気象庁データの再生可能エネルギー分野への応用利用 —産総研の取り組み—
Application of the JMA data for a renewable energy management field -AIST efforts and
future initiatives-

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Recently, many photovoltaic (PV) power systems have been installed in the Japan islands from an
introduction of feed-in-tariff in 2012. In the current situation, over 20 GW of PV systems has been
penetrated. However, renewable energy such as PV power production and wind power production has
significant large temporal and spatial variations due to cloud moving and wind speed over complex
topography. In order to control a total electric power system in an electric power service area,
electric power service companies has to adjust other power outputs (thermal power plants (oil,
coal, natural gas), hydraulic power, water pumping etc.) not only renewable energy resources. For a
safety control of energy management system (EMS) using renewable energy resources, forecast and
monitoring data of renewable power outputs will be necessary more and more.
 National Institute of Advanced Industrial Science and Technology (AIST) develop a PV power
forecast technology based on machine learning algorism (support vector machine, SVM). In this
system, grid point values (GPV) of a mesoscale model (MSM) of the Japan Meteorological Agency (JMA)
are used as an input data. In the current situation, solar irradiance forecast data are not
included in the GPV datasets of the JMA. Therefore, we must forecast solar irradiance and/or PV
power output based on a numerical prediction model. In order to forecast of PV power output, we use
the SVM with both MSM GPV and solar irradiance data as an input data. To perform a bias correction,
the SVM are also used in our forecast system.
 Research center for photovoltaics of AIST also collaborated with the Meteorological Research
Institute (MRI) of JMA and has been validated the solar irradiance forecast data from the MSM and a
local forecast model (LFM). Each horizontal resolution is 5km and 2km, respectively. MSM performed
39 hours forecasts every 3 hours and LFM performed the 9 hours forecasts every 1 hour. Therefore,
MSM was used day-ahead forecast and LFM are expected for short-term forecast in the EMS. From our
validation of solar irradiance forecast, negative bias in summer and positive bias in winter are
remained in the MSM. Actually, bias correction using the SVM is performed to reduce systematic
forecast errors in AIST. Furthermore, validation results would be useful information to improve
solar irradiance forecasts of the Numerical Weather Prediction[u1] (NWP). In previous study, our
research group investigated the relationship between solar irradiance forecasts and cloud types in
cases of large forecast errors. In PV forecasts, forecast errors are included in the model outputs
because of both uncertainties of model schemes of NWP and meteorological observations when
initializing models. Therefore, confidence intervals of solar irradiance forecasts are also
required for users of PV power outputs (or electrical system operators). A usability of ensemble
forecasts using different dataset from overseas NWP centers[u2] has been also examined.
Recently, users of PV power outputs have paid attention to aerosol optical depth and/or volcanic
ash not only clouds distribution because of the decrease of PV power outputs due largely to the
reduction of direct normal irradiance (see a related presentation by Dr. Uno (AIST) in the section
"Dynamics of eruption cloud and cumulonimbus; modelling and remote sensing" of JpGU 2016).
 AIST has taken part in the Japan Science and Technology Agency (JST) Core Research for Evolutional
Science and Technology (CREST) project of "Creation of Fundamental Theory and Technology to

establish a Cooperative Distributed Energy Management System and Integration of Technologies Across Broad Disciplines Toward Social Application" (EMS). In this presentation, we will show our effort in the JST CREST EMS project.

キーワード：太陽光発電予測、数値予報モデル、気象庁データ
Keywords: Forecast of PV power generation, Numerical Prediction Model, JMA data