Copernicus for Renewable Energy

Define zone of visual influence of wind turbines
• In many countries, the visual influence of a wind farm on the landscape is an important issue, especially in regions with a high population density.

• From a Digital Elevation Model (D.E.M) describing the topography, tools can delineate the zone of visual influence (ZVI) or visibility footprint.

• This session will access the EU-DEM reference data of the CLMS (Copernicus Land Monitoring Service) and use this data in a GIS.
Handson demo

• Get DEM from Copernicus: https://land.copernicus.eu/imagery-in-situ/eu-dem/eu-dem-v1.1/view
• Select the area of interest
• Download and decompress
• Visualize the map with QGIS
• Add location of wind turbine
• Delineate the zone of visual influence
The EU-DEM v1.1 is a resulting dataset of the EU-DEM v1.0 upgrade which enhances the correction of geo-positioning issues.

EU-DEM v1.1 is a contiguous dataset divided into 100x100 km tiles, resulting in a total of 1992 tiles at 25m resolution with vertical accuracy +/- 7 meters.

EU-DEM v1.1 data are single band raster with values relating to the actual elevation.

The EU-DEM map shows a colour shaded relief image over Europe, which has been created by the EEA.

The dataset is encoded as GeoTIFF easily importable to common G.I.S.
Get elevation model

Copernicus is a European system for monitoring the Earth. Data is collected by different sources, including Earth observation satellites and in-situ sensors. The data is processed and provides reliable and up-to-date information in six thematic areas: land, marine, atmosphere, climate change, emergency management and security. The land theme is divided into four main components:

- **Global**
  provides a series of biogeophysical products on the status and evolution of the land surface at global scale at mid and low spatial resolution

- **Pan-European**
  provides information about the land cover and land use (LC/LU), land cover and land use changes and land cover characteristics

- **Local**
  focuses on different hotspots i.e. areas that are prone specific environmental challenges and problems

- **Imagery and reference data**
  satellite imagery forms the input for the creation of Copernicus land products. In order to ensure an efficient and effective use of satellite data the Copernicus land monitoring service needs access to in-situ data
Land Monitoring

Get elevation model

Imagery and reference data

EU-DER
EU-Hydro
LUCAS

EU-DER
EU-DER v1.0 and Derived Products
EU-DER v1.1
Get elevation model

You are here: Home / Imagery and reference data / EU-DEM / EU-DEM v1.1

EU-DEM v1.1

User corner

- How to access our data
- Technical library
- Factsheets
- Use cases

Map View  Metadata  Download

Couches  Légende  Web services

Tile: E40N20

TILE ID: E40N20

DOWNLOAD: [Red Link]
### EU-DEM v1.1

<table>
<thead>
<tr>
<th>Name</th>
<th>Resolution</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEM-v1.1-25m-E40N20</td>
<td>25m</td>
<td>5.8 GB</td>
</tr>
</tbody>
</table>

Information about the different zones in which the dataset is divided can be found by clicking on the map in the Web View tab, where tiles can also be downloaded directly. The x,y-coordinates in the tiles are based on the EFSG:3035 (ETRS89-LAE4) projection. The 1000 x 1000 km tiles are provided as zipped GeoTIFF files with LZW compression.

To download the data, visit the EU-DEM v1.1 page and select the desired tiles. Log in to download the data.
• Viewshed analysis calculates visible surface from a given observer point over a digital elevation model.

• GRASS library
  – r.viewshed: Computes the viewshed of a point on an elevation raster map.
  – r.los: line of sight raster analysis program

• SAGA library
  – viewshed module

• QGIS plug-in:
  – **Advanced visibility analysis tool**: This plugin is native to QGIS. It is particularly performant for multiple viewshed calculations from a set of fixed points.
Video: Compute Zone of visibility in QGIS
Estimation of annual forest biomass production

Copernicus User Uptake Information Sessions

Renewable Energy
Introduction of use case

- Woody biomass produced by forest areas is abundant and can be used as a fossil fuel substitute.

- To use woody biomass as renewable energy source, we need to quantify it, to map it and to monitor it.

- Traditionally, allometry measurements and equations are used to determine the annual production of biomass by a forest stand.

- However, allometry is time-consuming, costly, limited to small areas.

- In addition, biomass and carbon stock estimates from forest inventory data have usually some spatial and temporal gaps, which can be filled in with remote sensing data.

- Remote sensing can be used to estimate biomass energy potential over large regions and for different land-cover classes.
**Introduction of use case**

- Remote sensing data are acquired by airborne campaigns or by instruments on board satellites.

- Remote sensing data are available at **different scales**, from local to global, from various sources including optical, radar and light detection and ranging (LiDAR) sensors.

- Optical remote sensing data allow to generate **vegetation indices** that are useful in biomass estimation:
  - Leaf area index (LAI);
  - Fraction of absorbed photosynthetically active radiation (FAPAR);
  - Normalized Difference Vegetation Index (NDVI);
  - Dry matter productivity (DMP).

- Currently, the **Copernicus Global Land Service** provides a suite of **vegetation indices** that can be used to estimate total forest biomass production on a annual basis.

- In this session, we will focus on the **Normalized Difference Vegetation Index (NDVI)** and on the **Dry Matter Productivity products** both at 300 m resolution derived from the PROBA-V sensor.
**The Dry Matter Productivity (DMP)**

- The **Dry Matter Productivity (DMP)** represents the overall growth rate or dry biomass (AGB) increase of the aboveground vegetation.
- The DMP is expressed in **kilograms of dry matter per hectare per day** (kgDM/ha/day).
- The DMP product of the Global Land service is currently computed with classical formula.
DMP = \( f_{\text{APAR}} \cdot DMP_{\text{max}} \)

- \( f_{\text{APAR}} \) quantifies the fraction of the solar radiation absorbed by live leaves for the photosynthesis activity.
  - \( f_{\text{APAR}} \) is provided by the Copernicus Global Land Service.

- \( DMP_{\text{max}} \) represents the climatic maximum reachable DMP.
  - Accessible thanks to Copernicus Atmosphere Monitoring Service & Meteorological data
Select and order 5 DMP summer seasons

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Download the data from FTP server

COPERNICUS Global Land Service
Free and harmonized collection of global land-geophysical parameters.
Visit our website: http://global.copernicus.eu/land

VDI - Research Networking
Environment - Land - 2015 - Berlin
E-Mail: land@copernicus.net

VDI hosts the production distribution facilities for the Copernicus Global Land Service, under assignment of the European Commission.

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Explore Copernicus DMP data in the ESA Time Series viewer