UNVEILING SOIL PROPERTIES FROM FTIR SPECTRA

López-Núñez Rafael[1], Cobos-Sabater Joaquín[2], Cayuela-Sánchez José A.[3], Almendros-Martín Gonzalo[4]

[1]INSTITUTO DE RECURSOS NATURALES Y AGROBIOLOGÍA DE SEVILLA (IRNAS-CSIC), [2]ESTACIÓN BIOLÓGICA DE DOÑANA (EBD-CSIC), [3] INSTITUTO DE LA GRASA (IG-CSIC), [4]MUSEO NACIONAL DE CIENCIAS NATURALES (MNCN-CSIC), rafael.lopez@csic.es

- The EJP Soil ProbeField project (A novel protocol for robust in-field monitoring of carbon stock and soil fertility based on proximal sensors and existing soil spectral libraries) proposes innovative techniques for determining SOC stocks and other relevant properties to the health of EU soils.

- This study aims to predict soil properties (calcium carbonate, sand, silt, clay, available-P, and available-K contents) using partial least squares regression (PLS) models and identify significant spectral bands for predicting soil physicochemical properties.

ANNUAL SCIENCE DAYS & 5TH GENERAL MEETING 2024

10 – 14 JUNE VILNIUS LITHUANIA

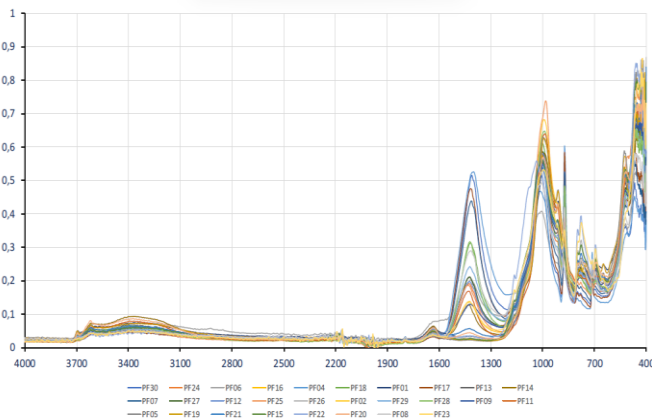**28 samples, 0-15 cm, of agricultural soils in southwestern Spain**
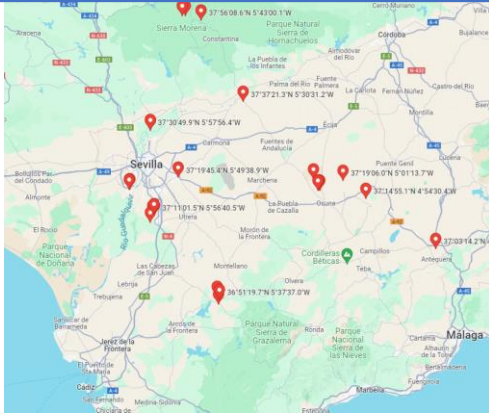
Soil properties determined using conventional laboratory techniques and Fourier transformed infrared (FTIR) spectrum were recorded (range of 4000–400 cm^{-1})


Pretreatment of spectral data: mean centering and MSC (Multiplicative Scattering Correction)


28 ProbeField spectra'23 (no C outliers)

- **Partial least square regression (PLS) with spectral points as independent variables and soil properties values as dependent ones.**
- **Root mean square error (RMSE) and Akaike information criterion (AIC) to select the model with the minimum number of latent variables (LVs), avoiding overfitted spurious models**
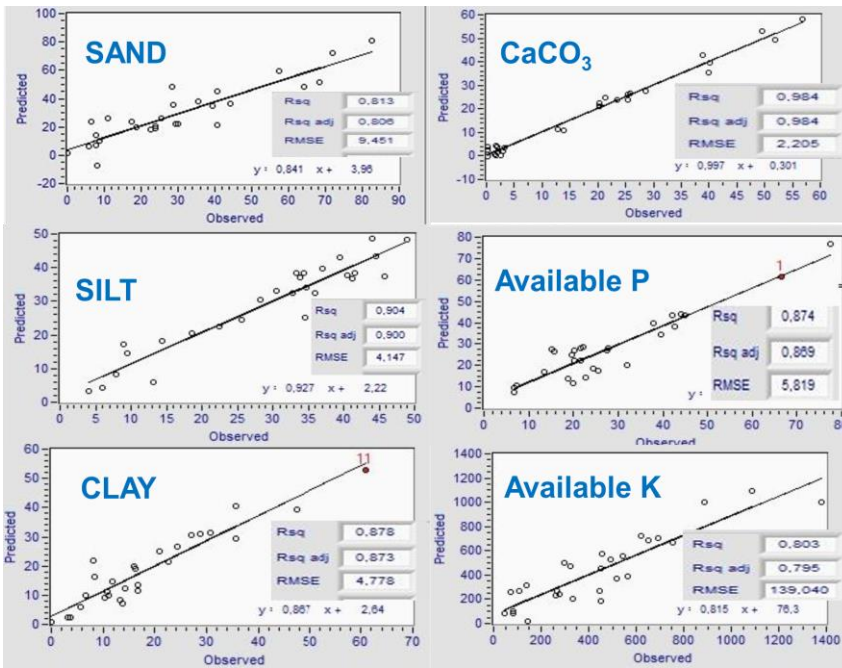
- **EXCELLENT predictions with 19 LV (without overfitting)**
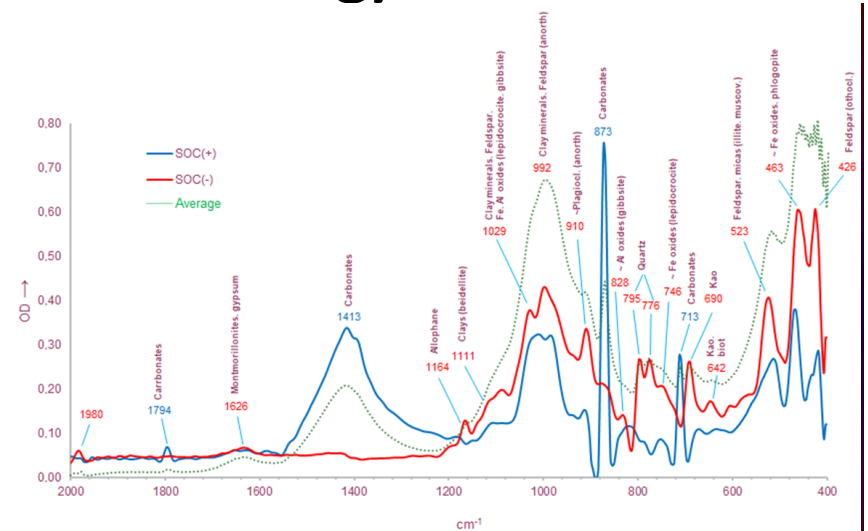
Tentative assignments of the major soil minerals are shown above the main peaks of the scaled subtracted spectra. Dotted line: original (average) spectrum: Red numbers: bands attributed to minerals that predominate in the C-depleted soils; blue numbers: bands that predominate in soils with high C content.

The latent variables include information on the various components of the soil (calcite, silicates, clays, oxides), that is, we can assign the spectral bands to the various minerals

Key message to stakeholders: Powerful, fast soil spectroscopy laboratories coming soon