Crustal deformation of the 2016 Kumamoto earthquake sequence (1) - Foreshocks -

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We will show the crustal deformation and the fault models obtained from SAR (ALOS-2) and Kinematic-GPS observations for the 2016 Kumamoto earthquake foreshocks that occurred on Apr. 14th and 15th, 2016 with a Japan Meteorological Agency (JMA) magnitude (Mj) of 6.5 and 6.4, respectively.

SAR: By applying conventional InSAR and MAI techniques, ground displacements have been successfully mapped (Kobayashi, 2017). The most concentrated crustal deformation is located on the western side of the Hinagu fault zone. A locally distributed displacement which appears along the strike of the Futagawa fault can be identified in and around Mashiki town, suggesting that a different local fault slip also contributed toward foreshocks. Distributed slip models show right-lateral fault motion on a plane dipping west by 80 deg for the Hinagu fault and normal fault motion on a plane dipping south by 70 deg for the local fault beneath Mashiki town. The slip in the north significantly extends down to around 10 km depth, while in the south the slip is concentrated near the ground surface, perhaps corresponding to the Mj 6.5 and the Mj 6.4 events, respectively.

Kinematic-GPS: InSAR data cannot further separate the individual crustal deformation due to its temporal resolution. In this context, we processed Kinematic-GPS data and successfully exploited the individual coseismic displcaements for the two events (Kawamoto et al., 2016). The constructed fault models show that the Mj6.5 event is located around the junction of the Futagawa fault and the Hinagu fault, while the Mj6.4 is located in the south of the Mj6.5 event (Kobayashi et al., 2018). This analysis result demonstrates that Kinematic-GPS data can contribute to derive the individual source properties for the two events that occurred temporarily close to each other within a day.

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Reference:

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Fig. 1. Coseismic displacements due to (a) the Mj6.5 event and (b) the Mj6.4 event estimated from kinematic-GNSS positioning data, respectively.



Fig.2 (a) InSAR image using ALOS-2 data for the foreshock. Focal mechanisms estimated from distributed slip models of both the Hinagu fault and the local fault beneath Mashiki town are shown in the inset. (b) Slip distribution model for the Hinagu fault. The arrows show slip vectors of the hanging wall. (c) Same as (b) but for the local fault beneath Mashiki town.