





Javier Pacheco-Labrador, MªPilar Cendrero-Mateo, Shari Van Wittenberghe, Gerbrand Koren, Itzá Alejandra Hernández Sequeira, Szilvia Fóti, Kadmiel Maseyk, Enrico Tomelleri, Rosario González-Cascón, Egor Prikaziuk, Nataša Čereković, SSC participants.

The SSC motivation

SENSECO Working Group 1 objectives

- Objective 1.1 To identify scalable leaf-to-canopy biophysical and biochemical traits that can be derived from optical data, and to evaluate the accuracy that can be conserved when upscaling.
- Objective 1.2 To provide clear, evidence-based guidelines of scaling protocols, in terms of measurement protocols and data treatment; this ensures consistent, reproducible, and comparable results across Europe (Objective 4.4).
- Objective 1.3 To provide a theoretical scaling assessment by means of RTMs that enable the coupling of the RT of biochemistry-leaf-canopy drivers and giving feedback to the modellers for improving RTMs scaling functionality and for across spectral domain approaches (Objective 3.2)

The SSC motivation

SENSECO Working Group 1 approach

- Ideally
 - Field campaigns or alternative datasets
 - Do not fully allow to understand / evaluate TOC-leaf down-scaling
 - Limitations in data acquisition (e.g., leaf gas exchange measurements)
- Alternatively
 - Simulate the campaign data
 - Let the community show us how they would process these data to down-scale TOC R and F to leaf level parameters





The SSC in short

- WHAT: Open exercise where the participants are challenged to down-scale or retrieve relevant biophysical and plant physiological variables (e.g., leaf chlorophyll content, leaf area index, maximal carboxylation rate, nonphotochemical quenching) from hyperspectral imaging spectroscopy data.
- WHERE: Zenodo. All the data, code and instruction
 - Main dataset: <u>https://doi.org/10.5281/zenodo.6451335</u>
 - Bonus dataset: https://doi.org/10.5281/zenodo.6530187
- WHO: Anyone, WG1 particularly encouraged to participate
 - Small **groups** (≤ 3) allowed
- **AIM: Joint manuscript** comparing the results and methods, identifying good and suboptimal scaling practices
- PARTICIPATION:
 - 13 Groups/Participants (23 people, PhD students, ECR and junior scientists)
 - 15 Contributions

The SSC in aims

- To provide clear, evidence-based guidelines of scaling protocols learnt from the remote sensing community and tested against a simulated dataset of vegetation under unknown stress conditions
- To assess the retrieval accuracy of different plant ecophysiological traits via the application of multiple approaches, data-driven or physically-based
- To gather the remote sensing community around the scaling topic and stimulate collaboration and discussion



The SSC datasets







The SSC datasets







The SSC process



The SSC participation

- SSC contributors
 - 13 individual or group participants
 - 25 people
 - 15 contributions
 - 2 contributors used two different approaches
- SSC analyses
 - WG1 core group (3 people)
 - Virtual Mobility Grants (2 people)
 - WG1 members (6 people)



Estimates presented (maps)



Comparison with simulated data





Comparison with simulated data



Comparison with simulated data



The SSC preliminary conclusions

- Leaf traits with physiological role and weak impact on spectra weakly estimated
- In particular, temporal mismatches between field and remote sensing data not accounted for.
- Intra-canopy spatial variability not considered either



The SSC preliminary conclusions

- Remote sensing community not always familiar with plant physiology and related variables and spectral proxies
 - Stress maps not produced despite having estimated NPQ
- Uncertainties estimated half of the cases



The SSC guidelines and protocols

Under elaboration in a joint manuscript!



