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Development of Solar Resources Map using Satellites and Numerical Prediction Data on Korean Peninsula

J.-B. Jee (1), S.-H. Jeon (1), Y.-J. Choi (1), and K.-T. Lee (2)

(1) National Institute of Meteorological Research, Seoul,Republic Of Korea (jbjee@korea.kr), (2) Gangneung-Wonju National University, Gangneung, Republic Of Korea

Solar energy is attenuated by absorbing gases (ozone, aerosol, water vapor and mixed gas) and cloud in the atmosphere and ambient topography. That energy is measured with solar instruments (pyranometer and phyheliometer) which are installed on the surface. However, solar energy based on observation is insufficient to represent detailed energy distribution, because the distributions of solar instruments are spatially limited. If input data of solar radiation model is accurate, the solar energy reaching at the surface can be calculated reasonably.

In this study, input data of solar radiation model used satellites data and reanalysis data of numerical model prediction from 2000 to 2010. Recently, a variety of satellite measurements from TERA/AQUA (MODIS), AURA (OMI) and geostationary satellites (GMS-5, GOES-9, MTSAT-1R, MTSAT-2 and COMS) has been made available. Input data of solar radiation model can use aerosols and surface albedo data from MODIS, total ozone amount data from OMI and cloud fraction data from meteorological geostationary satellites. Also, reanalysis data of numerical prediction model is good to use as an input of solar radiation model. Several outputs can be used with surface temperature, pressure and total precipitable water of RDAPS (Regional Data Assimilation Prediction System) and KLAPS (Korean Local Assimilation Prediction System) models from KMA (Korea Meteorological Administration).

In addition, the solar radiation model is equipped with topographic effect, which is the result of terrain shading or shielding the solar energy. Korean peninsula is composed of very complicated terrains. Therefore, considering the topographic effect is very important to calculate the solar energy at the surface. The hi-resolution DEM (Digital Elevation Model) is required to calculate the topographic effect.

The solar radiation reaching at the surface is calculated by hour in temporal and 4 km $\times$ 4 km in spatial using solar radiation model and input data. These results are verified and validated with ground observations from 22 KMA solar sites. Correlation coefficient is 0.95 and RMSE (Root Mean Square Error) is 67.53 W/m2. Then these hourly results are accumulated by month and year. Finally, the solar resources map is represented with mean accumulated solar radiation with and without topographic effect through 11 years. Regions with the strongest solar radiation are distributed across Andong, Daegu and Jinju which are low latitude and cloudless regions in Korea. Jeju island is located on the lowest latitude in Korean peninsula, but it is low solar energy region because it is abundant in water vapour and clouds.