[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-P07]Predictor of Large Forecast Error on Surface Solar Radiation using Multi-Center Grand ensembles forecast.

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Forecasting of surface solar radiation (SSR) using numerical weather prediction (NWP) models is better forecast accuracy than statistical models for forecast lead time in the range of several hours to several days. Large forecast errors (forecast busts) for SSR and therefore photovoltaic power generation may lead to either a shortage of power supply or production of excessive surplus power. Ensemble forecasting with NWP models has been developed to improve forecast accuracy by taking the average of individual ensemble forecast members and to consider forecast uncertainty and reliability by generating a probabilistic forecast of meteorological fields. A multi-center grand ensemble (MCGE) is a useful technique for evaluating the uncertainty of a weather forecast. MCGE decrease uncertainty by individual NWP centers. Lognormal ensemble spread (standard deviation of ensemble forecast) of MCGE ($LNES_g$) and single-NWP-center ensembles (LNES) relates to the forecast error (e.g., RMSE), and can be used as a predictor of reliability for the weather forecast. This study used 1- to 6-day global ensemble forecasts at four leading NWP centers (European Centre for Medium-Range Weather Forecasts: ECMWF, Japan Meteorological Agency: JMA, National Centers for Environmental Prediction: NCEP, and the UK Met Office: UKMO) for 2014 to 2016. We investigated the detectability of forecast busts of daily SSR over the Kanto Plain in central Japan in a day-ahead 5 km regional forecast operated by the JMA.

The positive correlations between the forecast error coefficient (Fc) and LNESg has 95% statistical significance in most months. Particularly, the correlations of winter season were higher than that of summer season. In the top 10%, 5% and 1% forecast busts in all and five winter months, the Receiver Operating Characteristic (ROC) scores of the MCGE in 1- to 6-day ahead forecast indicated statistical significance. The ROC score of five winter months was higher than that of all months. The maximum ROC score was 0.78 of MCGE in 3-days head forecast. The LNESg evaluated using global ensemble forecast can therefore be a valuable predictor for detection of forecast busts in the regional forecast.

In future plans, we predict for shortage of power supply and excessive surplus power event using proposed method in this study. Moreover, we estimate predictability the tendency of forecast busts (over or under-estimate) using MCGE for stable energy management.