

Bundesministerium für Bildung und Forschung

GEFÖRDERT VOM





# Machine Learning Assisted by Mechanistic Modeling for Estimating Subsurface Soil Texture and Organic Carbon Content

Workshop on Digital Soil Mapping assisted by Process-based data for Agriculture

#### September 04, 2025, at ZALF, House 45, Eberswalde Str. 84, 15374 Müncheberg

**Time duration:** One day (8:45 – 16:00)

Format: On-site

**Chairs:** Prof. Dr. Claas Nendel and Dr. Gohar Ghazaryan, Leibniz Centre for Agricultural Landscape Research (ZALF)

Lecturer: Dr. Leonardo Inforsato

#### Background

Künstliche Intelligenz Kompetenz in der Landwirtschaft (KIKompAg) is a multidisciplinary project that aims to coordinate and advance the integration of multisource data, artificial intelligence (AI), and various simulation methods for cross-scale monitoring of agricultural systems. One of its key objectives is to explore how AI applications and remote sensing technologies can support agriculture.

This workshop will provide hands-on activities for developing a machine learning model to estimate subsurface soil texture and soil organic carbon content at high spatial resolution using satellite imagery.

The workshop is structured into three main practical sessions:

- 1. Satellite Image Processing Working with Sentinel-2 L2A images of a selected arable field, participants will preprocess, interpolate, and smooth the time-series imagery.
- 2. Simulation with the MONICA Crop Model Learn how to calibrate the MONICA model parameters and generate synthetic data relevant to subsurface soil properties.
- 3. Machine Learning Model Training Apply machine learning to predict subsurface soil texture and organic carbon content based on the processed imagery and simulation results.

#### Outcomes

Participants will gain practical skills to estimate subsurface soil properties in a specific field using minimal input data — an approach accessible to both researchers and practitioners.



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## Data & Tools:

- Data: Sentinel-2 L2A satellite images, digital elevation models, and soil profile data from 12 field points.
- Required Materials: Computer, Python (with required libraries), MONICA model, and provided datasets.

### **Tentative Plan**

Time		Presenter	Activity
08:45	09:00		Opening and registration
09:00	09:20	Prof. Dr. Claas Nendel	Welcome and Introduction
09:20	09:40	Dr. Gohar Ghazaryan	Presentation by Dr. Ghazaryan
09:40	10:00	Guest Professor*	Presentation by Guest Professor*
10:00	10:15	Break	
10:15	11:00	Dr. Leonardo Inforsato	Theory and methodology Overview
11:00	12:00		Hands-on: Data Preparation & Point Selection
12:00	13:00	Lunch Break	
13:00	14:00	Dr. Leonardo Inforsato	Hands-on: Monica - Fitting 12 pts & Data Augmentation
14:00	15:00		Hands-on: Model Training (Linear & machine learning models)
15:00	15:15	Break	
15:15	16:00	Dr. Leonardo Inforsato	Hands on: Implementation, Interpretation and Discussion

\* Guest Professor to be confirmed.

Registration: https://bit.ly/42mBpea

Deadline: September 1, 2025

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