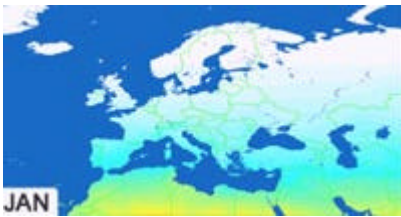


News

Sunshine mapping from space means brighter solar energy future



A year of European solar radiation

22 June 2005

How sunny is it outside right now – not just locally but all across Europe and Africa? Answering this question is at the heart of many weather-related business activities: solar power and the wider energy sector, architecture and construction, tourism, even health care. Today accurate and continent-wide scale measurements of ground radiances are provided every 15 minutes by ESA's Meteosat Second Generation satellite.

Integrating this information within the business practices of solar energy managers is the objective of the ENVISOLAR project (Environmental Information Services for Solar Energy Industries), funded by ESA within the framework of the Earth Observation Market Development Programme (EOMD).

Solar energy has switched from a green aspiration to a solid business. The solar market in photovoltaics – the direct conversion of sunlight to electricity – has an annual turnover of 600 million euros in Germany and 1000 million euros in the rest of Europe. The latter figure is predicted to increase to 2500 million euros by this decade's end. Furthermore, thousands of megawatt of renewable energy potential are also available in Africa, Asia and Central America as shown by the "Solar & Wind Energy Resource Assessment" (SWERA) project of the UN Environment Programme (UNEP).

There are two kinds of solar energy establishments: solar thermal plants which concentrate heat from the Sun, and photovoltaic plants that convert sunlight into electricity.

In both cases precise, long-term irradiance data is needed for choosing plant locations and estimates of likely energy yield for prospective investors. Then once a plant is built, managers need data updated in near real-time to check the facility is working optimally, and energy output tallies with available sunshine.



The European solar market is growing

"Today our audits form the basis of huge investments in the range of 50 million euros for single projects," explains Gerd Heilscher from Meteocontrol, a company

auditing photovoltaic systems and involved in ENVISOLAR. "Besides the layout, solar radiation is the most important issue. But unfortunately only a few high-quality ground-based measurements are available yet."



Radiance estimates are needed to optimally site solar installations

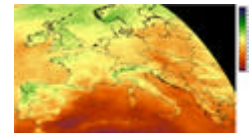
Within the wider energy market, such information is also valuable for forecasting electricity load – irradiance is the other major environmental influence on demand besides temperature.

How best to measure sunlight? Ground radiance is quite complex to quantify as it is influenced by much more than simply a site's distance from the equator. Variations in cloud cover, humidity, aerosols and ozone in the air determine the amount of incoming solar radiation actually reaching the ground. Local topography is also important and there are large regional differences – in Europe the southern side of the Alps receives twice the annual radiance of northern slopes.

Measuring from below using in-situ data is technically demanding, expensive on an ongoing basis and limited in coverage – there are only around 200 solar-energy-measuring stations to cover all of Europe and Africa in the official networks affiliated to the World Meteorological Organisation (WMO).

Measuring from above using satellites provides a wide-area, objective and cost-effective solution. Research by MeteoSwiss has shown that satellites are even more accurate than ground measurements once the distance to the next ground station is greater than about 30 kilometres.

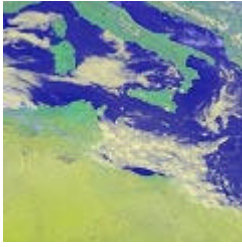
Today, ENVISOLAR partners are developing and marketing a variety of solar services based on satellite radiance data. These services benefit from the latest scientific results and state-of-the-art algorithms developed by a EU R&D project called Heliosat-3.



Monthly mean global Irradiance map from Meteosat 7 - April 2000

ENVISOLAR services based on these data products comprise solar plant yield estimates, plant fault detection and performance checking, energy forecasting for energy utilities, and time series services including maps and statistics of irradiance, its direct and diffuse components and spectral components such as illumination.

Customers of ENVISOLAR services include SAG Solarstrom AG, a publicly quoted German firm that builds and operates photovoltaic installations, providing entire financial investments in photovoltaics to its customers.



MSG water vapour product

"We need solid information for investment decisions, especially with regard to future markets like Spain," said Uwe Ilgeman, CEO of SAG Solarstrom AG. "The sampling and spatial resolution of ground-based data is too coarse— for example in Spain there are only 30 sites available at the moment."

High-resolution radiance data from the "Solar Energy Mining" (Solemi) service operated by the German Aerospace Center (DLR) (leader of ENVISOLAR) have contributed to the quantification of the renewable energy potential within 14 developing countries within the framework of the SWERA project of UNEP.

"These countries need greatly expanded energy services to help them in the fight against poverty and to power sustainable development," said Klaus Toepfer, Executive Director of UNEP. "SWERA offers them the technical and policy assistance to capture the potential that renewable energy can offer."

A wide range of users can benefit from EO-based solar services including not just climate scientists, but farmers, architects interested in knowing locally appropriate window sizes, and even PVC manufacturing companies such as Deceuninck, which used the ENVISOLAR Solar Database (SoDa) service to study how the ultraviolet in sunshine degrades PVC building parts so their warranties can be appropriate to local conditions.



MSG products used in ENVISOLAR

Medical researchers are using sunshine maps to investigate links between sunlight and health. The International Agency of Research on Cancer (IARC), an institute of the World Health Organisation (WHO) is probing the relationship between ultraviolet radiation exposure and skin cancer.

And scientists at the UK's University of Southampton and the Royal London Hospital have also used the data to study whether lack of vitamin D – supplied through sunlight – in pregnant women contributes to osteoporosis or 'brittle bone syndrome' in later life.

Envisat Ozone measurements

Another EOMD project called HappySun Mobile is also applying EO-based sunlight data to support public health and safe sunbathing. With exposure to sunlight the leading cause of melanomas and other skin cancers, this one-year project will set up a means of generating automatic warnings about safe sunbathing times based on measured ultraviolet levels, then deliver them to sunbathers via text messaging.

Contact

If you are interested to know more about the ENVISOLAR applications and opportunities, please contact eomd@esa.int

Related news

- Space shows way to Europe's renewable energy future
(<http://www.esa.int/ContentServer?pagename=CS/Render &c=Article &cid=SEMORAYO4HD &preview=true &tid=EOhome &Image=0>)

Related missions

- MSG-1 overview (http://www.esa.int/ContentServer?pagename=CS/Render &c=SCI_Mission &cid=SEMLFM2VQUD &preview=true &tid=EOhome &Image=0)
- Envisat overview (http://www.esa.int/ContentServer?pagename=CS/Render &c=SCI_Mission &cid=SEMWYN2VQUD &preview=true &tid=EOhome &Image=0)

In depth

- EO Market Development (EOMD) (<http://www.eomd.esa.int/>)

ENVISOLAR (<http://www.envisolar.com/>)

Related links

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- SWERA (<http://swera.unep.net/swera/index.php?id=1 &L=0>)

Medical Research Council (<http://www.mrc.soton.ac.uk/pageone.asp>)

International Agency for Research on Cancer (<http://www.iafrc.fr>)

Heliosat (<http://www.heliosat3.de/>)

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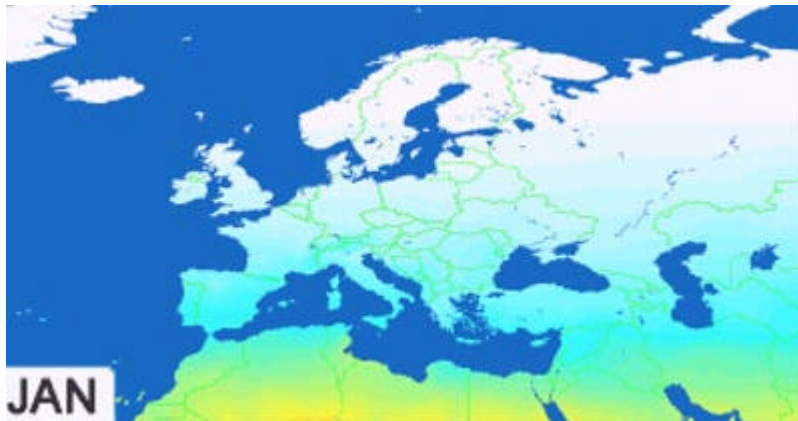
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- Virtual Institute of Energy Meteorology (<http://www.viem.de>)



Observing the Earth

European Space Agency

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This animation shows changes in the solar radiation over Europe and how it evolves over the course of a year. These maps were computed by fusing radiation values obtained either by ground stations or by processing satellite data. Copyright Ecole des Mines de Paris, 2000.



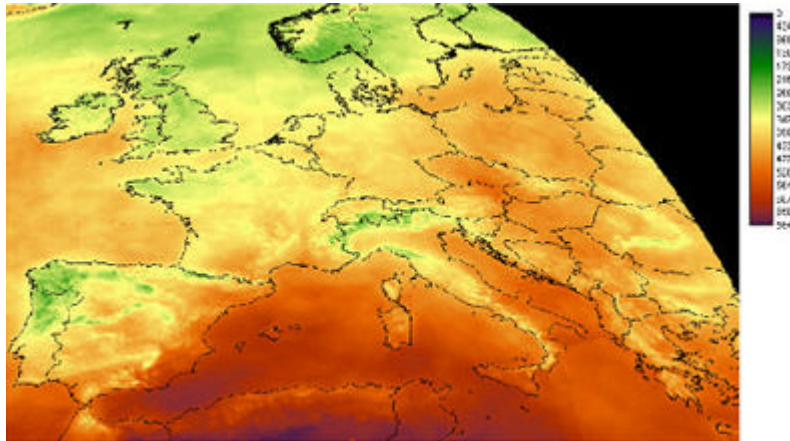
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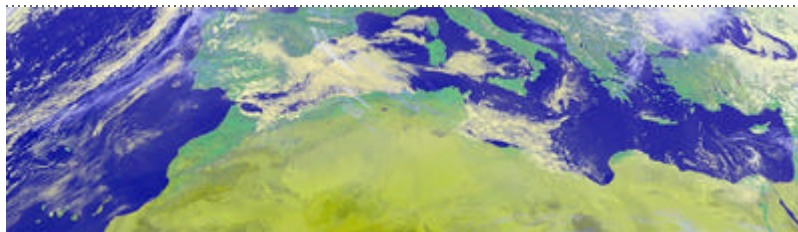
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Solar installations need reliable radiance data to help calculate their likely yield in advance of operation, then to serve as a benchmark to ensure they are functioning optimally. With ground-based monitoring sparse, satellite data is increasingly useful. Photovoltaic installations like the one shown can be monitored by ENVISOLAR service plant management.



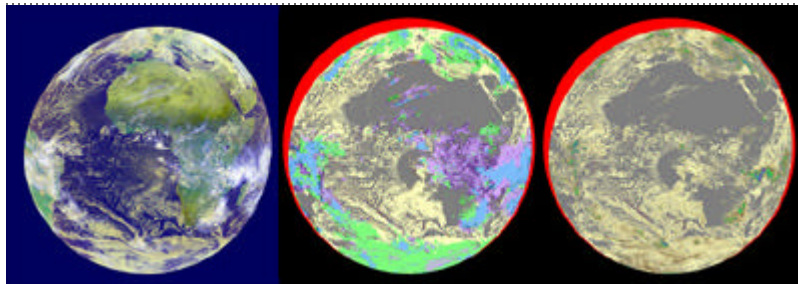
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Monthly mean European irradiance map from Meteosat 7 for April 2000, measured in Watt hours per metre squared, (Wh/m²). Copyright Univ. Oldenburg



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Example of water vapour column product derived from Meteosat Second Generation (MSG). Such Earth Observations are used as inputs for solar irradiance products in ENVISOLAR. Copyright DLR.



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Examples of cloud parameter products derived from Meteosat Second Generation (MSG). To the left is an MSG composite, in the centre is cloud cover, and to the right is optical thickness. These Earth Observation results are used as input for solar irradiance products in ENVISOLAR. Copyright DLR.

here we need an image of sunbath of this type



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Assimilation of MSG radiance data and ENVISAT atmospheric measurements into radiative transfer models enables one to make forecast of UV. An ESA Earth Observation Market Development (EOMD) project called HappySun Mobile aims to deliver text message warnings about safe sunbathing limits to holidays, based on ultraviolet forecasting.
