FINNISH METEOROLOGICAL INSTITUTE

Extreme weather and nuclear power plants (EXWE)

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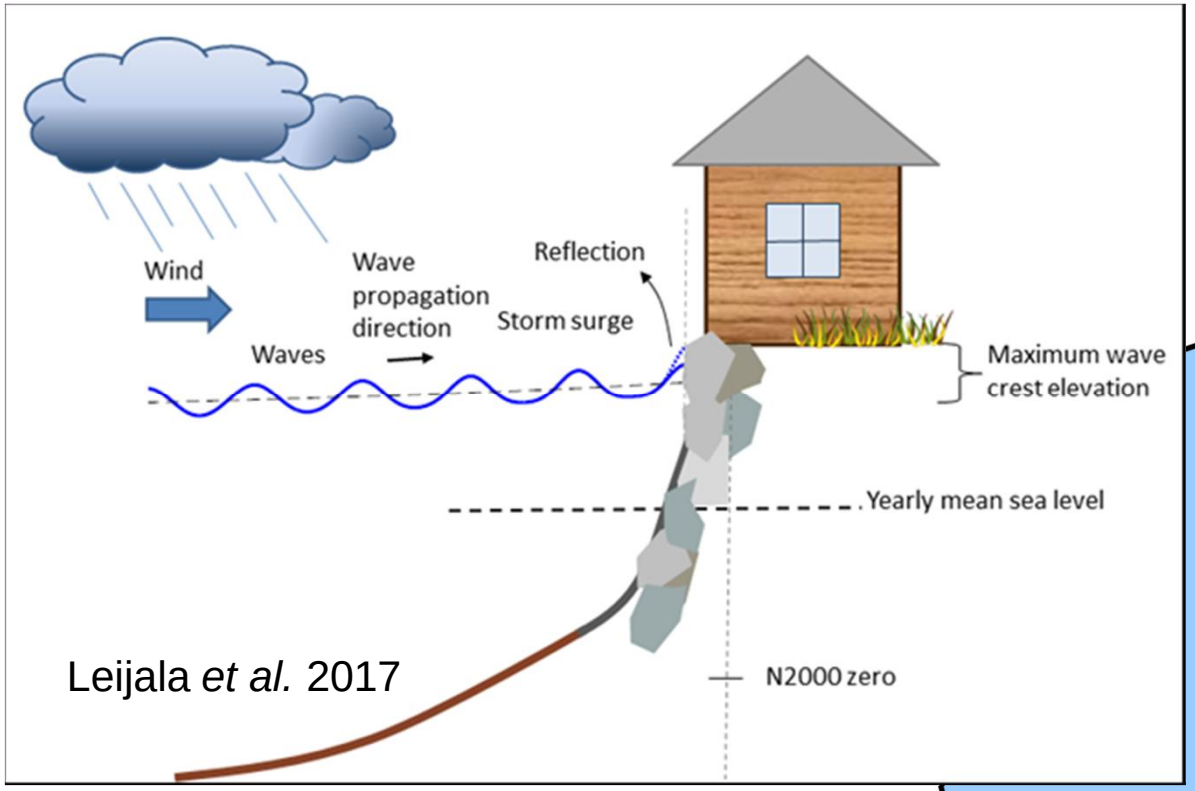
Background

- Extreme weather and sea level events affect the design principles of NPPs and may pose external threats to the plant operation.
- Estimates on the probabilities of **extremely rare events**, unseen in the past 100 years of observations, are needed.
- The ongoing **climate change** might change the frequencies and severity of the events in the future.
- Phenomena studied in EXWE include:
  - Extreme convective weather
  - Severe freezing rain
  - Large hail
  - Sea-effect snowfall
  - Strong winds
  - Extreme space weather
  - Sea level rise
  - Extreme sea level and waves
  - Short-period sea level oscillations

Figure: Large hail (diameter 7 cm) at Leppävirta, eastern Finland, on 28 June 2009.

Extreme sea level

- Flooding sea water could endanger the safe operation or shutdown of a NPP. Extreme sea levels are relevant in both the design bases of new plant units, and safe operation of the existing units.
- **Global sea level rise** affects the risks in the future. Locally, this is compensated by land uplift.
- The flooding level is a combination of high sea level (**storm surge**) and **wave heights**.
- Rapid sea level oscillations of up to **100 cm in less than an hour** have been observed on the Finnish coast.



Severe freezing rain

- A method for estimating the occurrence of freezing rain was used together with climate models to project future changes in the occurrence of the phenomenon.
- Freezing rain probabilities are projected to **increase in northern and decrease in southern Europe**.

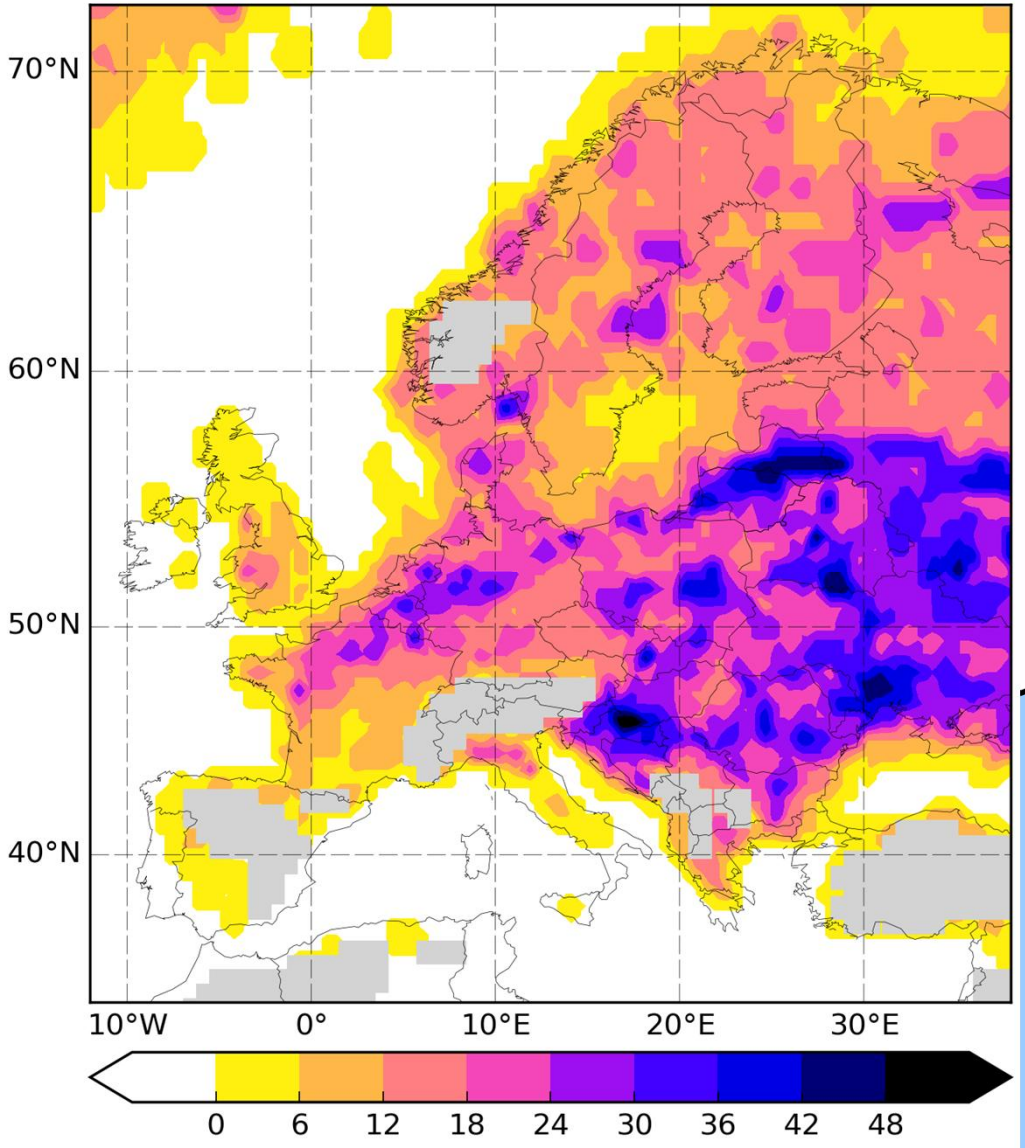


Figure: Estimated maximum duration (hours) of freezing rain events in the 1979-2014 study period (Kämäräinen *et al.* 2017)