Global solar radiation map

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A new service is making high-resolution data of direct sunlight publicly available for users such as planners of large solar power systems

Renewable energy sources play an important role in securing future energy supply and mitigating climate change. Even though the solar energy sector, so far, only contributes little to global energy production, it has grown faster than other energy sectors over the past years, according to a report published in 2011 by the International Energy Agency. In sunny parts of the world, such as Spain or California, concentrating solar power (CSP) plants are increasingly built and planned. These concentrate the sun's energy by using mirrors or lenses, turn it to heat and, ultimately, to electricity. Knowing when, where and how much the sun shines is essential in order to plan such large solar power systems.

Data on solar radiation for any given location worldwide is precisely one of the outcomes of the EU-funded research project MACC II. "We provide solar radiation data with 15 minutes temporal resolution and three to five kilometres spatial resolution," says Marion Schroedter-Homscheidt, sub-project leader and scientist at the Remote Sensing Data Center of the German Aerospace Center in Oberpfaffenhofen. The time series data run from 2004 until now. They will be available on the project's website later this year as part of a European information infrastructure within the Copernicus programme.

The data stem from a so-called clear sky model of solar radiation. In addition to information on water vapour and ozone, it includes best

estimates of aerosols that are based on observations and computer simulations. Combining this information with cloud data derived from satellite measurements allows the scientists to calculate the radiation reaching the surface of the earth at a given location and time. "It is the aerosol data the solar industry is particularly interested in," Schroedter-Homscheidt tells youris.com.

Indeed, knowledge of these tiny particles in the atmosphere is crucial for determining the direct radiation from the sun. Aerosols scatter or even absorb light, which is subsequently no longer available for concentrating solar power systems. Previous models of direct solar radiation used aerosol data derived from climate models with a rather low resolution. "Now we have a much higher data quality," Schroedter-Homscheidt says.

Experts welcome the efforts of the project consortium. Providing aerosol and direct solar radiation data is "a good service," comments Elke Lorenz, expert in solar energy meteorology from the University of Oldenburg, Germany. While clouds have the biggest influence on the total amount of solar radiation reaching the earth's surface, "aerosol data are important if the sky is clear, like in Spain," she tells youris.com. In her view, the data provided by the project consortium are of better quality than previous estimates based on climatological data.

Other experts agree. "It is a better approach [for estimating aerosols] than before, in absolute values as well as in the availability of continuous data," says Lourdes Ramirez Santigosa, head of the solar radiation group at CIEMAT, the Centre for Energy, Environment and Technology, in Madrid, Spain. Her team had previously tested other sources of aerosol data for its own research. "We think that [the project's aerosol data] is the best available for long term assessments," Ramirez says. "For planning of CSP plants, we need at least an hourly resolution of solar radiation data covering ten to 20 years," she adds.

However, "there is always room for improvement," Ramirez believes. Within the next five to ten years, models should get close to resolutions of ten metres and one minute. This would enable plant operators to simulate more accurately, for example, the temperature within the tubes of the solar panels and the orientation of the CSP plant mirrors.

Ramirez also points to the need for actually forecasting direct solar radiation. For already existing CSP plants, "forecasts are important because the promoters need to know the future output of their plant", she tells youris.com. "If you know when the electricity is produced, you can get a better price on the market", she explains. Including the aerosol data into models for forecasting direct solar radiation "is indeed the next step," Schroedter-Homscheid says. "The project is creating important prerequisites towards this," she concludes.

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