dsb

Norwegian Directorate for Civil Protection

Tsunami work in Norway

Some short info about tsunami work in Norway:

- **Responsibility**
- **Topography**
- **Projects**
- **Preparedness**

dsb Norwegian Directorate for Civil Protection

Managing tsunamis and floods

- **Norwegian Water Resources and Energy Directorate (NVE)**: NVE is responsible for hazards maps, landslide monitoring and early warning
- **Norwegian Geotechnical Institute (NGI)**: NGI conducts numerical modeling for the landslides with the highest risk
- **Geological Survey of Norway (NGU)**: NGU maps and risks and classifies the landslides that may fail and causes tsunamis
- **Norwegian Directorate for Civil Protection (DSB):** DSB is responsible for national risk analysis and consequences of all natural hazards and incidents

dsb Norwegian Directorate for Civil Protection

Topography in Norway

- Very low hazard from earthquake tsunamis – main tsunami hazard posed by large landslides/rockslides
- Approx. **1000 mountain peaks** over 1650 m. and approx. **1700 fjords**
- Almost **1100 unstable rockslopes** are identified **– 32 monitored**
- Several high steep mountains

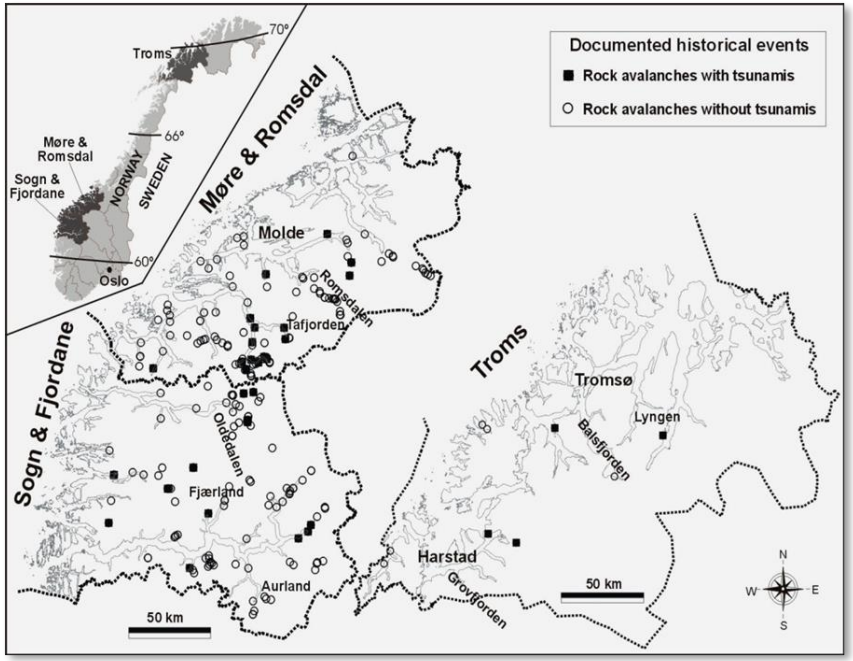
  + movement (landslide/rockslides)

  + narrow and long fjords

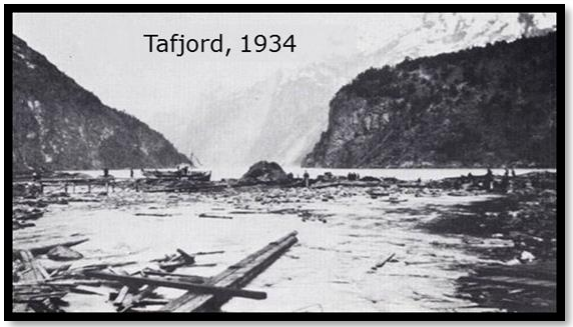
  = potential fjord tsunami if a heavy landslide or rockslide

Rockslide tsunamis

- **Historic: 2-3 events with fatalities pr. 100 year**
- **Loen in 1905 (lake)**:
  - 870.000 tons
  - 40 m. high wave
  - 61 fatalities
- **Tafjord in 1934 (fjord):**
  - 3.000.000 tons
  - 64 meters high wave
  - 64 fatalities
- **Loen in 1936 (lake):**
  - 1.000.000 ton
  - 70 meters high wave
  - 74 fatalities

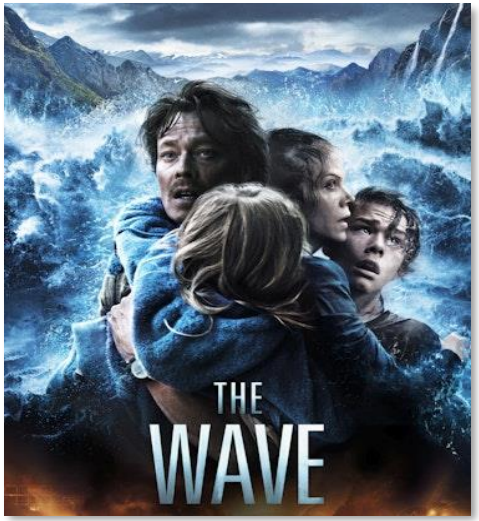


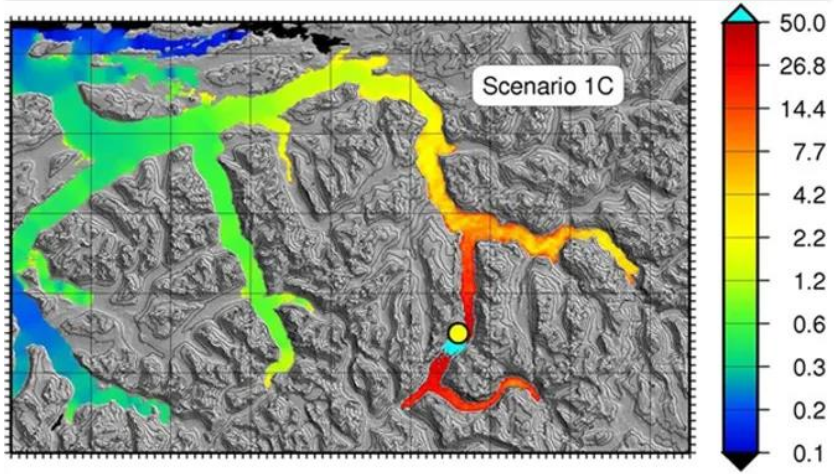
Blikra et al. 2006



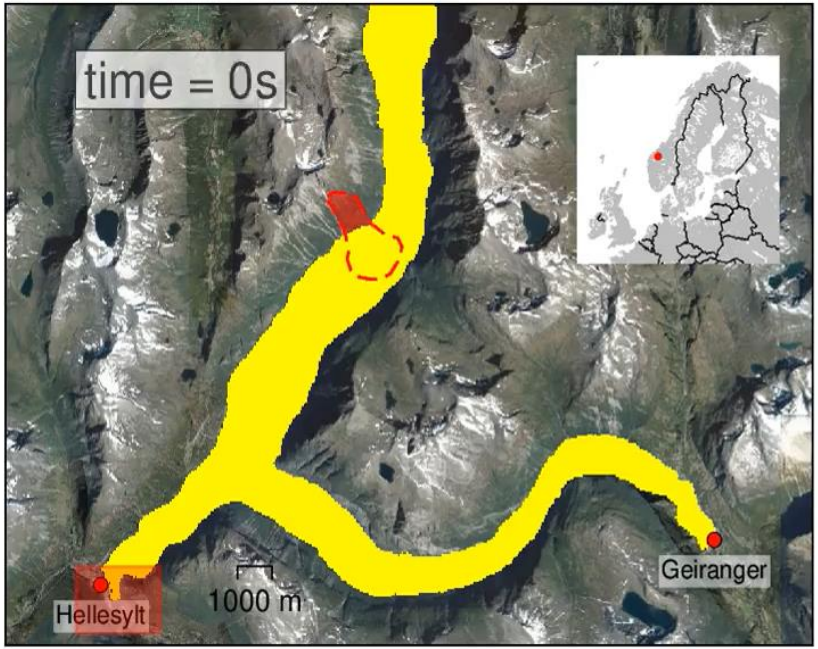
Åkneset – one example

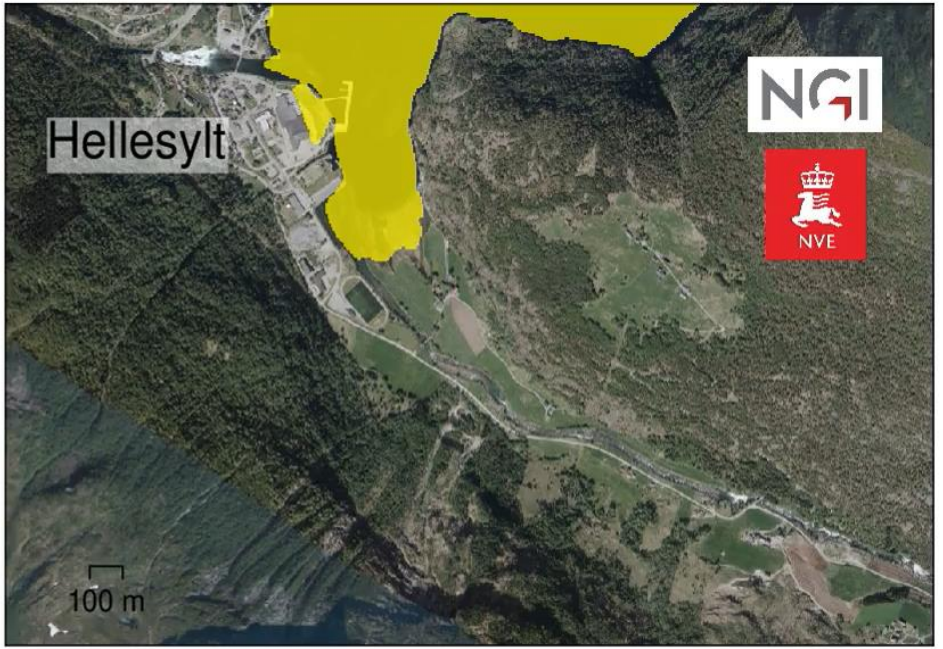
- Approx 55-60 mill. m^3 unstable mass = 90 mill. tons rock (7 mill. trucks…)
- Gap moving 3-10 cm each year
- Potential tsunami waves up to 50-100 m.
- Approx 10.000 people will be affected
- 2004: monitoring system (GPS)

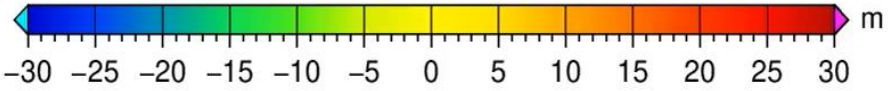




Animation of potential rockslide tsunami from Åkneset in Geirangerfjorden

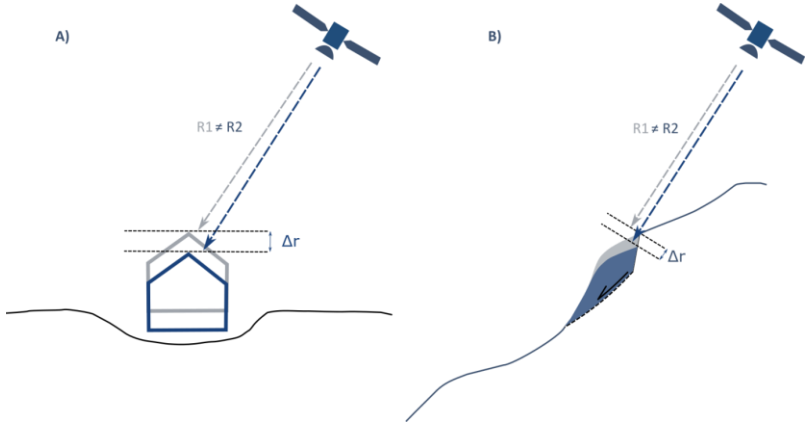






InSAR Map Service Norway

- **What**: A national, web-based map service for InSAR data (Interferometric Synthetic Aperture Radar) = a ground motion monitoring service based on satellite radar data (from ESA/Sentinel)
- **How**: Detect movement at 5 billions points over a period (years)
- **Purpose**: Maps and visualizes ground movements in Norway using satellite-based radar images
- **Launch**: The service was launched in 2018 by NGU, NVE, and the Norwegian Space Agency
- **Availability**: Freely accessible and use to everyone: https://insar.ngu.no

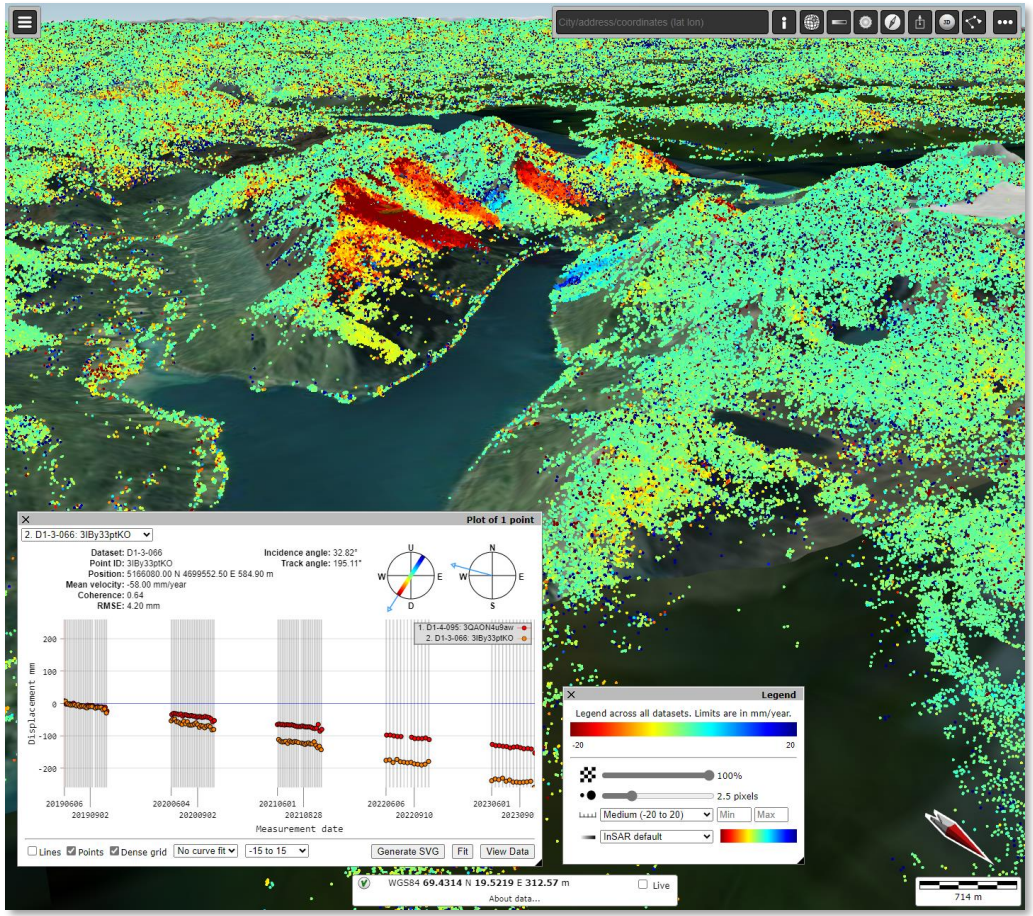


InSAR Map Service Norway

Two examples:

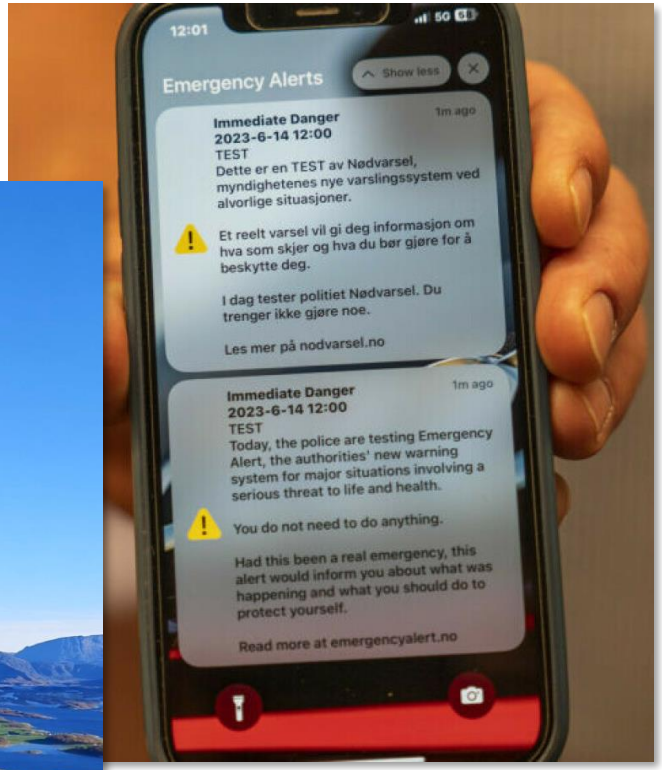
- **Stable**: My home
- **Unstable**: Parts of mountain in northern Norway (right):
  - **Green** = stabile
  - **Blue** = land uplift/rising
  - **Red** = land sinking/moving

  In this example up to 200 mm/20 cm sinking in 4 years, meaning approx. 5 cm/year



Preparedness

- Monitoring approx. 50 mountain areas
- Prevention work (reduce risk/effects)
- Competence and training/exercises
- Communication and information
- Early warning and emergency alerts
- Rapid evacuation (72 hours warning)
- Hazard mapping = essential for further analysis and work



dsb Norwegian Directorate for Civil Protection

Hazard mapping project

- Mapping of rockslide tsunamis in Norwegian fjords and lakes
- Methodology developed **since 2017**
  - Supported by NVE
  - Calibrated towards past events
  - Additional testing towards events abroad (in other countries)
- Study completed for **six locations** and **two potential new locations**
- Use of the **hazard models**
  - Maps of hazard zonation
  - Input to local government for new settlements, building new infrastructure, evacuation etc.