Detection and nowcast of severe thunderstorms over Slovenia

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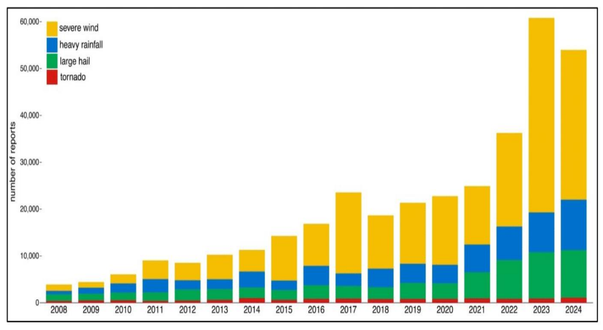
ARSO METEO
Slovenian Environment Agency

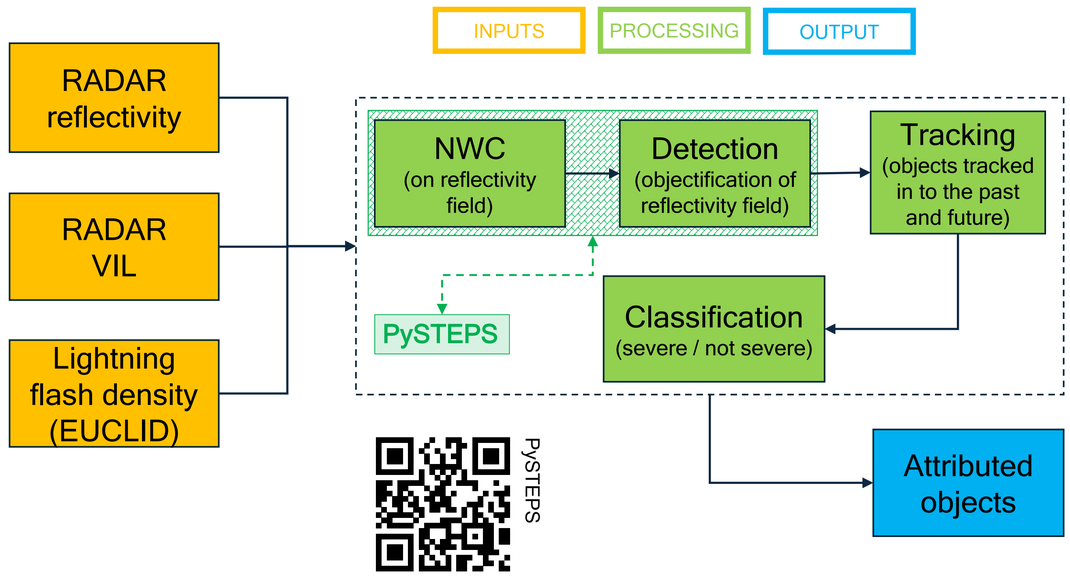
An increase of evidented severe weather events in Europe (e.g., ESSL reports statistics, climatological simulations, etc.).

Our goals:
- Automatic objectification of storms over Slovenia and surroundings
- Nowcasting of storms
- Classification of storms (severe / not severe)
- Tracking of storm features in time



Trend of reports in ESWD (ESSL Annual Report 2024).

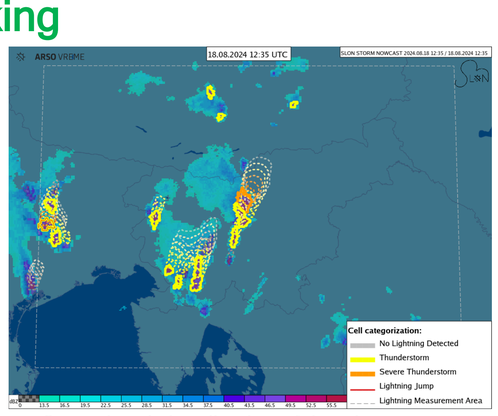
[1] Processing and data for „Thunderstorm module“



Output: Detected objects (cells) are stored as polygons along with a list of derived attributes in GeoJSON format.

[2] Nowcasting, detection and tracking

- NWC of radar reflectivity → PySTEPS
  - Advection-based extrapolation,
  - Advanced: SPROG, STEPS
- Detection → PySTEPS
  - Modified Thunderstorms Radar Tracking (TRT) method
- Tracking based on PySTEPS methodology
  - upgraded to allow tracking of temporally nonuniform distribution of objects

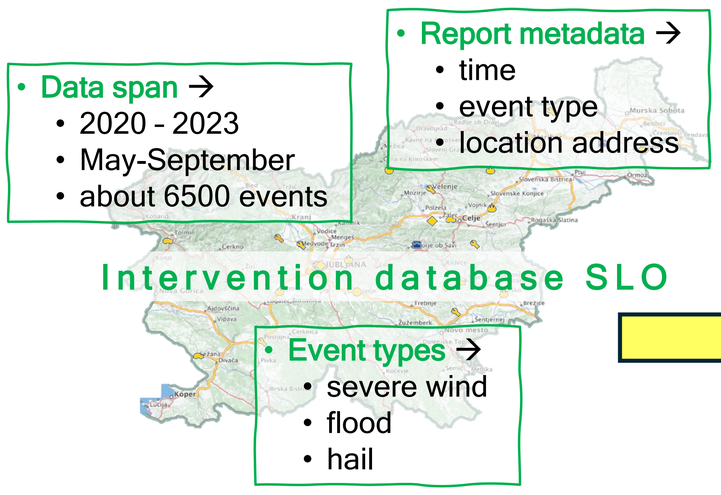


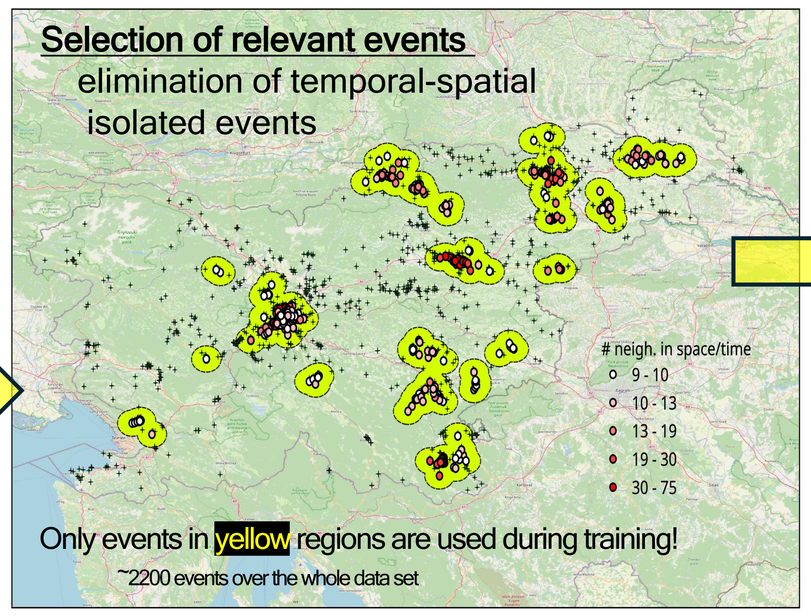
Operational visualisation of thunderstorms

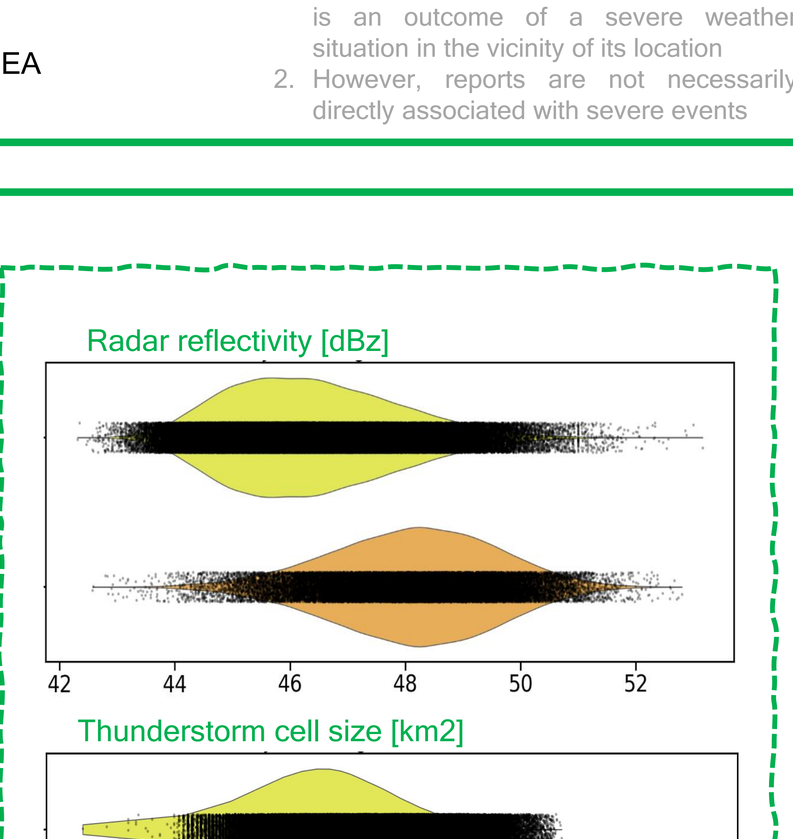
[3] Storms classification

Classification is trained on a **database of interventions** provided by *Administration of Slovenia for Civil Protection and Rescue (URSZR)* over Slovenia only.

HOW TO ASSOCIATE INTERVENTION EVENT AND CELLS FROM THUNDERSTORM MODULE?







Classification model: KNN (small model with good performance with POD>0.9, FAR …)
Parameters used for learning: SUM(LI), STD(LI), MEAN(LI), SUM(VIL), COUNT(VIL>25 kg/m2), MEAN(VIL), OBJECT AREA
Parameter importance (most to least): VIL , object area, LI. The most important is COUNT(VIL>25 kg/m2)

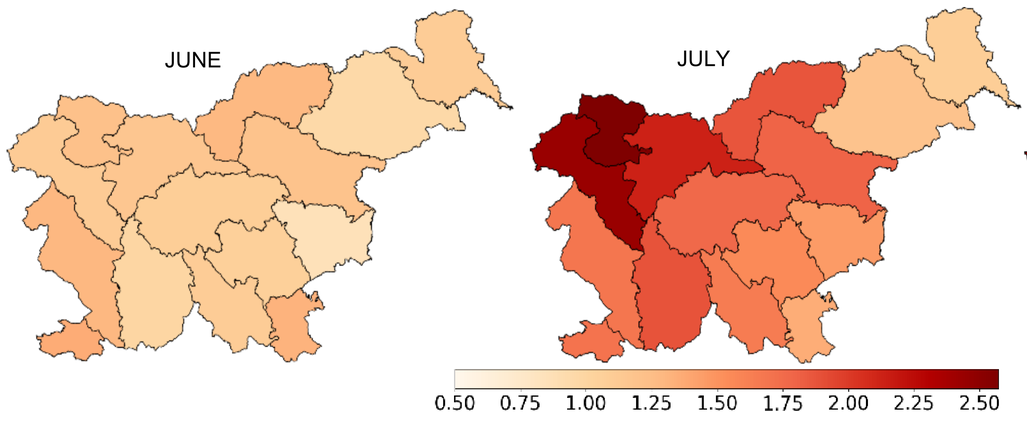
ATTENTION
1. It is assumed that a reported intervention is an outcome of a severe weather situation in the vicinity of its location
2. However, reports are not necessarily directly associated with severe events

[4] Thunderstorms over Slovenia by region

Analyzed period: 2019-2024

(TH) → detected thunderstorms

of all TH per km2



of TH developed in SLO vs # of all TH in %