

CSP vs PV Developing

From a Solar Resource Perspective

Riaan Meyer

MD, GeoSUN Africa

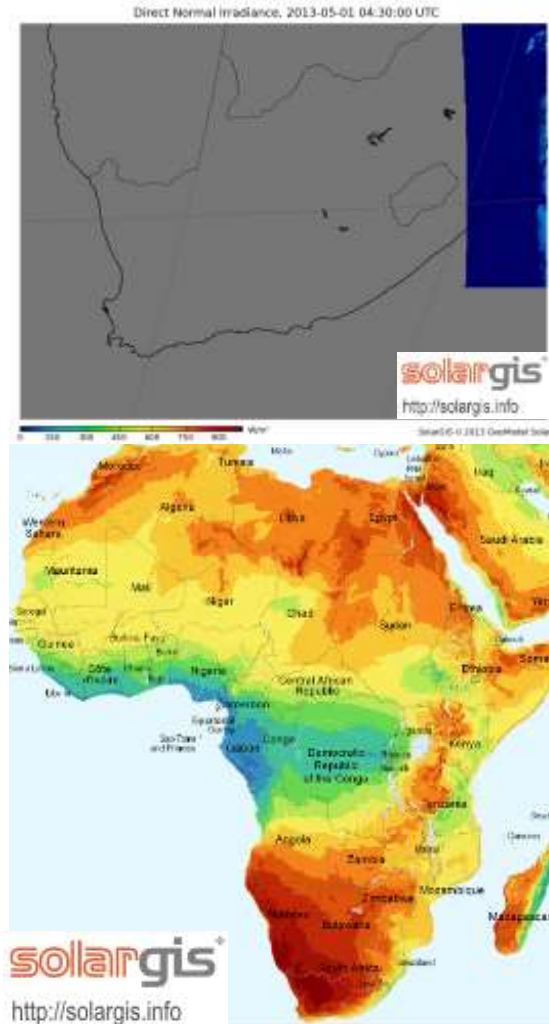
GeoSUN
AFRICA



RENEWABLE & SUSTAINABLE
ENERGY STUDIES

Contents

- Solar Resource 101
- PV Developers
- CSP Developers
- Comparison



GeoSUN Africa



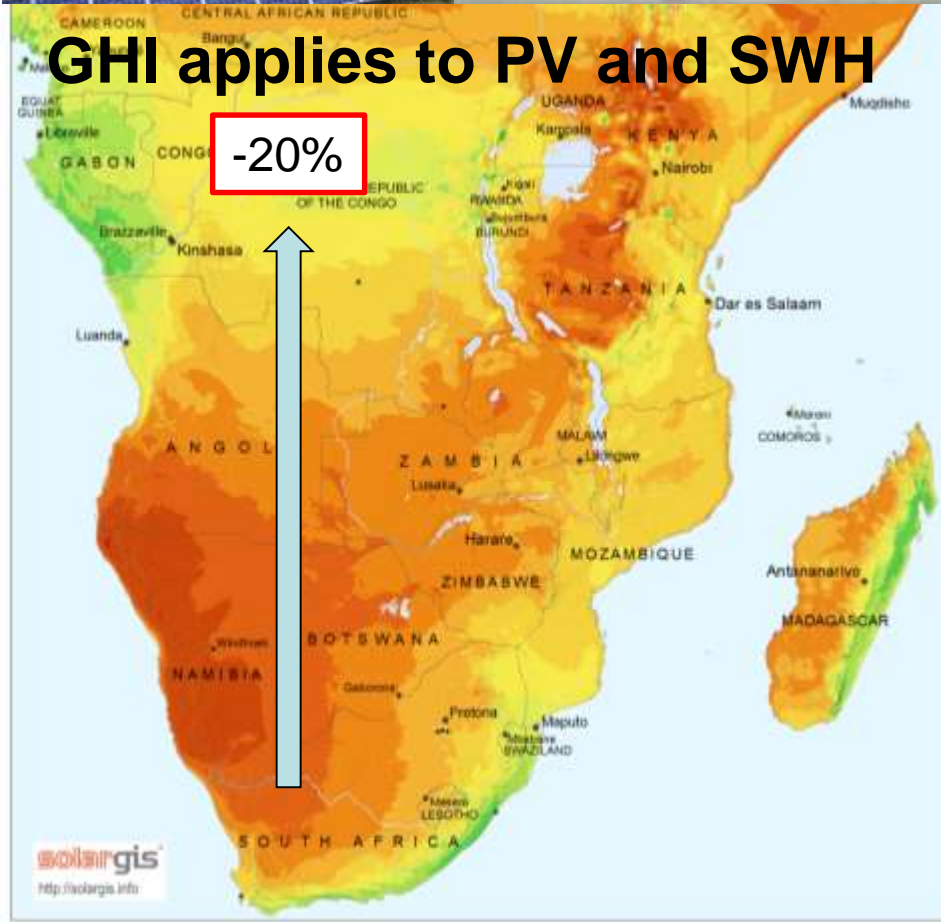
- Stellenbosch University spin-off, in partnership with GeoModel Solar
- Solar Resource
 - Solar Maps and GIS Layers
 - Bankable Solar Resource Studies
 - Yield Studies (PV)
- Instrumentation (Solar and Meteorological)
 - Onsite measurements
 - Supply and integration of equipment to solar plants under construction
 - Instrument Calibration
- Solar Forecasting





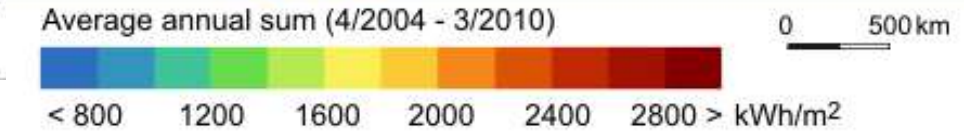
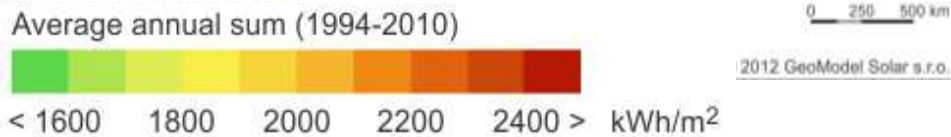
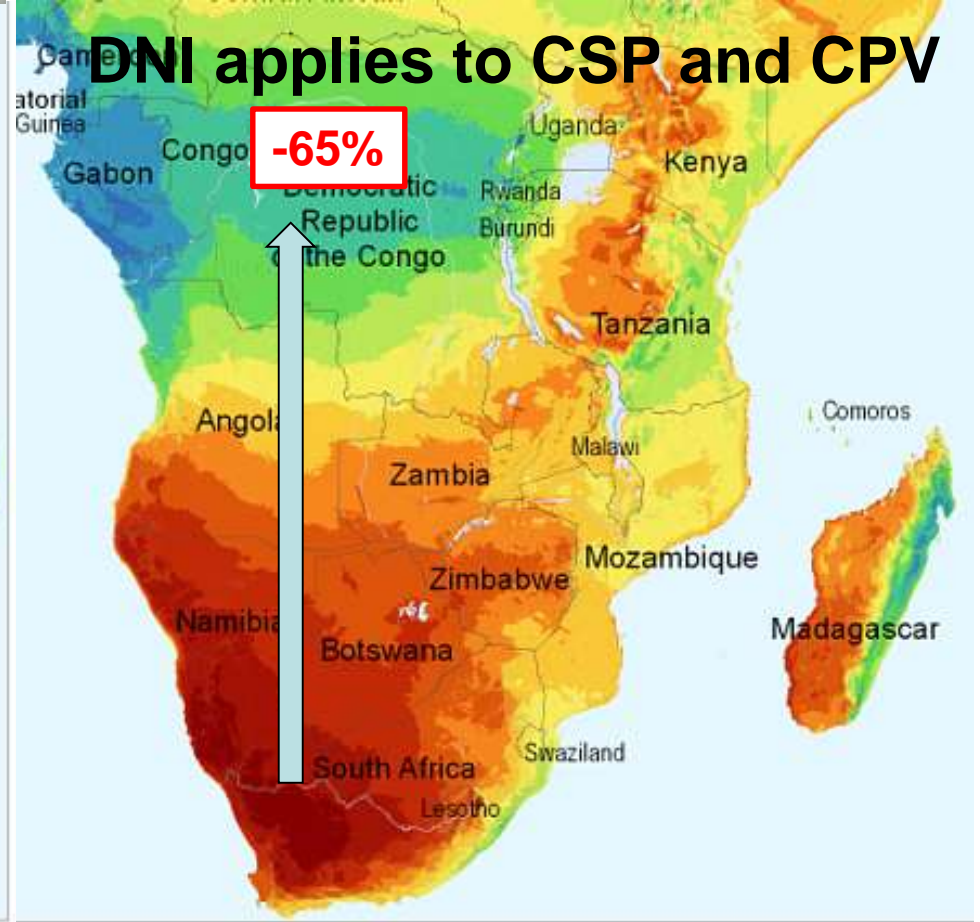
GHI applies to PV and SWH

-20%

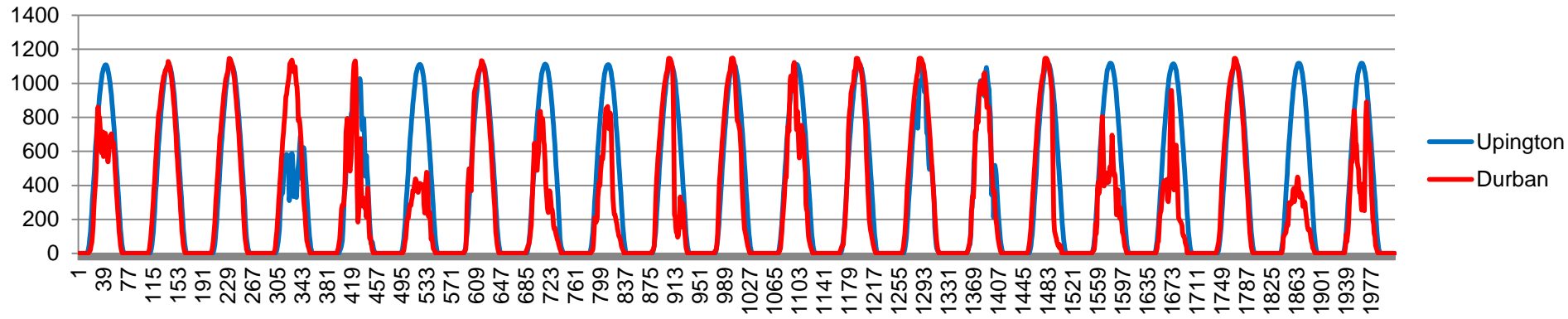


DNI applies to CSP and CPV

-65%

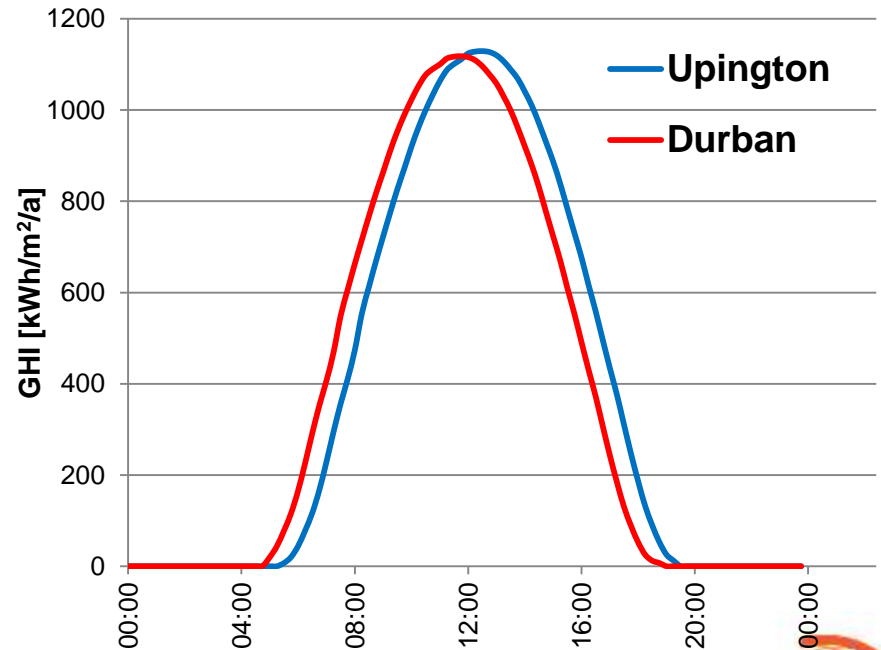
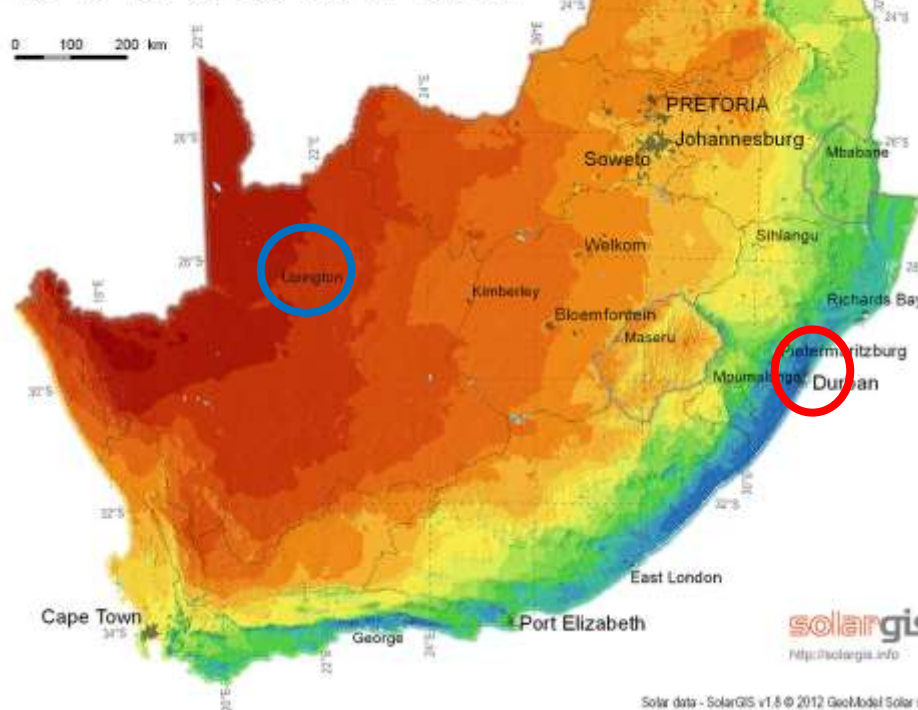


Upington vs Durban: GHI



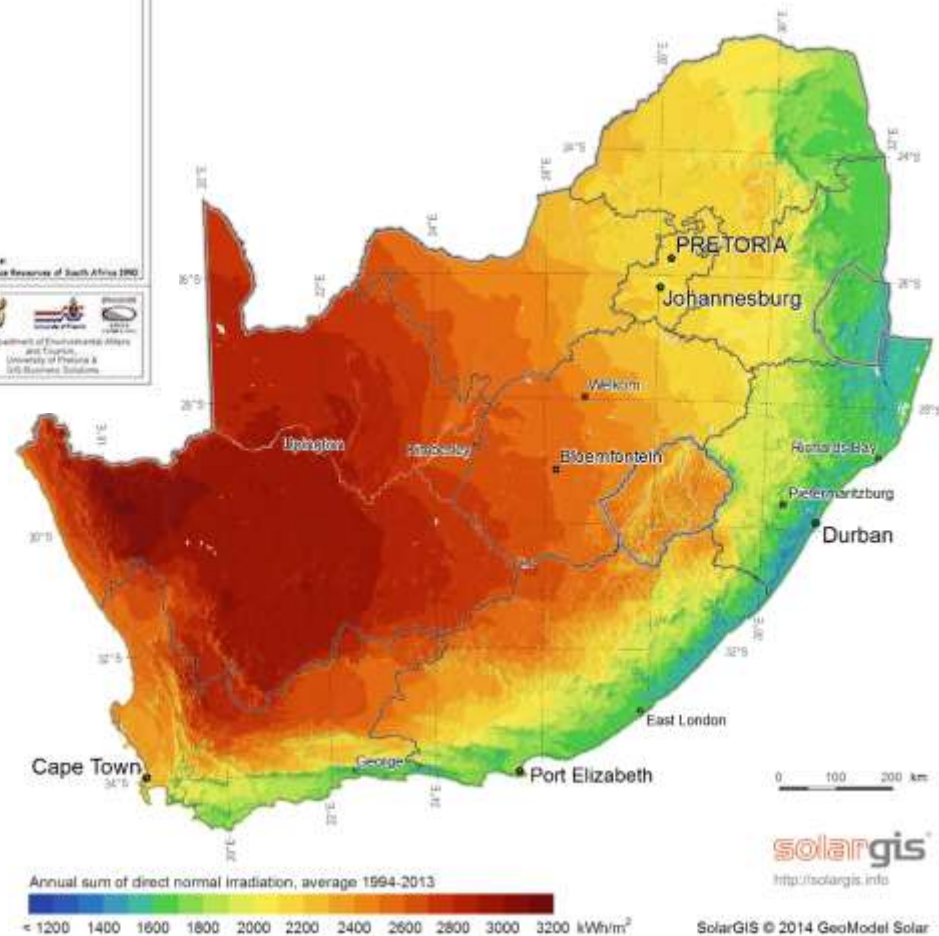
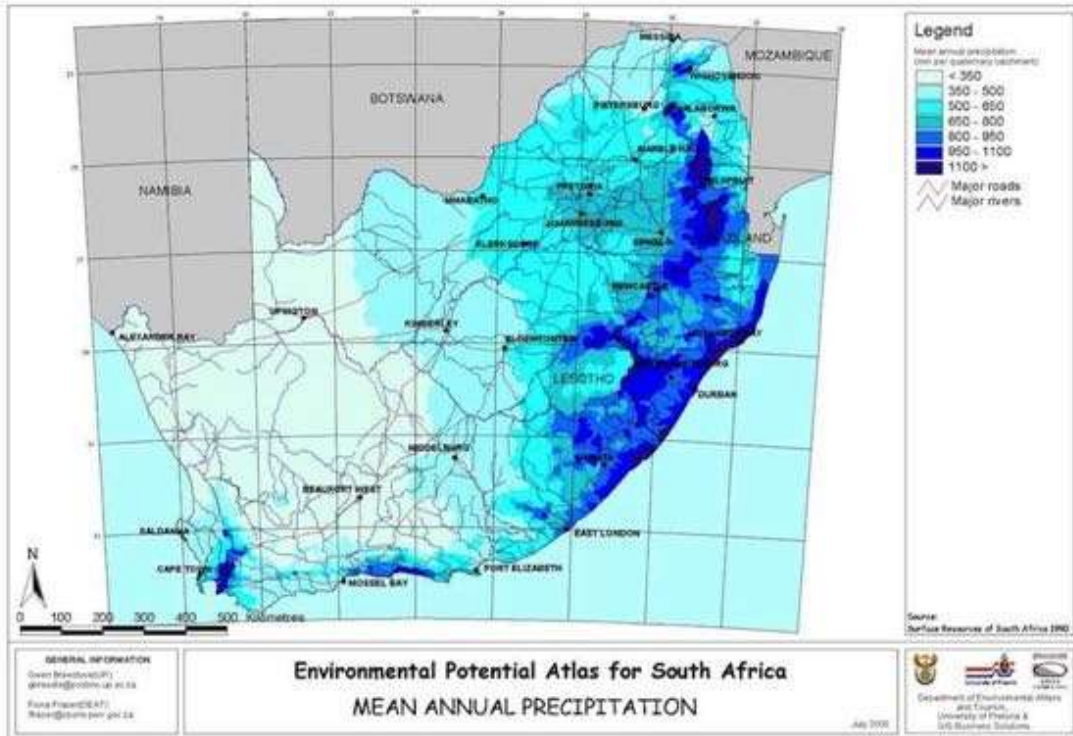
South Africa, Lesotho and Swaziland

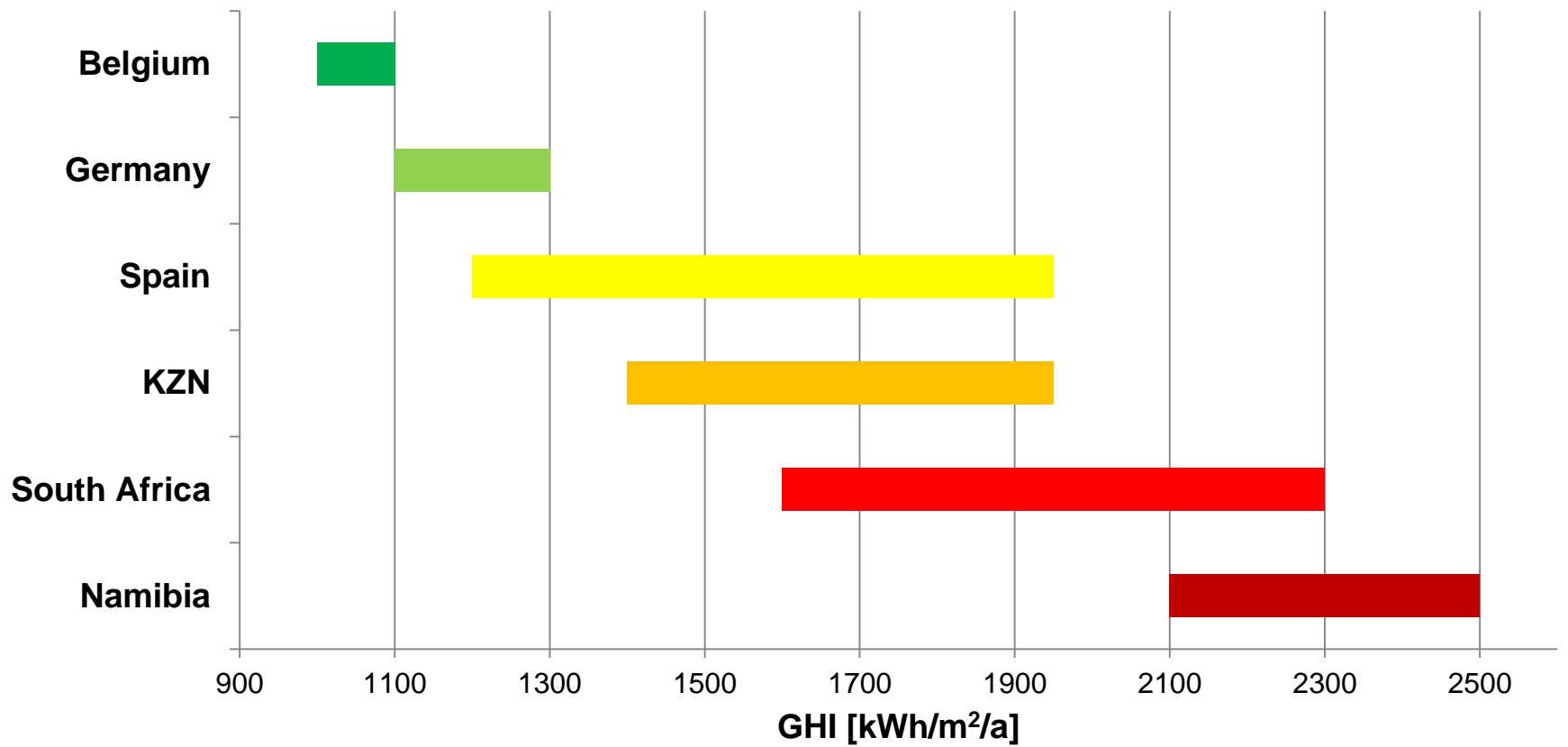
Annual sum of global horizontal irradiation, average 1994-2010



A clear day in Upington and Durban

Precipitation vs Irradiance

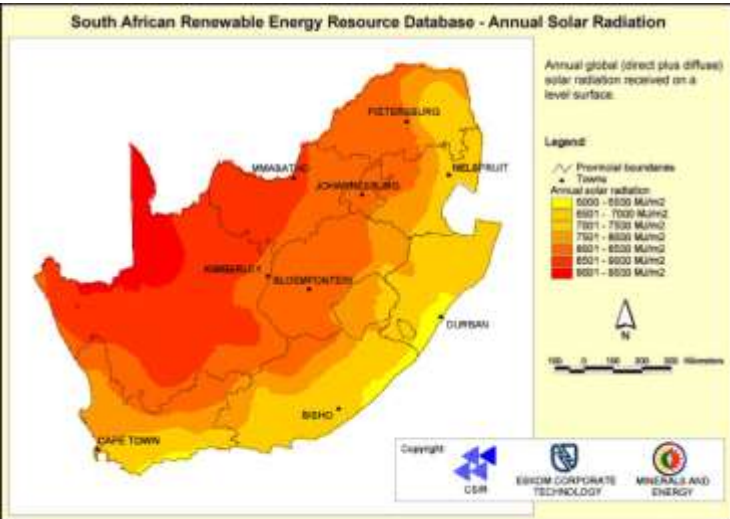




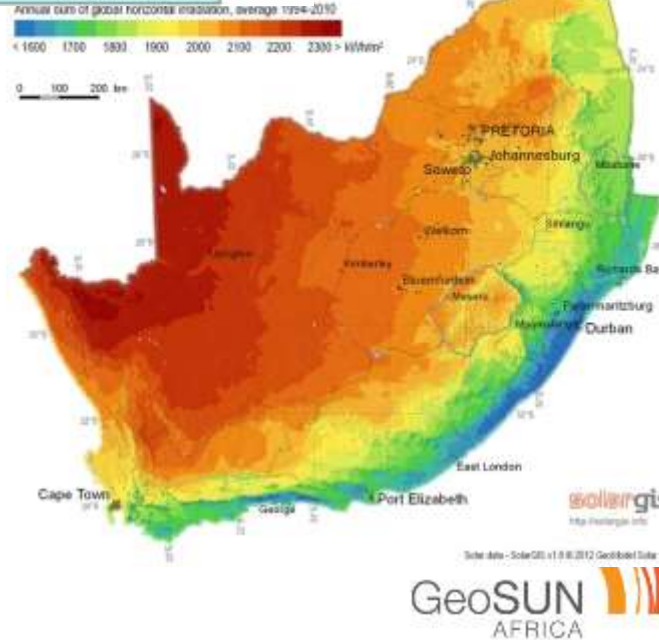
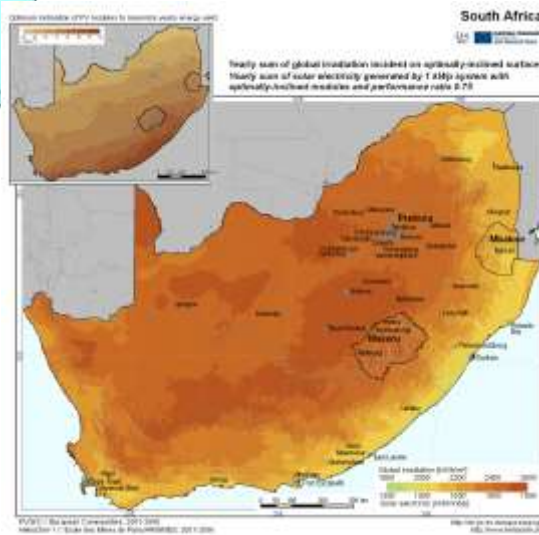
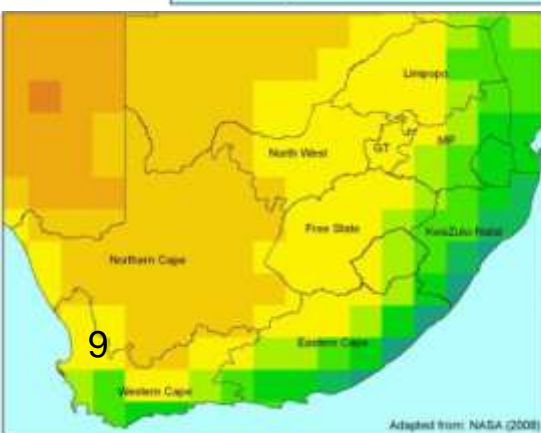
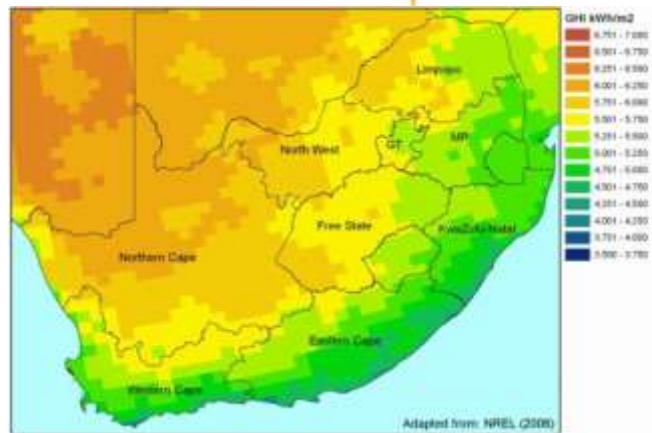
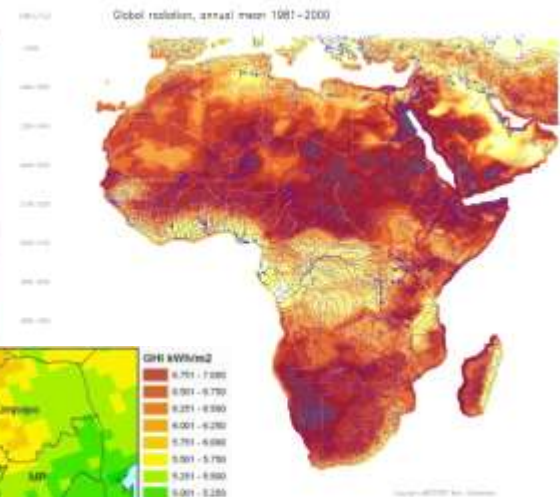
KZN's solar (GHI) resource is as good, if not better, than that of Spain!

PV Developers





Solar Maps for South Africa

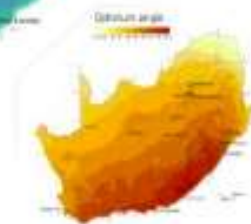
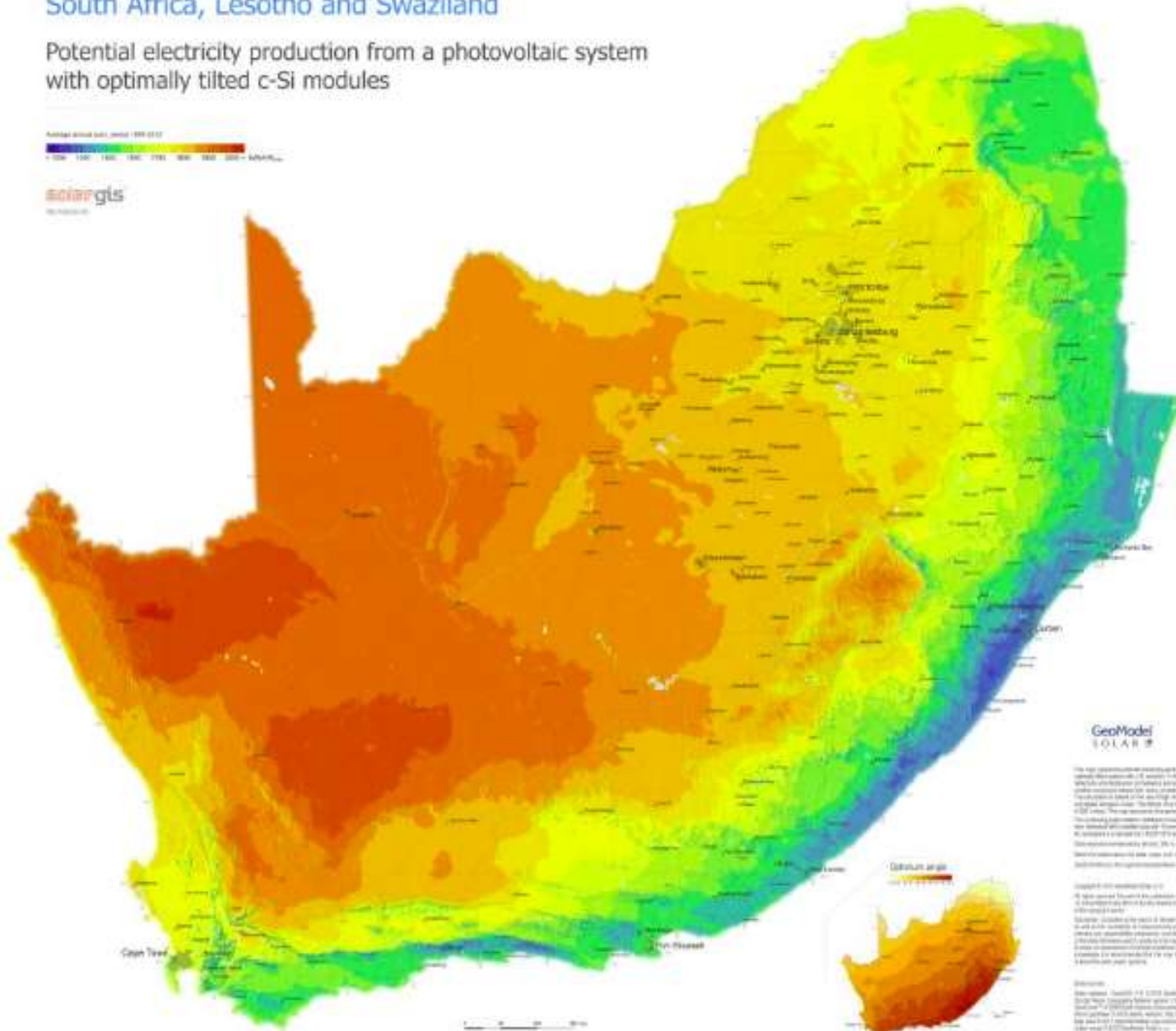


South Africa, Lesotho and Swaziland

Potential electricity production from a photovoltaic system with optimally tilted c-Si modules



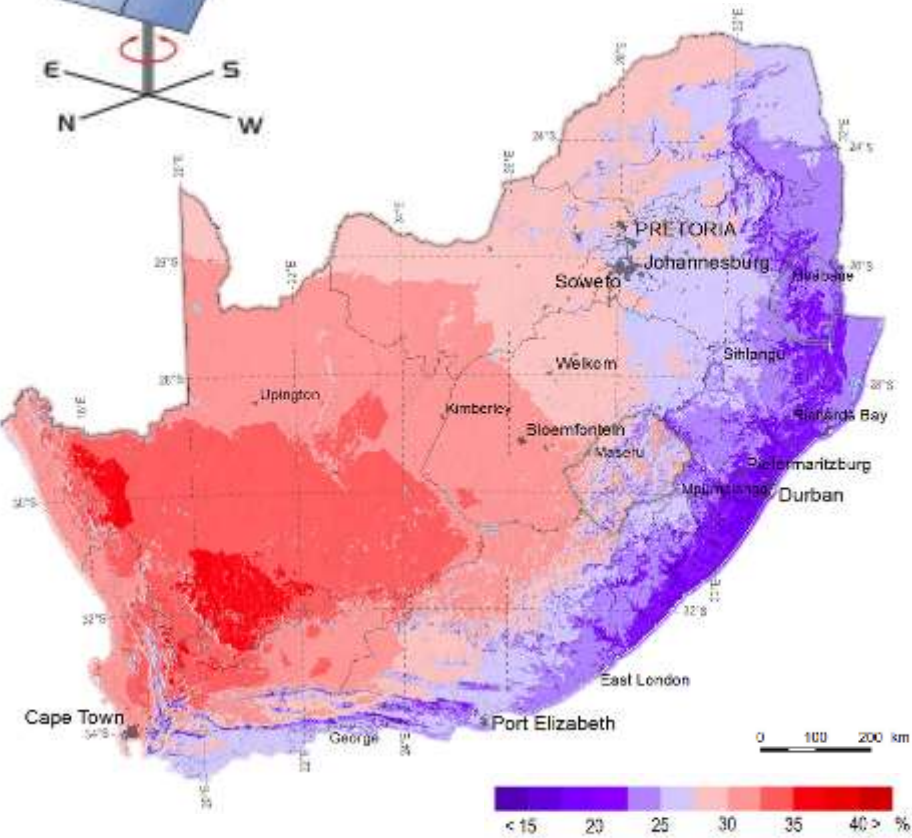
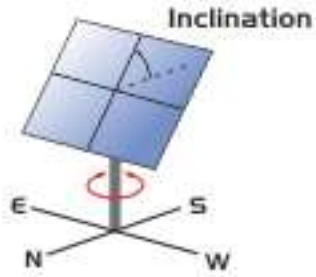
solar gis



GeoModel SOLAR
GeoSUN AFRICA

The map represents an estimated potential. It is produced by using satellite observations of solar irradiance. It does not take into account local conditions such as shading, dust, or other factors that may affect the actual electricity production. The map is intended for general information only and should not be used for investment decisions. The data is based on the year 2010. The actual production will vary depending on the actual conditions on the ground. It is recommended to consult a professional for more information. © 2010 GeoSUN AFRICA. All rights reserved.

Tracking?



1-axis – vertical axis at 30°



Satellite derived data

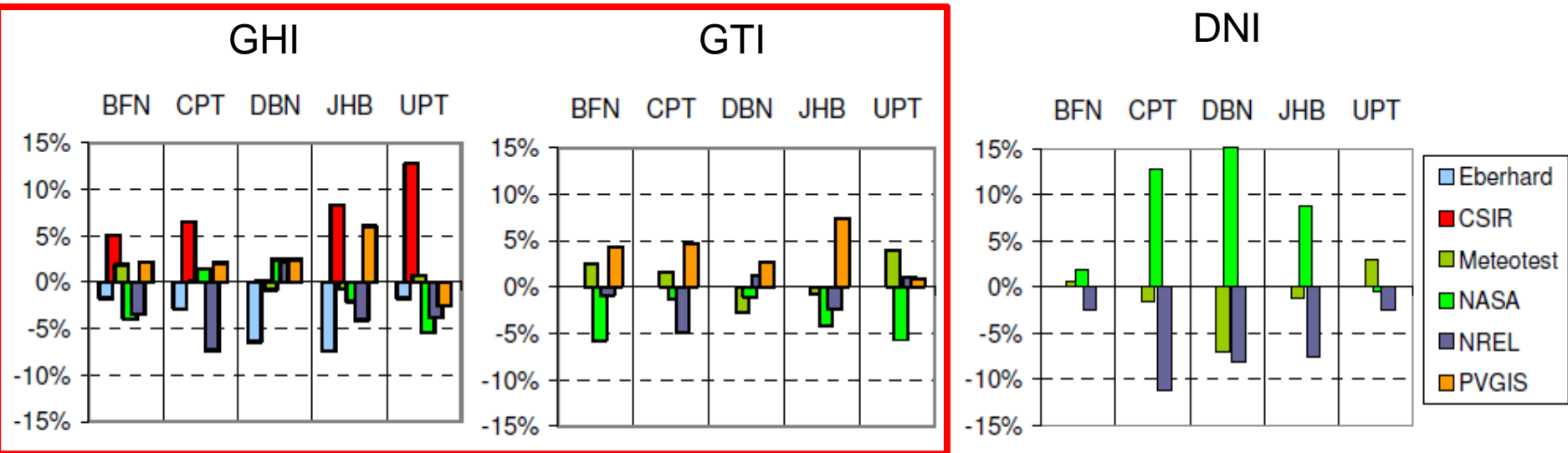
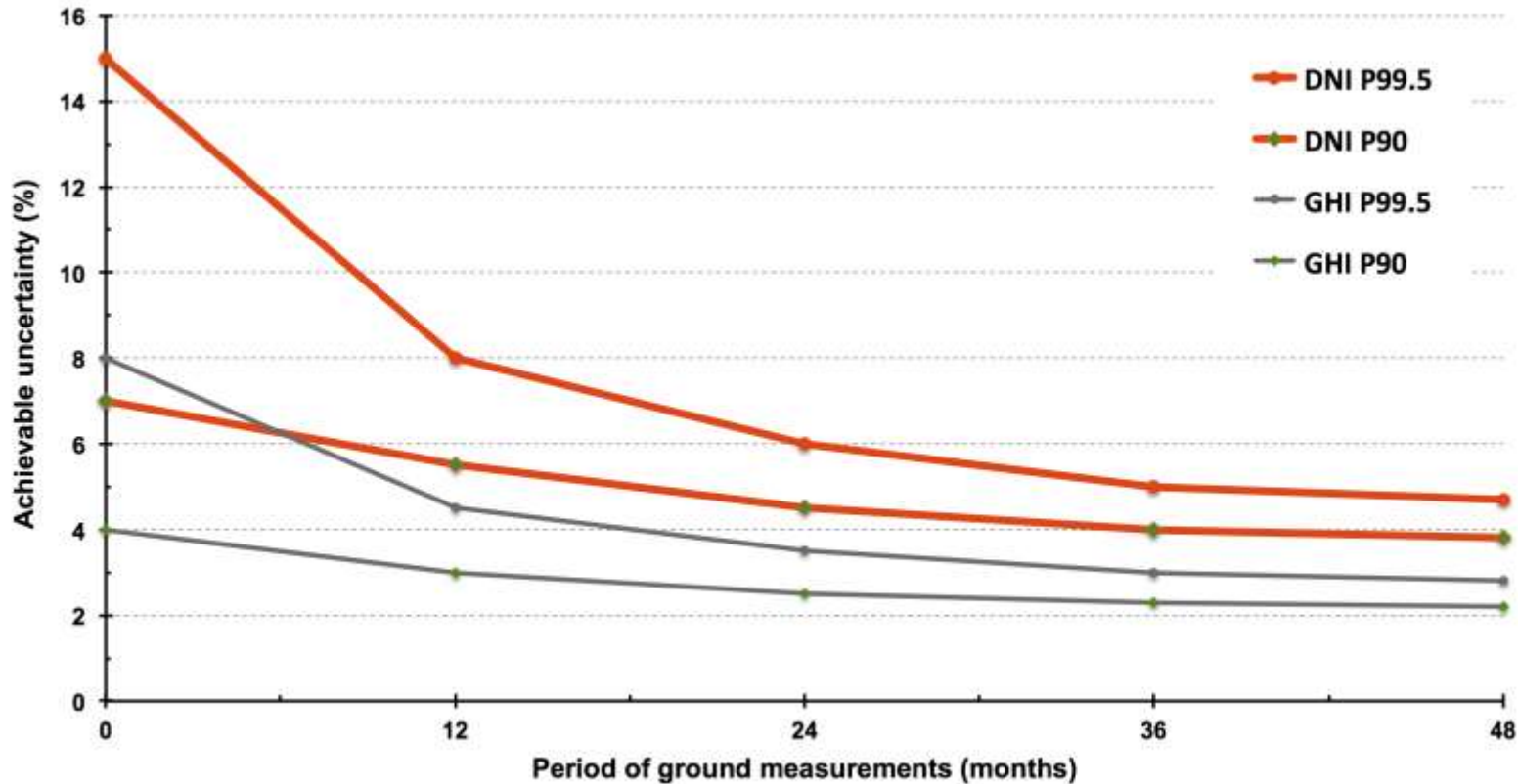


Figure 5. Mean-bias differences of values for global horizontal irradiation (left), latitude tilt irradiation (middle) and direct normal irradiation (right) extracted from various data sources for five sites in South Africa (BFN: Bloemfontein; CPT: Cape Town; DBN: Durban; JHB: Johannesburg; UPT: Upington)

Comparison of Solar Resource Assessments for South Africa, (2009), TP Fluri and TW von Backstrom, ISES Solar World Congress

SolarGIS satellite data uncertainty

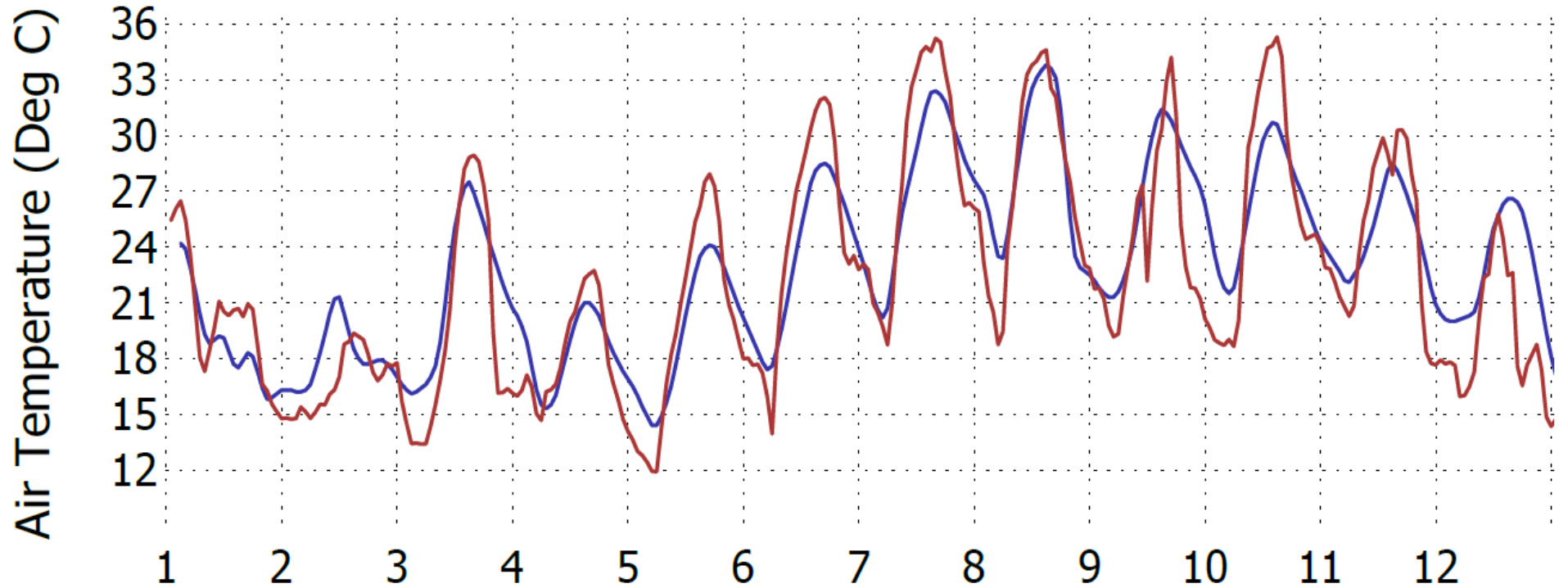
Best
Achievable
uncertainty
currently



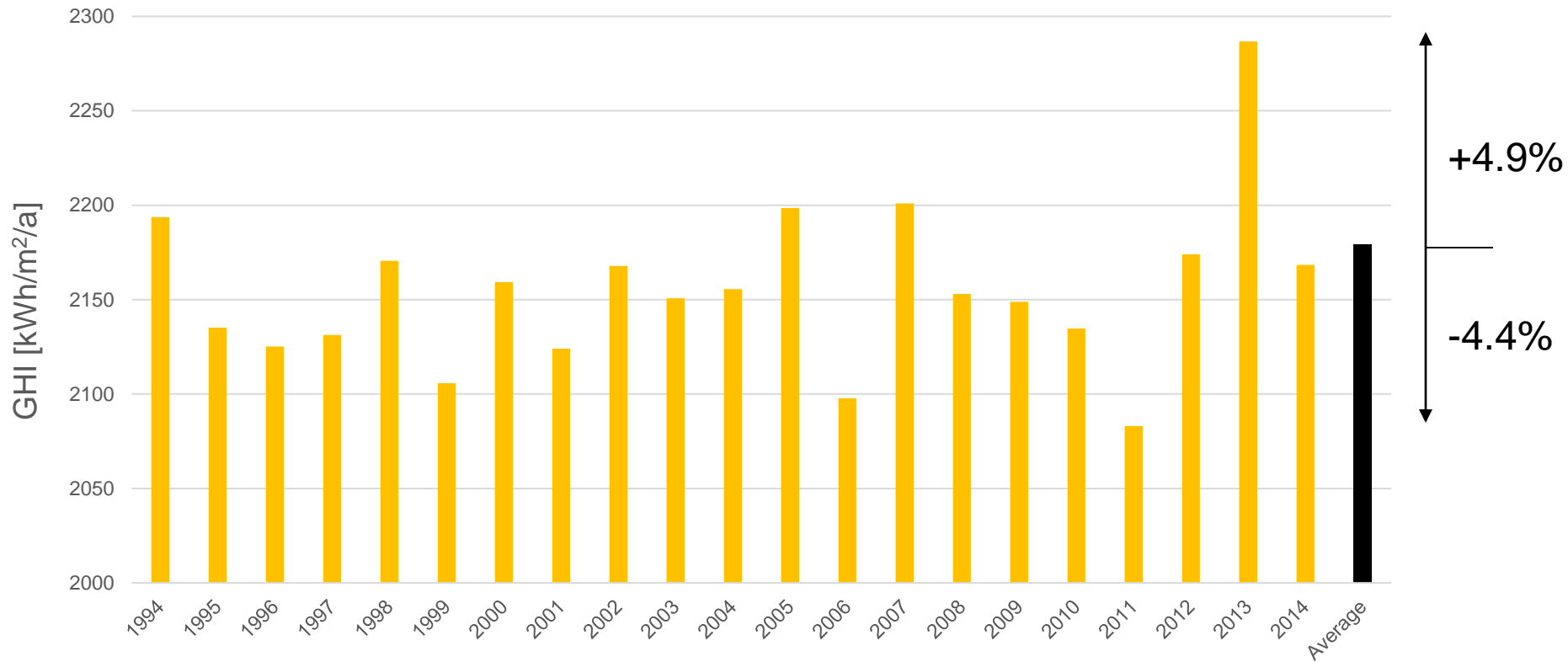
DNI: ±4%
GHI: ±2.5%

Source: GeoModel Solar, ESMAP Malawi project

Data Comparisons



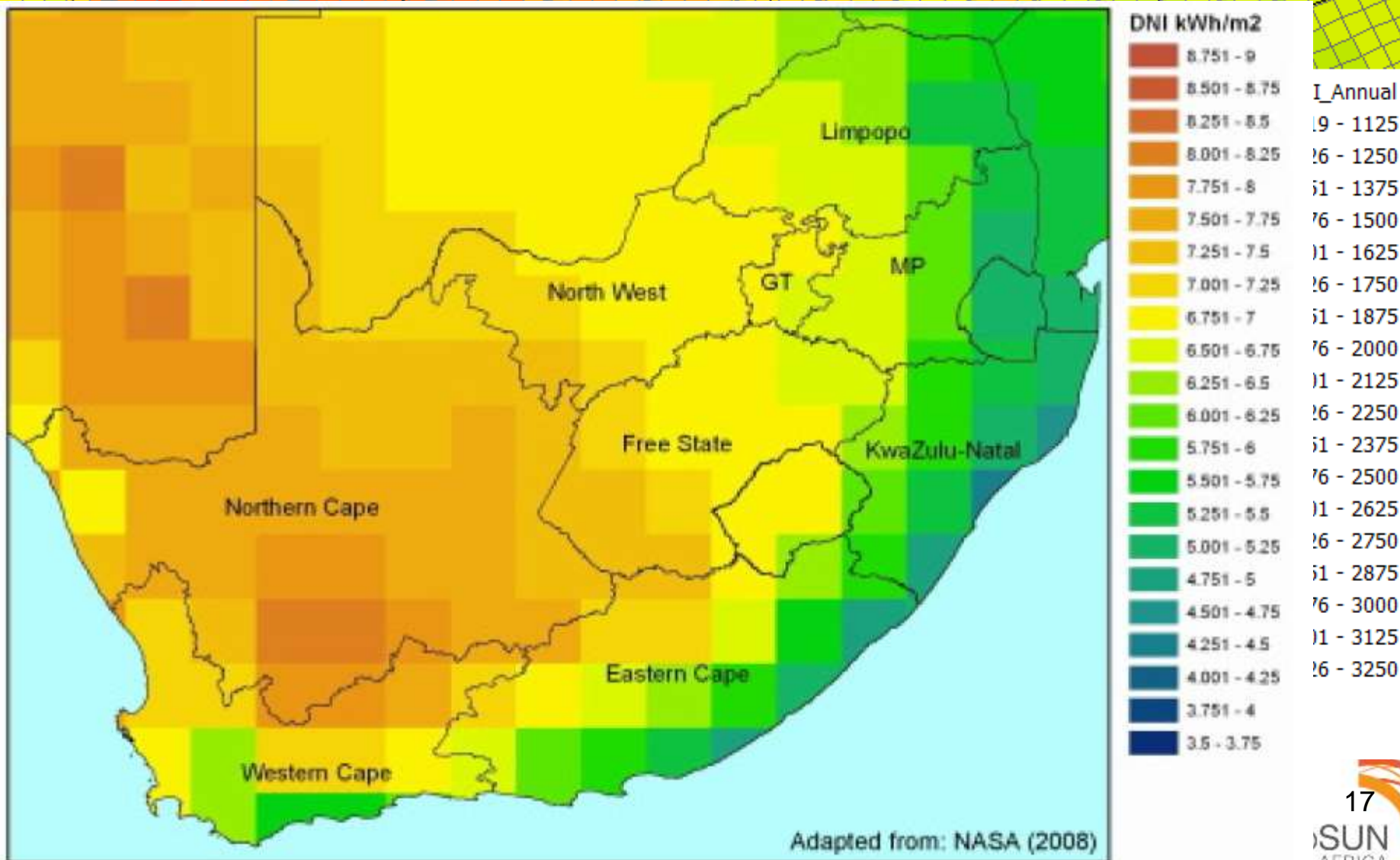
Inter-annual variability

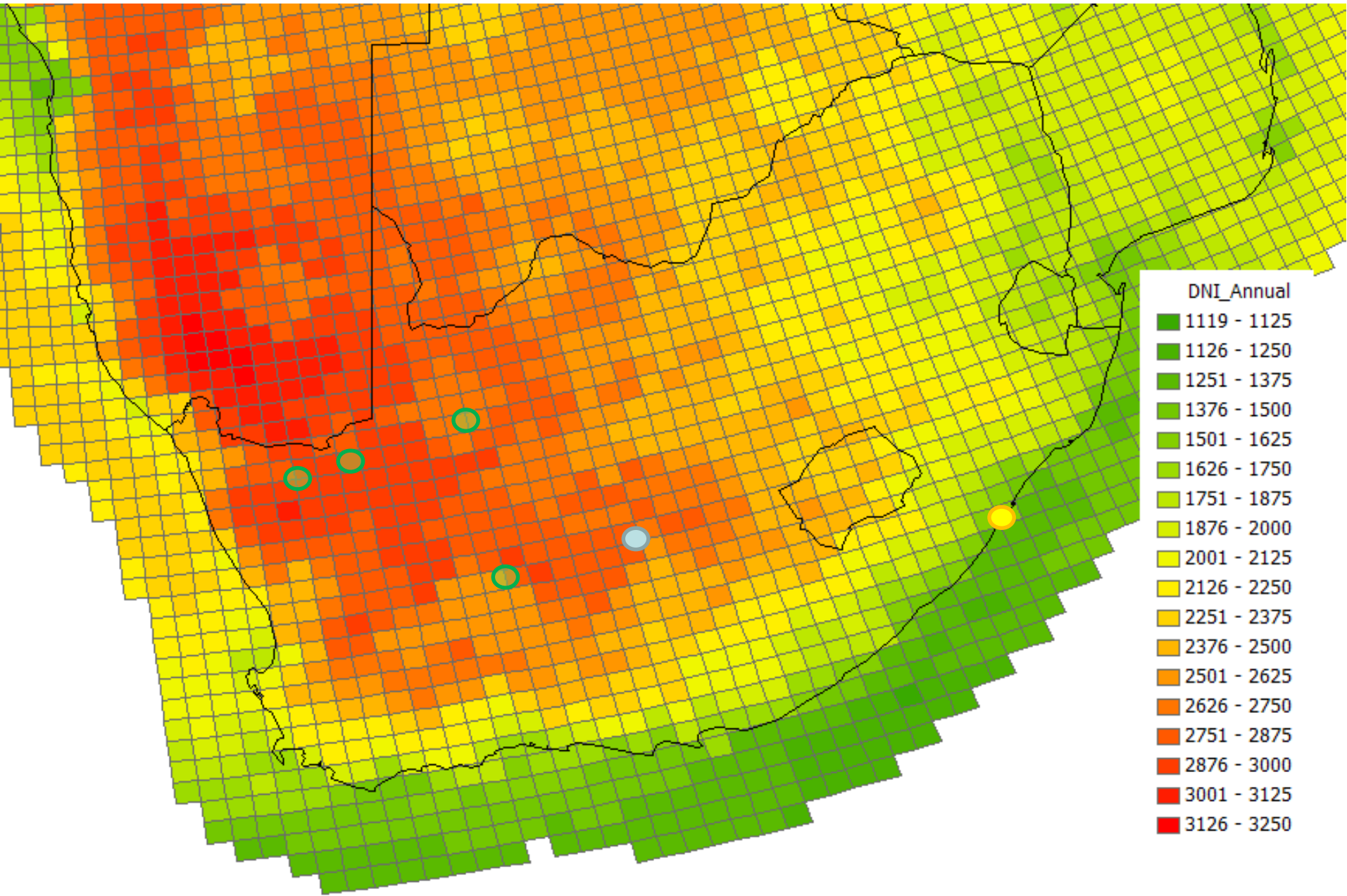


CSP Developers



DNI





Accuracy-Enhanced Solar Resource Maps of South Africa

Direct Normal Irradiation
Global Horizontal Irradiation

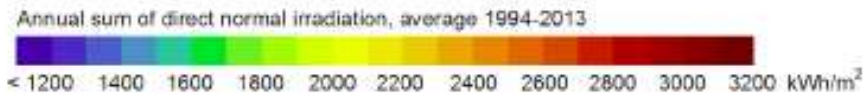
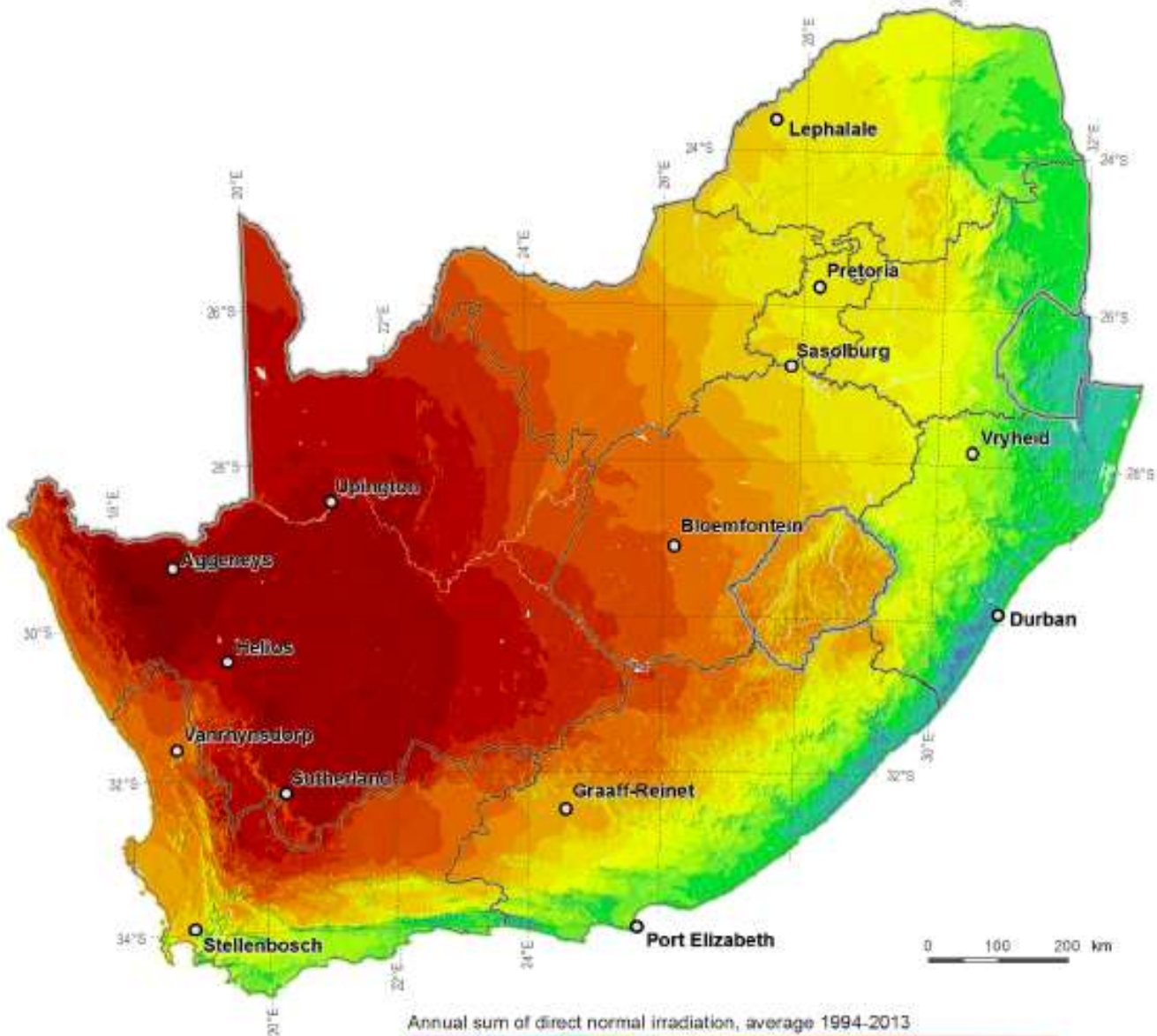
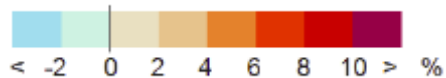
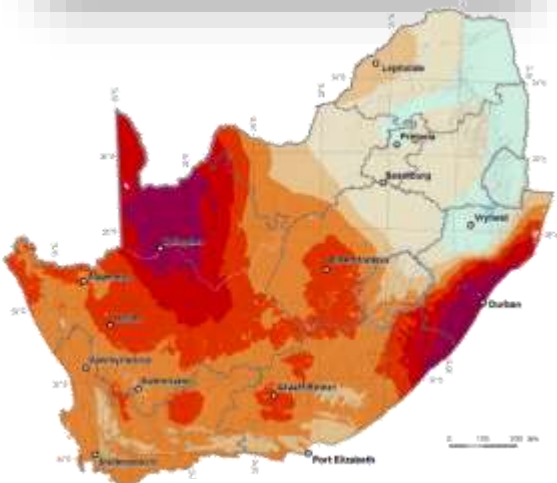
Technical report

Reference No. 58-15/2014 (DRAFT)

Date: 23 October 2014

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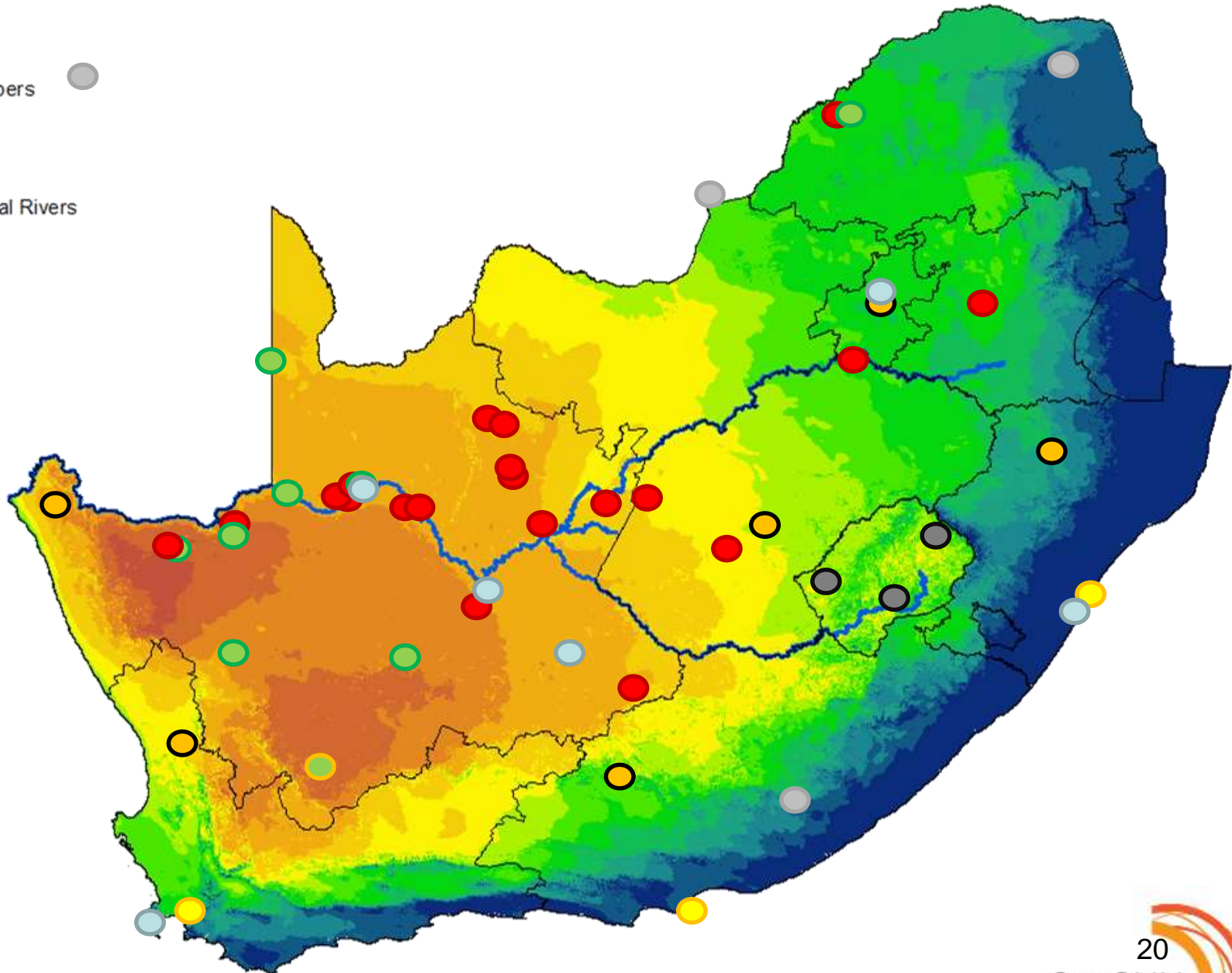
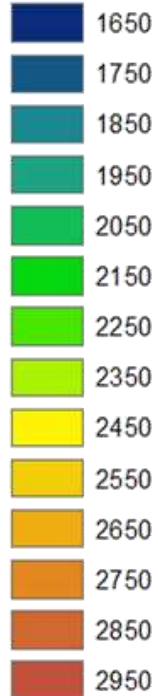
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DNI Measurement Stations in South Africa

- SAWS
- Solar Developers
- Eskom
- Universities
- Main Perennial Rivers

DNI [SolarGIS]
kWh/m²/a

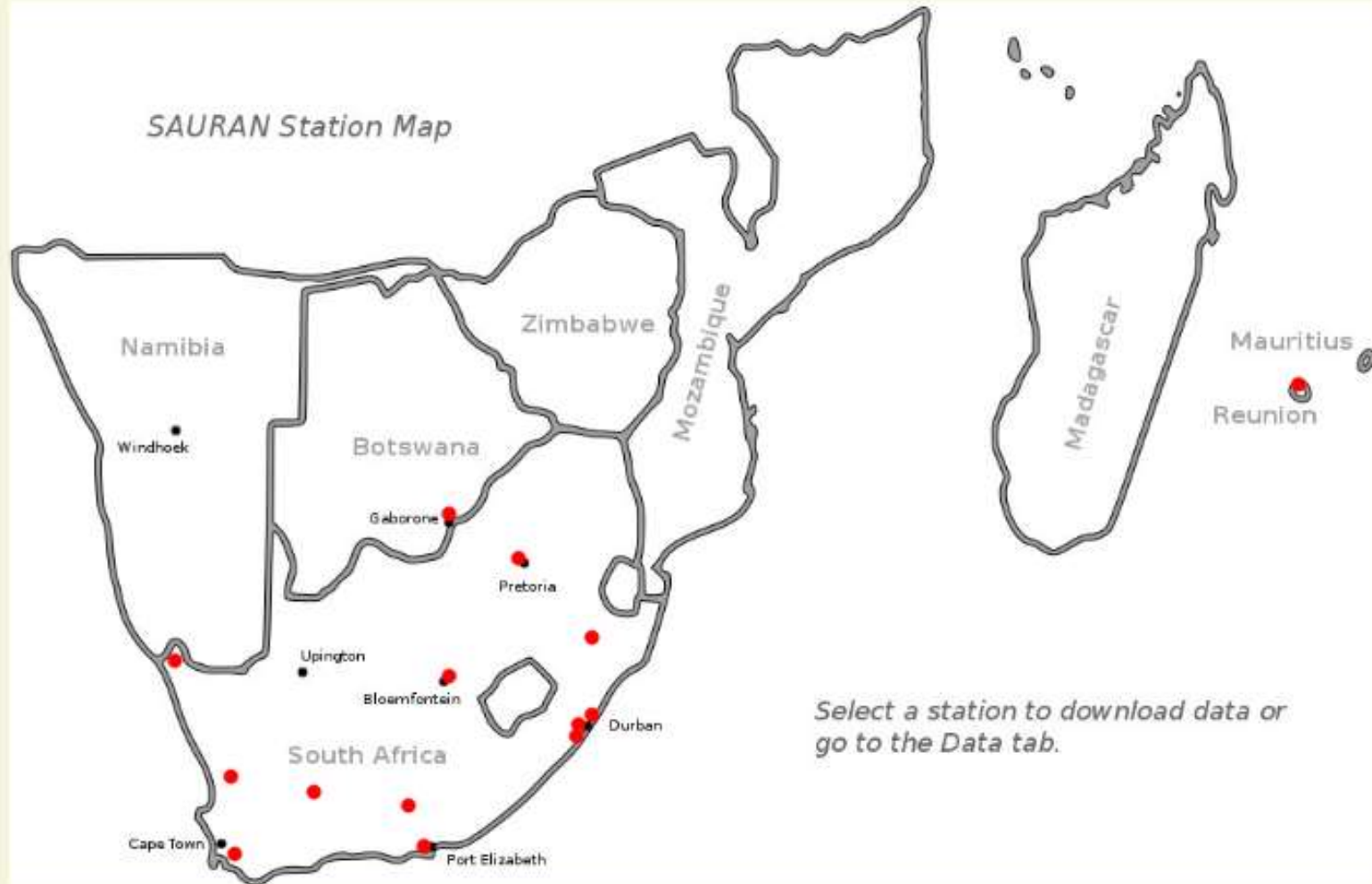




Southern African Universities Radiometric Network

Solar Radiometric Data for the Public

SAURAN Station Map



CSP/CPV

- All CSP and CPV developers deploy on-site measurements
- Mandated by RE-IPPPP (CSP) and banks (CSP and CPV)
- Due to higher uncertainties of satellite derived data





Satellite derived data

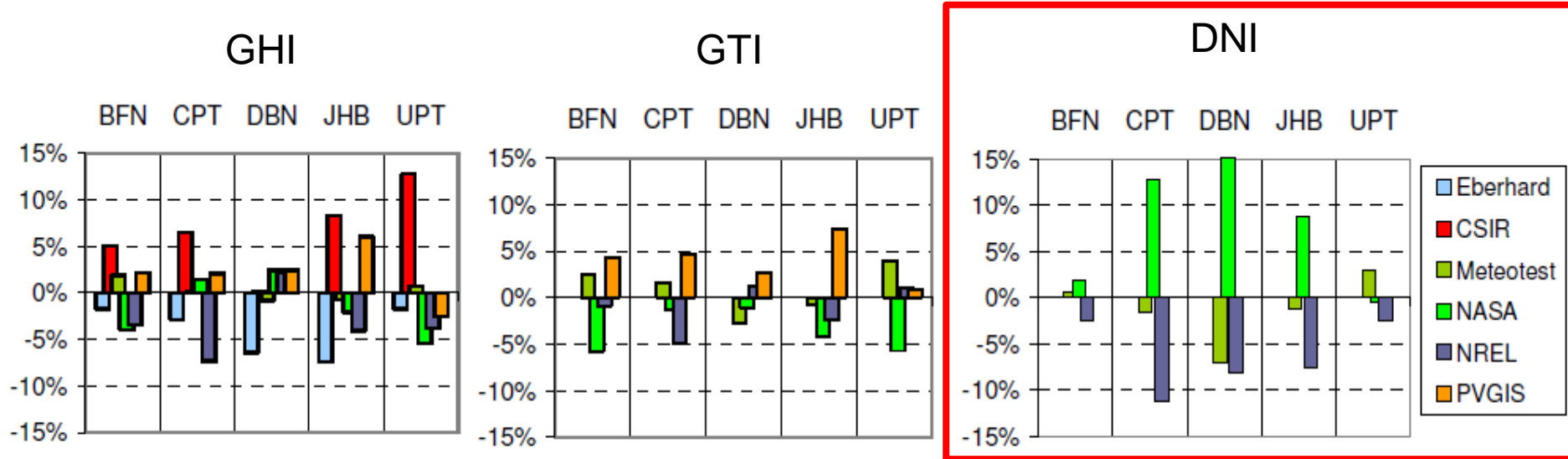
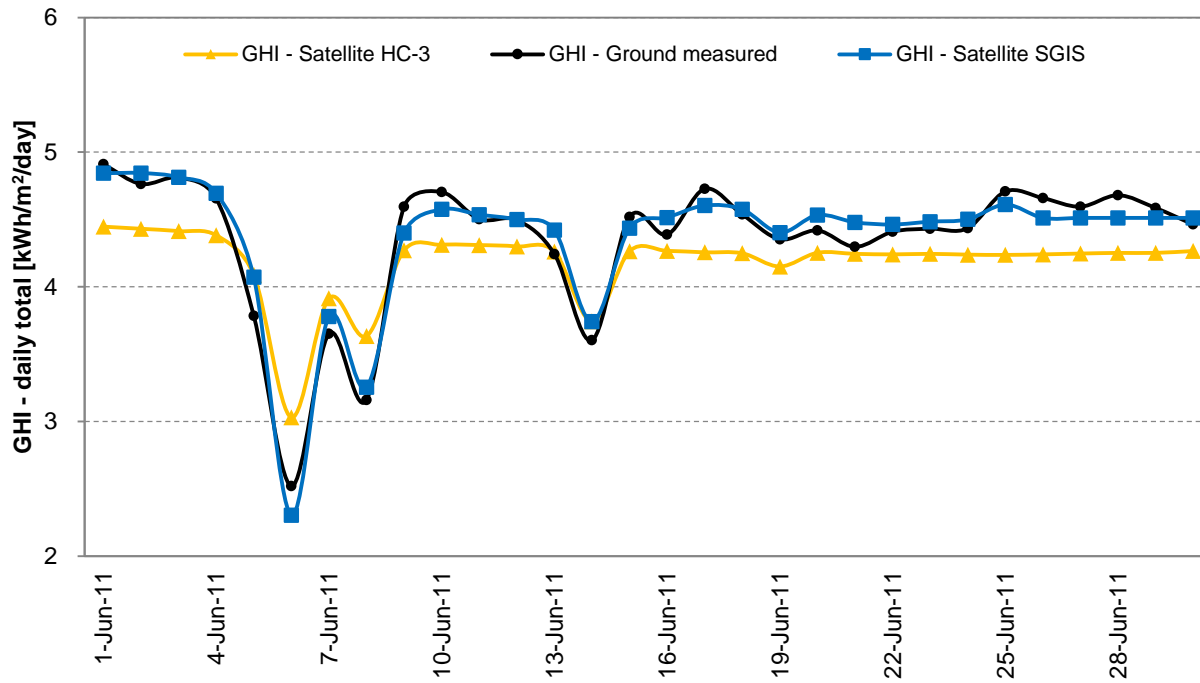
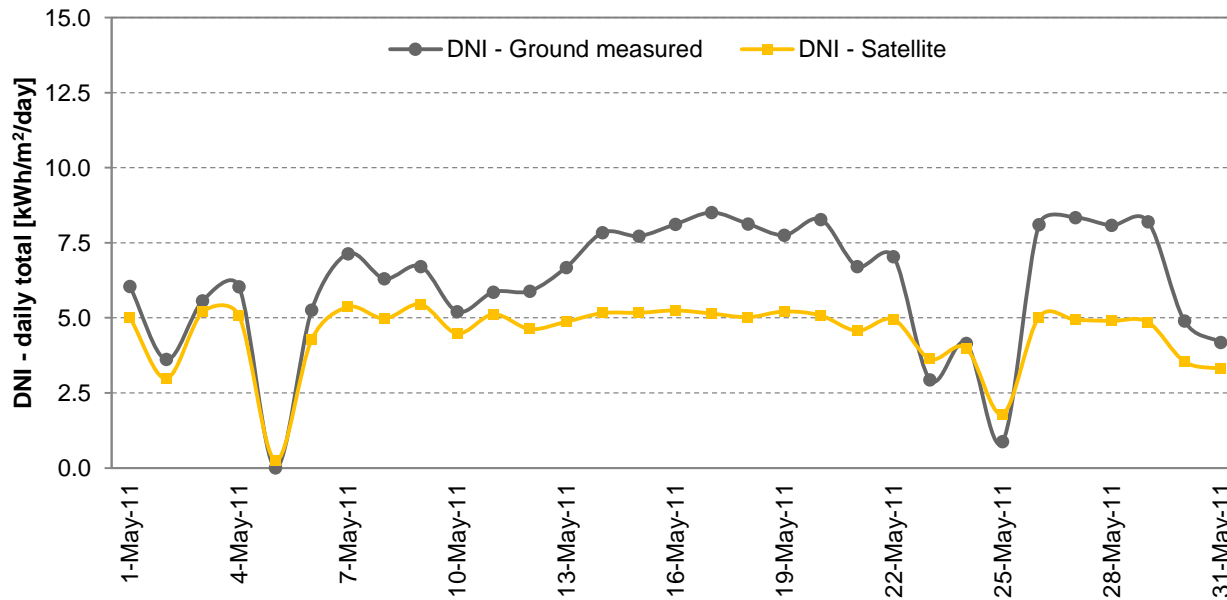


Figure 5. Mean-bias differences of values for global horizontal irradiation (left), latitude tilt irradiation (middle) and direct normal irradiation (right) extracted from various data sources for five sites in South Africa (BFN: Bloemfontein; CPT: Cape Town; DBN: Durban; JHB: Johannesburg; UPT: Upington)

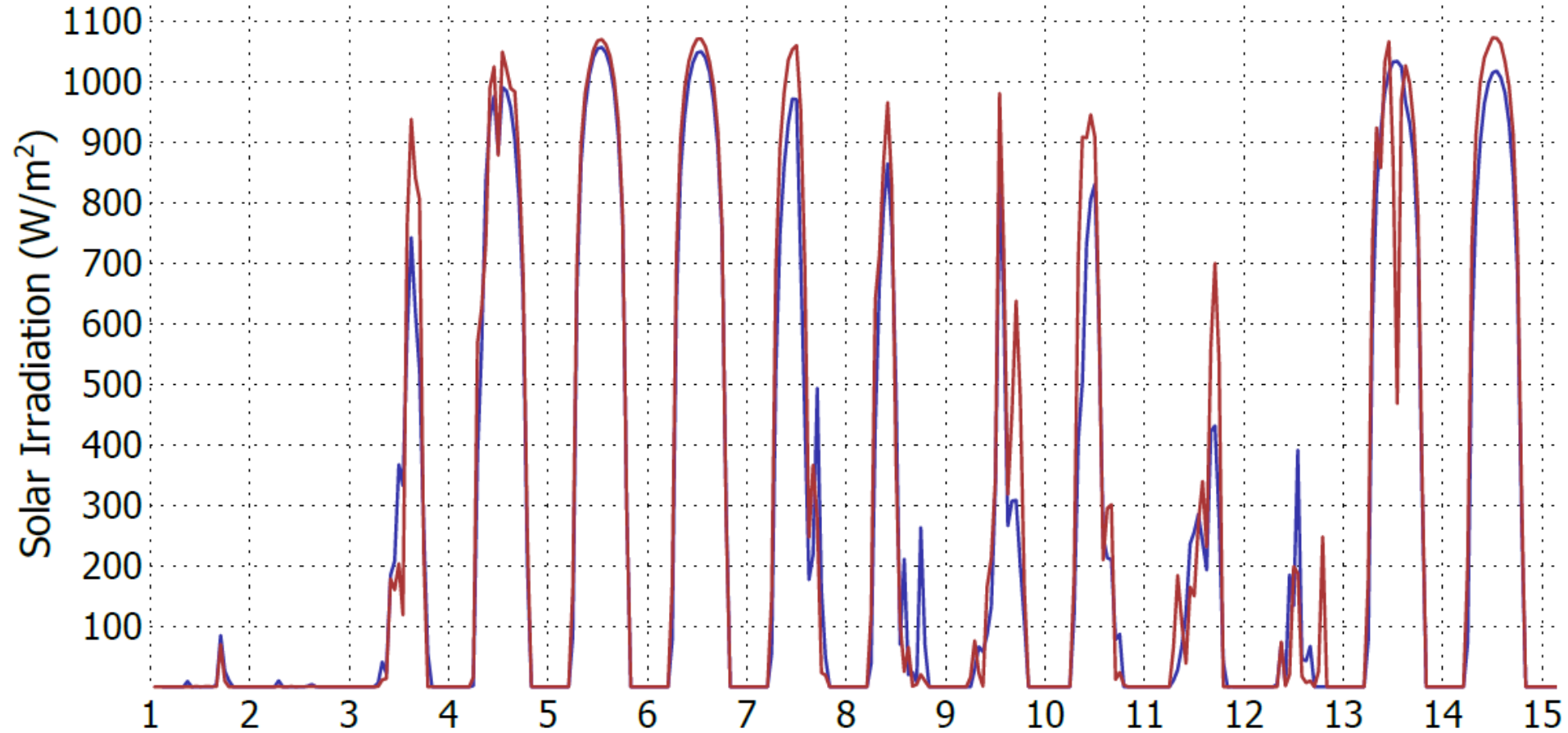
Comparison of Solar Resource Assessments for South Africa, (2009), TP Fluri and TW von Backstrom, ISES Solar World Congress



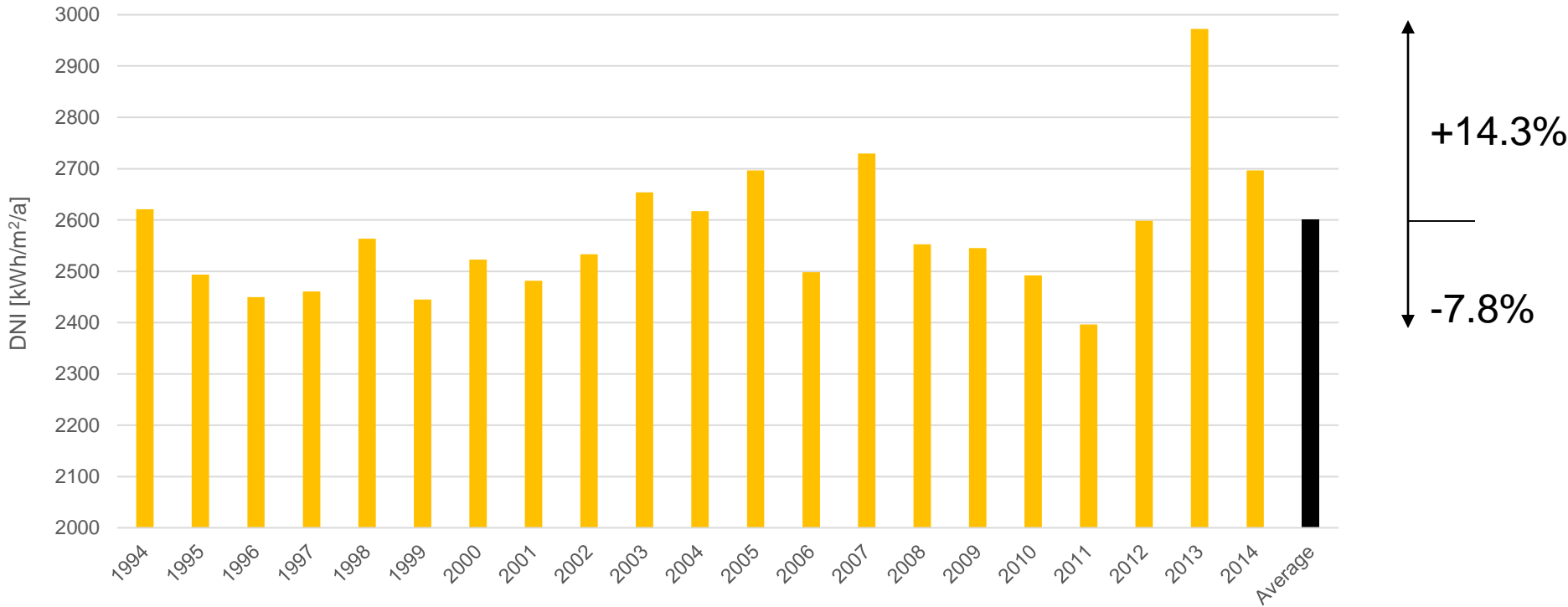
Satellite Derived vs Ground Measured Data



Data Comparisons



Inter-annual variability



Other factors.....

You need water!

The land must be flat

The shape of the land is important

Limited technology suppliers

You need more people on site

Road Access



Photovoltaics

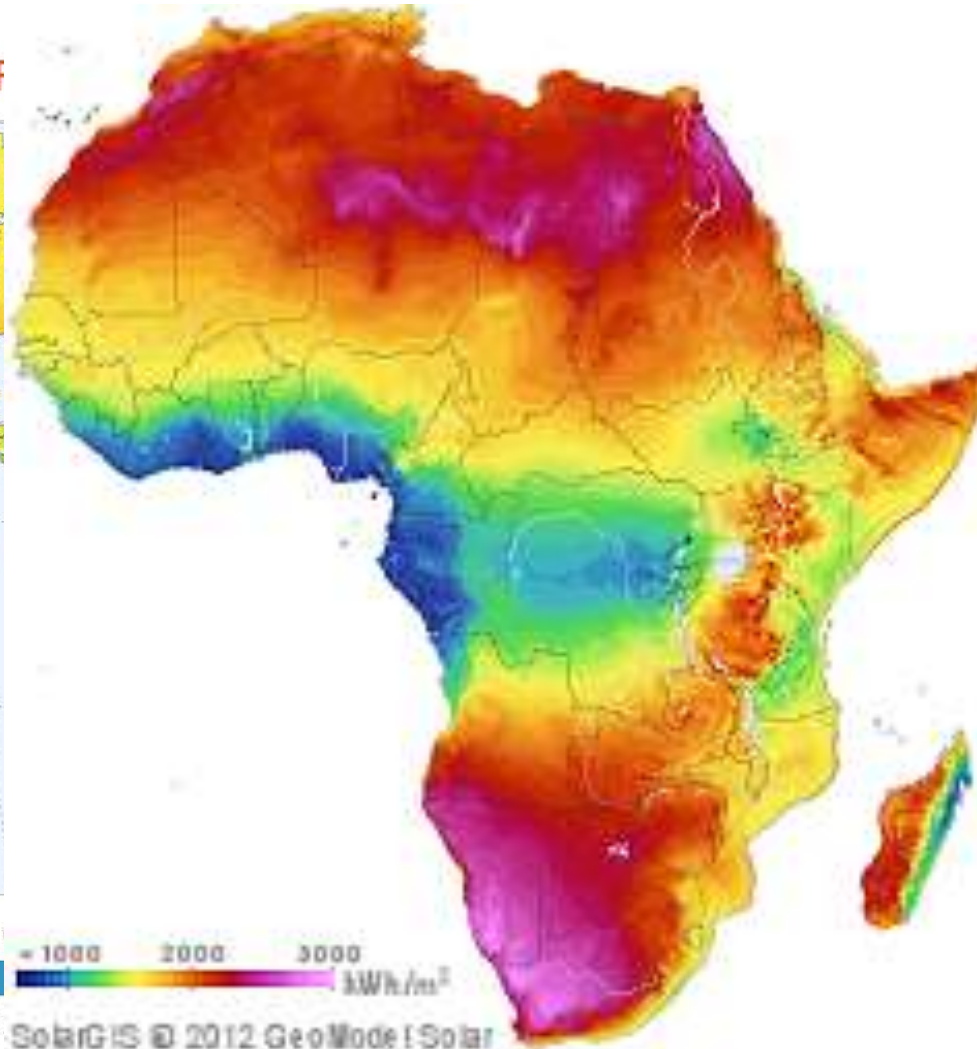
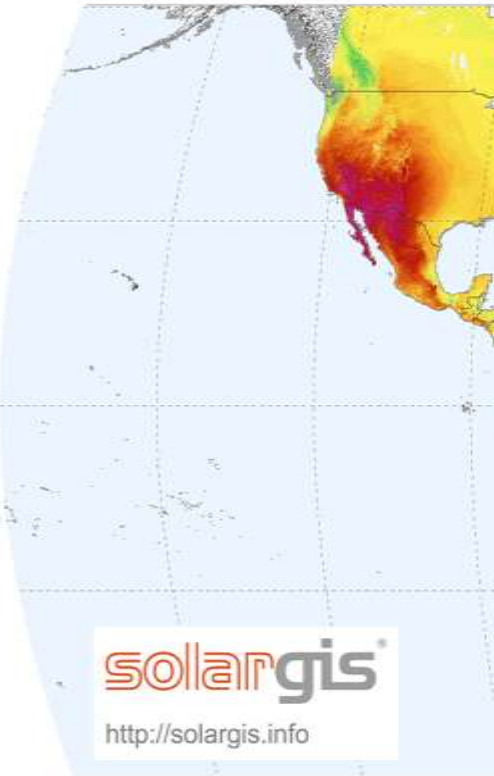
- GHI is the most common solar map with relative good accuracies – with other maps also now available (GTI, PVOut, PVTracking, etc.)
- GHI is the most commonly measured solar data parameter
- The cost of a PV solar measurement station is significantly lower than that of DNI
- Satellite derived GHI data is available at a lower cost than DNI data
- Satellite derived GHI data has lower uncertainty than DNI

Concentrating Solar Power

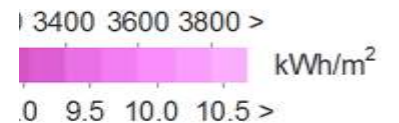
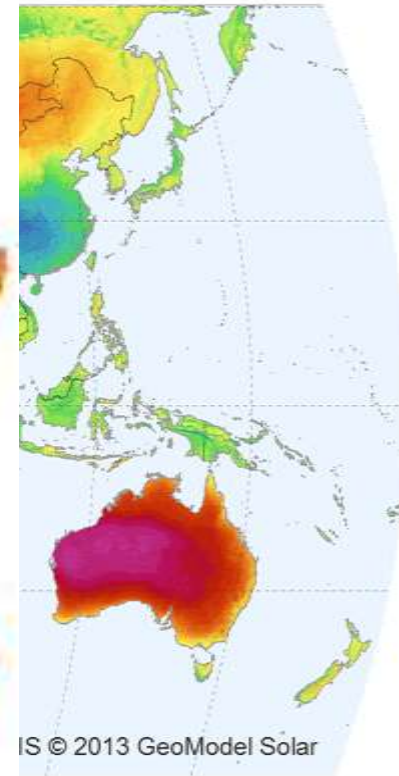
- Few DNI maps are available in general with relative high uncertainties
- Few DNI measurements are available, especially in the public domain
- The cost of a CSP solar measurement station is significantly higher than that of a PV station
- Satellite derived DNI data is more expensive than GHI/GTI data
- Satellite derived DNI data has higher uncertainties than GHI/GTI

World DNI Map (SolarGIS)

WORLD MAP OF DNI



GeoModel
SOLAR



www.solargis.info/imaps

Thank you for your attention



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GeoSUN Collaborators



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