README FILE

Products: Soil Moisture Maps

Data used: Sentinel-1 (SAR- radar sensor) and Sentinel-2 (optical sensor)

Scale: Plot scale

The soil moisture maps were carried out at a plot scale. A map is provided each 6 days (12 days with Sentinel-1A and 12 days with Sentinel-1B). Inversion algorithm for estimating soil moisture was applied for agricultural areas with any vegetation cover (for some sites and some years, the estimation was also applied to grasslands).

The Land cover maps used to mask the agricultural areas (and the grasslands) are provided by Theia Land Cover SEC (Scientific Expertise Center), the French RGP (Registered Geographical Parcels) dataset, Corine Land Cover, or by local land cover maps, depending on the examined study site.

Sentinel-2 images were used to calculate the NDVI (Normalized Differential Vegetation Index) required for the soil moisture estimation. In some cases, the NDVI is used to segment the agricultural areas in order to extract homogeneous polygons within agricultural plots. The Sentinel-2 images used are corrected for atmospheric effects by Theia Surface Reflectance SEC.

Data access: http://thisme.teledetection.fr

Deliverable description

The Soil Moisture Maps are divided into two main folders:

- **S1A: referring to maps derived from Sentinel 1A satellite**
- **S1B: referring to maps derived from Sentinel 1B satellite**

Format:

Format description of soil moisture maps (for example MV_S1A_OCC-FP4_20180904T175524.TIF)

- Image Format: GeoTIFF
- Structure of files name: MV_[Satellite]_[ProductionSite]-[Footprint]_yyyymmddThhmmss.TIF

  - [Satellite]: S1A or S1B
  - [ProductionSite]: Localisation name of production site
  - [Footprint]: Sentinel-1 Footprint
  - yyyy: year
  - mm: month
  - dd: acquisition day

T is used to separate the date and the time (UTC)

  - hh: hour
  - mm: minutes
  - ss: seconds

Important:

1. In the provided soil moisture maps (WGS84, EPSG: 4326), the soil moisture values (*mv*) are multiplied by ***5***. In order to derive the estimated soil moisture value from the provided maps ***it is necessary to divide*** by ***5***.

$$\boldsymbol{Soil\ Moisture\ Estimation\ (mv\ Vol.\%)} = \frac{\boldsymbol{Value\ obtained\ from\ the\ Map}}{\mathbf{5}}$$

2. In the provided NDVI maps (NDVI folder, Geotiff format), the NDVI values are multiplied by ***100***. To derive the NDVI value from the maps ***it is necessary to divide*** the obtained value by ***100.***

$$\boldsymbol{NDVI} = \frac{\boldsymbol{Value\ obtained\ from\ the\ Map}}{\mathbf{100}}$$

   Format description of NDVI maps (for example NDVI_OCCITANIE_201609.TIF):

   - GeoTIFF
   - Structure of files name: NDVI_[ProductionSite]_yyyymm.TIF
     - [ProductionSite] : Localisation name of production site
     - yyyy: year
     - mm: month

3. Null values in the soil moisture maps = no data (no soil moisture estimation)

4. **Caution 1:** When the soil temperature is negative (Frozen Conditions), the real water content of the soil is higher than that which could be estimated from SAR images because a part of the water content is found on ice form.

5. **Caution 2:** The estimation of the soil moisture is not relevant for many types of vegetation when the NDVI is greater than a threshold of about 0.7. Indeed, for NDVI>0.7, the soil contribution in C-band is very low and the backscattered radar signal contains little or no soil information. In this case where the soil contribution is low (NDVI>0.7), the estimated soil moisture is low (generally less than 10%). Thus, it is advisable to eliminate or use with caution (false or not precise estimates) the soil moisture estimates for plots with NDVI> 0.7 when the estimated soil moisture is less than about 10%.

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