Documentation - EnMetSOL

Satellite Data – Available Regions at Oldenburg University

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Introduction

At University of Oldenburg satellite derived irradiance data are available as timeseries and maps. These data are based on the cloud index which is calculated from satellite images of both Meteosat generations (MFG and MSG).

MFG: 1995-2005, 2.5*2.5km^2 resolution at sub satellite point, 2 images per hour
MSG: 2005-2010, 1.0*1.0km^2 resolution at sub satellite point, 4 images per hour

Irradiance from satellite imagery

The Heliosat method is a technique of determining the global radiation at the ground by using data from a geostationary satellite, see [1,2]. We use this method in combination with a clear sky model to calculate GHI, DHI and DNI.

Heliosat method

The key parameter of the Heliosat method is the cloud index n, which is taken from the satellite measurements and related to the transmissivity of the atmosphere via

$$k^* = 1 - n,$$

where the transmissivity is expressed by the clear sky index k* defined as the ratio of global irradiance and clear sky irradiance:

$$k^* = Ig / Iclear.$$

The clear sky irradiance must be known for each site.

Clear sky models

The clearsky case is determined by the atmospheric turbidity.

For GHI the Clearsky model of Dumortier [3] can be used with two alternative turbidity data sets:

- Satellight zones with yearly pattern of Bourges [4]
- high resolution data base of Remund (MeteonormHR) [5]

The SOLIS clear sky model [6] uses the radiative transfer model libRadtran [7] to calculate input parameters for a fitting function called the modified Lambert–Beer (MLB) relation. For this, only two radiative transfer calculations are needed for a given atmospheric state to get the irradiance for a full day. We use climatologies with monthly averages of AOD [8] and water vapour content [9] as input parameters for SOLIS and get DNI and GHI as output.

The cloudy sky

For the Dumortier Clearsky Model a diffuse fraction model [10] is used to calculate the all sky diffuse horizontal irradiance. In a second step DNI is calculated from the difference GHI-DHI.

A recently developed beam fraction model [11] is used to calculate the DNI for all sky conditions with the SOLIS model. This enables a more direct route to calculate DNI.

Data base of satellite images

For DNI timeseries the following regions can be calculated:

- Europe
- Canary Islands
- some regions in Middle East, Northern and South Africa specified in the images given below

References:

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[10] Lorenz E (2007): Improved diffuse radiation model, MSG. Report for the EC-project PVSAT-2: Intelligent Performance Check of PV System Operation Based on Satellite Data, NNE5-2001-0571, Deliverable D4.2b, Univ. Oldenburg

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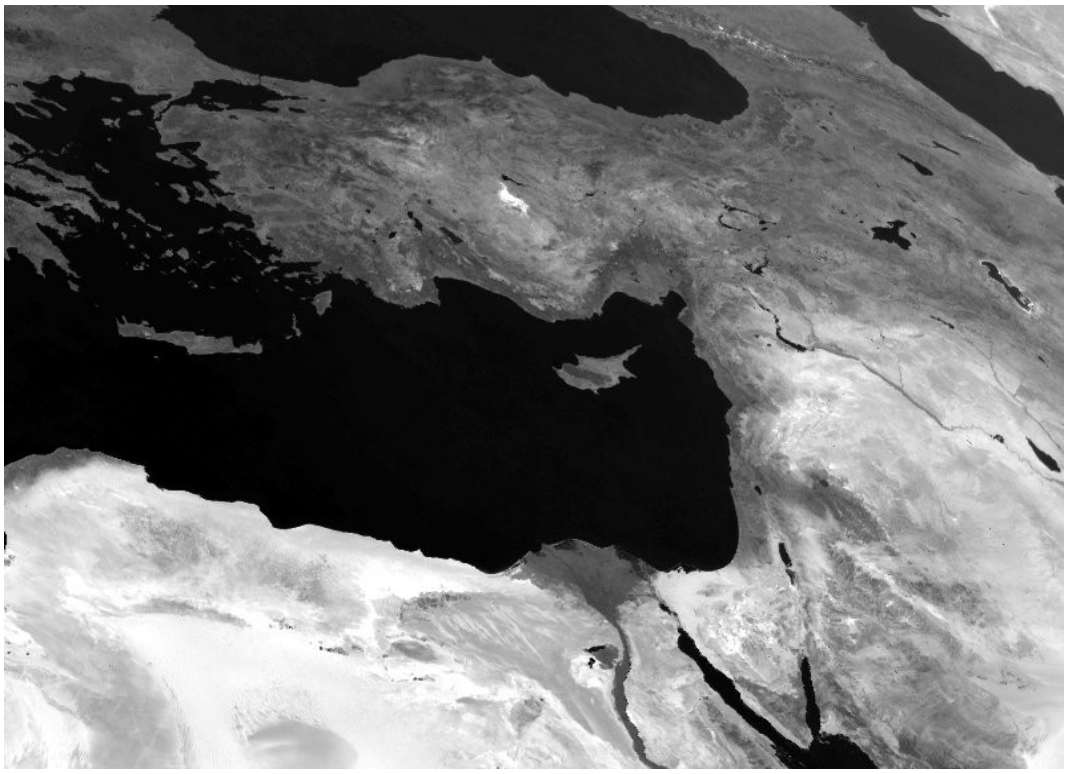
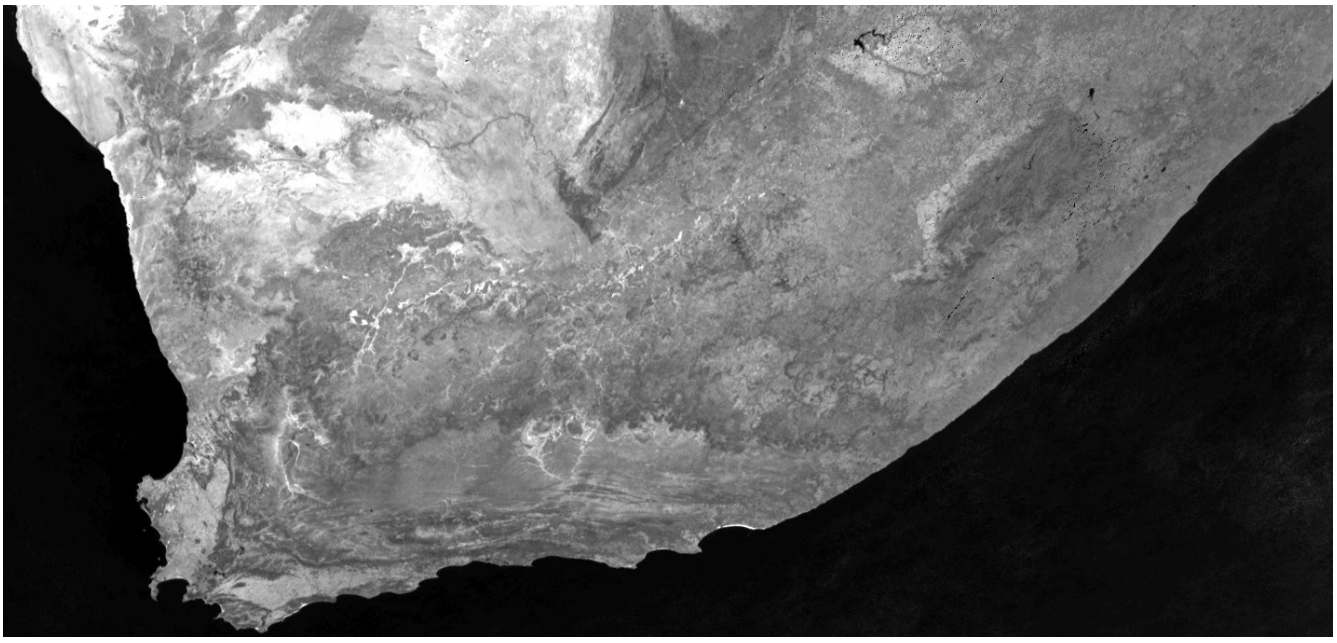
MFG: 1995-2005, 2.5*2.5km^2 resolution at sub satellite point, 2 images per hour



MSG: 2005-2010, 1.0*1.0km^2 resolution at sub satellite point, 4 images per hour



MSG: 2005-2009, 1.0*1.0km^2 resolution at sub satellite point, 4 images per hour