



PVGIS: a web application for estimating solar energy output, status and future developments

Thomas Huld, Ewan Dunlop, Nigel Taylor

Outline of talk

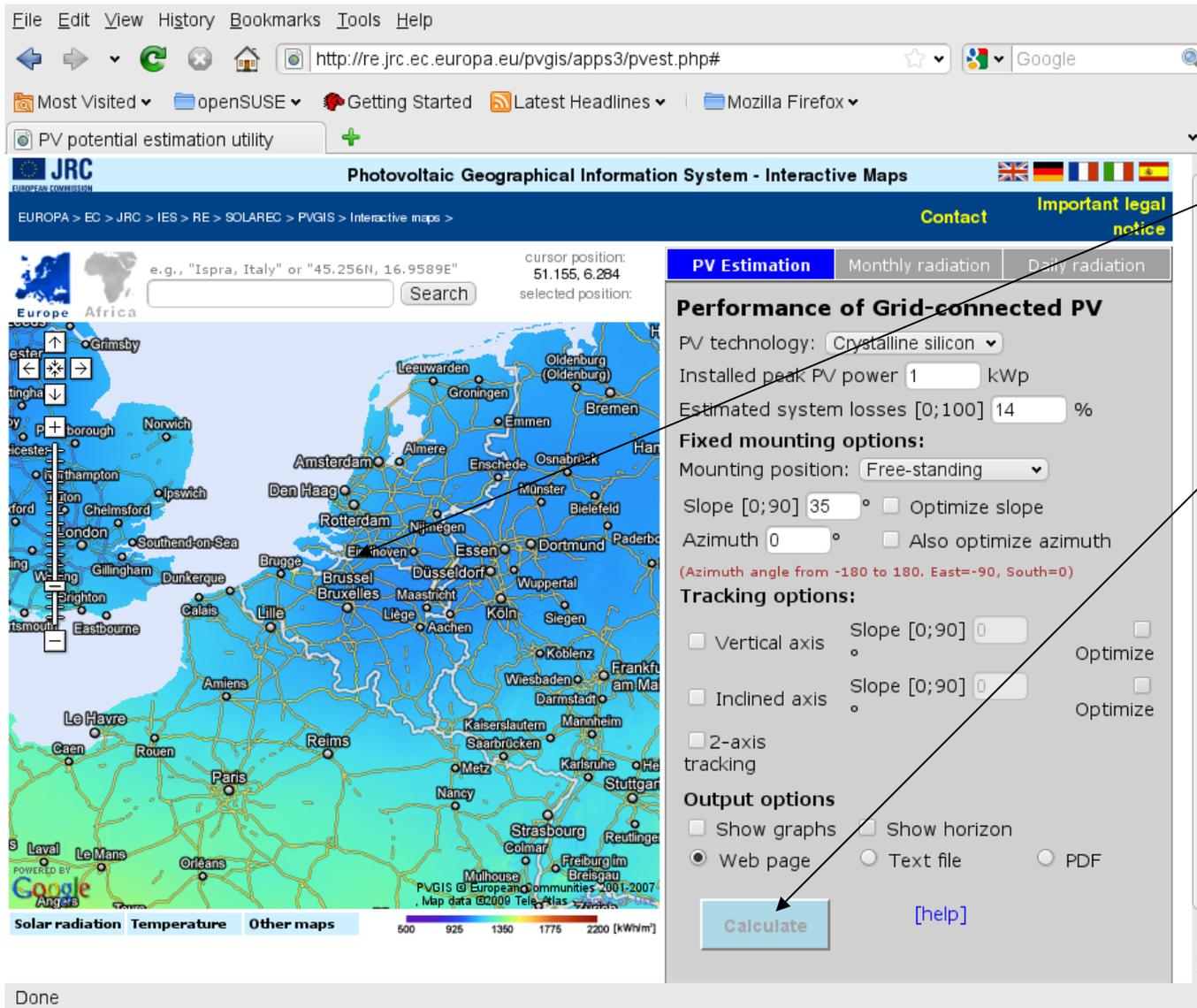
- What is PVGIS?
- Capabilities
- Particular issues for the African database / web application
- New developments

What is PVGIS?

- PVGIS is a database of solar radiation data combined with a web interface that lets users calculate the energy output of photovoltaic (PV) systems.
- PVGIS is also a scientific tool that allows us to do research on the performance of PV systems over large geographical areas and estimate the potential for solar energy deployment in Europe and Africa

Web interface features

- Covers Europe and Africa
- Various types of PV installations: fixed or tracking, models for different PV technologies
- High-resolution terrain data allows calculation of the effects of shadowing
- Google Maps interface with search and zoom facilities.



File Edit View History Bookmarks Tools Help

http://re.jrc.ec.europa.eu/pvgis/apps3/pvest.php#

Most Visited openSUSE Getting Started Latest Headlines Mozilla Firefox

PV potential estimation utility

JRC Photovoltaic Geographical Information System - Interactive Maps

EUROPA > EC > JRC > IES > RE > SOLAREC > PVGIS > Interactive maps >

Contact Important legal notice

Europe Africa

e.g., "Ispra, Italy" or "45.256N, 16.9589E"

Search

cursor position: 51.155, 6.284
selected position:

PV Estimation Monthly radiation Daily radiation

Performance of Grid-connected PV

PV technology: Crystalline silicon

Installed peak PV power 1 kWp

Estimated system losses [0;100] 14 %

Fixed mounting options:

Mounting position: Free-standing

Slope [0;90] 35 ° Optimize slope

Azimuth 0 ° Also optimize azimuth
(Azimuth angle from -180 to 180, East=-90, South=0)

Tracking options:

Vertical axis Slope [0;90] 0 ° Optimize

Inclined axis Slope [0;90] 0 ° Optimize

2-axis tracking

Output options

Show graphs Show horizon

Web page Text file PDF

Calculate [help]

Solar radiation Temperature Other maps

500 925 1350 1775 2200 [kWh/m²]

Done

Click here

Then click here

1000-2000 hits per day

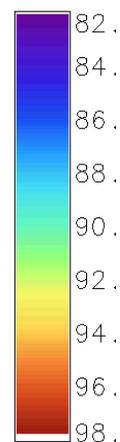
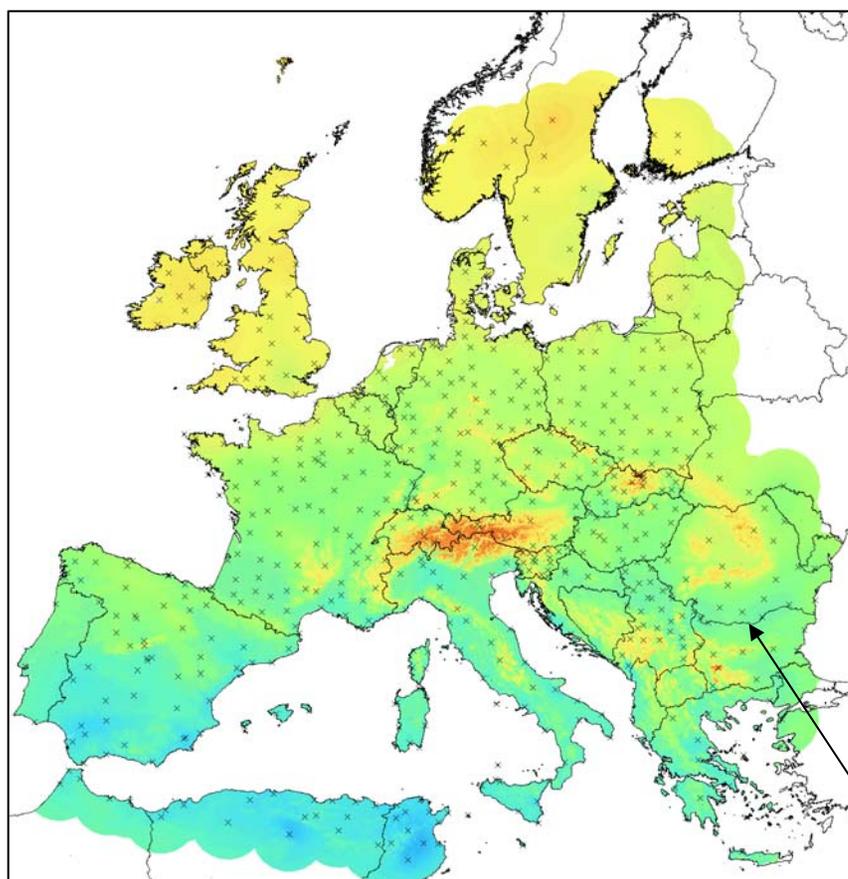
Reasons for success

- Simple interface: 2 clicks and you have results
- Easily understood results: energy production in kWh
- Immediate access:
 - Relevant information is not buried 8 menu levels deep
 - No registration needed
 - It's free!

Research applications

- Mathematical models of PV performance, together with the colleagues of the ESTI laboratory
- Performance of PV technologies in different climates
- Performance of different PV mounting strategies
- Research on applications of satellite-based radiation data

Annual relative efficiency, crystalline silicon



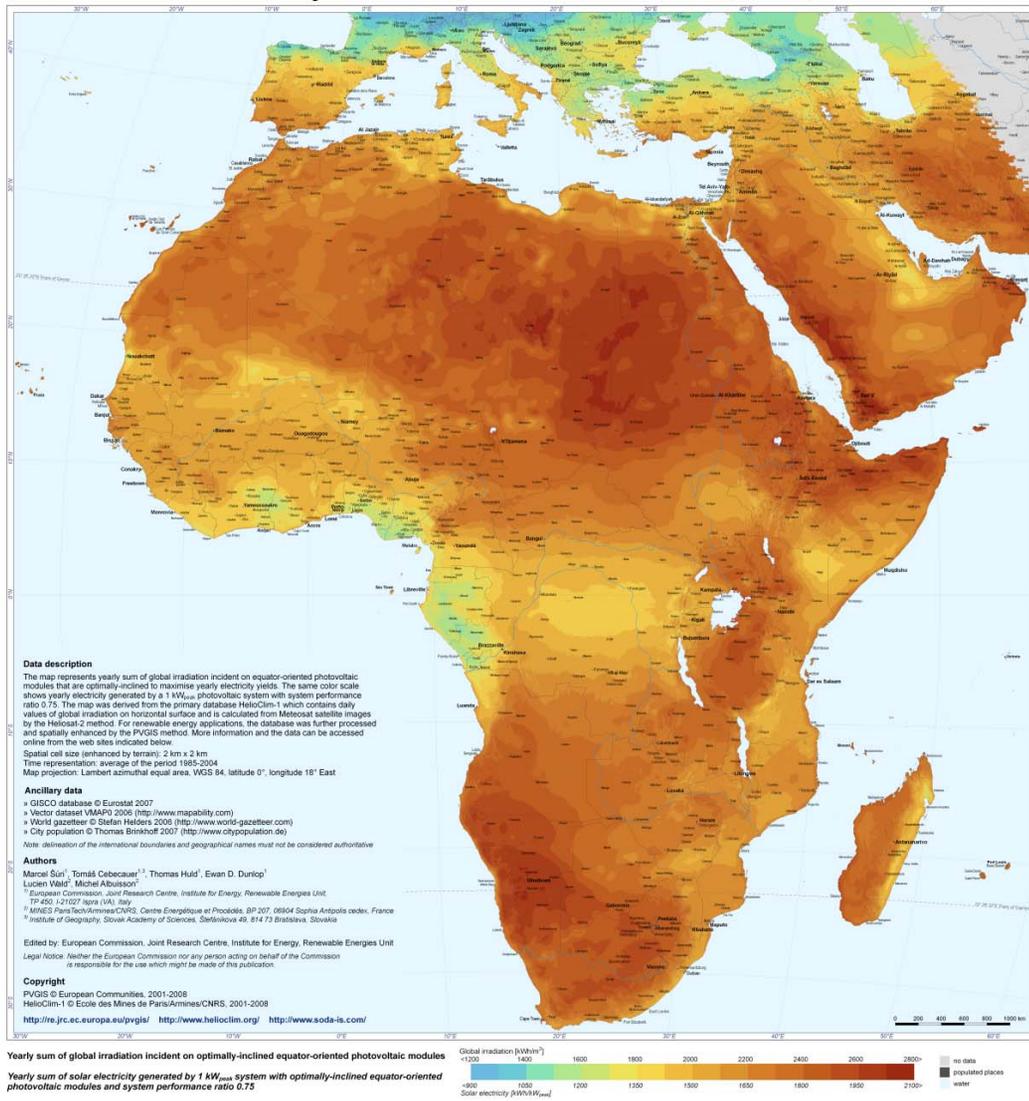
Efficiency as percentage
of the nominal value, for
free-standing modules

Crosses represent locations with data

- **African database**

- Data based on calculations from satellite images
- Data provided by Ecole de Mines de Paris, France
- Relatively low resolution: 30x30km
- Long time series: daily values from 1985-2004
- Limited validation in Africa due to sparseness of ground station measurements
- Air temperature data not available

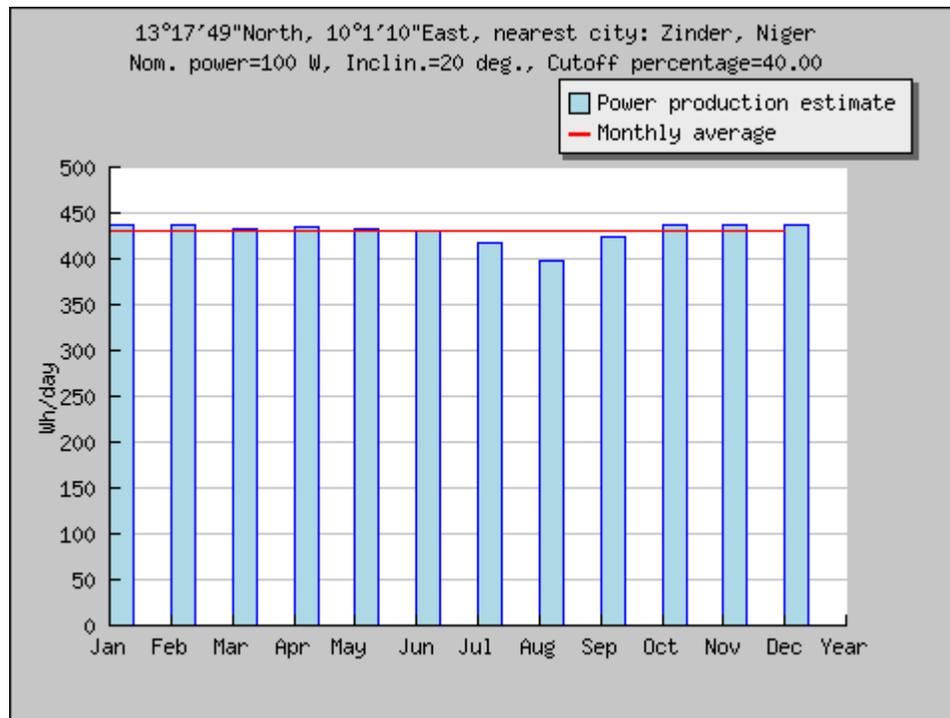
Photovoltaic Solar Electricity Potential in the Mediterranean Basin, Africa, and Southwest Asia



Off-grid PV calculator

- Requires high time resolution data (daily or better)
- Calculates the performance of stand-alone PV systems
- Available only for Africa right now
- Known problems:
 - Lack of data on performance of stand-alone systems
 - Lack of data on power consumption patterns

Sample calculation for off-grid system



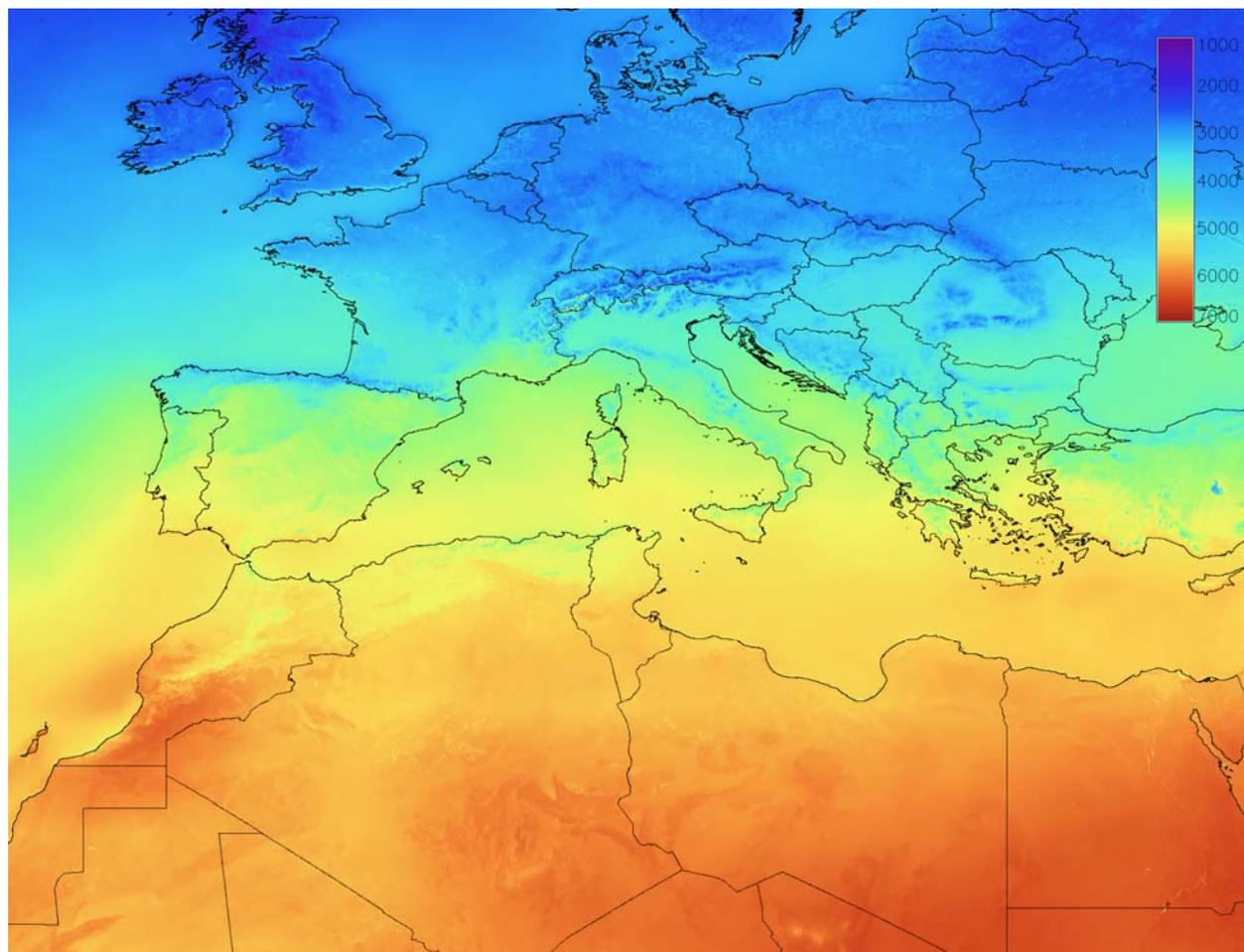
100Wp PV panel
12V, 40Ah battery
450Wh daily consumption

Improvements needed

- Quality improvements in the solar radiation data
- Higher temporal resolution, for research on intermittency and for off-grid PV installations
- Direct normal irradiance for concentrating PV applications
- Temperature data needed for Africa

- Collaboration with DWD on high-resolution satellite-based data. Incorporation into PVGIS in 2010.
- Need for more solar radiation measurements for validation of satellite-based methods in Africa

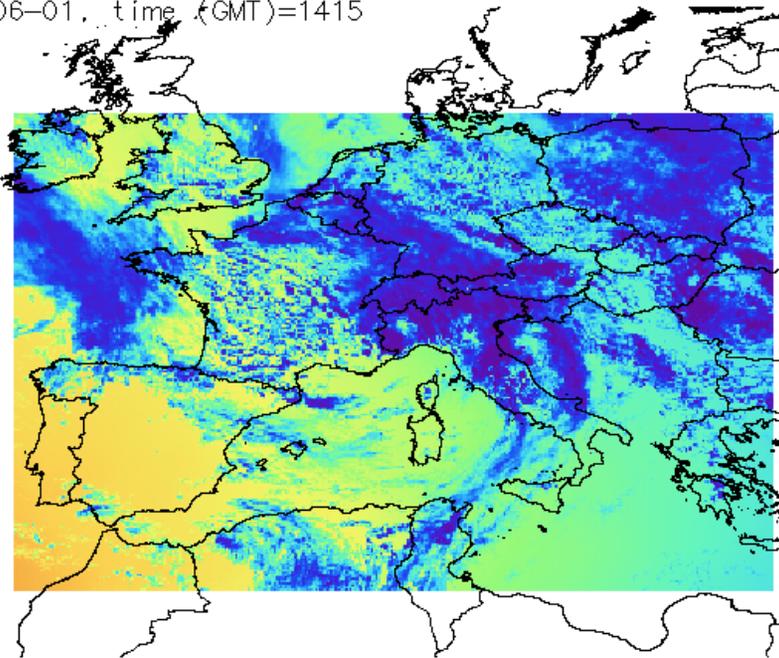
Data from DWD CM-SAF



Global horizontal irradiation,
(Wh/m²/day)
Annual average
based on 3.5 years
of data

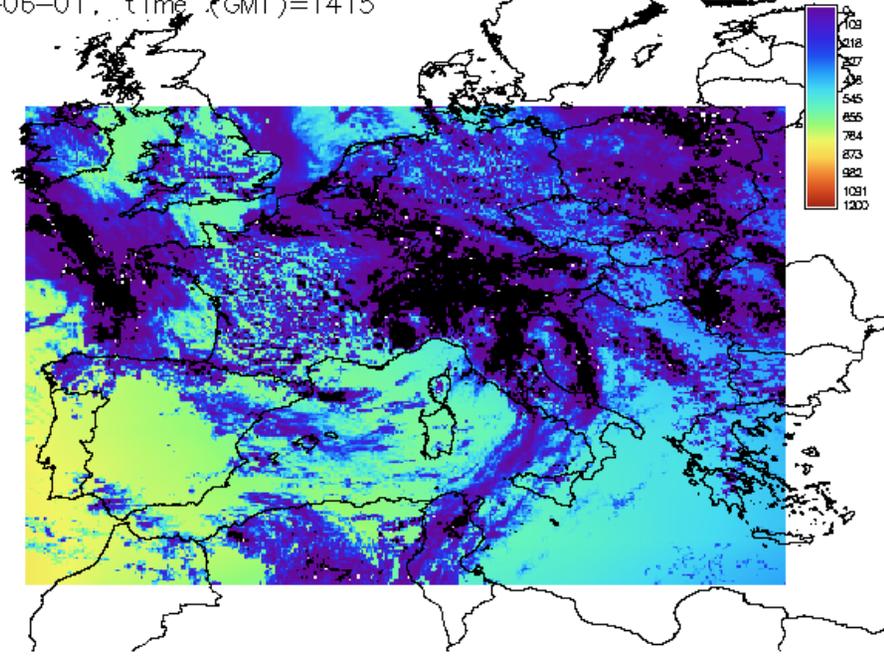
Sample data from DWD CM-SAF

Date: 2007-06-01, time (GMT)=1415



Global horizontal irradiance

Date: 2007-06-01, time (GMT)=1415



Direct horizontal irradiance