Surface Reflectance Intercomparison for Vegetation (SRIX4VEG) Overview

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FRM4Veg

- ESA-funded Fiducial Reference Measurements for Vegetation (FRM4Veg)

- Support the validation of key European satellites and vegetation biophysical variables: surface reflectance (SR), fraction of absorbed PAR (fAPAR) and canopy chlorophyll content (CCC)

- FRMs have the following qualities:
  - Documented SI traceability (or conform to appropriate international community standards)
  - Independent from the satellite geophysical retrieval process
  - Accompanied by an uncertainty budget for all instruments and derived measurements
  - Adhere to community-agreed, published and openly-available measurement protocols/procedures and management practices
  - Accessible to other researchers allowing independent verification of processing systems
Why surface reflectance over vegetation?

- Dynamic in:
  - Time
  - Space
  - Spectrally
  - Angularly

- Several biophysical satellite products derived for vegetation depend on SR
Previous work at Barrax and Wytham

Origo et al (2020)
Context of research problem

- Significant interest in UAV-based hyperspectral instruments
- Expected to grow as instruments get lighter, cheaper and easier to use
- Surface reflectance validation is expected to become a key use of these instruments
  - Cover a greater area
  - Removes site disturbance
  - Measure inaccessible sites (water, trees, etc.)
  - Compliment permanent infrastructure
  - Measure complicated sites (mixed pixels, etc.)
Premise of SRIX4VEG

- Protocols around this are yet to be developed and lots of people are developing different things (some more systematically than others)

- The idea of SRIX4Veg is to assess the variability associated with different teams conducting the same validation work

- Then move towards a community-agreed protocol to reduce this variability
Premise of SRIX4VEG

Two experiments:

1. SR validation data collected as you (the participants) would do it given some pre-defined information

2. SR validation data collected by you following a pre-defined initial protocol (developed by the SRIX4Veg team, CSIRO, USGS and GA)

Following feedback from the participants the draft protocol will be refined and put forward as a community good practice protocol
Experiment 1

The first experiment requires each participant to document, prior to the campaign, the procedure they will use to collect SR validation data for a specific (theoretical) satellite overpass.

What we want to know:

- instrument setup
- flight plan
- data capture
- post-processing

This will be the process you follow in the field for experiment 1
Experiment 1

We will provide information on:

- Spatial resolution
- Spectral bands and response function
- Orbit inclination
- Viewing geometry
- Spatial location and extent of each of the satellite pixels on the ground
- Reflectance quantity
Experiment 2

Once we have received all of your data collection procedures we (SRIX4Veg team, USGS, CSIRO and GA) will circulate a draft protocol which everyone will follow in the second experiment (the aim is to minimise cross-fertilisation).

The draft protocol will be circulated at least 1 month prior to the campaign so you can gain familiarity with it.
Experiment time line

- Release overpass specs: 11/04/2022
- Participants complete their data collection plans: 16/05/2022
- Draft protocol released to participants: 16/05/2022
- Begin SRIX4Veg: 18/07/2022
- End SRIX4Veg: 22/07/2022
How will it work
Flight scheduling for comparability

- Each experiment will be a round-robin (everyone will do a flight back-to-back with everyone else)
- Only the pairs will be compared
- Only one UAV in the air at one time
- Because of no self-pairing and AB==BA:
  \[ n\text{Pairs} = \frac{n(n-1)}{2} \quad (n = \text{no of participants}) \]
- Because in a sequence pairs can be made forward and backwards:
  \[ n\text{Sequences} = \frac{n\text{Pairs}}{(n-1)} \]
Flight scheduling for comparability

* works for even numbers; for odd numbers the last participant will have to do one extra flight
On ground instruments

Solar Light Company
Microtops II

ASD FieldSpec 4

Trimble base station

Tarpaulin
+Spectralon Panel

NPL
EOLAB
University of Southampton
eesa
Other instruments and measurements

- ASD Fieldspec 4 (measurements of spectralon panel)
- Microtops (measurement of AOT)
- Spectralon panel
- Reflectance tarpaulins
- Differential GPS base station (Trimble)
- Hypernets HYPSTAR (?)

ASD measurements:
Spectralon > Light > Middle > Dark > Spectralon

5 spectrums per location @ 4 locations
Expectations of participants

- Be ready for collecting measurements on Monday morning of the 18\textsuperscript{th} July
  - Stay until the end of the 22\textsuperscript{nd} July or whenever all the measurements are completed (whichever is sooner)

- You need to do all data processing specific to your instrument

- You will need to bring anything extra

- You will need to ship your instruments to make sure they arrive on time, ensure they are labelled correctly, and ensure return shipping takes place after the campaign

- Your own/your team’s health and safety
What SRIX4VEG is **not** doing

- Validating a specific satellite overpass
- Developing a protocol for all surface reflectance data collection
- Ground measurements with ASDs in the same location as the UAV overpasses (for the vegetation)
Time line

**Workshop 1**
28th March 2022
- Official workshop 1
- Additional participant meetings

**Field Campaign**
18th – 22nd July 2022
- Exercise implementation over Las Tiesas – Barrax (Spain)

**Workshop 2**
October-December 2022
- Official workshop 2
- Discussion of the results
- SRIX4VEG report and publication
- Initial contribution to development of international good practice guidelines for validating surface reflectance products
SRIX4VEG participants

- 12 confirmed participants (with requirements gathered)
- Number of platforms and payloads may be higher
Outputs and next steps

- Post-campaign workshop
- Scientific paper on the intercomparison
- Good practice protocol for SR data collection for validation
- Considerations for future activities
  - Laboratory comparisons
  - Other sites
  - Repeats
Thanks for your attention

wwwfrm4veg.org/srix4veg/