Solar Med Atlas

Introduction to the simulation tools and Web Services

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SOLARMED atlas

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ARMINES

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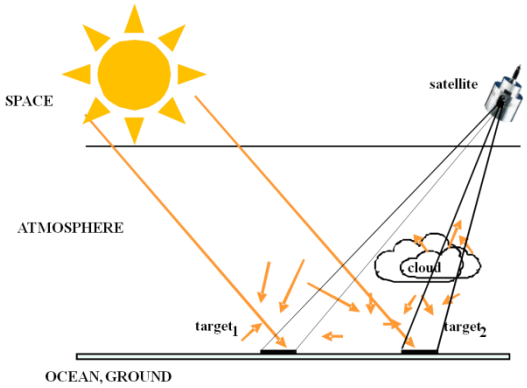
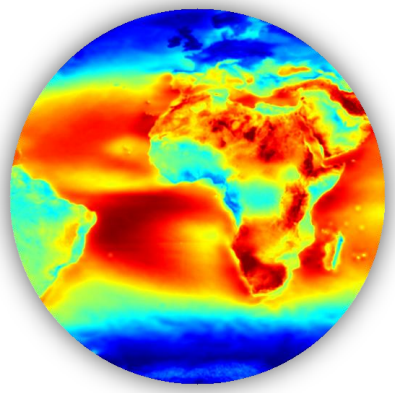
Satellite-based cartography of Solar Resource

- Two solar databases
  - SOLEMI (DLR): 1991 - 2004
  - HelioClim-3 (MINES ParisTech / Transvalor) 2005 – 2011
- Heliosat-based methods
- Use of Meteosat imagery
  - Meteosat First Generation (1985 – 2005)
  - Meteosat Second Generation (since 2004)
- Spatial resolution: ~ 3 – 4 km

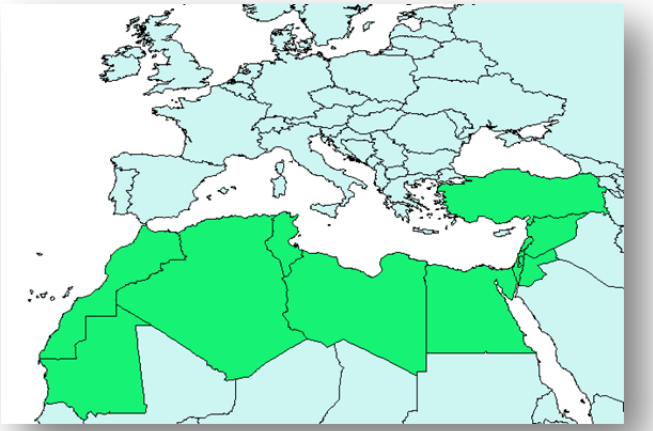




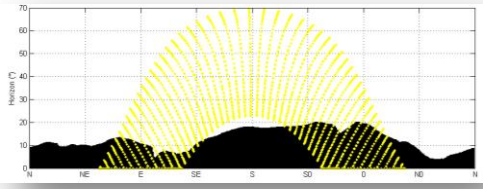
Introduction

- **Focus on**

  Turkey, Syria, Lebanon, Jordan, Israel, Palestine National Authority, Egypt, Libya, Tunisia, Algeria, Morocco, and Mauretania



- **Global, Diffuse and Direct irradiations (Tilted plans, normal incidence)**
- **Spatial resolution: 1 km with orographic effects**
  - Variation of the length of the optical path due to the local 1-km altitude derived from the Digital Elevation Model SRTM
  - Shadow effects from SRTM-derived horizon

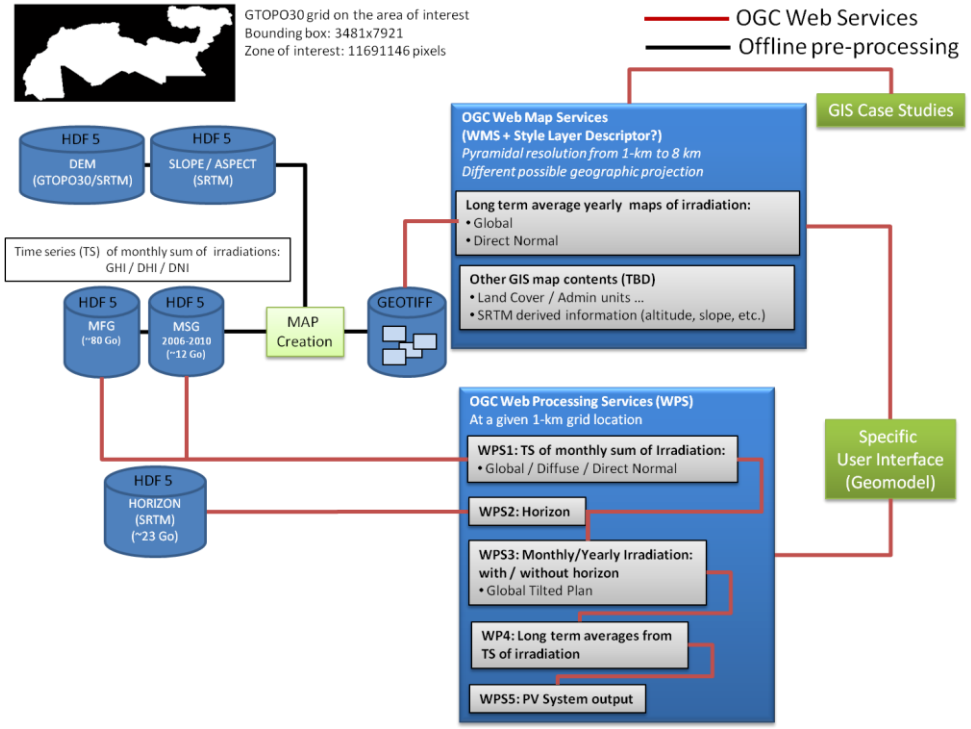


- **Temporal resolution: monthly irradiations from 1991 to 2010**

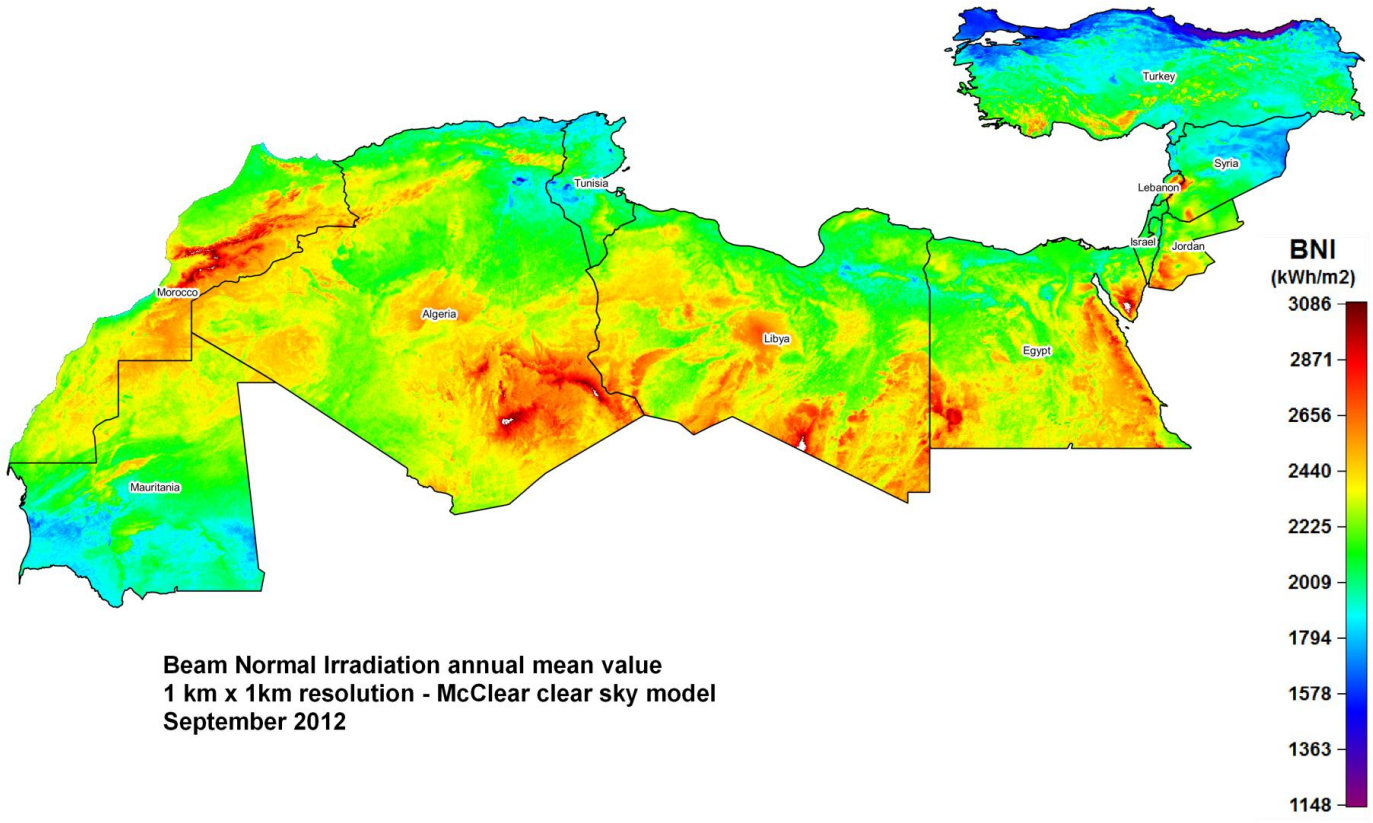
- **The potential end-users and usages of a solar atlas:**
  - Governmental and private actors
    - Geographical analysis of local solar potential
    - Sitting and sizing solar power plants
      Advanced feasibility pre-studies based on geographical analysis
      (before, for example, a local installation of a pyranometric station)
  - Individual
    - High resolution map suitable for sizing small individual solar systems (small PV system, solar water heating systems, etc)
    - Accurate and well-presented solar maps are concrete and instructive for everybody (e.g. education) to promote solar energy

Data dissemination:

- Dedicated web-based interface at www.solar-med-atlas.org
- Distributed architecture compliant to the GEOSS / OGC architecture
  - Web Map Services for GIS-based analysis
  - Web Processing Services for solar estimation at a given geo-point

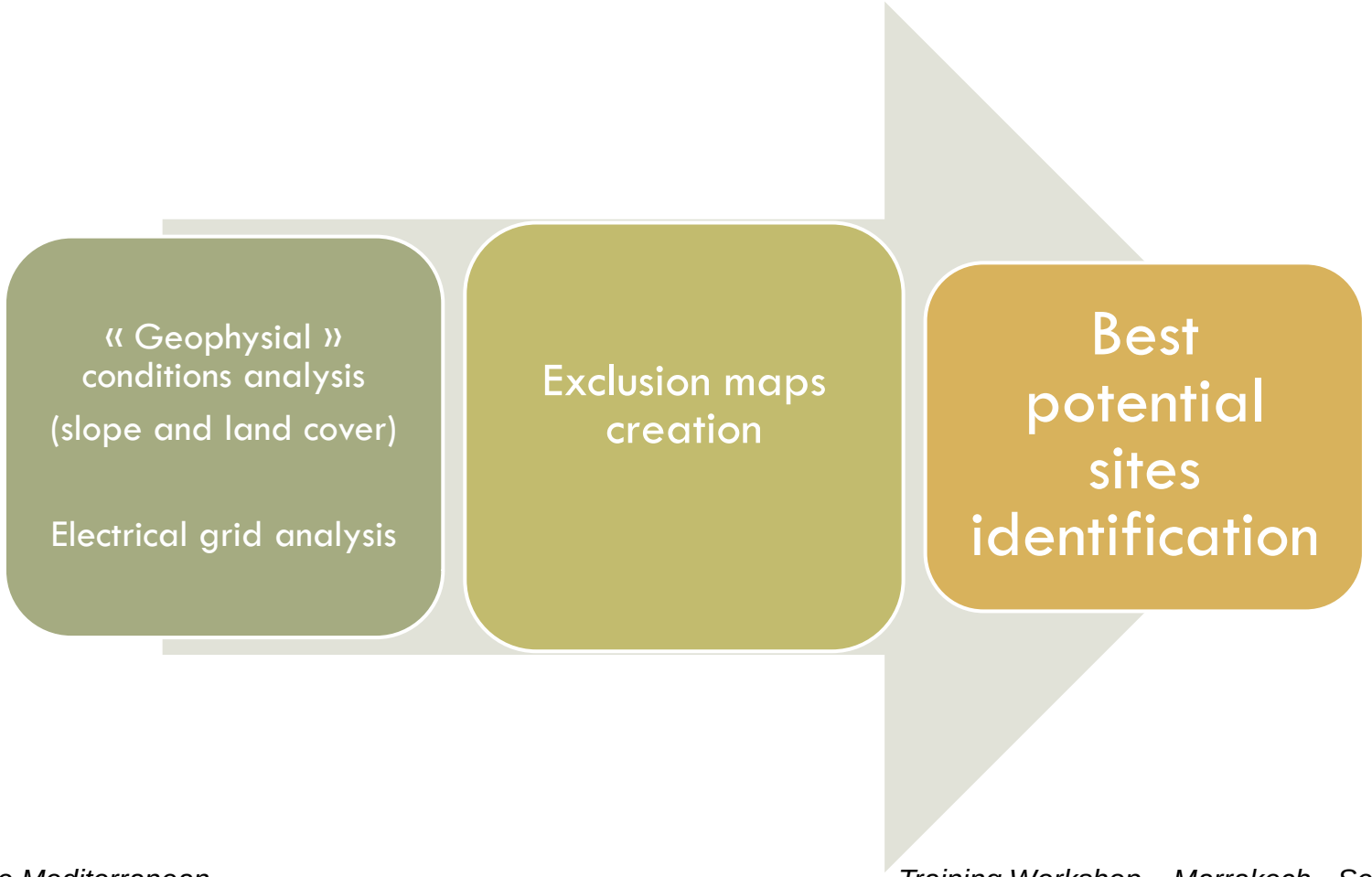


Yearly average BNI map from Helioclim3 data (2004-2010)



Application from the solar atlas

- **Creation of maps to determine “best” potential solar sites**



Getting the BNI and SRTM data

- **The BNI maps can be downloaded from the Web Map Service for the Morocco zone**
  - wget -O BNI_Morocco.tif http://www.solar-med-atlas.org/mapserv/solar_med_atlas?SERVICE=WMS&VERSION=1.3.0&REQUEST=GetMap&BBOX=20.7,-17.25,36.2,-0.6&CRS=EPSG:4326&WIDTH=1998&HEIGHT=1860&LAYERS=solar_med_atlas_BNI_16bits&FORMAT=image/tiff
- **Same procedure to get the SRTM 16 bits image**
- **This can be executed in a Windows .bat file**

Getting the land cover and other data

- For the landcover, we use the GLOBCOVER map, restricted to the same zone with the same pixel size (0.00833206° ~1km) (desert area value is 200)
- The country boundary and power lines are obtained as shape files from the DIVA GIS web site. You must best use your own data for the power lines…

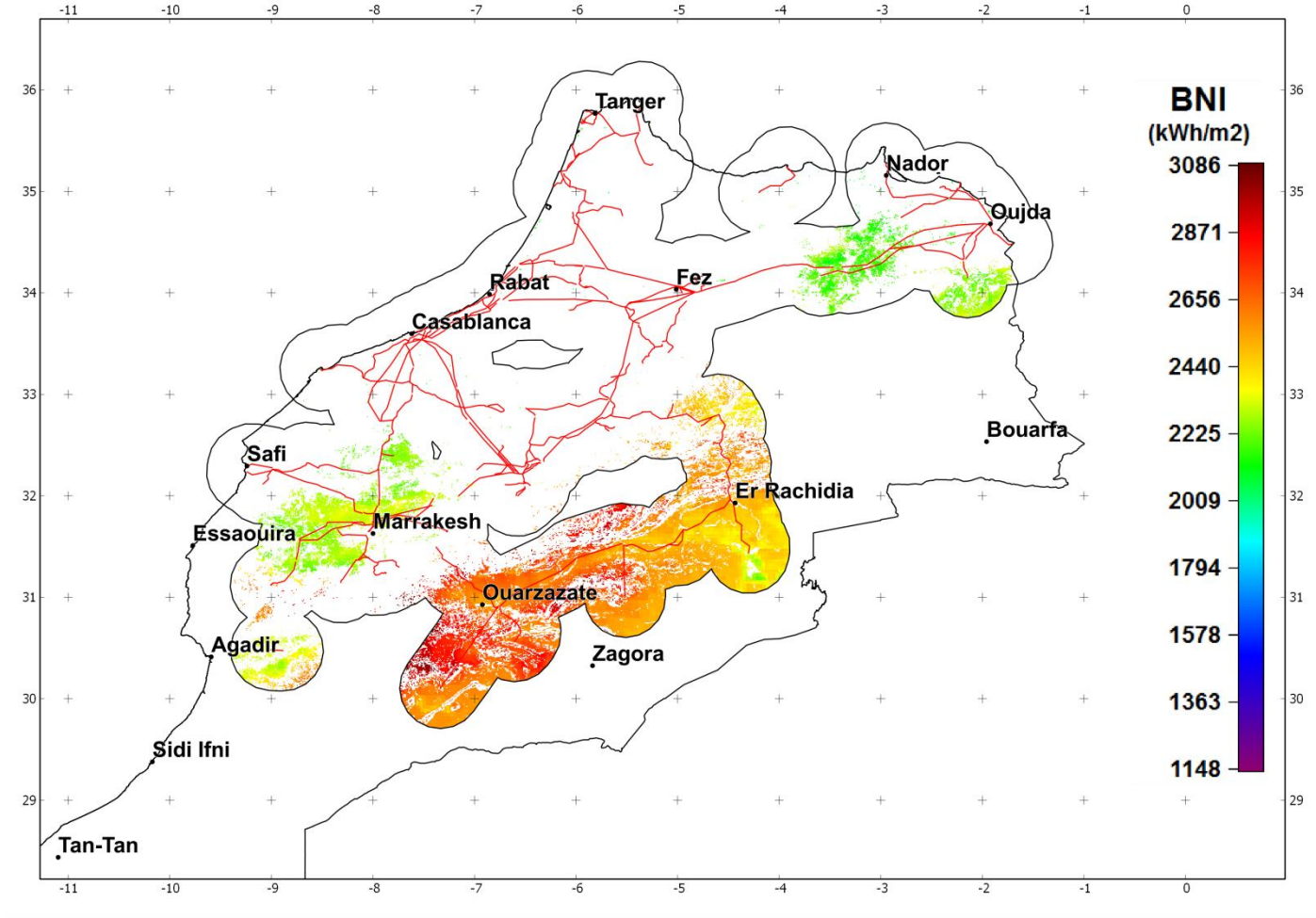
Creating the exclusion maps

- In Qgis, we use the raster calculator to compute a mask combining the zones of :

  (landcover=200) AND (slope<5°)

- The mask is applied to the BNI map
- In Qgis, we use one of the vector plugins to create a shape file of the zone of 50 km distance from any power line
- We use this shapefile to « cut » the BNI restricted map to further refine the analysis

Final exclusion map



Conclusion

- **Creation of a potential “best” sites map**
  - Exclusion zones based mainly on land cover and Digital Elevation Model
  - Further exclusion based on :
    - Distance from electricity grid source points
- **Fine local assessment for the site need then**
  - Installation of an irradiation measurement ground station
  - Calibration of the satellite data with the ground station
  - Creation of TMY time series (P50, P90) to calculate the solar energy project yield