[JJ] Evening Poster | H (Human Geosciences) | H-RE Resource and Engineering Geology

[H-RE13]Availability of earth science data in renewable energy field

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Renewable energy penetration is increasing dramatically in the world. Renewable energy power generations have become a strong presence in an electric power system. However, it is a challenge for renewable energy to be stable power sources due in part to natural variability of renewable energy and its uneven distribution. For effective use of renewable energy, a combinational of power resources (e.g., thermal power plants, hydropower systems) and energy storage technologies (e.g., pumped-storage power generation and storage battery system) should be desired. Therefore, we need to understand the amount of renewable resources, causes of variation, and the predictability of power output. Then, observation and forecast information from earth science field should be analyzed and applied to power energy field to achieve easy use of earth science databases.

Recently, observation databases from remote sensing technology and/or forecasts from numerical models have become essential for both renewable energy and electric power system fields. This proposed session needs your presentation from the whole of renewable energy fields (solar power, wind power, geothermal power, tidal power, wave power and biomass power generations). Our goal of this session is to exchange views with various researchers between renewable energy field and earth science field (e.g., usage-trends of earth science datasets for renewable energy field, the subjects in hand, earth science datasets availability, and a request from renewable energy field to earth science field, and so on).

[HRE13-P05]Predicting temporal variation of local solar PV generation from all sky images based on Stereo and CNN approaches

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Solar photovoltaic (PV) power generation is one of important renewable energy, and both mega-solar and small scale solar PV systems have been rapidly increasing these days. While the solar PV is a common renewable energy source, it is difficult to predict temporal variation of power generation accurately due to its strong dependence on weather conditions. Especially it has been reported that passing of patchy clouds makes the prediction more difficult (Itagaki et al., 2011, 2012). The difficulty is from restriction of spatial resolutions of both weather forecast and observations, that is the grid interval of current weather forecasting is the order of 1 km, and the typical spatial resolution of geostationary satellites, such as Himawari-8, is 500m - 1km size, both are not enough to resolve the small-scale cloud structures (less than 1 km).

To have better spatial resolution for observing clouds, we have developed a cloud monitoring system constructed with multi (more than two) wide field of view (FOV) cameras, the interval of each camera is a few hundred meters. The interval allows us to monitor cloud locations and cloud-base altitude with a stereo estimation method. The wide FOV cameras used in this study can resolve cloud position with a smaller resolution than 100m. In addition, we have corrected solar PV generation data whose time interval is 6 seconds. Training a convolutional neural network about the relationship between sequential

cloud images and temporal variation of PV generation, we successfully determined amount of solar PV generation under specified weather conditions. In this presentation, we will introduce our approach for measuring three-dimensional cloud positions and its results, and we will discuss predicting temporal variation of solar PV power generation with the cloud positions and the cloud motions.