Local surface deformation of 2018 Hokkaido Eastern Iburi earthquake detected by ALOS-2 SAR

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We constructed and analyzed the ground surface displacement associated with the 2018 Hokkaido Eastern Iburi earthquake using satellite radar interferometry images of the Advanced Land Observing Satellite 2. The radar interferogram generally shows elastic deformation caused by the main earthquake but numerous complex displacements which cannot be explained by the motion of the seismic source fault appeared on the surface.

In this presentation we present following two phenomena:

(1) Linear surface ruptures as secondary earthquake faults appeared to the west of the epicenter

(2) Liquefaction occurred in fill land valleys

(1) Linear surface ruptures

The linear surface ruptures are derived from linear phase discontinuities and/or offsets showing displacement in the interferograms of ALOS-2 SAR. From Atsuma to Mukawa town, the linear surface ruptures showing east-west shortening extend for about 15 km in the direction of NNW –SSE. The linear surface ruptures have following features:

- ✓ Displacement amount of east-west shortening is about 5 cm to 10 cm.
- ✓ Vertical displacement is rather small.
- ✓ The displacement along the linear surface ruptures can be described as reverse fault motion with extremely low dip angle.
- ✓ Since there is a certain distance from the linear surface ruptures to the aftershocks, it is questionable whether they directly connect to the main earthquake fault or not.
- ✓ The strike and displacement (reverse fault of east-west shortening) is harmonious with the surrounding topography and tectonics, but they have not been recognized as active faults.
- ✓ These linear surface ruptures exist on the SSE extension of a major fault zone.

From these circumstances, the linear surface ruptures are likely secondary fault motion passively generated by the Hokkaido Eastern Iburi earthquake appeared near the surface of the earth.

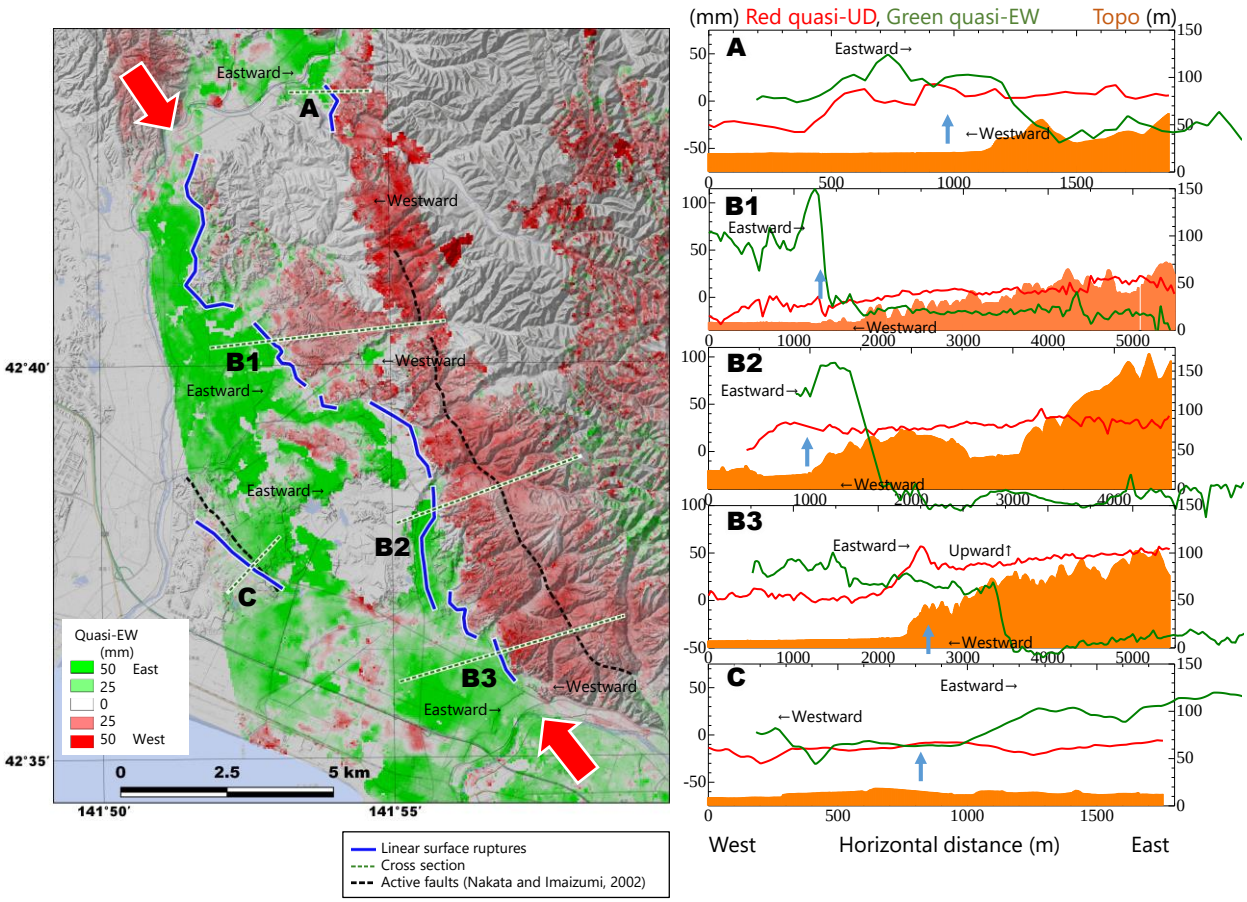

Fig. 1 Linear surface ruptures detected by InSAR images

Left Detected linear surface ruptures and quasi-EW displacement by 2.5D method

Right Cross sections of the ruptures

(2) Liquefaction occurred in fill land valleys

In the residential area, southern part of Sapporo city, sediment-related disasters caused by liquefaction occurred with the earthquake. Based on the SAR interferograms and the decrease in coherence of the interferograms, the liquefied areas were detected. Surface displacement detected by ALOS-2 InSAR observation before and after the earthquake mostly show subsidence of several centimeters, but it is estimated that the displacement amount exceeds 1 m in some places where the coherence of the interferograms is greatly reduced.

By constructing the past topography (altitude) from aerial photographs, we obtained the change of topography due to cut / fill land in the time of urban development. The liquefied places remarkably coincide with fill land area (valley topography in the past). The liquefaction likely occurred along with the earthquake in such fill land valley.