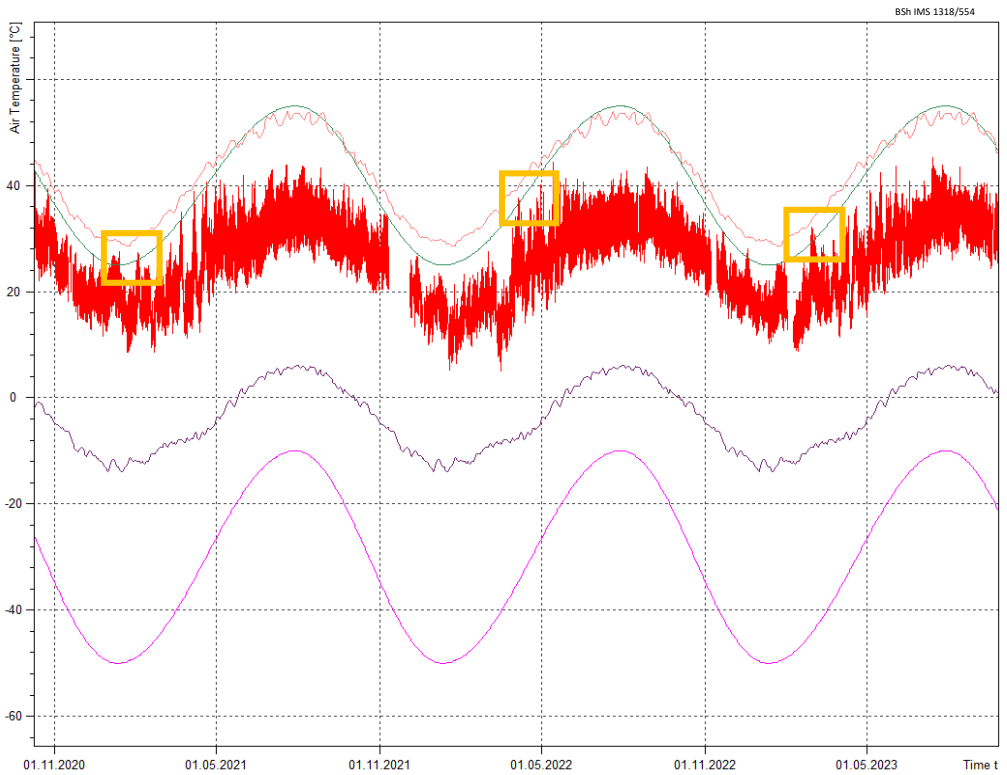
Example Air Temperature climate zone Dfc

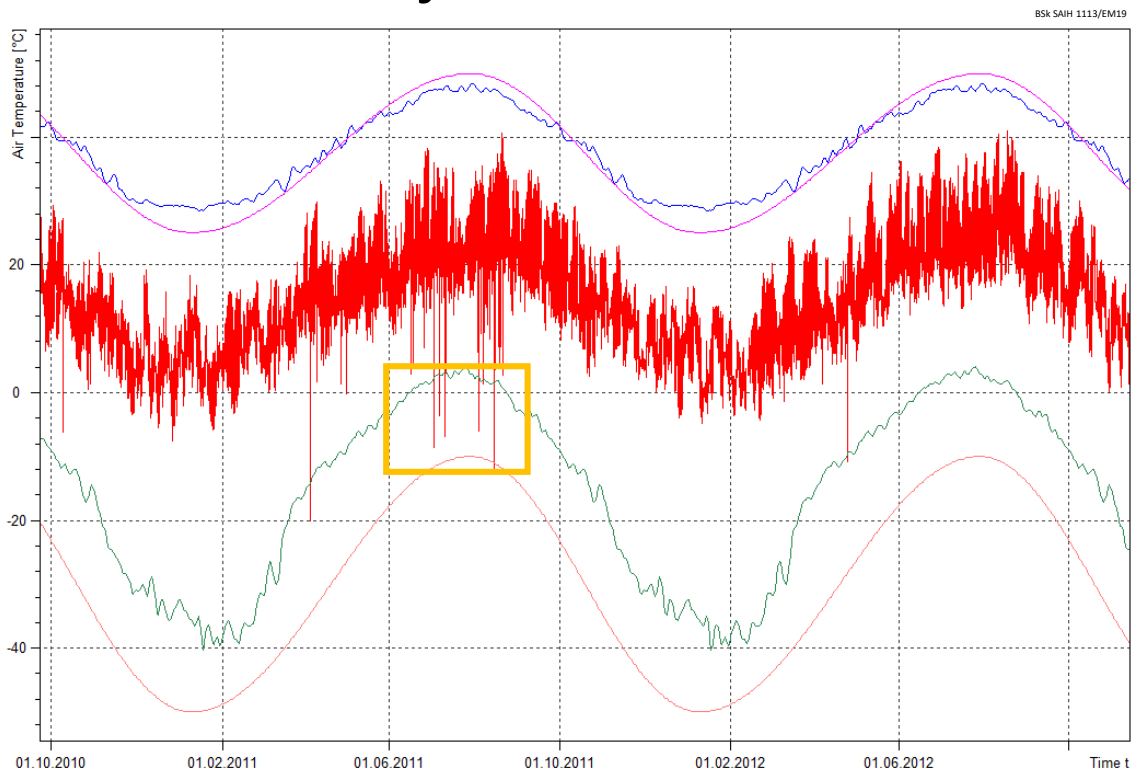
www.efas.eu

KISTERS Deutscher Wetterdienst Wetter und Klima aus einer Hand DWD Copernicus Europe's eyes on Earth European Commission

Meteo Data Validation: Thresholds by Climate Zone and Season

- Some results
- Region A: rejected before 6875
  rejected now 5168
- Region B: rejected before 23104
  rejected now 39280

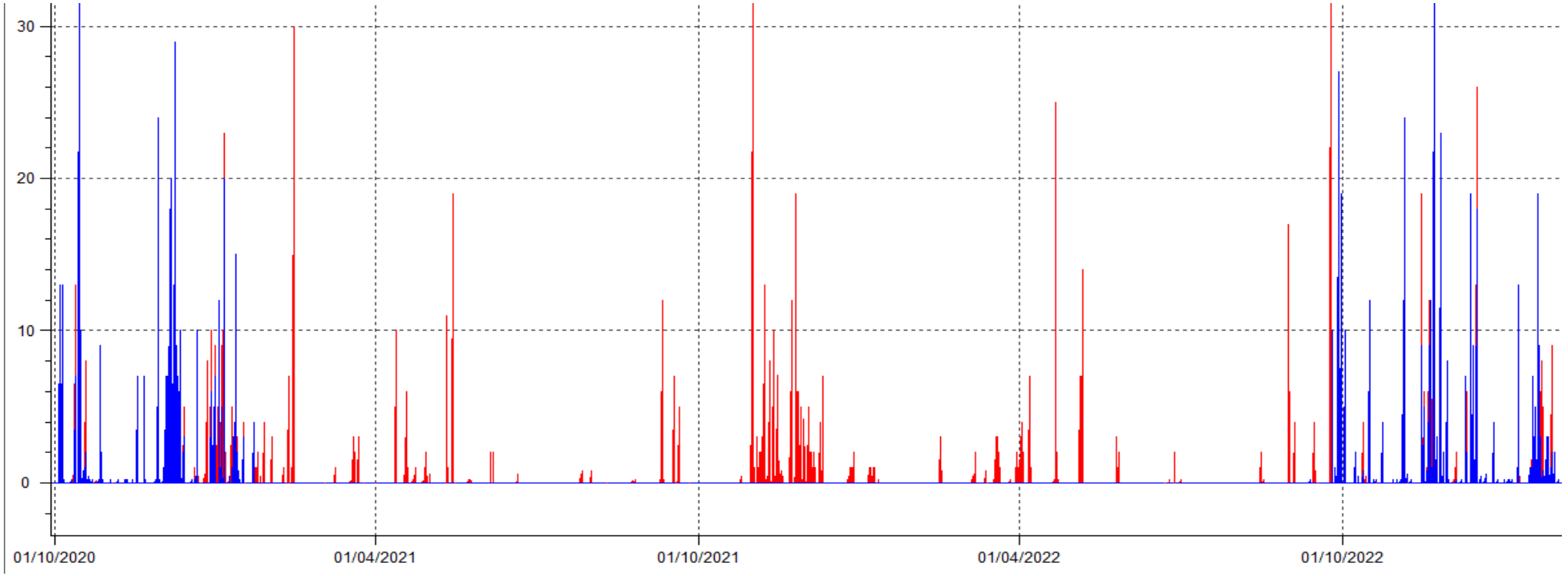




Meteo Data Validation: Flatliner Detection

Emergency Management

- Introduction of flatliner detection for different parameters
- Objective
  - Check on consecutive equal values that exceed a plausible time period



www.efas.eu

KISTERS

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Copernicus
Europe's eyes on Earth

European Commission

Meteo Data Validation: Flatliner Detection

Emergency Management

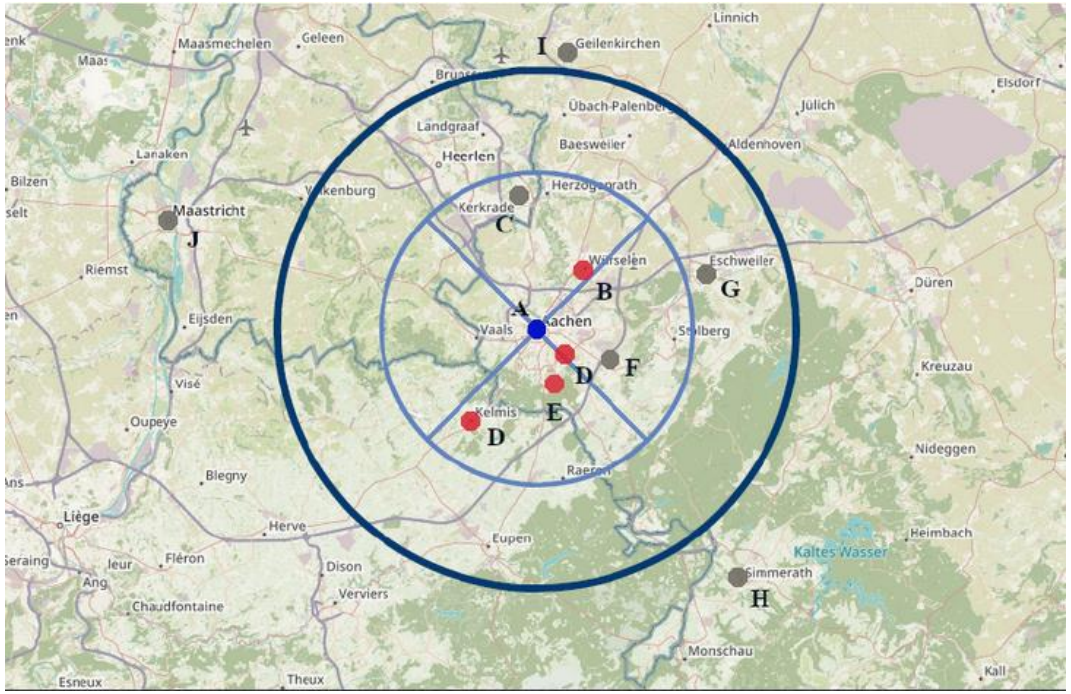
- Introduction of flatliner detection for different parameters
- Objective
  - Check on consecutive equal values that exceed a plausible time period
- Estimate plausible time periods of consecutive equal values
  - Precipitation: long dry periods
    - Define length depending on climate zone
  - Planned: Temperature / Relative Air Humidity / Dew point temperature
    - Shorter time periods than for precipitation
    - Depending on temporal resolution of timeseries (e.g. 1 hour / 6 hours / 24 hours…)

KISTERS Deutscher Wetterdienst Wetter und Klima aus einer Hand DWD Copernicus Europe's eyes on Earth European Commission

Meteo Data Validation: Spatial Comparison

Emergency Management

- Introduction of spatial validation checks
- Objective
  - Use measurements from neighboring stations to assess the quality of an isolated observation
- Identification of neighbours
  - Search radius: 50 km
  - Priority radius: 30 km
  - Use at least 3 and not more than 8 neighboring stations
  - Prioritize use of stations from every cardinal directions



www.efas.eu

KISTERS

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Copernicus
Europe's eyes on Earth

European Commission

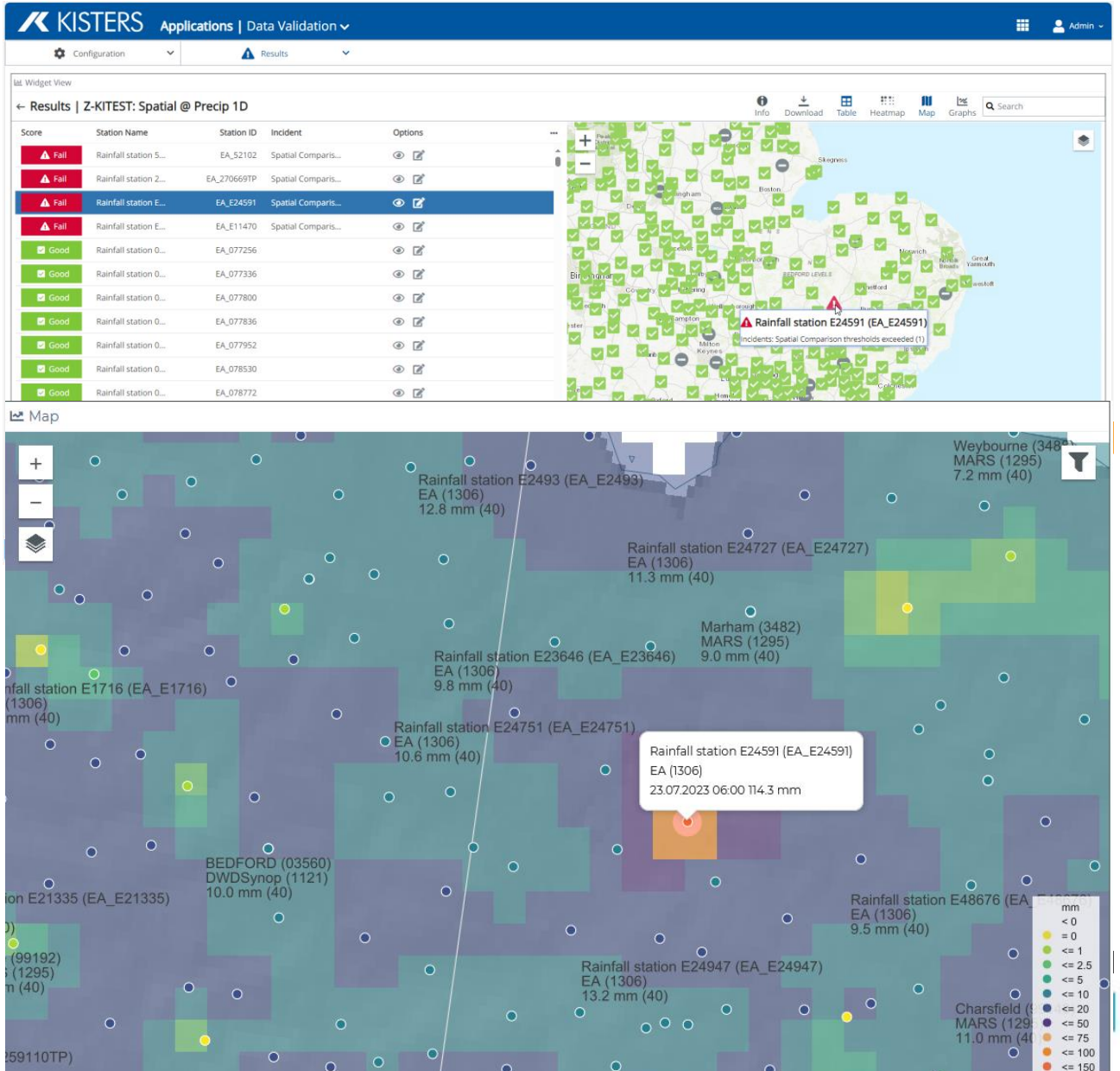
Meteo Data Validation: Spatial Comparison

Emergency Management

- Spatial Comparison

- Identifies stations with unusually high precipitation if neighbours show significantly less rain

- Flags such incidents and excludes those from usage in METEO products



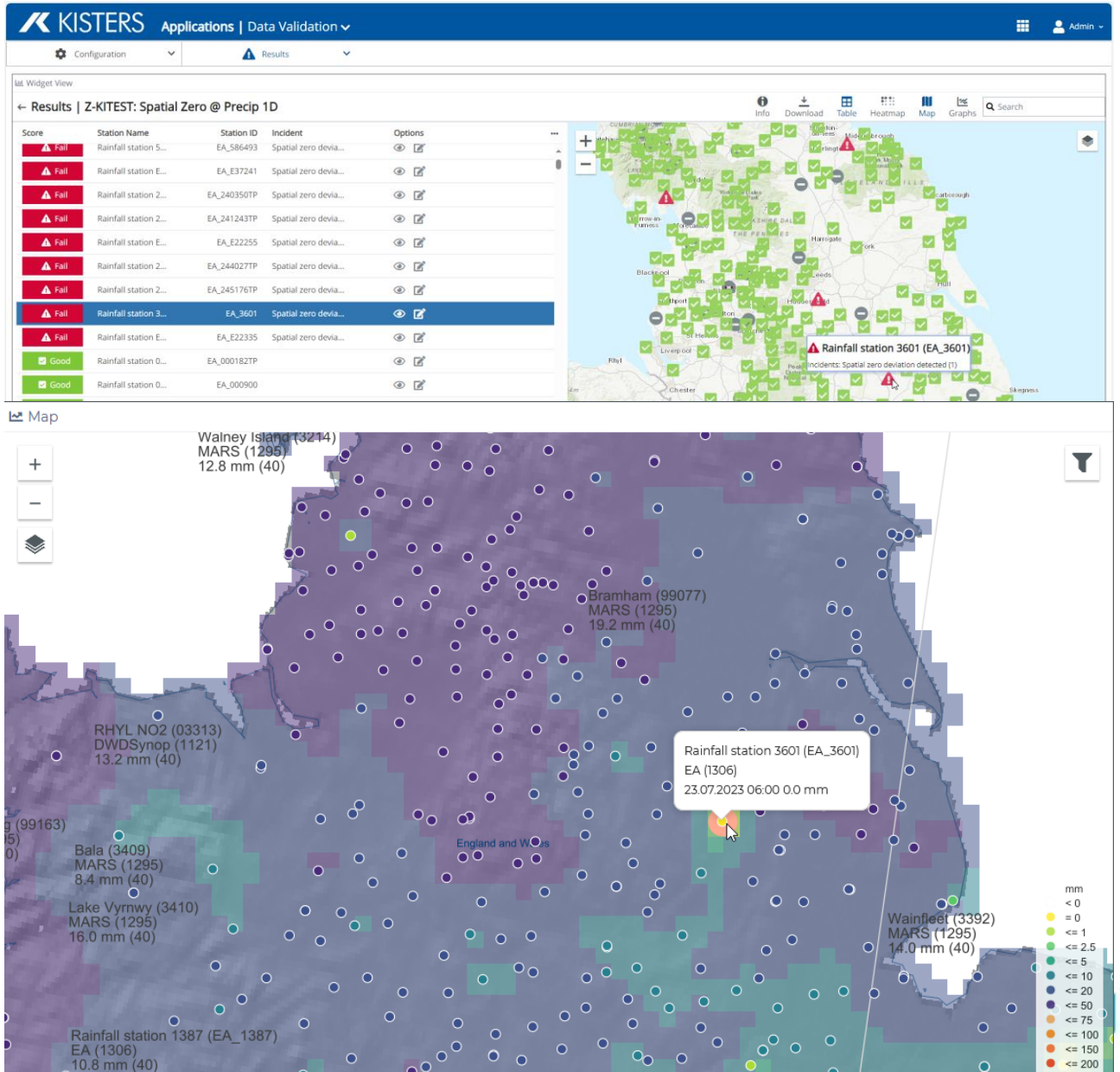
Meteo Data Validation: Spatial Zero Comparison

Emergency Management

- Spatial Zero Comparison

- Identifies stations with zero precipitation if neighbours show significant rain

- Flags such incidents and excludes those from usage in METEO products



Emergency Management

Meteo Data Validation: Status & Outlook

- Seasonally varying thresholds per climate zone
  - Statistical calculations of thresholds finished
  - Integration into production is ongoing
- Flatliner detection
  - Implementation into production ongoing for precipitation
  - Other parameters planned
- Spatial comparison for precipitation
  - Software development finished
  - Integration into production in near future
- Expected Results
  - Better identification of issues in observation data
  - Better quality of data products created at Meteo DCC
  - Better quality of the historical database that is used for the calibration of the hydrological model in EFAS5

KISTERS Deutscher Wetterdienst Wetter und Klima aus einer Hand DWD Copernicus Europe's eyes on Earth European Commission

Preparedness
Response
Recovery
Rapid Mapping
Risk & Recovery Mapping
Floods
Fires
Droughts
Population
Built-up areas