

## Vertical Deformation Detected by the Precise Levelling Survey in the Periods of Before and After the 2014 Mt. Ontake Eruption and Their Interpretations (2006-2015)

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We conducted the precise leveling survey in Ontake volcano in April 2015 and discussed vertical deformations detected in the Periods of Before and After the 2014 Mt. Ontake Eruption (2006-2015). Notable uplift (2006-2009) and subsidence (2009-2014) were detected on the eastern flank of the volcano. We estimated pressure source models based on the vertical deformation and used these to infer preparatory process preceding the 2014 eruption. Our results suggest that the subsidence experienced between 2009 and 2014 (including the period of the 2014 eruption) occurred as a result of a sill-like tensile crack with a depth of 2.5 km. This tensile crack might inflate prior to the eruption and deflate during the 2014 activity. A two-tensile-crack model was used to explain uplift from 2006 to 2009. The geometry of the shallow crack was assumed to be the same as the sill-like tensile crack. The deep crack was estimated to be 2 km in length, 4.5 km in width, and 3 km in depth. Distinct uplifts began on the volcano flanks in 2006 and were followed by seismic activities and a small phreatic eruption in 2007. From the partially surveyed leveling data in August 2013, uplift might continue until August 2013 without seismic activity in the summit area. Based on the uplift from 2006 to 2013, magma ascended rapidly beneath the summit area in December 2006, and deep and shallow tensile cracks were expanded between 2006 and 2013. The presence of expanded cracks between 2007 and 2013 has not been inferred by previous studies. A phreatic eruption occurred on 27 September 2014, and, following this activity, the shallow crack may have deflated. In the period between October 2014 and April 2015, small uplift less than 4mm was detected.

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