

Land Deformation Measurement of Mud Volcano, Porong, East Java by InSAR using PALSAR Data

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Huge amount of muddy water were erupted around the natural gas well located at Porong, East Java in Republic of Indonesia on May 29th 2006. It is widely accepted that the eruption could be activities of mud volcano. The muddy water is expected to continue for a while. Enormous amount of muddy water flow has buried the neighboring villages and caused a large-scale ground deformation, damaging on the highways, railroad, natural gas pipelines, high-voltage electrical power lines and others. The muddy water, nearly at 100 degrees temperature, has heated the air, giving off a stench even in the area 1 km away from the center of mud volcano. In this study, we conducted InSAR processing using PALSAR loaded on ALOS, which was launched in January 2006.

InSAR processing using PALSAR data, obtained May 19th 2006 and January 4th 2007, detected land deformations in three areas. First, there was a deformation in the vicinity of the natural gas well. Fringe meaning deformation away from the satellite densely appeared, indicating that a huge subsidence had taken place. The largest amount of subsidence was approximately 2m converting in the vertical. The observation interval was 230 days, and this leads that the movement of the deformation was about 27 cm in monthly average. The amount of deformation near the natural gas well should be assumed to be larger. The second is a deformation detected in the northwest of the subsidence around natural gas well. The maximum amount of deformation was approximately 12m converting in the vertical. Natural gas production existing in this area is assumed to have given substantial effects on the ground deformation. The third is an uplift detected in the eastern part of the subsidence around natural gas well. The largest amount of uplift was approximately 36 m converting in the vertical. The cause of this uplift is still unknown, but in order to clarify the relation between the mud volcano and the subsurface structure need to be studied.

PALSAR data in this area was obtained four times: May 19th 2006, October 4th 2006, November 19th 2006, January 4th 2007. With the purpose to understand and predict the temporal change of ground deformation, we measured the transition of ground deformation at 11 points. The results confirmed that the steady subsidence and uplift have taken place as a whole, and the movement keeps going to date.

Republic of Indonesia has many issues to be solved such as measuring the amount of the erupted muddy water, compensation against inhabitants of Porong, environmental conservation for the future. The country needs techniques that enable continuously to make observation on broad range area with high accuracy at a moderate price. This area is covered by cloud throughout the year and PALSAR is effectively used due to its capability of making observation without the effects of weather condition. Some ground deformations obtained had not been clarified before and those were newly detected by InSAR processing. It can be said that this detection is the achievement only remote sensing could reach. This shows effectiveness of remote sensing techniques for accident prevention and environmental monitoring covering broad area. The authors will continue to conduct this ground deformation measurement in this area with increasing frequency of PALSAR observation.