Preliminary study of near surface detections at geothermal field using optic and SAR imageries

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Abstract. Current remote sensing technologies shows that surface manifestation of geothermal system could be detected with optical and SAR remote sensing, but to assess target beneath near the surface layer with the surficial method needs a further study. This study conducts a preliminary result using Optic and SAR remote sensing imagery to detect near surface geothermal manifestation at and around Mt. Papandayan, West Java, Indonesia. The data used in this study were Landsat-8 OLI/TIRS for delineating geothermal manifestation prospect area and an Advanced Land Observing Satellite(ALOS) Phased Array type L-band Synthetic Aperture Radar (PALSAR) level 1.1 for extracting lineaments and their density. An assumption was raised that the lineaments correlated with near surface structures due to long L-band wavelength about 23.6 cm. Near surface manifestation prospect area are delineated using visual comparison between Landsat 8 RGB True Colour Composite band 4,3,2 (TCC), False Colour Composite band 5,6,7 (FCC), and lineament density map of ALOS PALSAR. Visual properties of ground object were distinguished from interaction of the electromagnetic radiation and object whether it reflect, scatter, absorb, or and emit electromagnetic radiation based on characteristic of their molecular composition and their macroscopic scale and geometry. TCC and FCC composite bands produced 6 and 7 surface manifestation zones according to its visual classification, respectively. Classified images were then compared to a Normalized Different Vegetation Index (NDVI) to obtain the influence of vegetation at the ground surface to the image. Geothermal area were classified based on vegetation index from NDVI. TCC image is more sensitive to the vegetation than FCC image. The later composite produced a better result for identifying visually geothermal manifestation showed by detail-detected zones. According to lineament density analysis high density area located on the peak of Papandayan overlaid with zone 1 and 2 of FCC. Comparing to the extracted lineament density, we interpreted that the near surface manifestation is located at zone 1 and 2 of FCC image.

1. Introduction

Preliminary survey is the earliest part in geothermal exploration. In this stage of exploration, the geologists map the prospect area to determine it's geological setting as early recognition of the geothermal system. The results of this survey are geological and surface manifestation map that can be applied to determine the focus area for next exploration and early prediction of the geothermal system that occurred in that area.