



Coordinating and integrating state-of-the-art Earth Observation Activities in the regions of North Africa, Middle East, and Balkans and Developing Links with GEO related initiatives towards GEOSS

GEO-CRADLE Regional Workshop in Cairo,
Addressing regional needs in the Middle East to Earth Observation
May 24th, 2017, Cairo, Egypt

The Solar Energy Nowcasting System (SENSE)

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GEO-CRADLE Regional Workshop in
Cairo, 25/5/2017



The GEO-CRADLE project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 690133.





Addressing regional needs in the Middle East to Earth Observation

Main Goal: To exploit solar energy potential of Middle East countries using satellite based Earth Observation systems

Problem: Optimizing solar energy integration to the electrical grid

- Use synergies of satellite measurements, modeling and machine learning techniques for solar energy now-cast and forecast on high spatial and temporal resolution
- Use scientific data of solar energy long term series for solar energy planning
- Create synergies with public and private sector (solar plants, energy distributors, solar energy related end-users).

Impact on:

- **Forecasting solar variability**
- **Energy storage**
- **Production distribution**
- **Demand management**

Access to energy (Sense), Partners: PMOD/WRC, NOA

Sense: a solar energy now-casting and short term forecasting system

Purpose:

- **Demonstrate ways to maximize value and benefits at the Region of Interest (e.g. mid. East). Contribute to energy related capacity building.**
-
- **Create synergies with public and private sector (solar plants, energy distributors, solar energy related end-users).**

Provision of (tailored to end-user):

- **Now-casting and forecasting of solar radiation and solar energy**
- **Long term solar energy atlases for various areas with high temporal and spatial detail**
- **Solar radiation related products (real time and forecasts) related with: health (UV Index (melanoma), DNA damage, cataract, Vitamin D efficiency), agriculture (photosynthesis), scientific..**

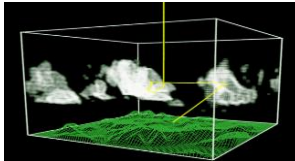
Satellite Data



Copernicus Atmospheric Monitoring Service



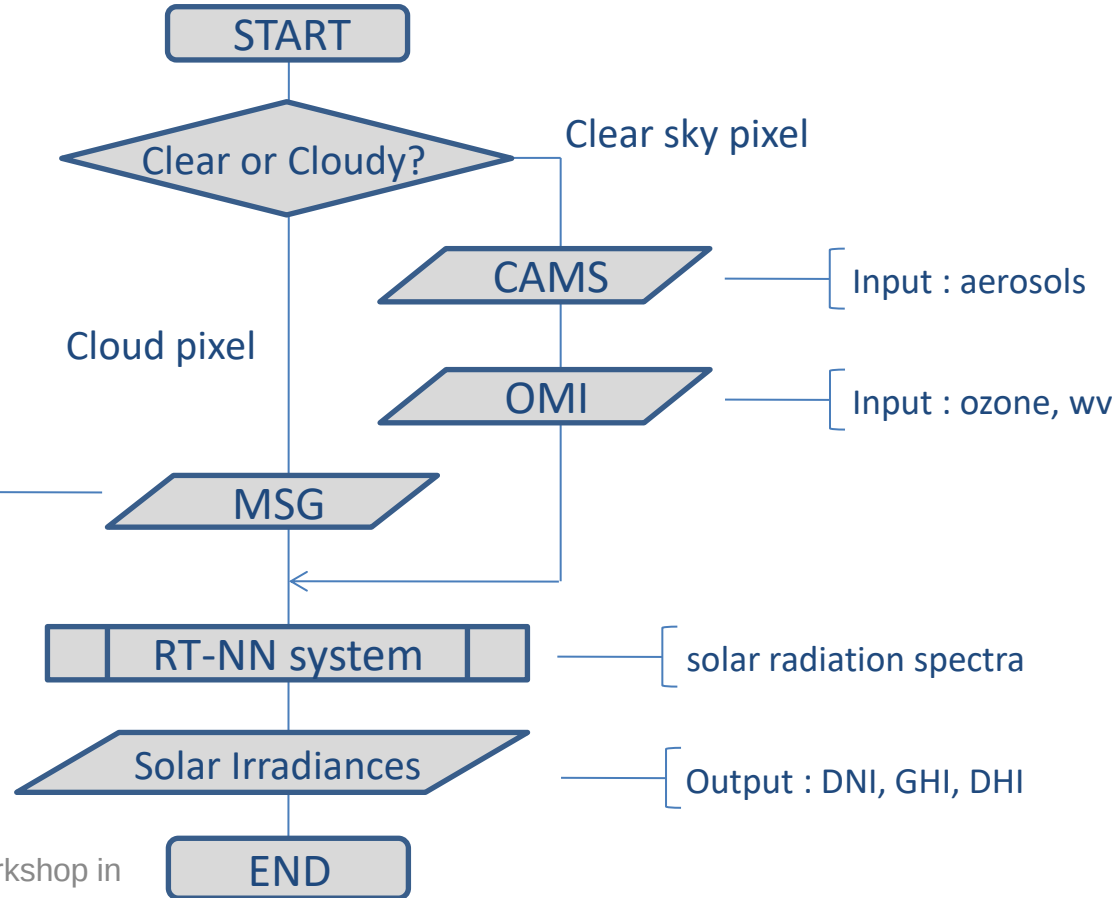
Radiative Transfer models



Neural networks



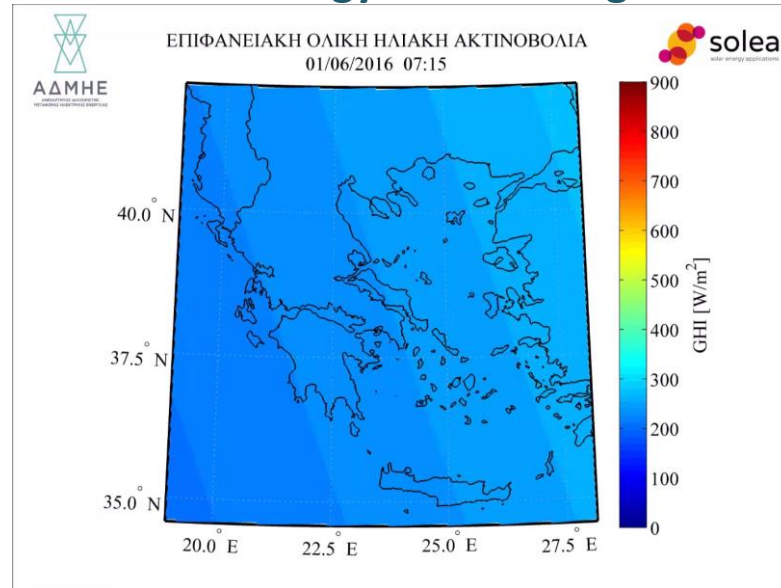
Cloud Input
MSG



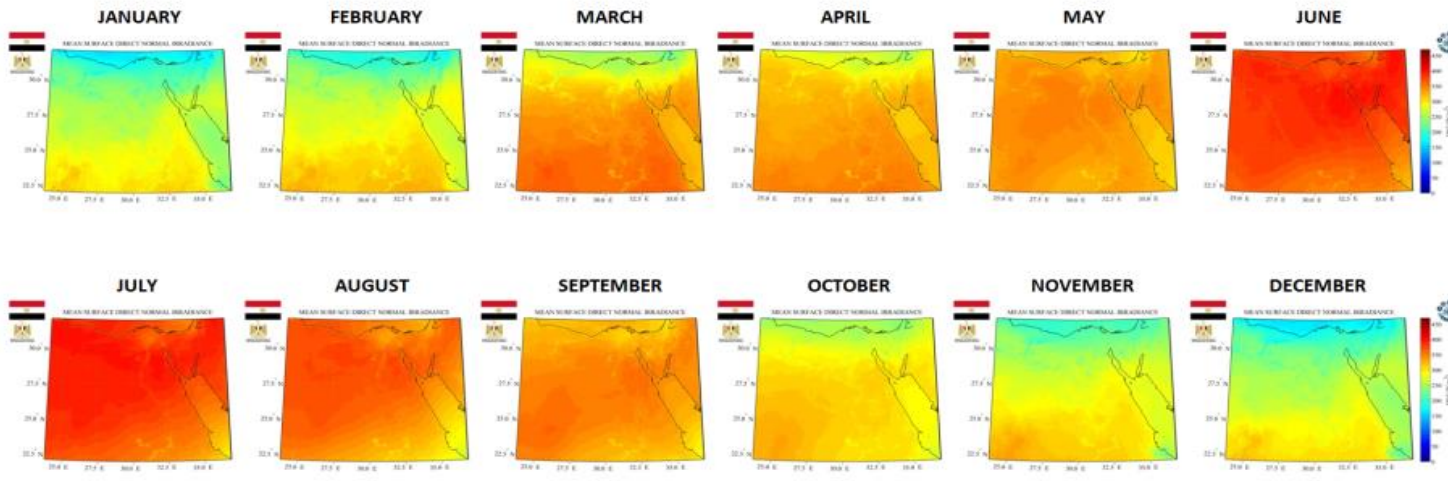


- IPTO is the Independent Power Transmission Operator for Greece
- Control the energy demands

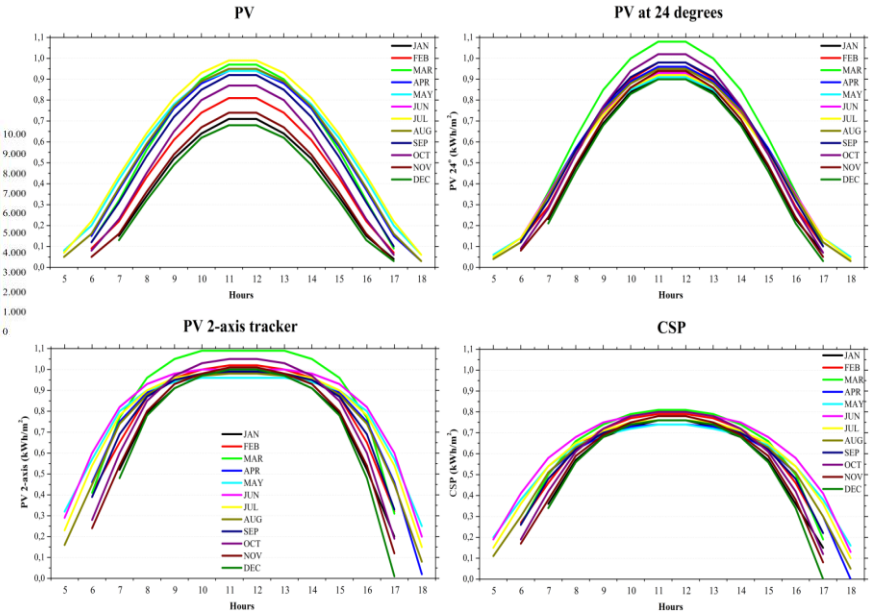
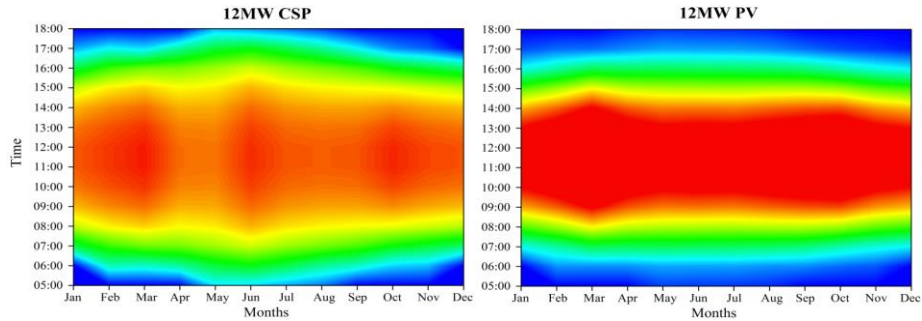
Solar Energy now-casting



- Optimum locations for CSP & PV installations using solar Atlas energy maps



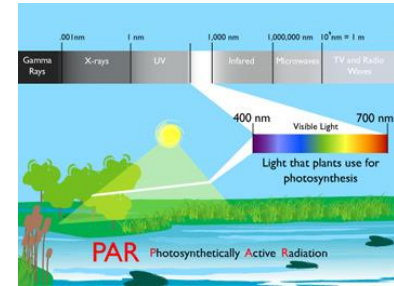
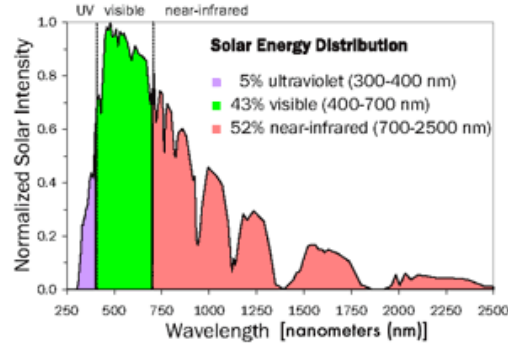
- Optimum locations for CSP & PV installations using solar Atlas energy maps



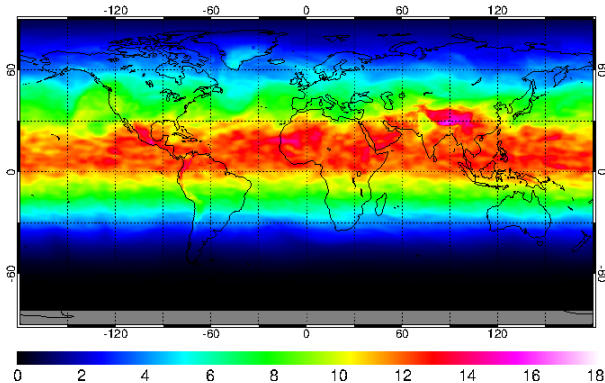


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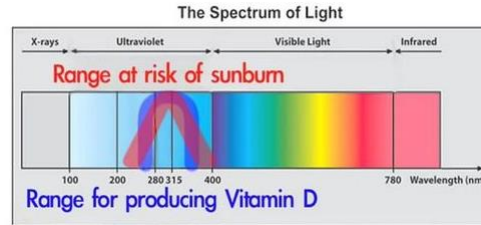
SENSE Spectral product



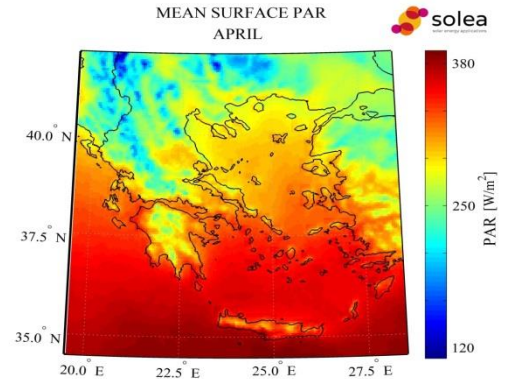
UV Index, May 24, 2017



Medical: Vitamin D production



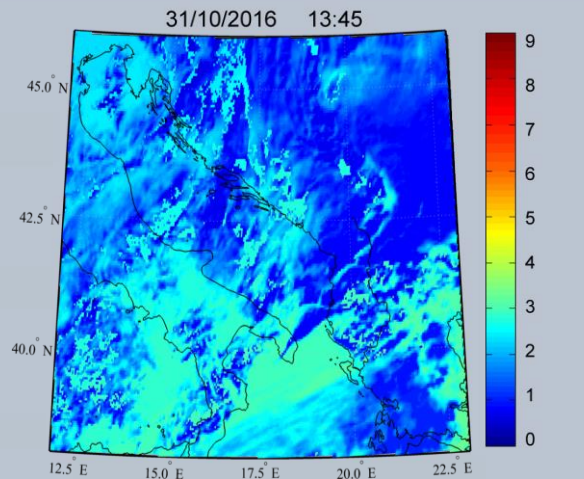
Agriculture: Photosynthetically Active Radiation



SUPERFAST FERRIES

provided by **solea**
solar energy applications

UV index
ΔΕΙΚΤΗΣ ΥΠΕΡΙΔΟΥΣ ΑΚΤΙΝΟΒΟΛΙΑΣ



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GEO GROUP ON EARTH OBSERVATIONS

Openicus
European Union Earth



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<ftp://UVAK:12@194.177.195.105/UVAEG.png>

Active links

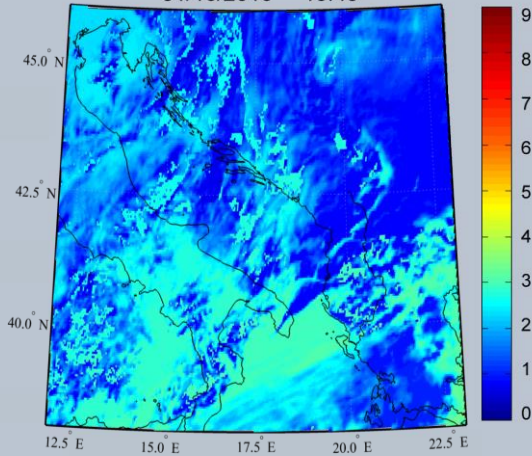
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SUPERFAST FERRIES

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31/10/2016 13:45



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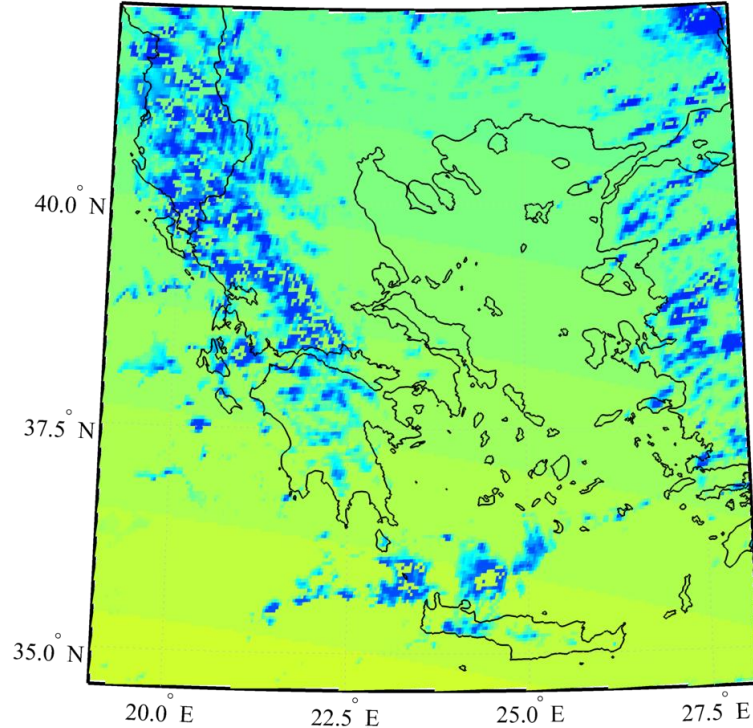


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Openicus
European open science



11/11/2016 12:45



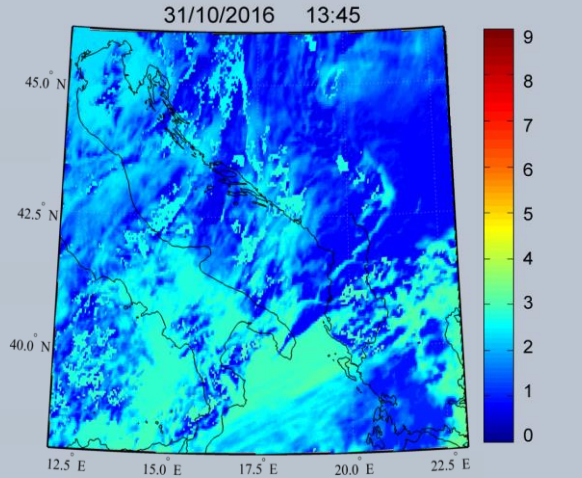
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Active links

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SUPERFAST FERRIES

provided by **solea**
solar energy applications

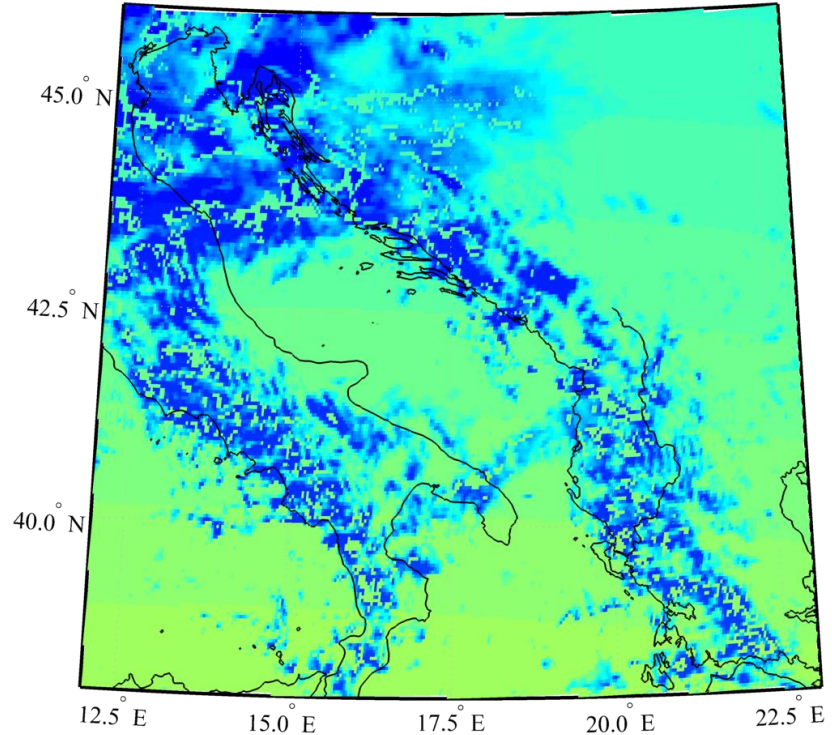


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Openicus
European open air Earth

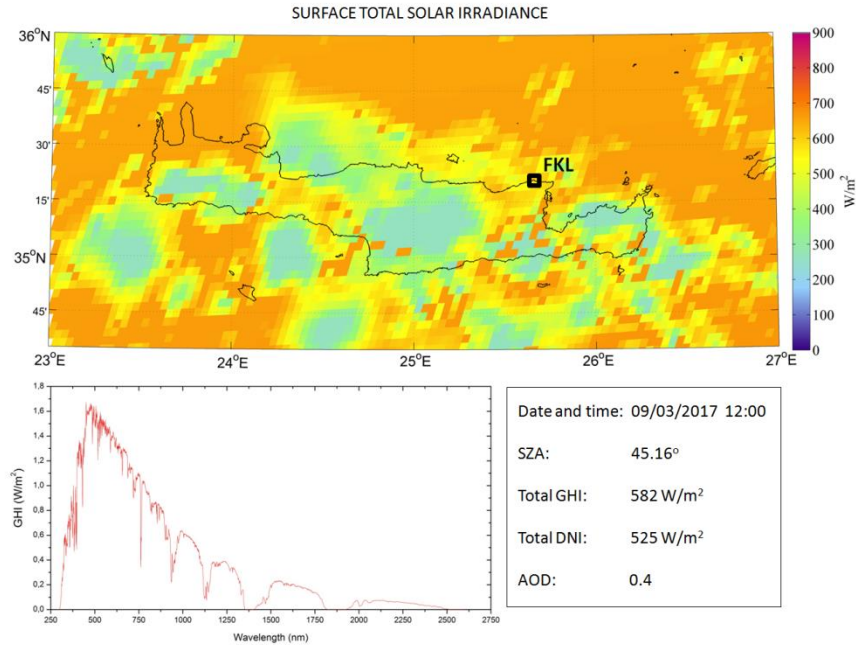


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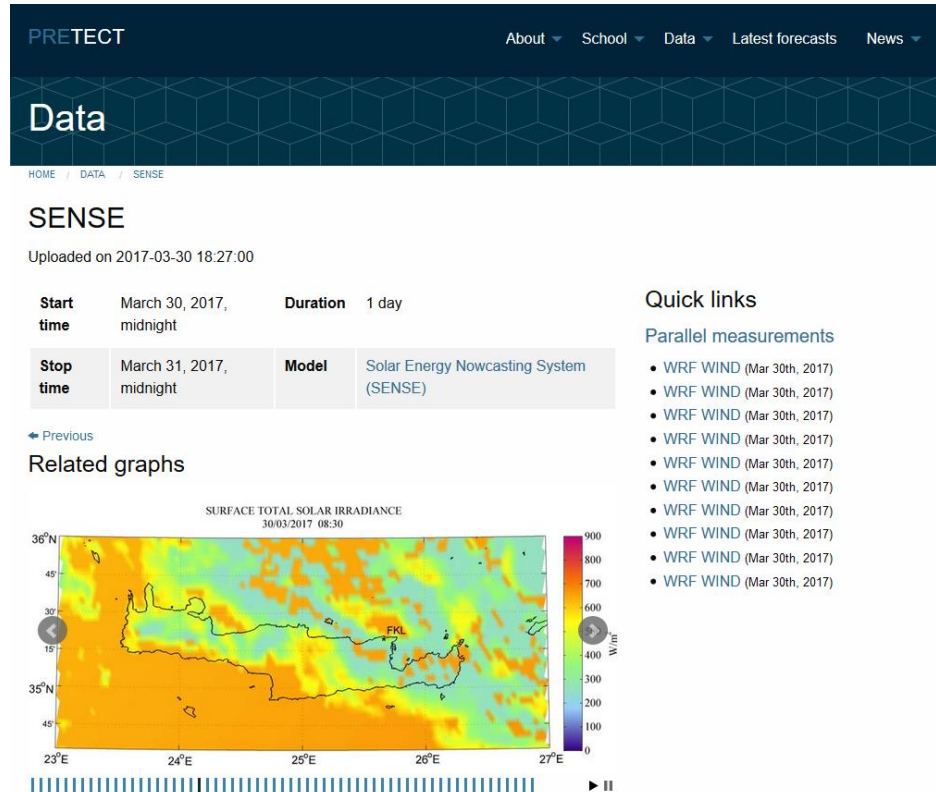
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Impact on aerosols on solar energy

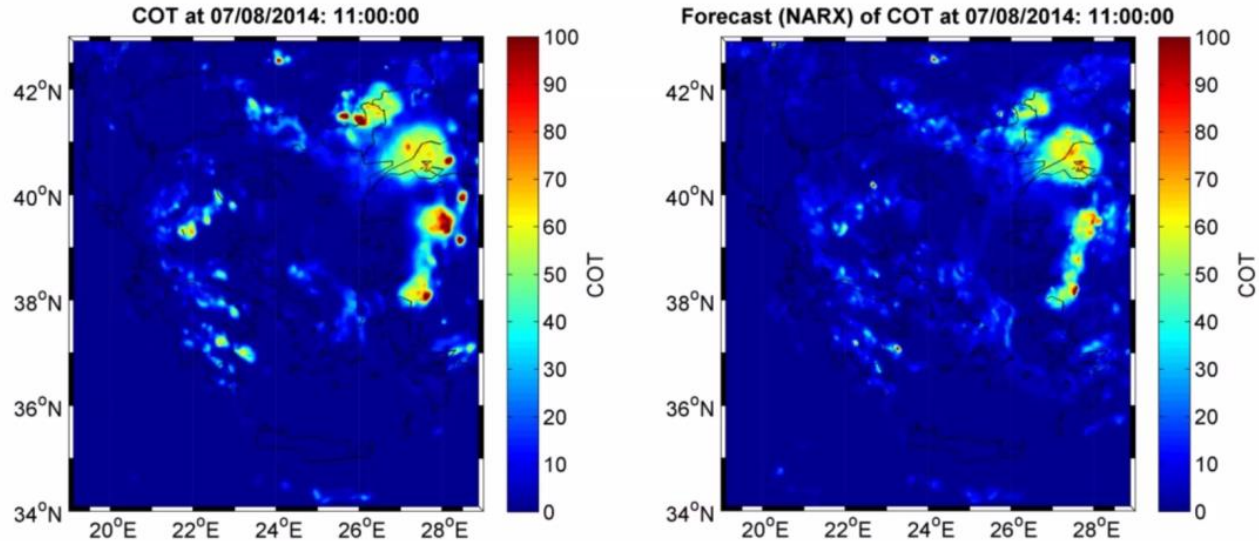
Active link:

<http://pre-TECT.space.noa.gr/instruments/25/>

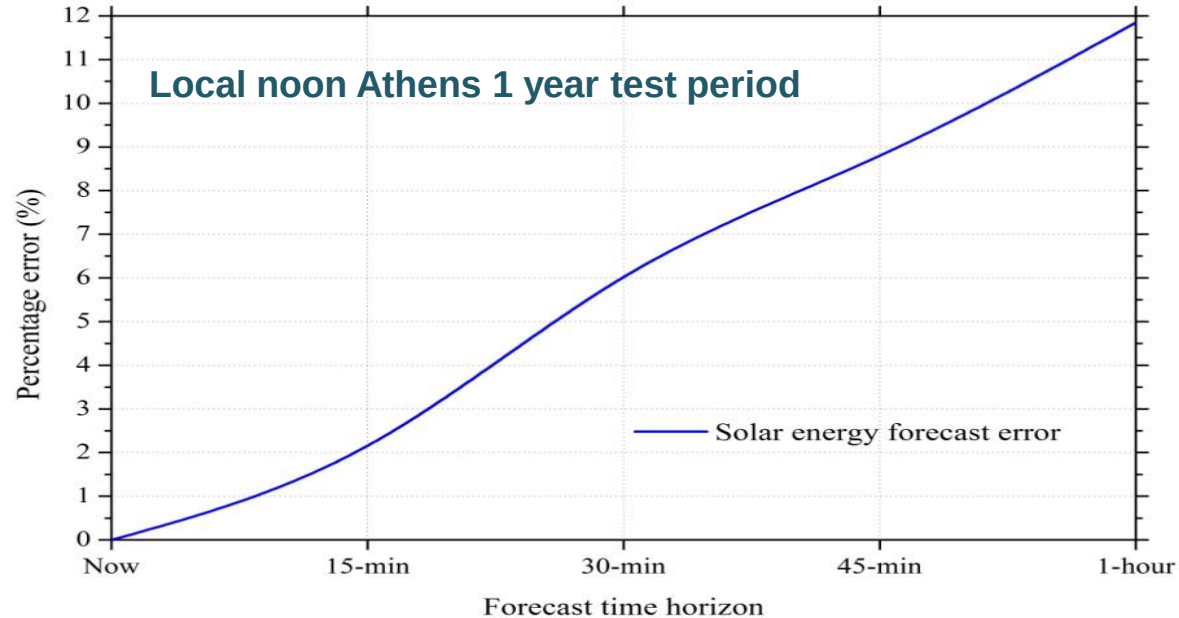


Graph 1.21: Surface total solar irradiance - 2017-03-30 08:30

Cloud forecast 0 -2 hours narx method



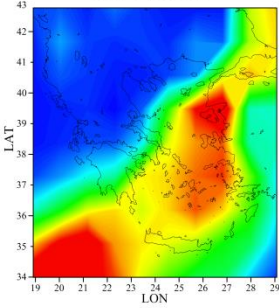
Cloud forecast 0 -2 hours narx method



➤ CAMS validation under extreme dust event

AOD

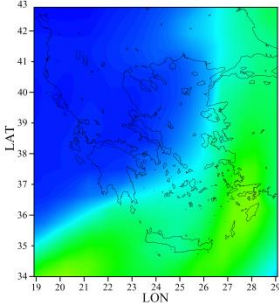
MODIS AOD



AOD

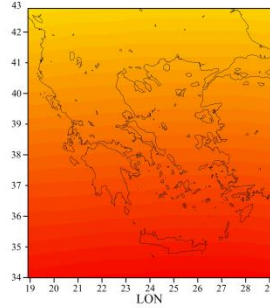


CAMS AOD

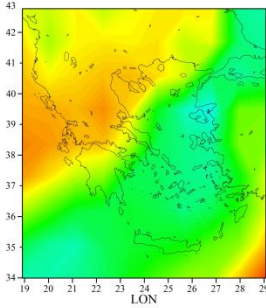


GHI & DNI

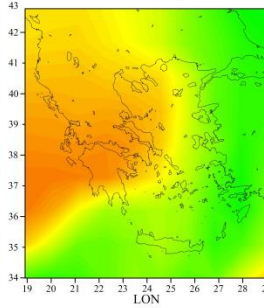
GHI0



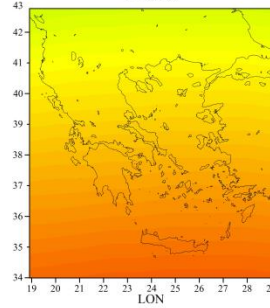
GHI MODIS



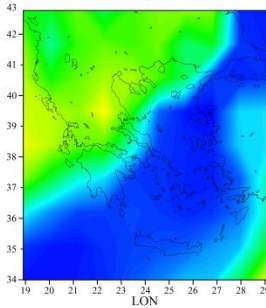
GHI CAMS



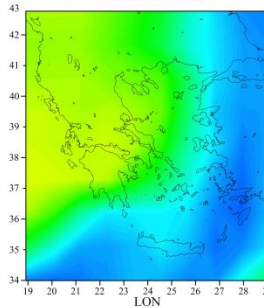
DNI0



DNI MODIS

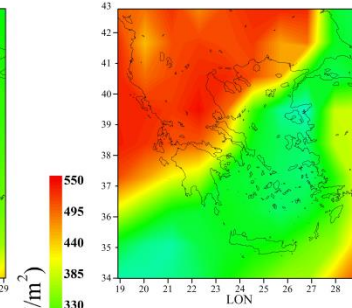


DNI CAMS

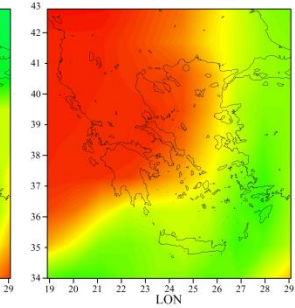


Energy impact

GHI MODIS attenuation



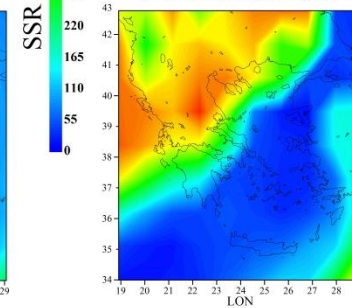
GHI CAMS attenuation



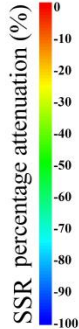
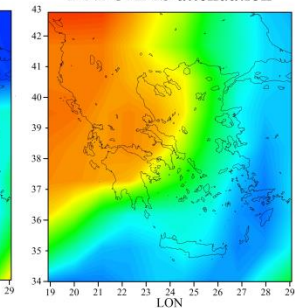
SSR (W/m²)

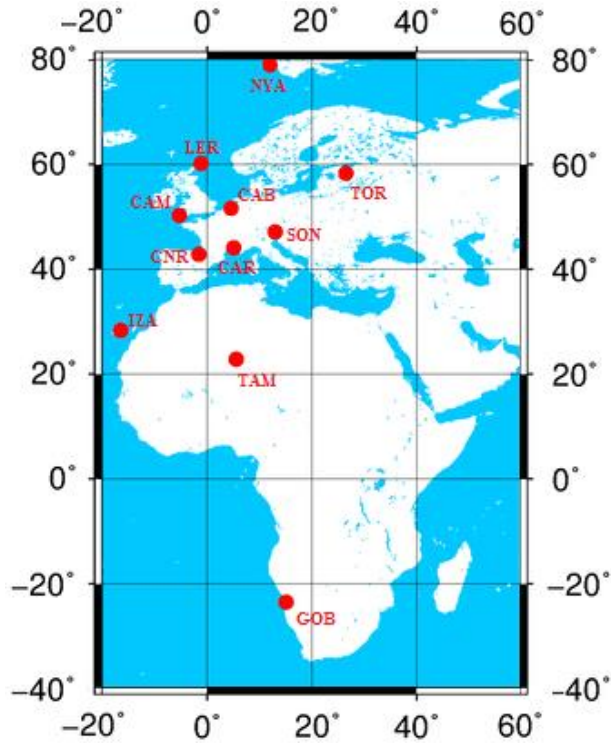


DNI MODIS attenuation

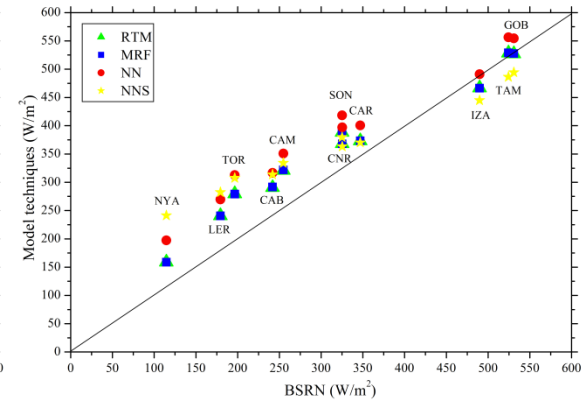
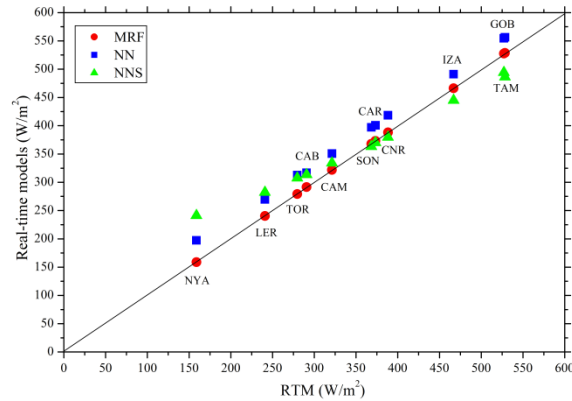


DNI CAMS attenuation





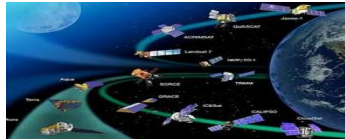
➤ SENSE validation with BSRN



The Solar Energy Nowcasting and Forecasting System SENSE

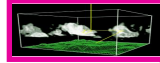
Geo-Cradle users

SENSE



Satellite Data

Radiative
Transfer
models



Neural
networks

- Solar power production **now-casting and forecasts**, from $t+0$ min to $t+2$ hours ahead, with a time resolution from 15 minutes
- Nowcasts and forecasts on different spatial horizons: from the **local plant production to the country scale**
- integration in any already existing Information System. Possibility to add meteorological sensors on-site to **optimize forecasts**
- Use of solar irradiance spectra for: **Agricultural, health, biological** and scientific application and studies



The PRE-TECT campaign
Revealing the secrets of desert dust

1st – 30th April, 2017



Copernicus Atmospheric
Monitoring Service

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End users

- Private sector (direct, indirect)
- Public sector (energy operators, EPAs, public information sectors e.g. weather and meteorology related bodies)
- Government based initiatives
- EU projects (Scientific development, user oriented products, case studies)
- Bilateral calls
- Copernicus related calls

Sense can be implemented anywhere Middle East – tailored products

- Identify common calls for projects (e.g. GMES in Africa, AfriGEOSS)
- Capacity building
- Continuation collaboration with Egypt & Mediterranean countries

Municipalities, private and government based Energy transmission operators, solar farms, renewable energy planning, smart phone apps, health and agricultural sectors, scientific community

**Long term funding:
Science towards applications**



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Thank you

