Five satellite products deriving beam and global irradiance validation on data from 23 ground stations

INEICHEN, Pierre

Abstract

Models converting satellite images into the different radiation components become increasingly performing and give often better estimation of the solar irradiance availability than ground measurements if the station is not situated in the near vicinity of the application. Five different satellite products deriving both global and beam irradiance are validated against data from 23 ground sites. The main conclusions are: * the global irradiance is retrieved with a negligible bias and an average standard deviation around 16% for the best algorithm. For the beam irradiance, the bias is around several percents, and the standard deviation around 35%; * the main deviation comes from the knowledge of the aerosol optical depth; * the high latitude sites give not poorer results than the other sites, The interannual variability of the irradiance conditions, the lack of independent ground measurements such as aerosol data, the difficulty to assess the exact calibration of the ground data, and the choice of a specific year to carry out the validation, conduct to results that give good indications, but from which it is difficult to

Reference


Available at:
http://archive-ouverte.unige.ch/unige:23669

Disclaimer: layout of this document may differ from the published version.
Five satellite products deriving beam and global irradiance validation on data from 23 ground stations

Annexe

Pierre Ineichen
University of Geneva
February 2011
Figures in the following pages:

- scatter plots for the global horizontal and normal beam (if available) solar irradiance,

- global horizontal and normal beam (if available) irradiance mean bias difference against the solar elevation angle,

- global irradiance and normal beam (if available) mean bias difference against the atmospheric water vapor content,

- global irradiance and normal beam (if available) mean bias difference against the daily aerosol load of the atmosphere (if available),

- global irradiance and normal beam (if available) mean bias difference against the modified clearness index $K_t'$,

- global clearness index $K_t$ and beam clearness index $K_b$ (if available) represented against the solar elevation angle. In yellow, the measurements and in blue the evaluated irradiance,

- global irradiance and clearness index $K_t$ relative frequency of occurrence; the grey bars are representative of the measurements,

- if available, the beam irradiance $B_n$ and clearness index $K_b$ relative frequency of occurrence; the grey bars are representative of the measurements,

- cumulated relative frequency of occurrence for the global and the beam (if available) irradiance.

**Cabauw** (The Netherlands)

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*Annexe*
Five satellite products deriving beam and global irradiance against ground data validation
P. Ineichen

Camborne (United Kingdom)
Latitude: 50.22°
Longitude: -5.31°
Altitude over sea level: 88m

Figures in the following pages:

- scatter plots for the global horizontal and normal beam (if available) solar irradiance,
- global horizontal and normal beam (if available) irradiance mean bias difference against the solar elevation angle,
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- cumulated relative frequency of occurrence for the global and the beam (if available) irradiance.

Carpentras (France)

Latitude: 44.08°
Longitude: 5.06°
Altitude over sea level: 100m
Five satellite products deriving beam and global irradiance against ground data validation

P. Ineichen

Figures in the following pages:

- scatter plots for the global horizontal and normal beam (if available) solar irradiance,
- global horizontal and normal beam (if available) irradiance mean bias difference against the solar elevation angle,
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- global irradiance and normal beam (if available) mean bias difference against the daily aerosol load of the atmosphere (if available),
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- cumulated relative frequency of occurrence for the global and the beam (if available) irradiance.

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Davos Dorf (Switzerland)

Latitude: 46.81°
Longitude: 9.84°
Altitude over sea level: 1610m
Five satellite products deriving beam and global irradiance against ground data validation

P. Ineichen

El Saler (Valencia, Spain)

Latitude: 39.35°
Longitude: -0.32°
Altitude over sea level: 10m

Figures in the following pages:

- scatter plots for the global horizontal and normal beam (if available) solar irradiance,
- global horizontal and normal beam (if available) irradiance mean bias difference against the solar elevation angle,
- global irradiance and normal beam (if available) mean bias difference against the atmospheric water vapor content,
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Geneva (Switzerland)

Latitude: 46.20°
Longitude: 6.13°
Altitude over sea level: 420m

Figures in the following pages:

- scatter plots for the global horizontal and normal beam (if available) solar irradiance,

- global horizontal and normal beam (if available) irradiance mean bias difference against the solar elevation angle,

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Five satellite products deriving beam and global irradiance against ground data validation

P. Ineichen

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- cumulated relative frequency of occurrence for the global and the beam (if available) irradiance.

Jungfraujoch (Switzerland)

Latitude: 46.55°
Longitude: 7.98°
Altitude over sea level: 3571 m

Annexe
Las Majadas (Spain)

Latitude: 39.94°
Longitude: -5.77°
Altitude over sea level: 260m

Figures in the following pages:

- scatter plots for the global horizontal and normal beam (if available) solar irradiance,

- global horizontal and normal beam (if available) irradiance mean bias difference against the solar elevation angle,

- global irradiance and normal beam (if available) mean bias difference against the atmospheric water vapor content,

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- cumulated relative frequency of occurrence for the global and the beam (if available) irradiance.
Five satellite products deriving beam and global irradiance against ground data validation

P. Ineichen

Locarno (Switzerland)

Latitude:  46.171°
Longitude:  8.78°
Altitude over sea level:  367m

Figures in the following pages:

- scatter plots for the global horizontal and normal beam (if available) solar irradiance,

- global horizontal and normal beam (if available) irradiance mean bias difference against the solar elevation angle,

- global irradiance and normal beam (if available) mean bias difference against the atmospheric water vapor content,

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Five satellite products deriving beam and global irradiance against ground data validation
P. Ineichen

Nantes (France)
Latitude: 47.15°
Longitude: -1.33°
Altitude over sea level: 30m

Figures in the following pages:

• scatter plots for the global horizontal and normal beam (if available) solar irradiance,

• global horizontal and normal beam (if available) irradiance mean bias difference against the solar elevation angle,

• global irradiance and normal beam (if available) mean bias difference against the atmospheric water vapor content,

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Annexe
Five satellite products deriving beam and global irradiance against ground data validation

P. Ineichen

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Annexe

**Payerne (Switzerland)**

Latitude: 46.82°
Longitude: 6.95°
Altitude over sea level: 490m
Figures in the following pages:

- scatter plots for the global horizontal and normal beam (if available) solar irradiance,
- global horizontal and normal beam (if available) irradiance mean bias difference against the solar elevation angle,
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Five satellite products deriving beam and global irradiance against ground data validation

P. Ineichen

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- cumulated relative frequency of occurrence for the global and the beam (if available) irradiance.

Sion (Switzerland)

Latitude: 46.22°
Longitude: 7.33°
Altitude over sea level: 489m

Annexe
Sonnblick (Austria)

Latitude: 47.05°
Longitude: 12.95°
Altitude over sea level: 3105m

Figures in the following pages:

- scatter plots for the global horizontal and normal beam (if available) solar irradiance,

- global horizontal and normal beam (if available) irradiance mean bias difference against the solar elevation angle,

- global irradiance and normal beam (if available) mean bias difference against the atmospheric water vapor content,

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**Thessaloniki (Greece)**

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Annexe
Toravere (Estonia)

Latitude: 58.27°
Longitude: 26.47°
Altitude over sea level: 70m

Figures in the following pages:

- scatter plots for the global horizontal and normal beam (if available) solar irradiance,
- global horizontal and normal beam (if available) irradiance mean bias difference against the solar elevation angle,
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- global irradiance and normal beam (if available) mean bias difference against the daily aerosol load of the atmosphere (if available),
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- global irradiance and normal beam (if available) mean bias difference against the daily aerosol load of the atmosphere (if available),

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Annexe

Vaulx-en-Velin (France)

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Zurich (Switzerland)

Latitude: 47.48°
Longitude: 8.53°
Altitude over sea level: 558m

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