

## Surface deformation and tree tilt around surface ruptures of the June 14, 2008 Iwate-Miyagi inland earthquake revealed with terrestrial LiDAR observation

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### 1. Introduction

We surveyed surface ruptures associated with the 2008 Iwate-Miyagi inland earthquake, including field observation, trenching, airborne LiDAR image analysis and terrestrial LiDAR observation. One of the highlights of our survey is terrestrial LiDAR observation along the largest slip surface rupture in forest, Aratozawa rupture. Ultra-high resolution terrain data was acquired to clarify various representations of ruptures in 800 m x 400 m area (Fig. 1).

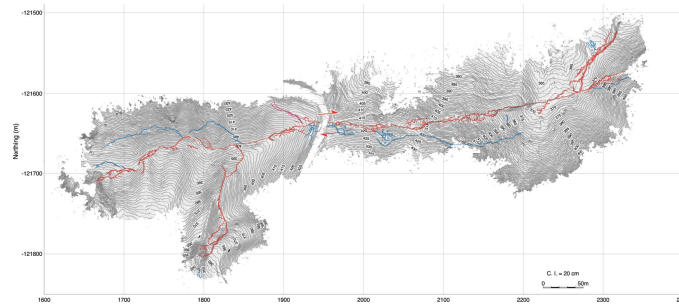


Figure 1. Terrestrial LiDAR oriented ultra-high resolution topography map of the Aratozawa rupture

### 2. Tree identification from LiDAR point cloud

We focused on tilting trees around the ruptures as an indicator of ground deformation. Since the raw point clouds obtained with LiDAR are composed of reflection from trees, leaves, grass and other reflectors in addition to the ground surface, it is possible to extract trees from them. By a grouping procedure we invented we could extract more than 4000 trees from the raw point clouds. Then by principle component analysis, we picked the tree direction vector from each of the tree point cloud. Tilt distributions or other features indicate surface deformation of the whole of the ridge around the surface rupture.

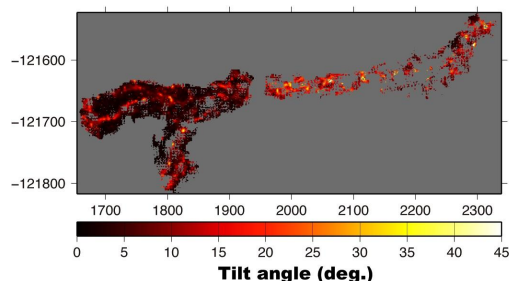
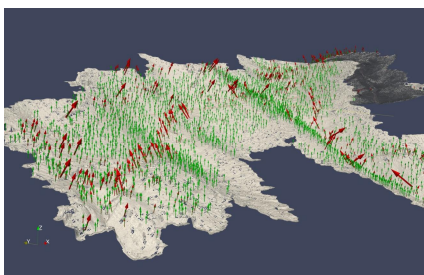


figure 2 3D view of the surface ruptures and trees. Figure 3. Tilting angle distribution from tree direction vectors

#### References

1) Toda et al (2010) Zishin 2) Yoshimi et al. (2008) Active Fault Research 3) Maruyama et al (2008) AGU Fall Meeting 4) Yoshimi et al. (2010) ESC2010