

Estimation of Disaster Waste Generation from Flood Inundated PV Panels

Kenji Sugimoto^{1*}, Kazuhiro Ueda¹ and Kiichiro Hayashi²

¹Graduate School of Engineering, Osaka Metropolitan University

² Institute of Technology Institute of Materials and Systems for Sustainability, Nagoya University

* sugimoto@omu.ac.jp

Introduction

The introduced amount of renewable energy has been increased due to the feed-in tariff (FIT) in Japan. As a result, many renewable power generation facilities were constructed in disaster-expected areas, and there are concerns that waste generation may increase caused by the natural disaster. Especially, solar photovoltaics (PV), which account for half of renewable energy generation, use various materials for panels, frames, and foundations. Therefore, it is important to estimate the damage risk of PV panels due to disasters and to estimate the amount of disaster waste generated by each material for planning efficient waste treatment plans. In this study, we calculated the damage risk of PV panels and the amount of disaster waste generated by overlaying PV location data with flood inundation assumed areas.

Method

Figure 1 shows the flow of estimation. The location data of PV panels were created by extracting pixels classified as “solar panels” from “High-resolution Land Use and Land Cover Map”^[1]. Next, assuming that the possibility of flooding up to the roofs of buildings in a flood is low, the location data were overlapped with building polygons^[2]. Finally, assuming that solar panels located in the flood inundated area^[3] would be damaged, the amount of disaster waste was estimated by multiplying by the material mass per area. The material mass per area was calculated based on design drawings of general specifications^[4].

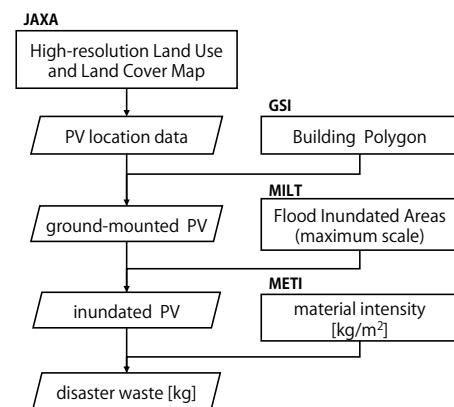


Figure 1 Flow of estimation

Results and Discussion

The results of Hokkaido are shown below. The extracted PV panels were 31.4 million m² in Hokkaido, of which 8.3 million m² were located in the flood inundation area. The amount of disaster waste generated was estimated 1.14 million tons, of which 0.88 million tons were concrete, 0.14 million tons were steel. Figure 2 shows the amount of disaster waste generated by municipalities. The amount of waste was large in municipalities on the Pacific Ocean side, where many solar panels are located. Concrete, which accounts for a large amount of waste, can be crushed and reused as roadbed material, while glass and silicon must be disposed of in landfills after appropriate separation. Therefore, a future work is to consider a treatment plan that takes into account the residual capacity of the final disposal site.

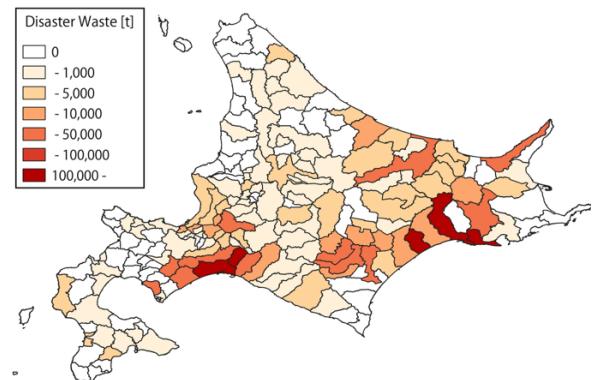


Figure 2 Estimated disaster waste in Hokkaido

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References

- [1] JAXA, High-resolution Land Use and Land Cover Map (10m resolution) v25.04, https://www.eorc.jaxa.jp/ALOS/jp/dataset/lulc_j.htm
- [2] Geospatial Information Authority of Japan (GSI), Fundamental Map Information, <https://service.gsi.go.jp/kiban/>
- [3] Ministry of Land, Infrastructure, Transport and Tourism, Japan (MLIT), Digital National Land Information, <https://nlftp.mlit.go.jp/ksj/>
- [4] Ministry of Economy, Trade and Industry, Japan (METI), Ground-mounted solar system structural design example.