Method For Acquiring and Comparing Spatially Explicit Measurements of Sun-induced Fluorescence on the Ground

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Problem

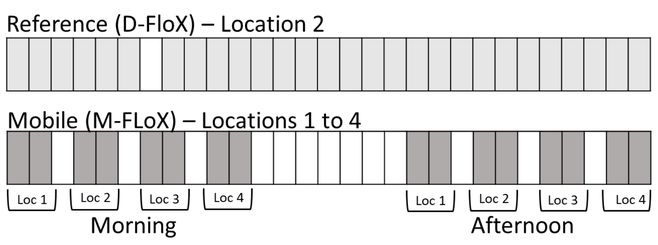
- Levels of Sun-induced fluorescence (SIF) are dependent on the time of day (through light intensity)
- Any ground sampling protocol must include a correction factor

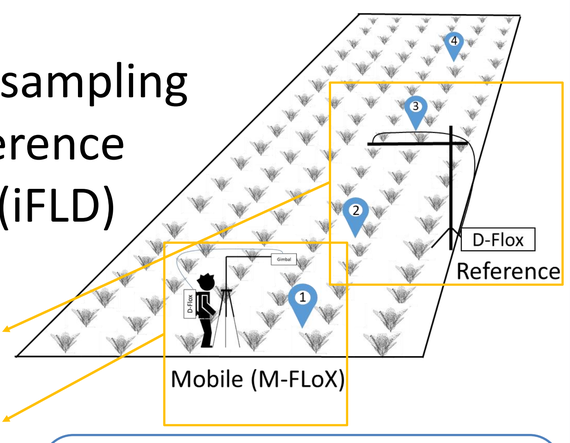
Aim

- Establish a procedure to align temporally mismatching SIF observations

Method

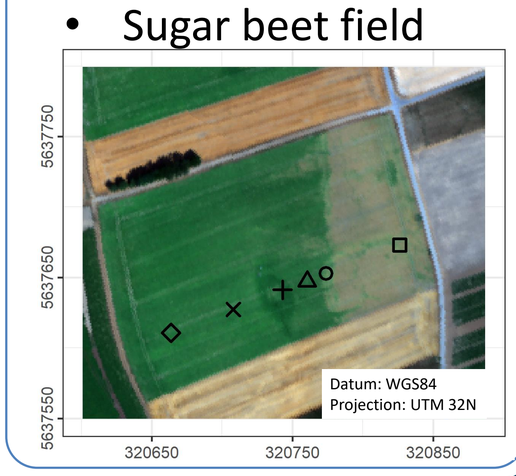
- FloX device used for spatial sampling
- Identical device used to reference diurnal development of SIF (iFLD)



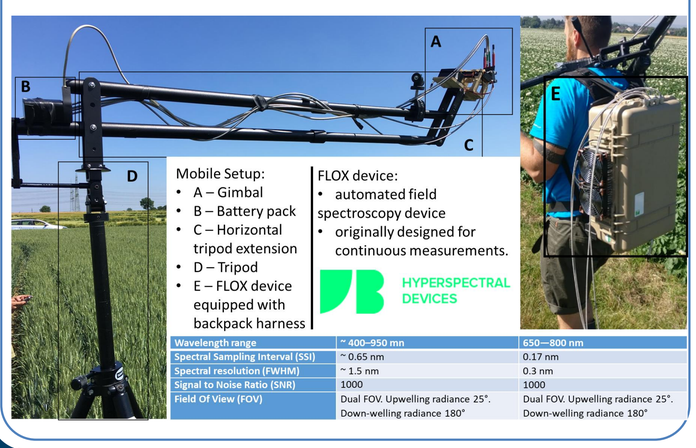


Study site

- TERENO station
- Sugar beet field



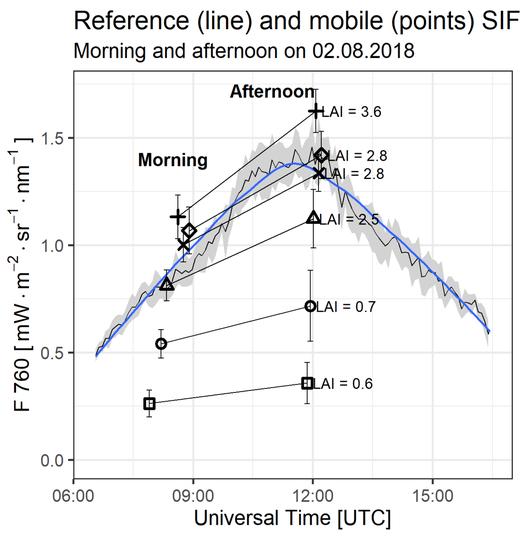
Setup

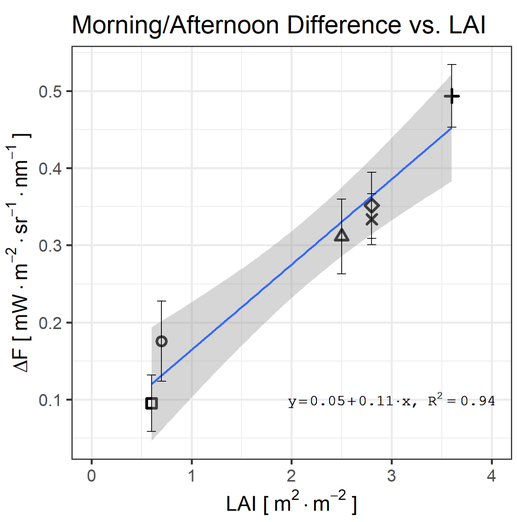


Wavelength range	~ 400–950 nm	650—800 nm
Spectral Sampling Interval (SSI)	~ 0.65 nm	0.17 nm
Spectral resolution (FWHM)	~ 1.5 nm	0.3 nm
Signal to Noise Ratio (SNR)	1000	1000
Field Of View (FOV)	Dual FOV. Upwelling radiance 25°. Down-welling radiance 180°	Dual FOV. Upwelling radiance 25°. Down-welling radiance 180°

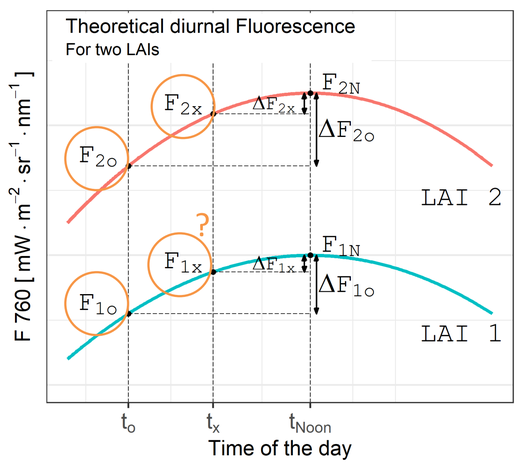
Development of correction mechanism

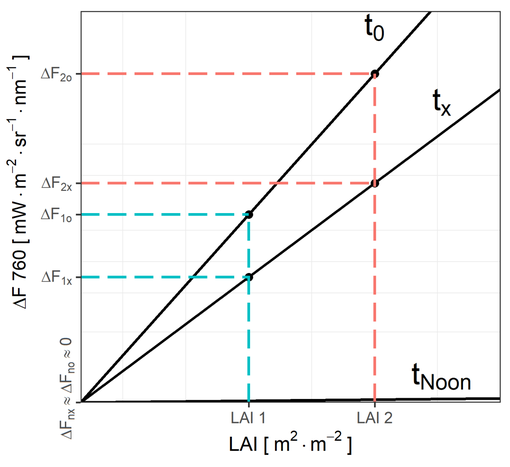
- Test transect sampled ***morning and afternoon***





- Deriving correction equation





LAI 1

$$t_0 = \frac{F_{1N} - F_{10}}{LAI_1} \qquad t_x = \frac{F_{1N} - F_{1x}}{LAI_1}$$

LAI 2

$$t_0 = \frac{F_{2N} - F_{20}}{LAI_2} \qquad t_x = \frac{F_{2N} - F_{2x}}{LAI_2}$$

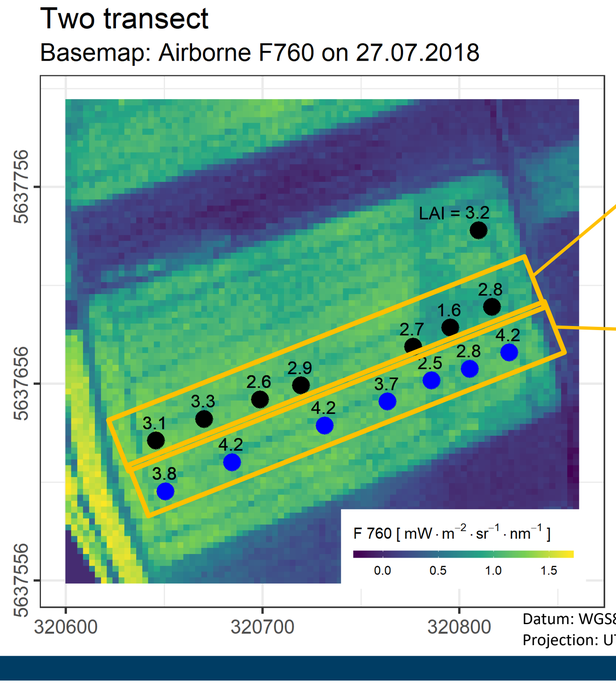
Solving for $F_{1\chi}$:

$$F_{1x} = F_{1o} + \frac{LAI_1}{LAI_2}(F_{2x} - F_{2o})$$

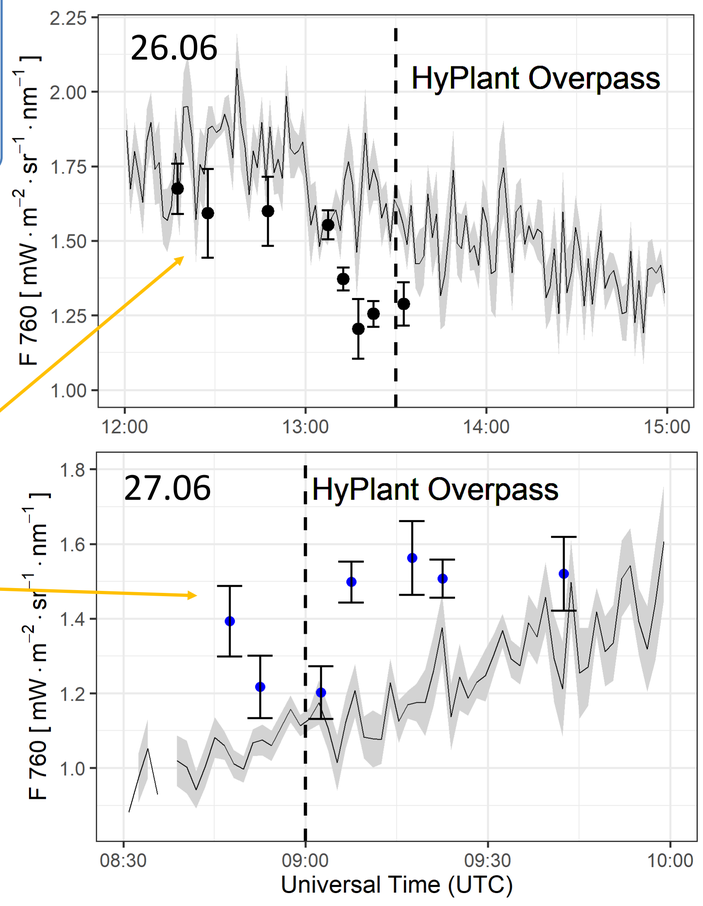
Case study: AtmoFLEX 2018

Airborne SIF acquisition with parallel ground sampling

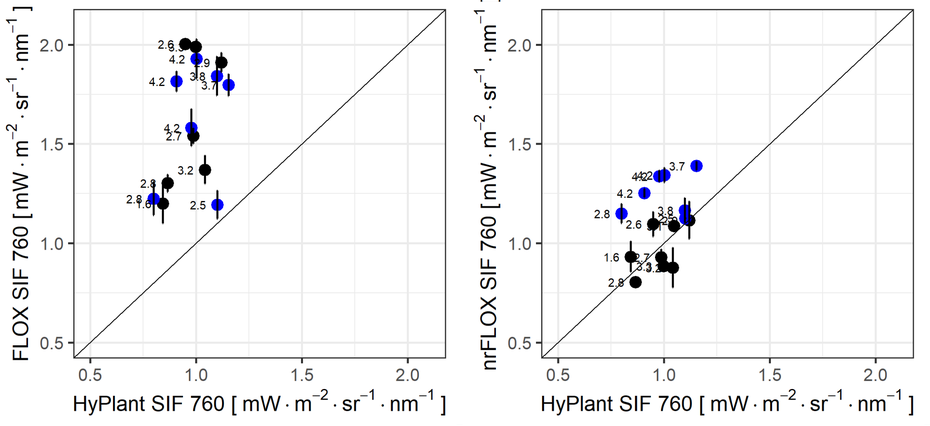
- HyPlant Instrument



- Raw FLoX data



- Application of correction



Summary and Outlook

- Simple correction mechanism incl. LAI
- Correction improves agreement b/w ground and airborn data
- Better on the afternoon transect
- Next: apply the method on other crops