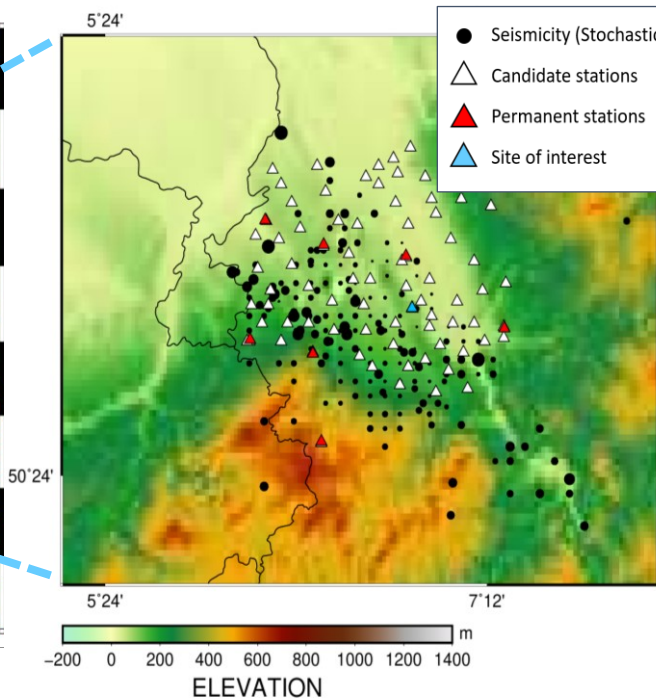
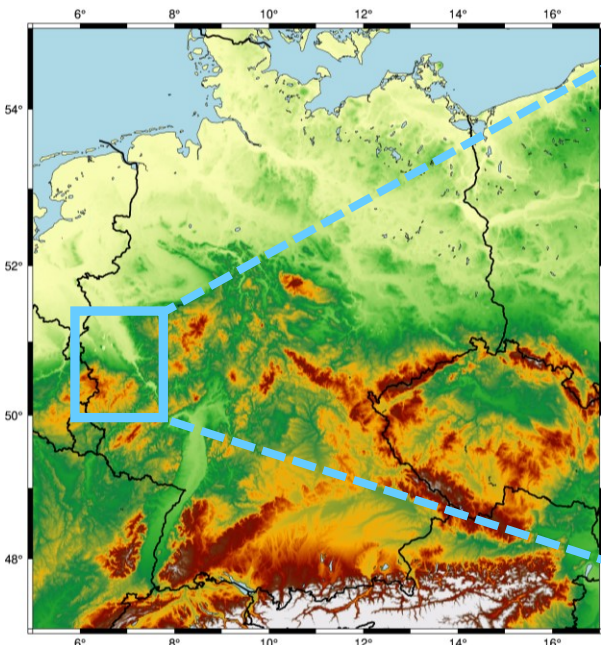


# ROBUST, an Earthquake Early Warning System in the Lower Rhine Embayment, Germany

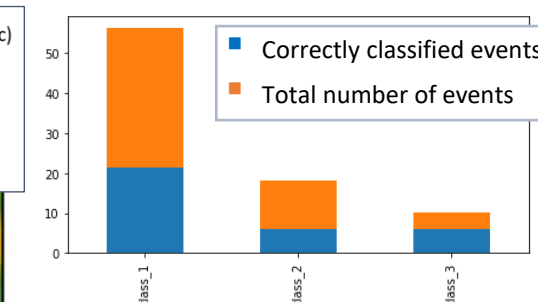
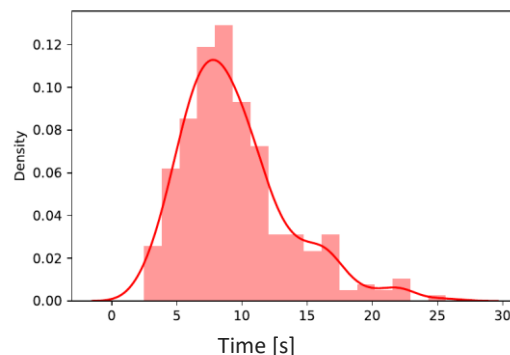
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**Goal:** Finding the optimal station configuration and designing a user-oriented hybrid earthquake early warning and rapid response system.

**Importance:** The Lower Rhine Embayment in western Germany is one of the most important areas of earthquake recurrence north of the Alps, facing a moderate level of seismic hazard in the European context but a significant level of risk due to a large number of important industrial infrastructures.

A stochastic catalogue of earthquakes has been produced, which is fully consistent with the PSHA seismicity model (see talk of Hoby Razafindrakoto, EGU21-8882)



Cost definition:

$$\text{cost} = \sum_{i=1}^{N_{\text{ev}}} W_i [L \cdot (1 - K) \cdot \text{sigmoid}(t_{\text{warn},i}, t_{\text{center}}, S) + K]$$

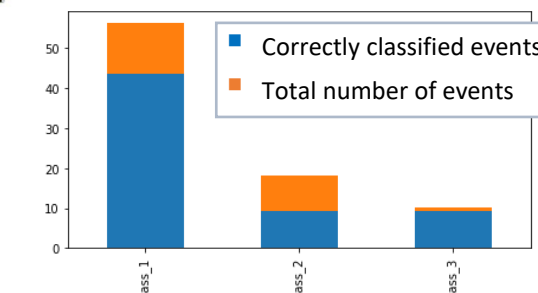
with

$$\text{sigmoid}(t_{\text{warn},i}, t_{\text{center}}, S) = 1 - \frac{1}{1 + \exp[-S(t_{\text{warn},i} - t_{\text{center}})]}$$

Annotations:   
 - Weighting of events (points to  $W_i$ )   
 - Available warning time (points to  $t_{\text{warn},i}$ )   
 - Fixed center time of the sigmoid function (points to  $t_{\text{center}}$ )

**Optimization with the genetic algorithm**

The best EEW system:



**Result:**

- A user-oriented hybrid EEW and rapid response system is designed.
- With the optimally compacted network, ground movements can be detected with higher accuracy for different classes of events.

