Achievements under the NoR project No. 66232

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Overview of the project

Two proposals joined under one application scenario

- Detection of co-seismic phenomena in Ethiopia and other worldwide test sites
- Detection of long-term subsidence across Czech Republic

Services used under NoR:

- **Geohazards TEP**
  - The GEP was used for:
    - Generation of displacements based on the DInSAR technique (SNAP, Diapason service);
    - Generation of InSAR time series displacement products (FASTVEL service);
    - Generation of velocities based on the optical data (Sentinel-2) (MPIC-OPT service);
    - Exploiting further amplitude-based possibilities related to geohazard mapping (SNAC service);
    - Exploitation of simultaneous utilization of Sentinel-1 and Sentinel-2 for geohazard detection and mapping;
    - Testing of FASTVEL results in comparison to commercial workstation-based InSAR processing software;
    - Testing of GEP services for landslide monitoring in case of densely vegetated landscape.

Overview of the project results 1

Scientific publication

Data generated on the GEP platform were part of the research published in the following paper:

Jelenek, J., & Kopačková-Strnadová, V. (2021). Synergic use of Sentinel-1 and Sentinel-2 data for automatic detection of earthquake-triggered landscape changes: A case study of the 2016 Kaikoura earthquake (Mw 7.8), New Zealand. *Remote Sensing of Environment, 265*, 112634.
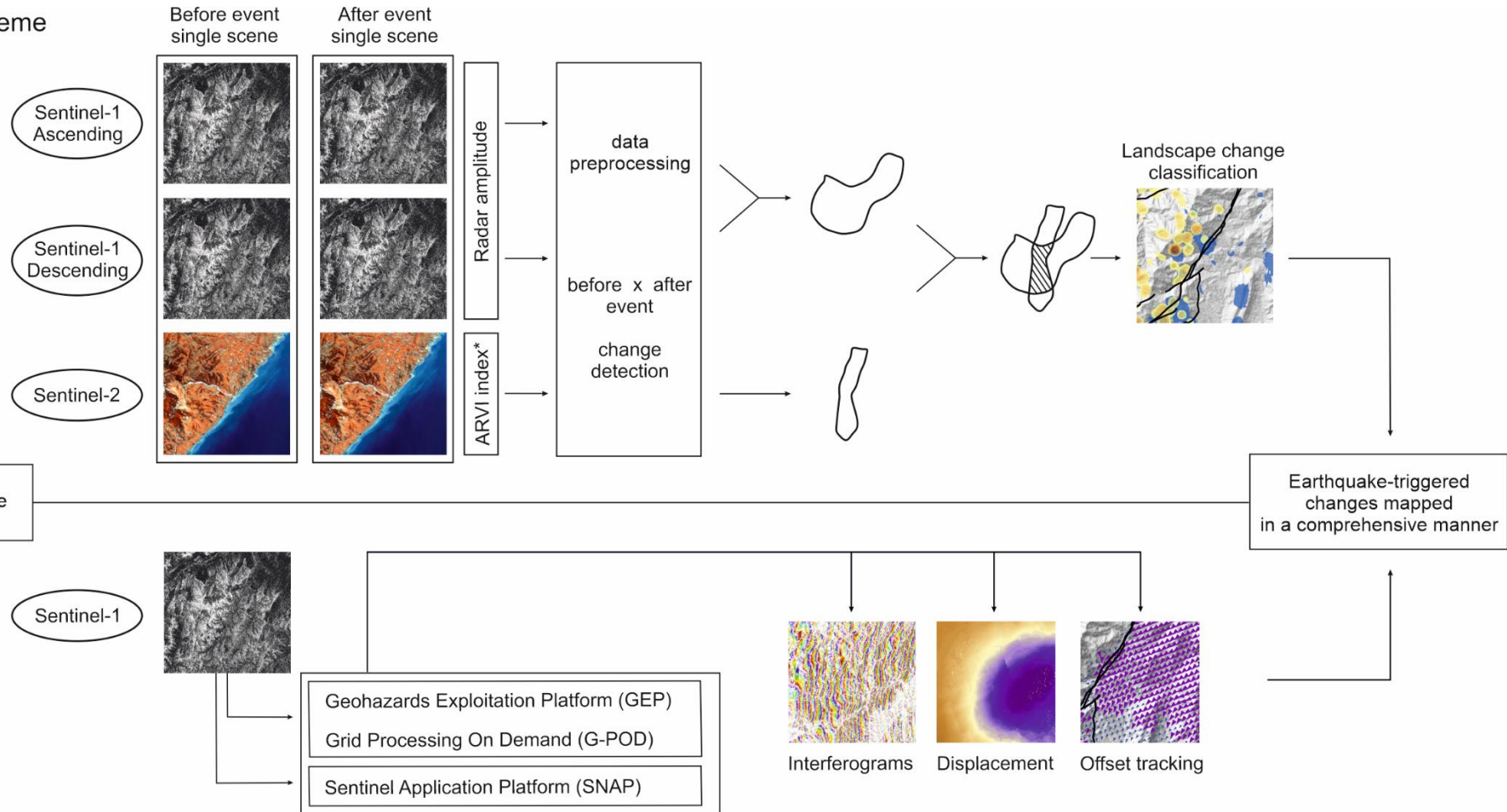DOI: 10.1016/j.rse.2021.112634

The paper dealt with:
- Identification co-seismic phenomena post a major earthquake
- Development of a novel methodology based on both optical and radar data
- Review of available free tools for earthquake analysis and research, including tools based on GEP

New methodology for landscape changes detection

Jelenek, J., & Kopačková-Strnadová, V. (2021). Synergic use of Sentinel-1 and Sentinel-2 data for automatic detection of earthquake-triggered landscape changes: A case study of the 2016 Kaikoura earthquake (Mw 7.8), New Zealand. *Remote Sensing of Environment*, *265*, 112634.

Freely available data used

Freely available tools used

Primary data
- Sentinel-1 and -2 (Copernicus)

Supporting datasets
- Local geology (GNS Science)
- Land use (Ministry of Environment, New Zealand)

Validation datasets
- GNSS (GNS Science)
- In-situ landslide database (DesignSafe of NSF)

Processing radar data
- GEP (Geohazards Exploitation Platform)
- SNAP - Sentinel Toolboxes

Processing optical data
- QGIS toolboxes
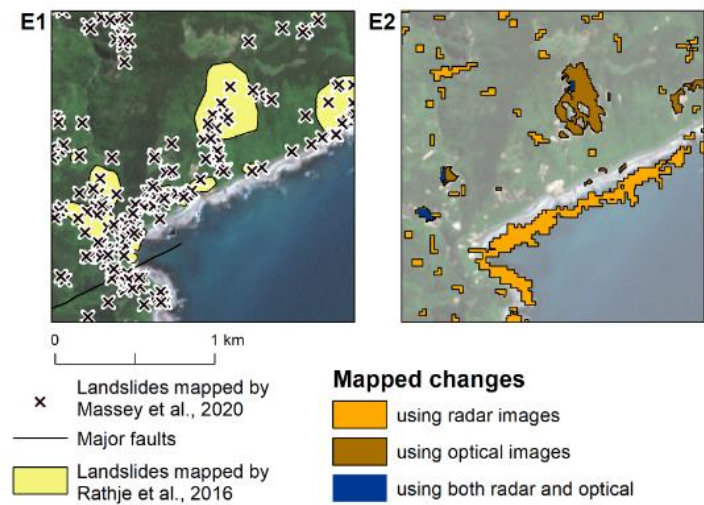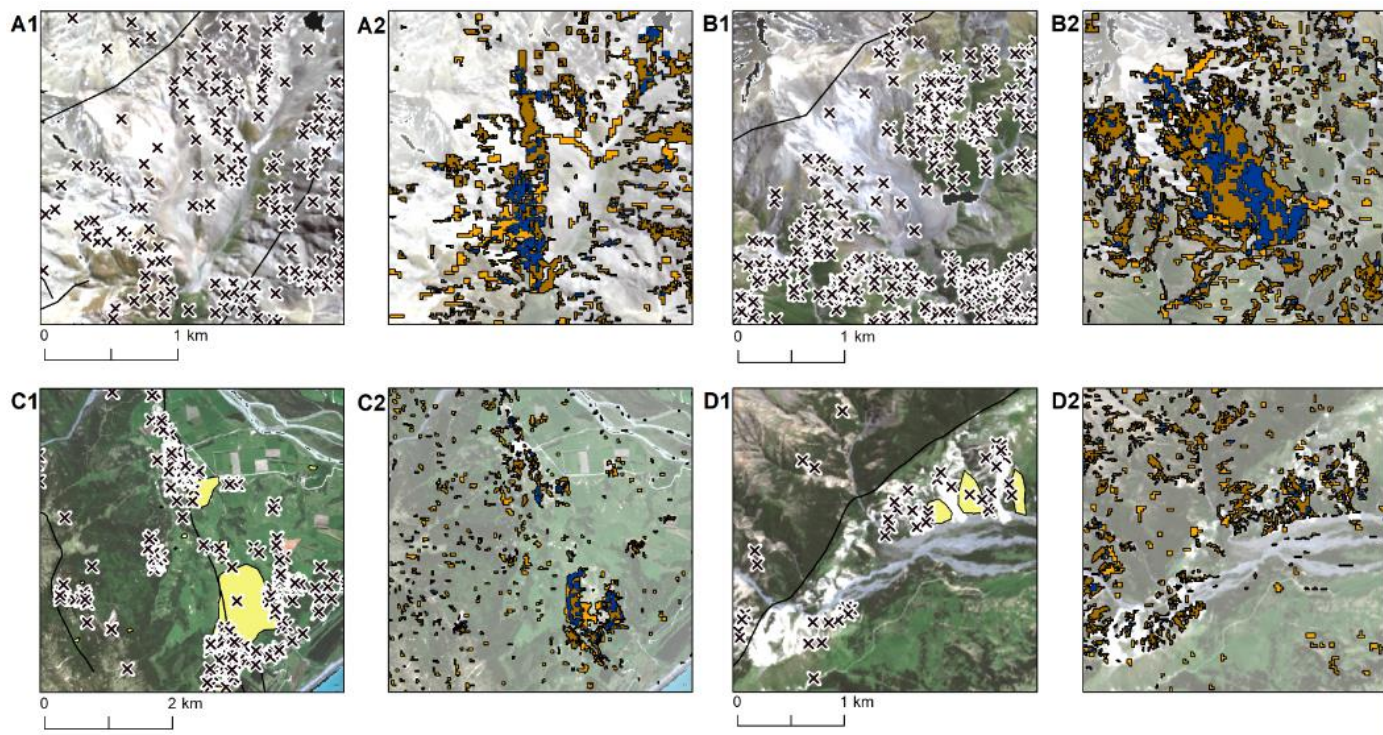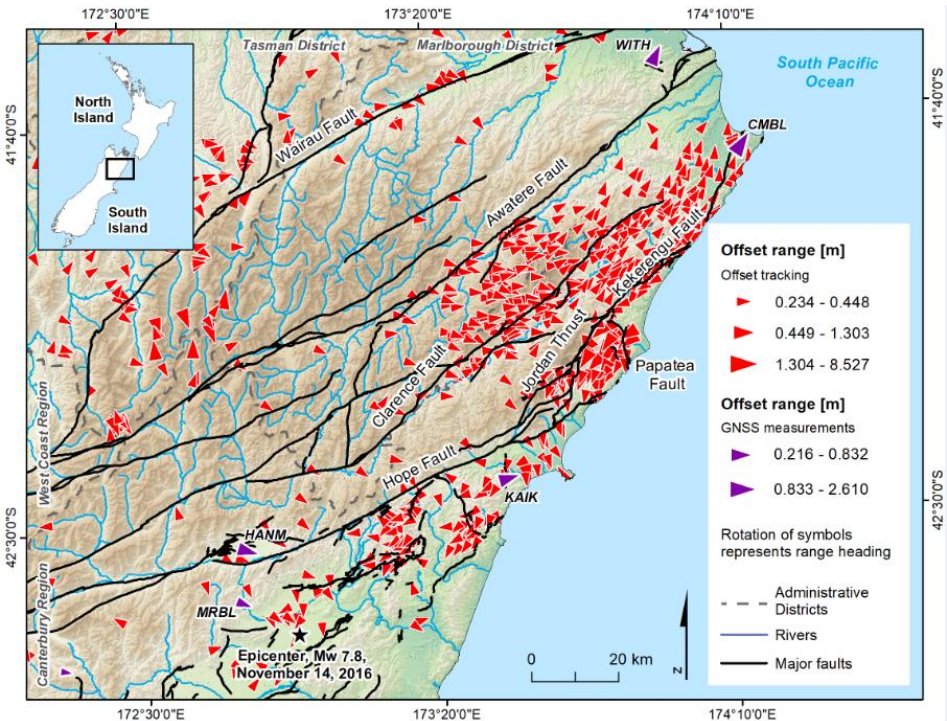
Commercial tools used

Maps preparation
- ArcGIS suite

Horizontal offset caused by the earthquake

Most prominent landscape changes recorded:
- Landslides
- Dammed lake
- Elevated seabed

Overview of the project results 2

Dataset generated, GEP tools testing

GEP tools were also used at other research sites, where large number of dataset were generated. Some of them were used for the individual tools validation and testing. Some fo the datasets still wait for scientific processing and scientific evaluation.

These datasets are mostly connected with densely vegetated areas of the Czech Republic, where most of the remote sensing techniques deal with related difficulties. Our interest was focused on surface subsidence and landslides. These are usually not very dynamic, rather slow or inactive.

We have generated long time series of interferometric product on **GEP** using mostly **Fastvel** and **Snapping** tools. These time series will be validated with upcoming in-situ data collecting and with interferometric product from commercial software.

Besides New Zealand, we have also generated Differential interferograms for worldwide test sites in **Ethiopia, Peru and Vanuatu** where some of our projects are based and these data will be used together with other geological data and in situ data to study seismic and subsidence phenomena.

All results which will be published in the future using any data generated within the NoR will be properly acknowledged.