

Detection of soiling on photovoltaic solar farms using multi-spectral remote sensing in arid regions

(乾燥地域におけるマルチスペクトルリモートセンシングを用いた太陽光発電ソーラーファームの汚れの検出)

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The soiling of solar panels from dry deposition affects the overall efficiency of power output from solar power plants. This study focuses on the detection and monitoring of sand deposition (wind-blown dust) on photovoltaic (PV) solar panels in arid regions using multitemporal remote sensing data. The study area is located in Bhadla solar park of Rajasthan, India which receives numerous sandstorms every year, carried by westerly and north-westerly winds. This study aims to use Google Earth Engine (GEE) in monitoring the soiling phenomenon on PV panels. Optical imageries archived in the GEE platform were processed for the generation of various sand indices such as the normalized differential sand index (NDSI), the ratio normalized differential soil index (RNDSI), and the dry bare soil index (DBSI). Land surface temperature (LST) derived from Landsat 8 thermal bands were also used to correlate with sand indices and to observe the pattern of sand accumulation in the target region. Additionally, high-resolution PlanetScope images were used to quantitatively validate the sand indices. Our study suggests that the use of freely available satellite data with semiautomated processing on GEE can be a useful alternative to manual methods. The developed method can provide near real-time monitoring of soiling on PV panels cost-effectively. This study concludes that newly developed Solar Panel Soil Index (SPSI) is the most accurate (90.1% Accuracy) in monitoring of soiling and is expected to have high potential in this field. The findings of this study can be useful to solar energy companies in the development of an operational plan for the cleaning of PV panels regularly.