ANALYZING SURFACE ROUGHNESS MODELS DERIVED BY SAR AND DEM DATA AT GEOTHERMAL FIELDS

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Sari - Kekasaran permukaan merupakan unsur fisik yang digunakan dalam berbagai aplikasi, misalnya untuk analisis hidrologi, erosivitas batuan, dan identifikasi manifestasi permukaan geotermal. Kekasaran permukaan dihitung dengan menggunakan alat pin-meter. Alat digunakan untuk menghitung kekasaran permukaan tanah yang berasosiasi dengan fragmen material di permukaan tanah. Pengukuran menggunakan pin-meter masih memiliki kemungkinan kesalahan yang berasal dari efek undulasi topografi, sehingga diperlukan detrending profil untuk mengurangi efek undulasi tersebut. Pada makalah ini, kami menggunakan data Synthetic Aperture Radar (SAR) Sentinel-1A dan Digital Elevation Model (DEM) SRTM untuk mengevaluasi efek undulasi topografi setelah dilakukan detrending. Model kekasaran permukaan yang diperoleh ditargetkan mendekati fragmen material di permukaan tanah. Lokasi penelitian yang dipilih yaitu di daerah sekitar Gunung Wayang-Windu dan Patuha. Pembuatan model awal kekasaran permukaan dengan data Sentinel-1A dilakukan dengan memanfaatkan nilai backscattering coefficient dan local incidence angle. Untuk mengetahui efektifitas detrending, kami memodelkan kekasaran permukaan menggunakan data DEM dengan menghitung Root Mean Square (RMS) untuk setiap grid dengan ukuran 19×19 piksel. Kedua model tersebut kemudian dikorelasikan terhadap data kekasaran permukaan lapangan dari pin-meter dan dihitung besarnya koefisien determinasi (R^2). Model dari data Sentinel-1A memiliki nilai R^2 sebesar 0.1130 lebih besar daripada model kekasaran dari DEM sebesar 0.060. Hal ini menunjukan bahwa data kekasaran pin-meter yang di-detrending terhindar dari efek undulasi topografi. Model kekasaran permukaan dari data Sentinel-1A digunakan untuk pengidentifikasian manifestasi permukaan berbasis nilai pH tanah. Analisis dilakukan berdasarkan pengukuran lapangan dan pola scatter plot. Berdasarkan model yang dipilih, secara umum pada zona manifestasi geotermal memiliki hubungan berbanding terbalik antara pH dengan model kekasaran.

Kata kunci: Sentinel-1A, DEM, geotermal, kekasaran permukaan, pin-meter

Abstract - *Surface roughness is a physical property which is used in many applications such as hydrological analyses, erosivity of rocks, and identification of geothermal surface manifestations. In this study, the surface roughness was calculated by a pin-meter. This tool is expected be able to measure the fragmental size at ground surface. However, there is a possibility that the tool still has some errors from the effect of topography undulation. In previous research, detrending method was used to minimise the topographical effect in the measured surface roughness. In this paper, we used Synthetic Aperture Radar (SAR) data from Sentinel-1A, and Digital Elevation Model (DEM) SRTM to evaluate the effectiveness of detrending method of pin-meter. Therefore, the measured surface roughness originated solely from fragmental materials. The selected research areas were Wayang Windu and Patuha geothermal field in Indonesia. Modelling the surface roughness by Sentinel-1A image was conducted by utilising backscattering coefficient and local incidence angle. While surface roughness model from DEM is formed by the Root mean square (RMS) for each grid with the optimum size 19×19 pixels. Both models were compared to pin-meter data which have been detrended. Then, the comparison was analyzed based on determination correlation value (R^2). Surface roughness model derived by Sentinel-1A produced R^2 about 0.1130 higher than DEM about 0.060. It might indicate that the surface roughness measured by the pin-meter following detrending process is free from the effect of topography undulation. Then, surface roughness model derived by Sentinel-1A data was used to identify surface manifestation. Analysis was performed based on pH measurement at field and scatter plot pattern. According to the selected model, the surface roughness at geothermal surface manifestation zones are inversely proportional to the soil pH.*

Keywords: *Sentinel-1A, DEM, geothermal, surface roughness, pin-meter*