

Global Solar Dataset for PV Prospecting

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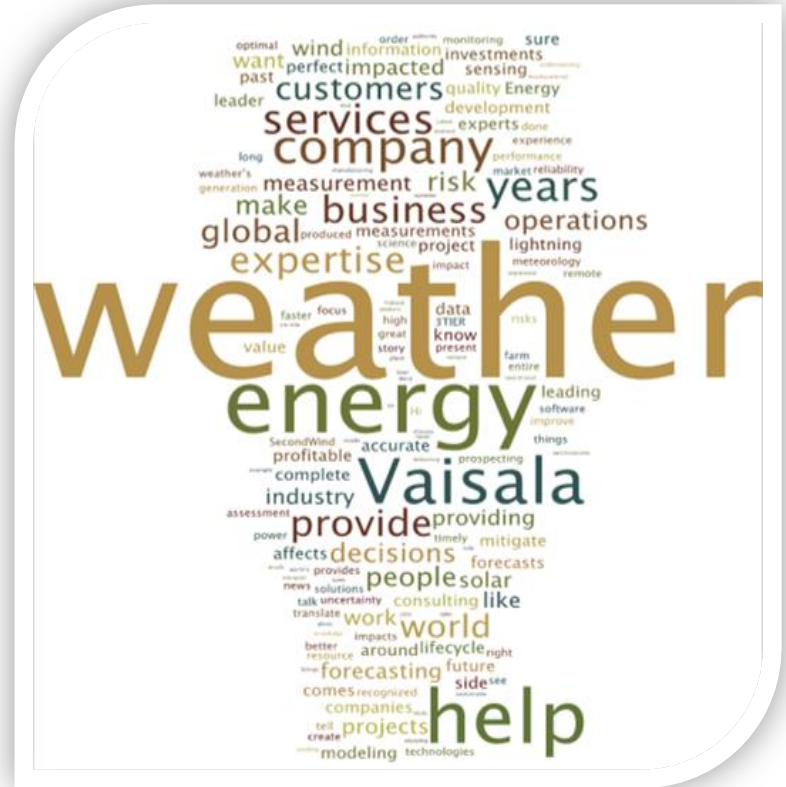
Vaisala is Your Weather Expert!

- We have been helping industries manage the impact of weather for nearly 80 years
- Our weather analysis and consulting services are based on proven science
- We help you understand the true impact of weather on your business, allowing you to improve efficiency and profitability

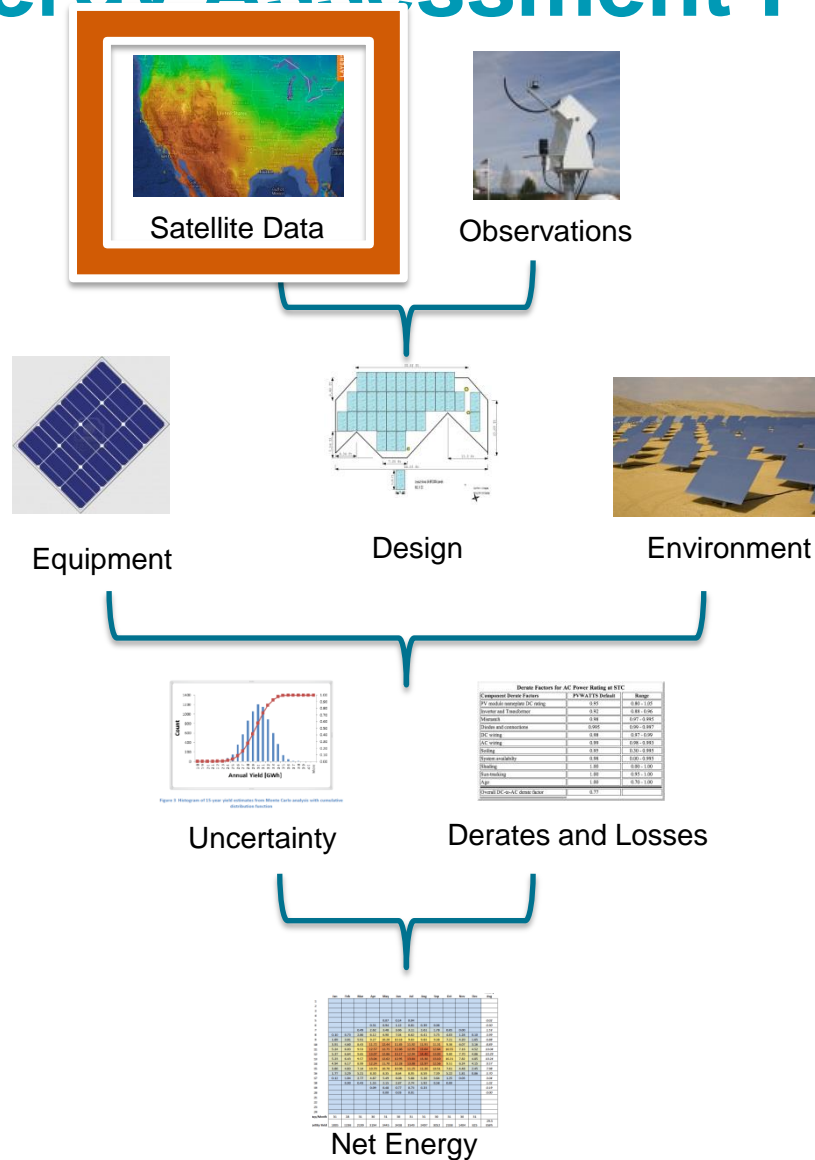


Solar Experience

- Developed the world's first high resolution solar irradiance dataset in 2009
- Delivered over 500 resource assessment projects on all 6 continents
- Produced financial grade energy assessments for more than 50 photovoltaic projects in countries including the United States, Brazil, India and others
- Supported over \$5.5 billion dollars worth of project financing for some of the largest PV and CSP plants in the world



Solar Energy Assessment Process



What Data is Available

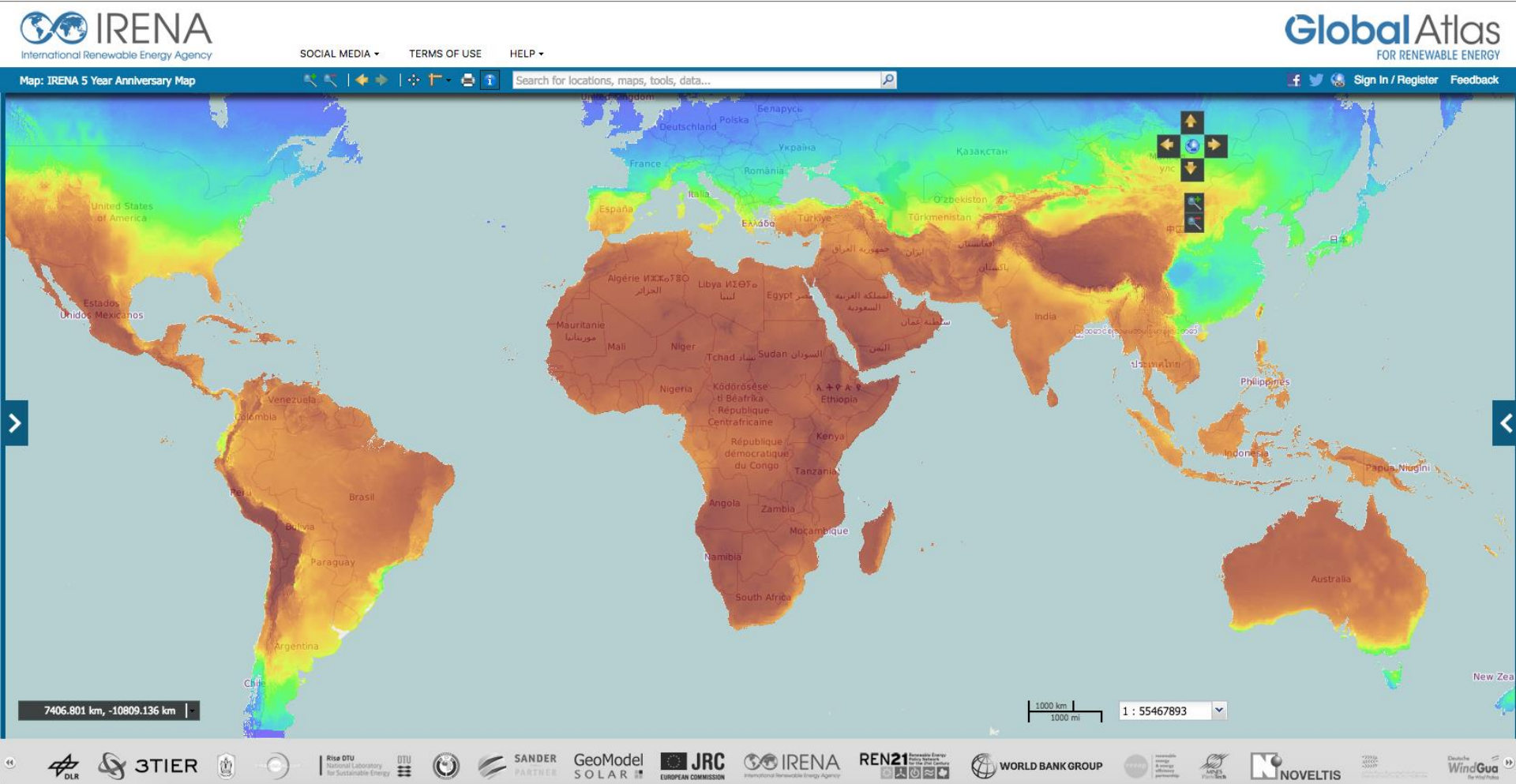
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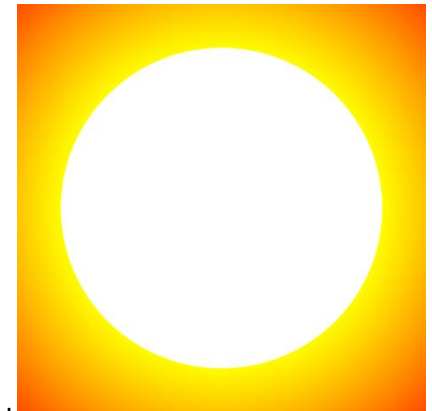
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Available IRENA Dataset



What Are We Looking For?



GHI – Global Horizontal Irradiance

Global horizontal irradiance is the total amount of shortwave radiation received from above by a horizontal surface. This value is of particular interest to photovoltaic installations and includes both direct radiation and diffuse radiation.



DNI – Direct Normal Irradiance

Direct radiation is solar radiation that comes from the direction of the solar disk in the sky. This value is important for concentrating solar power installations and tracking photovoltaic installations.



DIF – Diffuse Irradiance

Diffuse radiation is solar radiation that has been scattered by molecules and particles in the atmosphere and comes equally from all directions.

On a clear day, most of the solar radiation received by a horizontal surface will be direct radiation, while on a cloudy day most will be diffuse radiation.

Available IRENA Dataset

10 year annual means of GHI

Temporal Coverage

<u>Region Covered</u>	<u>Satellites Used</u>	<u>Dates</u>
<u>Western Hemisphere</u>	<u>GOES 8-13</u>	<u>January 1997 - December 2010</u>
<u>South Asia and Middle East</u>	<u>Meteosat 5 and 7</u>	<u>January 1999 – December 2010</u>
<u>East Asia and Oceania</u>	<u>GMS 5, GOES 9, MTSAT 1-2, Himawari8</u>	<u>December 1998 – December 2010</u>
<u>Europe and Africa</u>	<u>Meteosat 7, Meteosat 9-10</u>	<u>July 1998 – December 2010</u>

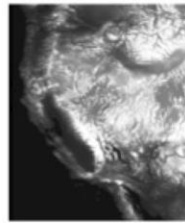
Spatial Coverage



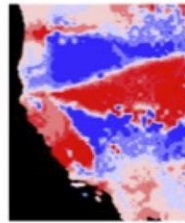
Data is available between 60 degrees North and 58 degrees South.

Satellite Derived Assessments

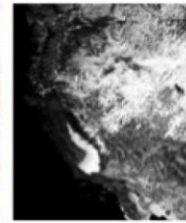
Shuttle Radar
Topography
Mission
(SRTM)



Elevation



Turbidity



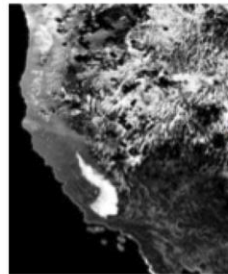
Raw Data



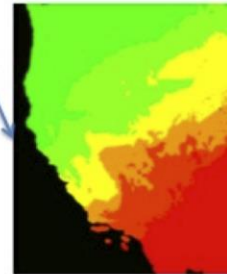
Snow Cover

IMS Daily
Northern
Hemisphere
Snow and Ice
Analysis

MODIS
Atmosphere
Daily Global
Product



Cloud Index

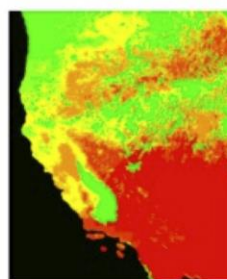


Clear Sky Irradiance

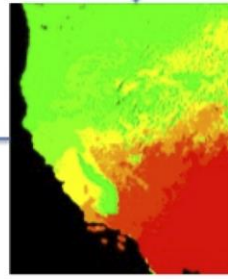
5 Geostationary
Satellites

Proprietary
3TIER Services
cloud algorithm

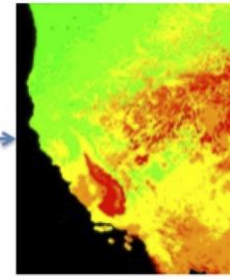
Perez SUNY
methodology



DNI



GHI



DIFF

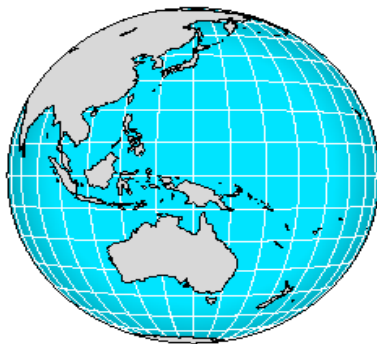
Satellite Derived Assessments

Benefits

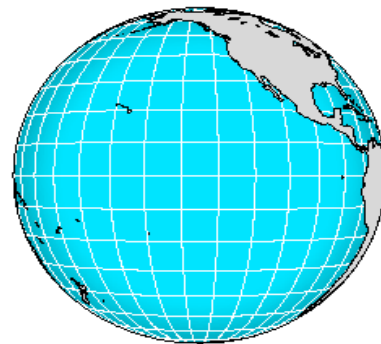
- Consistent global approach.
- Interannual variability captured with multiple years of data
- Satellite derived data is known to be the most accurate source of irradiance information beyond 25 km of a well-maintained ground station (Zelenka et al., 1999)

Considerations

- Greater uncertainty than observations (over the same time period)
- Known issues with satellite modeling include areas of high albedo, turbidity modeling, areas of snow cover and satellite degradation



140° E



GMS-5

135° W



GOES-9

75° W

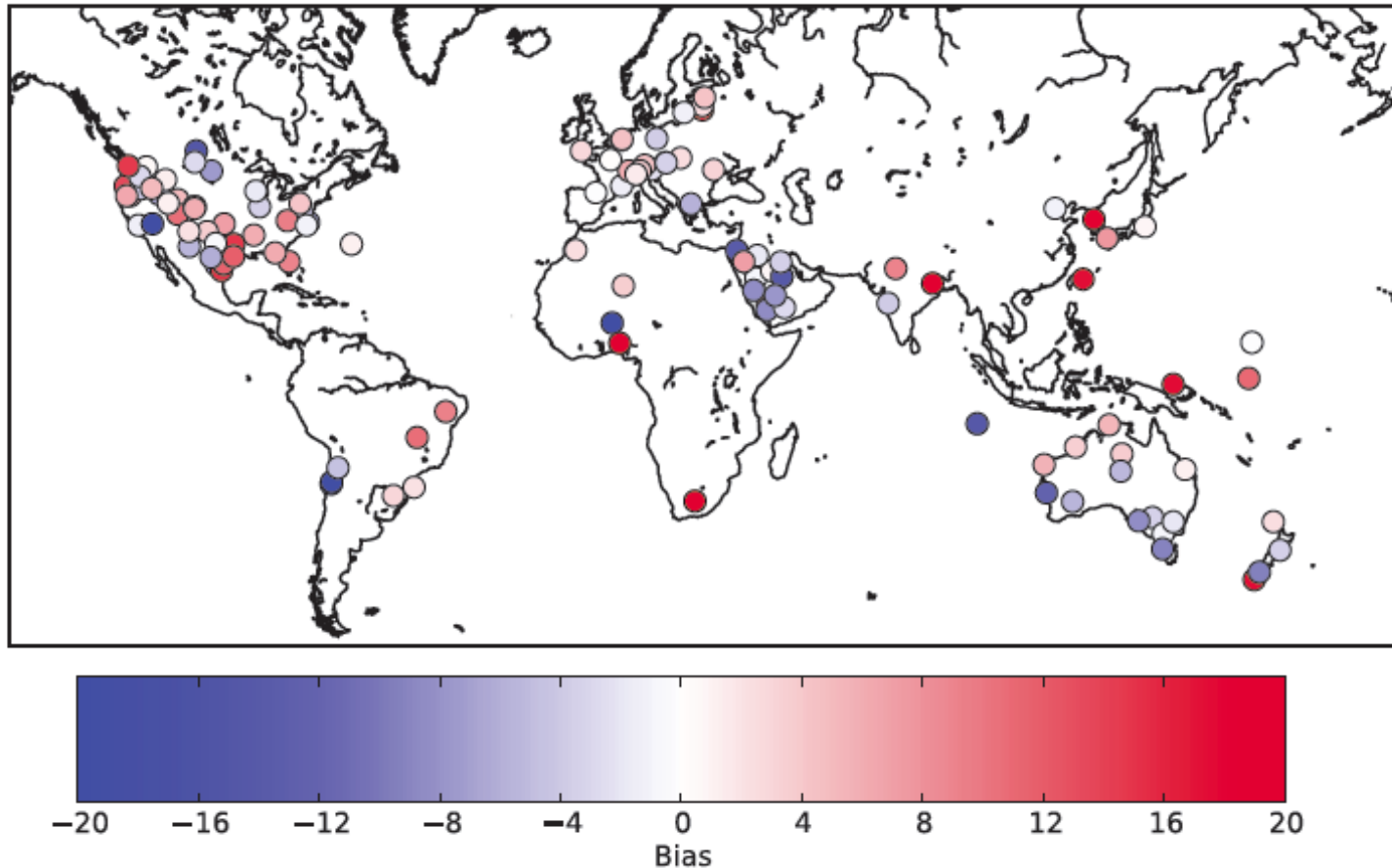


GOES-8

0°

Meteosat-5

Independent Validation of Accuracy



Percent bias for GHI against 100+ independent ground stations for an overlapping period of time

How to Use the Data

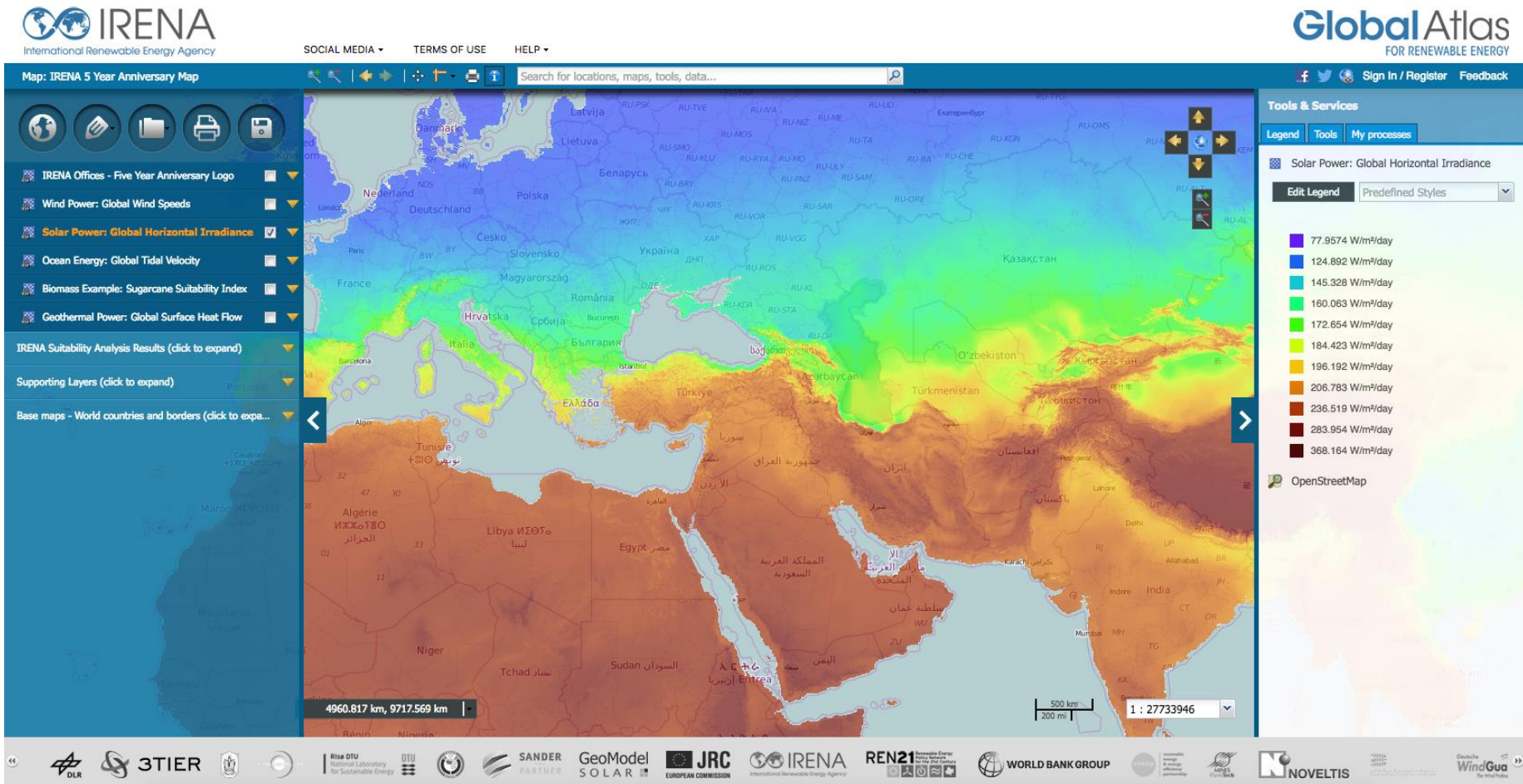
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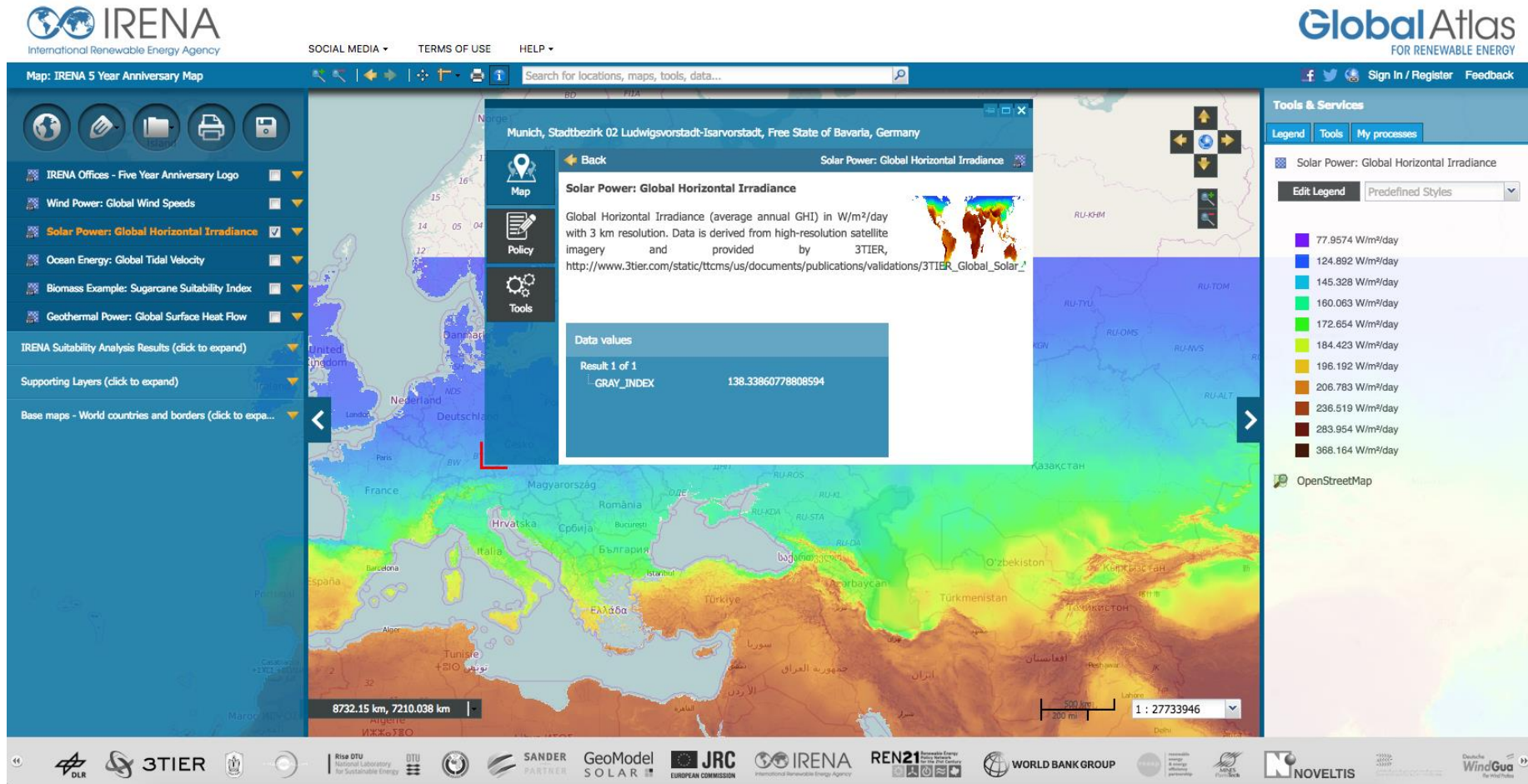
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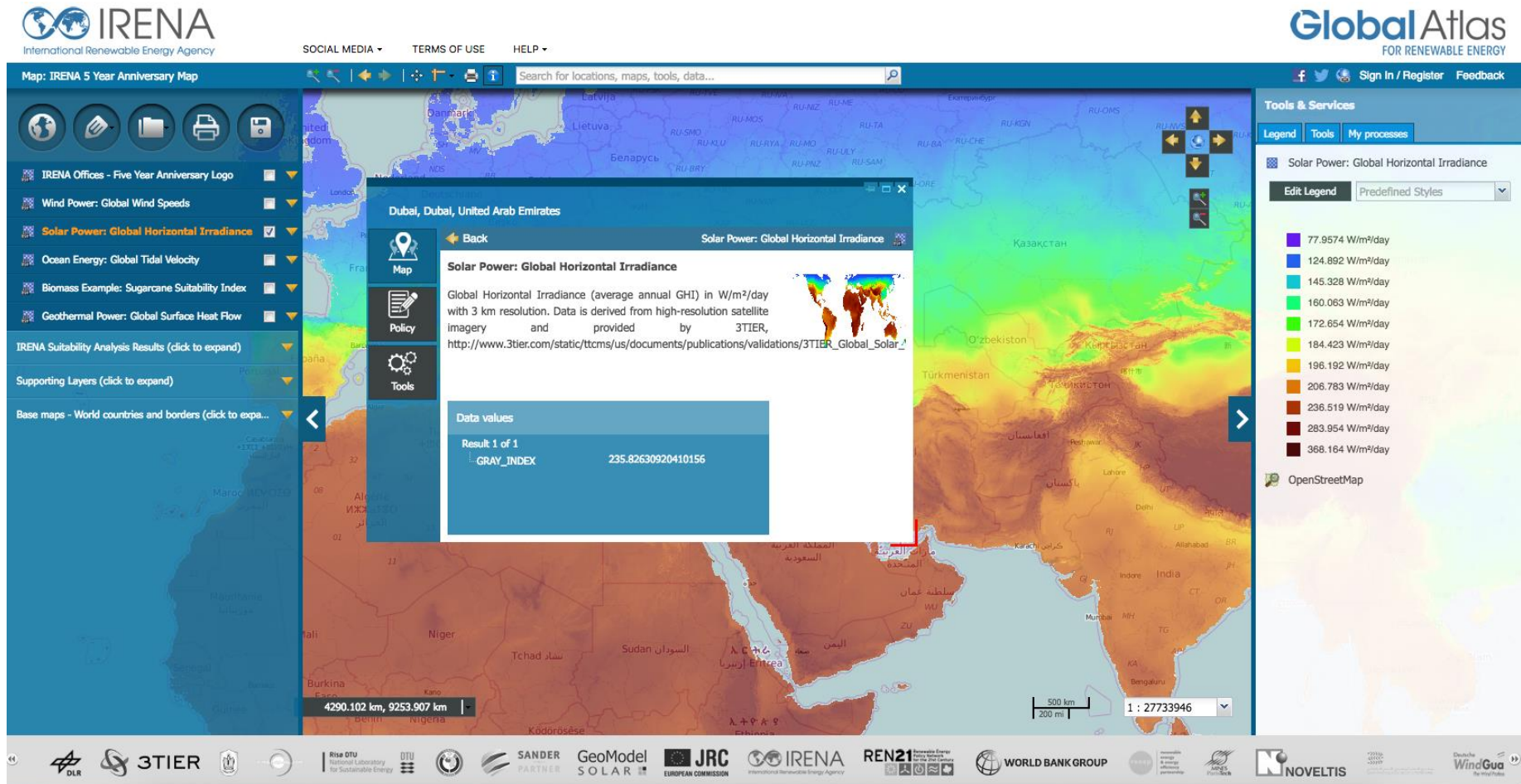
Comparing Locations in IRENA



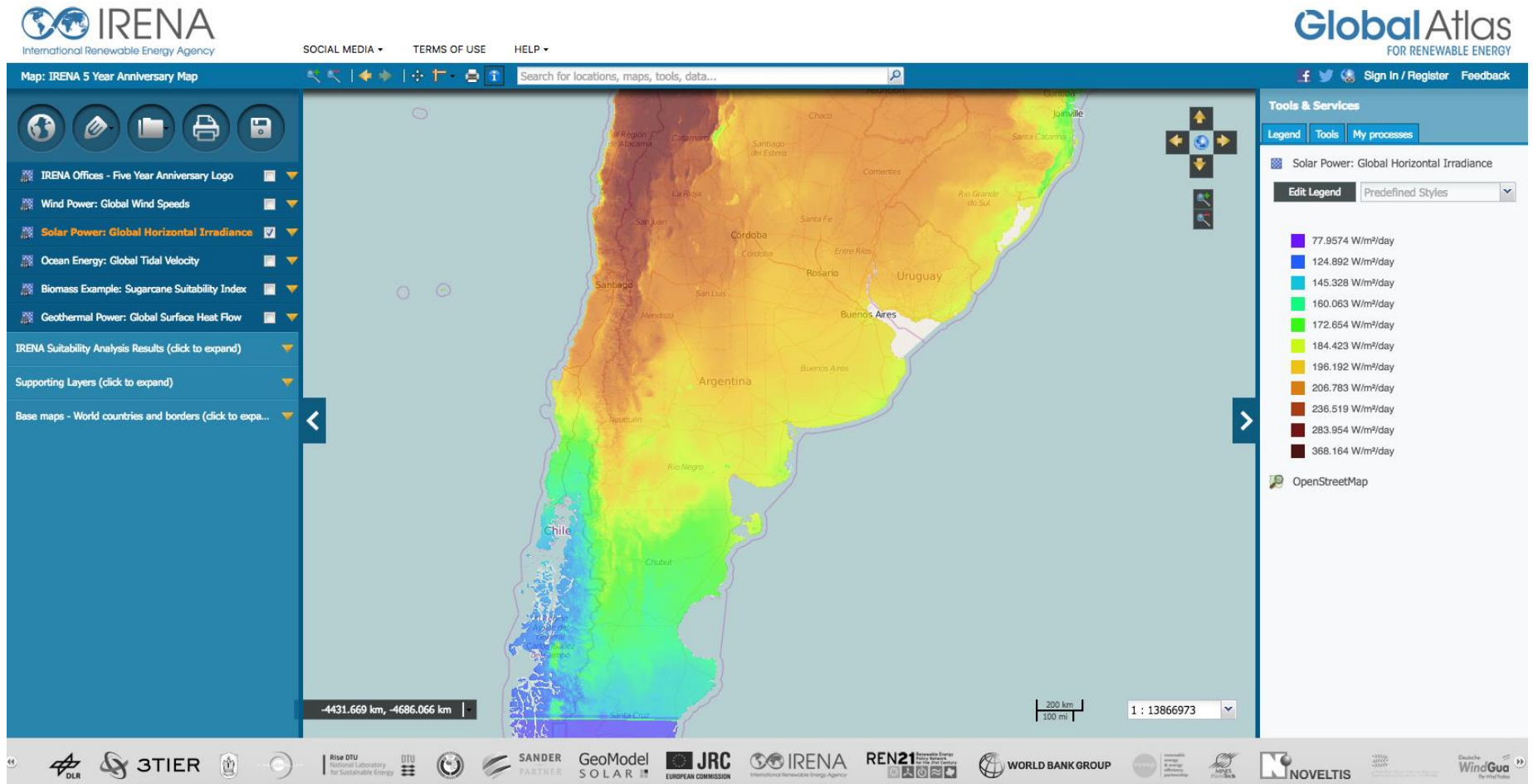
Comparing Locations in IRENA



Comparing Locations in IRENA



Comparing Locations in IRENA



Next Steps

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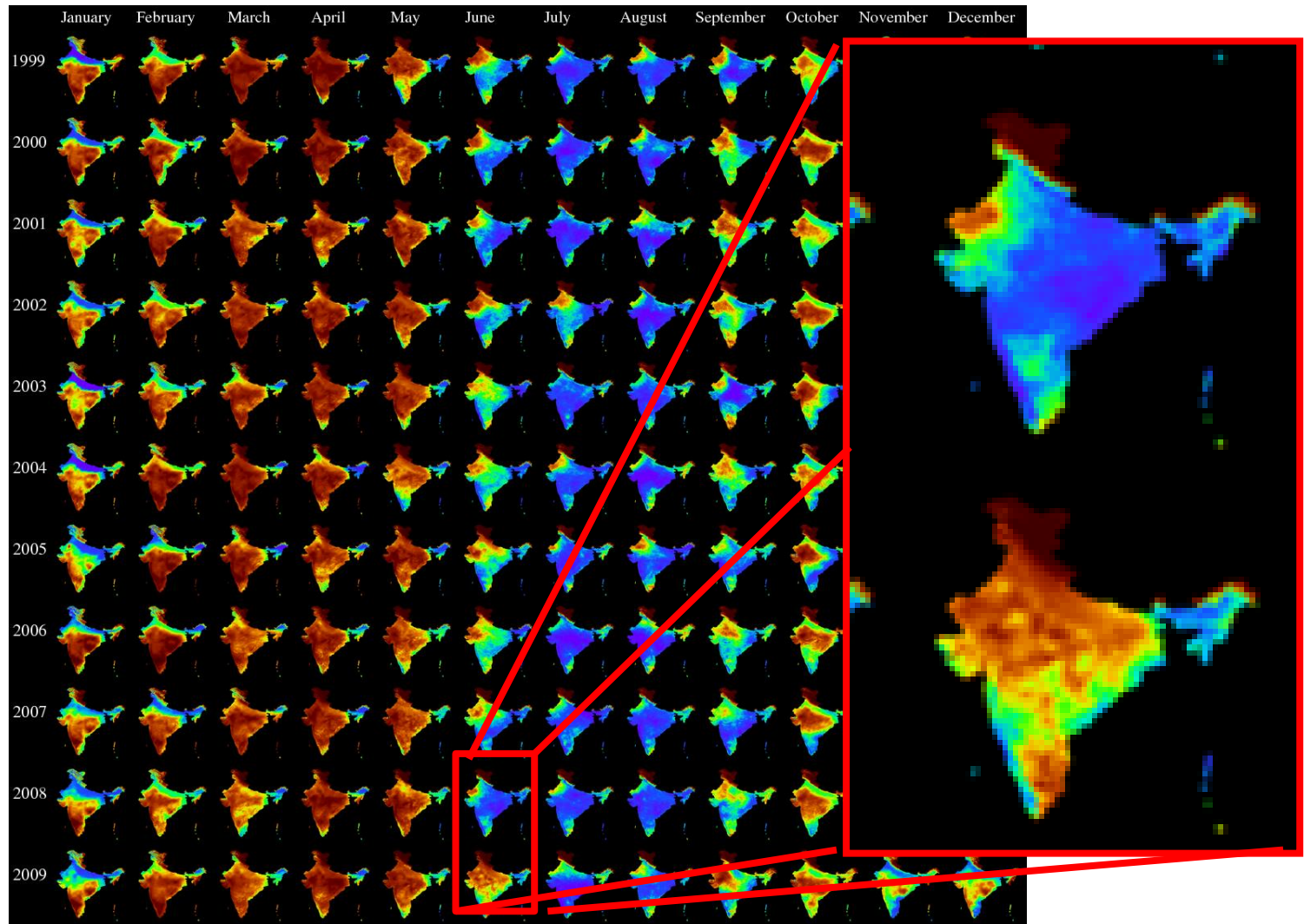


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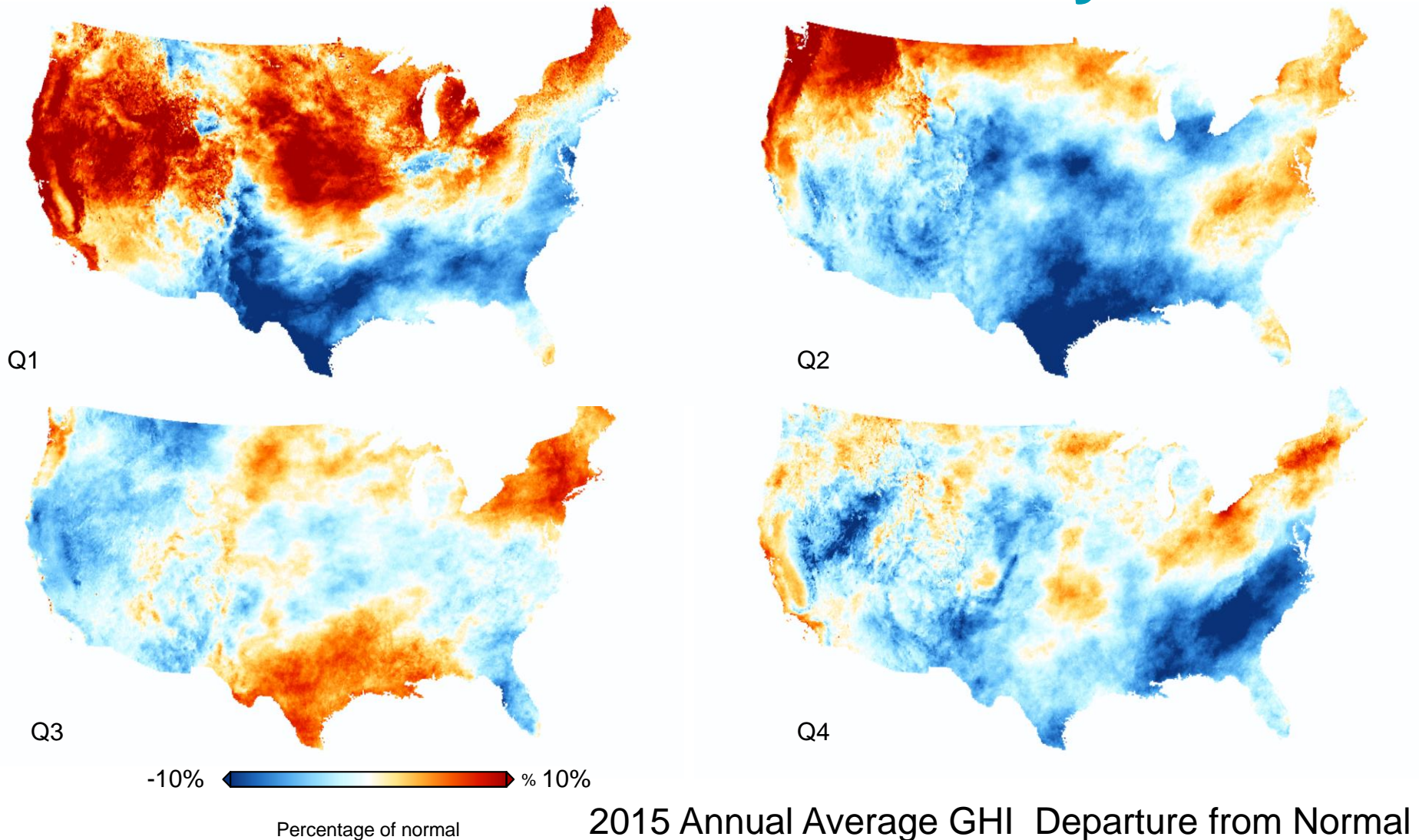
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Get to Know the Variability at Your Site

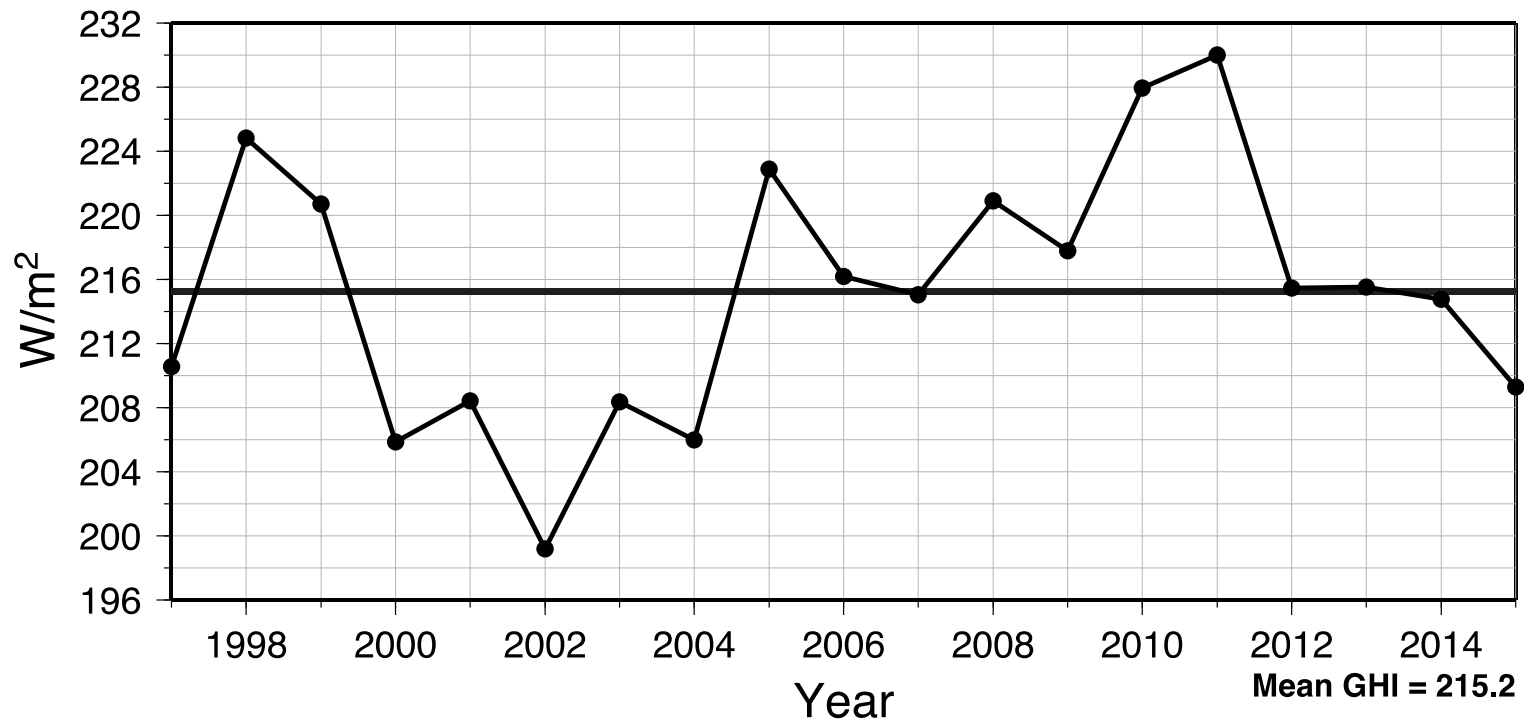
DNI
Variability in
India by
month and
year.



2015 Solar Resource Variability



Maps are Step 1. Time series are Step 2.



Questions?

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