

EO-based solar energy applications into a wider GEOSS driven system through the GEO-CRADLE project in the international scale



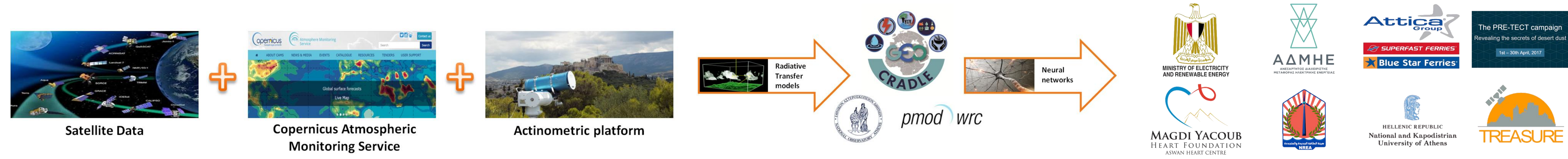
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Motivation & Methodology

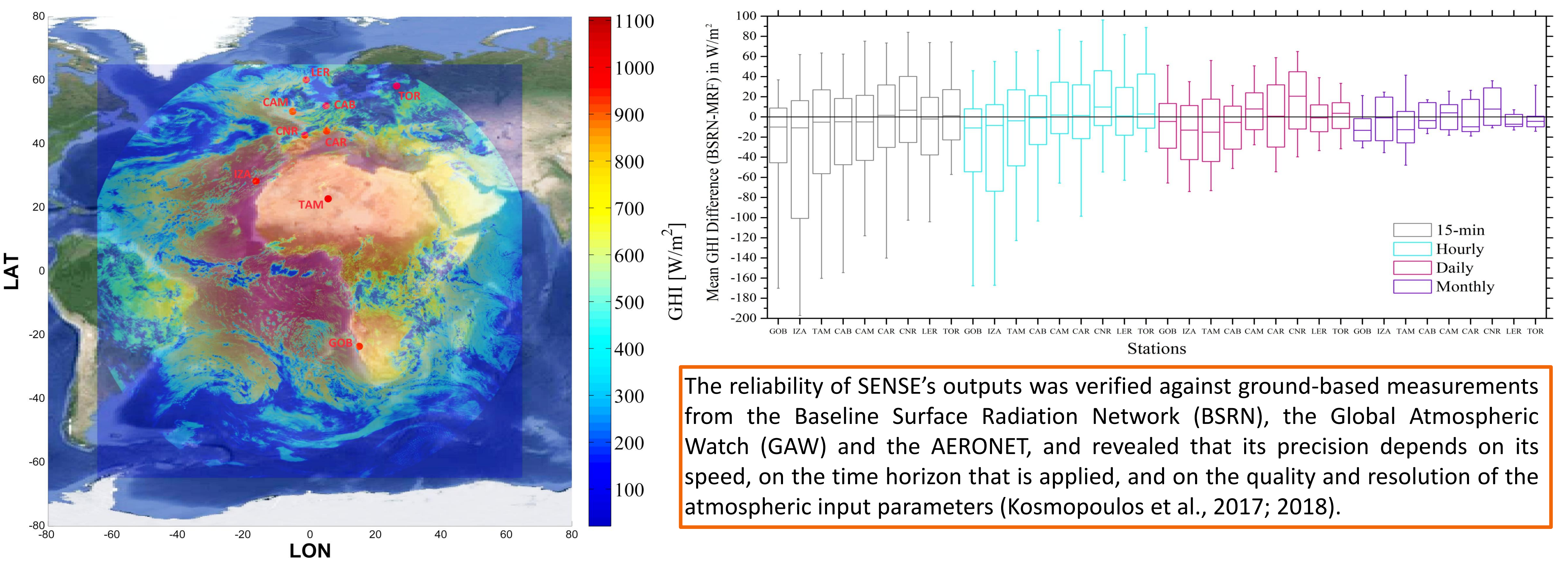
In the framework of the GEO-CRADLE project (<http://geocradle.eu/en/>), we introduced a novel Solar Energy Nowcasting System (SENSE; <http://solea.gr/>), in order to coordinate, improve and support the regional Earth Observation (EO) infrastructures and capabilities, in Europe, North Africa and Middle East, related to "access to energy". The niche for this feasibility study is the operational, satellite-driven and real-time system for solar energy applications. SENSE was intended to be a starting point for energy related investments towards and beyond the implementation of GEO, GEOSS and Copernicus Energy activities and envisioning innovative high-end applications and technologies with multifarious collaborations and carefully selected end-users. Towards this direction, the SENSE's objectives were: (i) the effective dissemination of the high precision and resolution nowcasting and forecasting solar energy services for the fulfillment of the regional needs taking advantage of the nowadays satellite data, efficient envision of new but crucial model inputs and state-of-the-art real time solar energy calculating system capabilities, (ii) development of reliable, high resolution solar Atlases and broader climatology studies for the RoI, and (iii) engraving strategy methods of how to integrate such a solar energy nowcasting system into a wider GEOSS driven system in the international scale.

1. The SENSE pilot



SENSE is based on the synergy of Radiative Transfer Model (RTM) simulations, speed-up technologies (neural networks and multi-regression functions) and real-time atmospheric inputs from the Spinning Enhanced Visible and Infrared Imager onboard the Meteosat Second Generation satellite (MSG/SEVIRI) and the Copernicus Atmosphere Monitoring Service (CAMS). As a result, solar energy products and services were operationally produced in high spectral, spatial and temporal resolutions (1 nm, 0.05 x 0.05 degrees, 15 min). Through the GEO-CRADLE's networking platform, SENSE succeeded in stimulating the interest of relevant energy stakeholders, decision makers and solar energy investors from the public and private sector like the Egyptian Ministry of Electricity and Renewable Energy, the Greek Power Transmission and Distribution System Operator, the Attica Group and various scientific communities (research institutes, universities, health sector).

2. The validation



The reliability of SENSE's outputs was verified against ground-based measurements from the Baseline Surface Radiation Network (BSRN), the Global Atmospheric Watch (GAW) and the AERONET, and revealed that its precision depends on its speed, on the time horizon that is applied, and on the quality and resolution of the atmospheric input parameters (Kosmopoulos et al., 2017; 2018).

3. The applications

The application fields of SENSE include the production planning support on large scale solar farm projects (photovoltaics and concentrated solar power plants) and the efficient control of the electricity balancing and distribution (in support to the TSOs and DSOs), by incorporating the produced energy of the solar farms into the electricity grid. At the same time, the surface solar radiation in different spectral regions highlight spectrally-weighted outputs like the UV-index, the Vitamin D efficiency and a number of agriculture and oceanographical related processes (<http://solea.gr/>).

From GEO-CRADLE's regional datahub to GEOSS portal and applications

All the above SENSE's implementations were transformed into EO-based SOLAR Energy Applications (SOLEA) and will be submitted to GEOSS portal as open access services and databases. Through GEOSS portal, SOLEA aims to fulfill the regional needs for optimum solar energy exploitation and for active and effective integration of these technologies to the national sustainable development economies and strategies. The forthcoming applications will include dynamic services with background databases for Europe, North Africa and Middle East, real-time and short-term forecast (3 hours ahead) products for energy (DNI and GHI in kWh/m²), health (UV-index and Vitamin D) and agriculture (PAR). As a result, SOLEA will enable mainly the solar industry to better plan clean energies, its transmission and distribution, which in turn will boost the relative contribution to national portfolios.

Major Applications & Contribution to Emerging Technology

- Location studies for the placement of CSP plants and PV installations
- Large-scale and precise solar energy calculations to assist Public Authorities in energy planning policy
- Supporting the work of various scientific communities
- Provision of specialized data of high spectral precision for private and public sectors dealing with health protection, energy consumption and solar energy exploitation

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