

PhD position at AgroParisTech (ECOSYS) and Infosol (INRA) Remote Sensing/Pedometrics

Spatial monitoring of soil organic carbon stocks from Sentinel time series at regional cropland scale

The 4 per 1000 initiative launched at the Paris climate summit (COP21) in December 2015 aspires to increase global SOM stocks by 0.4 percent per year as a compensation for the global emissions of greenhouse gases by anthropogenic sources (Minasny et al., 2017) and targets the agricultural soils in priority. In keeping with the 4 per 1000 initiative, there is a crucial need for assessing and monitoring the SOM stocks or organic C stocks of soils for agricultural areas. So far, at regional scales, there is no efficient and straightforward way of monitoring topsoil organic C (SOC). Both scarcity, spatial and spectral resolution of the satellite data that were acquired in the past did not enable to monitor SOC from space. This PhD project is backed by the several projects aspiring to take advantage of the recently available satellite Sentinel time series for this purpose.

Now that one can collect a large number of Sentinel images over the time of crop cycles, there are several challenges to face: i) target the acquisition time(s) that are best adapted for predicting SOC contents; ii) construct methods for mosaïcking bare soil pixels in order to increase the predicted area; iii) carry out mixed methods combining spatial statistics and multirate imagery, for producing spatially exhaustive maps and their related uncertainties.

The objective of this PhD thesis is to evaluate the capacity of Sentinel 2 and/or 1 satellite time series to monitor SOC for agroecosystems. It questions the quantitative performance that is reachable through plurimensual and multiyear optical Sentinel-2 combined or not to Sentinel-1 radar time series, for diversified croplands with contrasted soil types, climatic conditions and agricultural practices, located within the Parisian Basin (Versailles Plain, Beauce), region of Toulouse or in French Brittany.

Varied models will be constructed and compared, being either (i) spatial-geostatistical SOC prediction models based on spatial data only in the absence of information derived from image reflectance spectra; (ii) reflectance-derived SOC prediction models, particularly based on spectral S2 data (Vaudour et al., 2019); (iii) mixed spatial-spectral models based on both (Loiseau et al., 2019).

Keywords: Soil organic carbon, digital soil mapping, remote sensing of soil, agroecosystem

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Doctoral School	ABIES (http://www2.agroparistech.fr/abies/)
Infosol supervisor	Dominique ARROUAYS , head of Infosol national soil mapping service, dominique.arrouays@infosol.fr
PhD location	Infosol, Orléans or Grignon or Saclay
Duration and start date	3 years, starting preferably on October 1, 2019
Employer	INRA ECOSYS
Academic requirements	University Master degree in soil science or remote sensing and inclination to digital soil mapping
Language requirements	Fluency in French or English, willingness to learn French

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References

Loiseau, T., Chen, S., Mulder, V.L., Román Dobarco, M., Richer-de-Forges A.C., Lehmann, S., Bourenanne, H., Saby N.P.A., Martin, M.P., Vaudour, E., Gomez, C., Lagacherie, P., Arrouays D., 2019. Satellite data

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