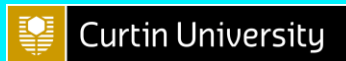# Some thoughts on ASD-derived Reflectance Data Quality

Peter Fearns

CSIRO, Curtin University
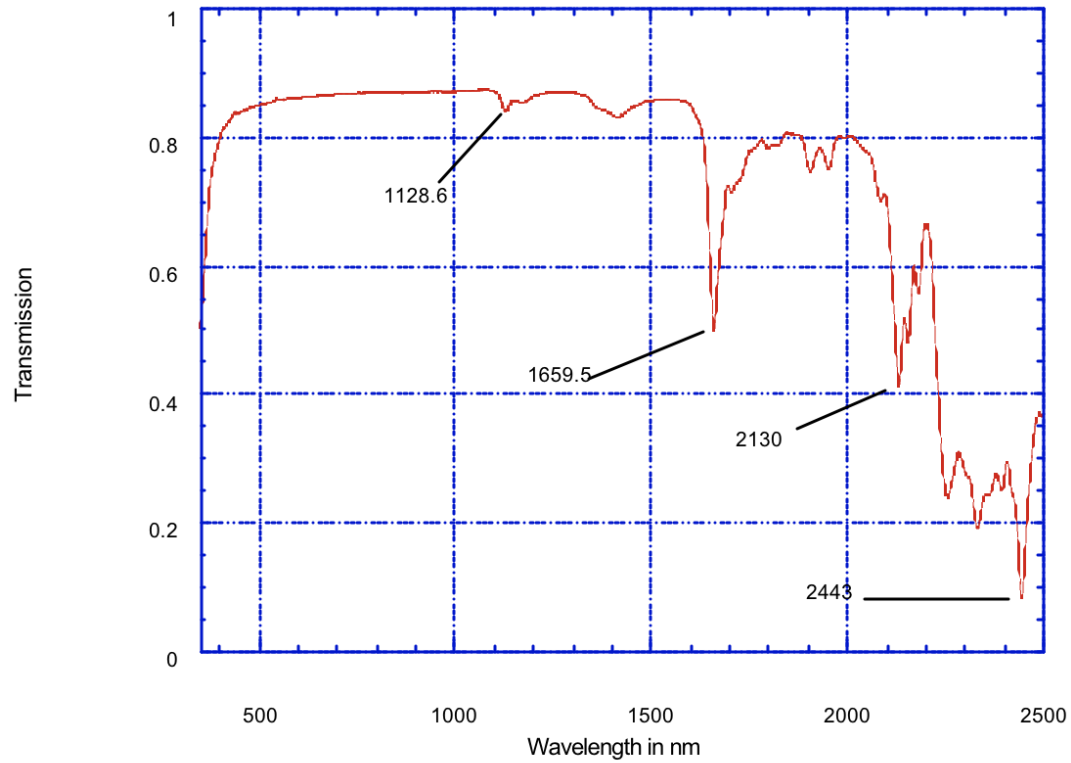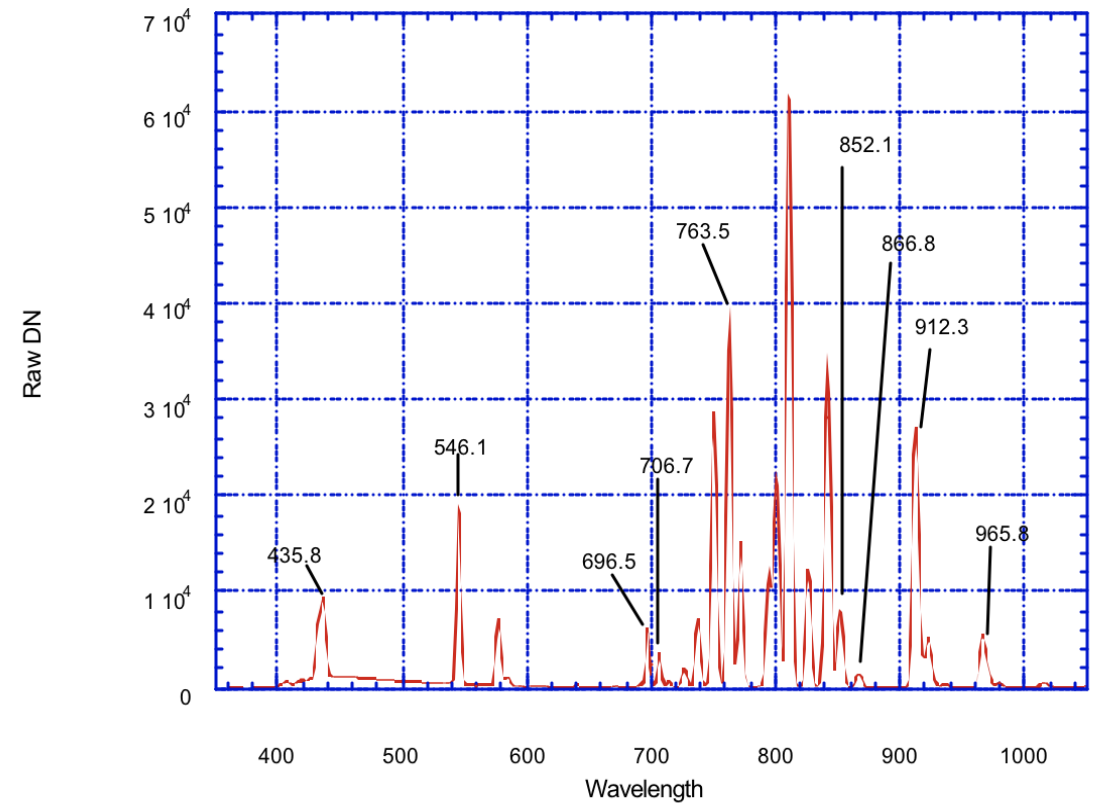
TWO STORIES

- Monitoring wavelength stability through time
- Estimating uncertainty in derived ground reflectance

The ASD comes with a Mylar sheet

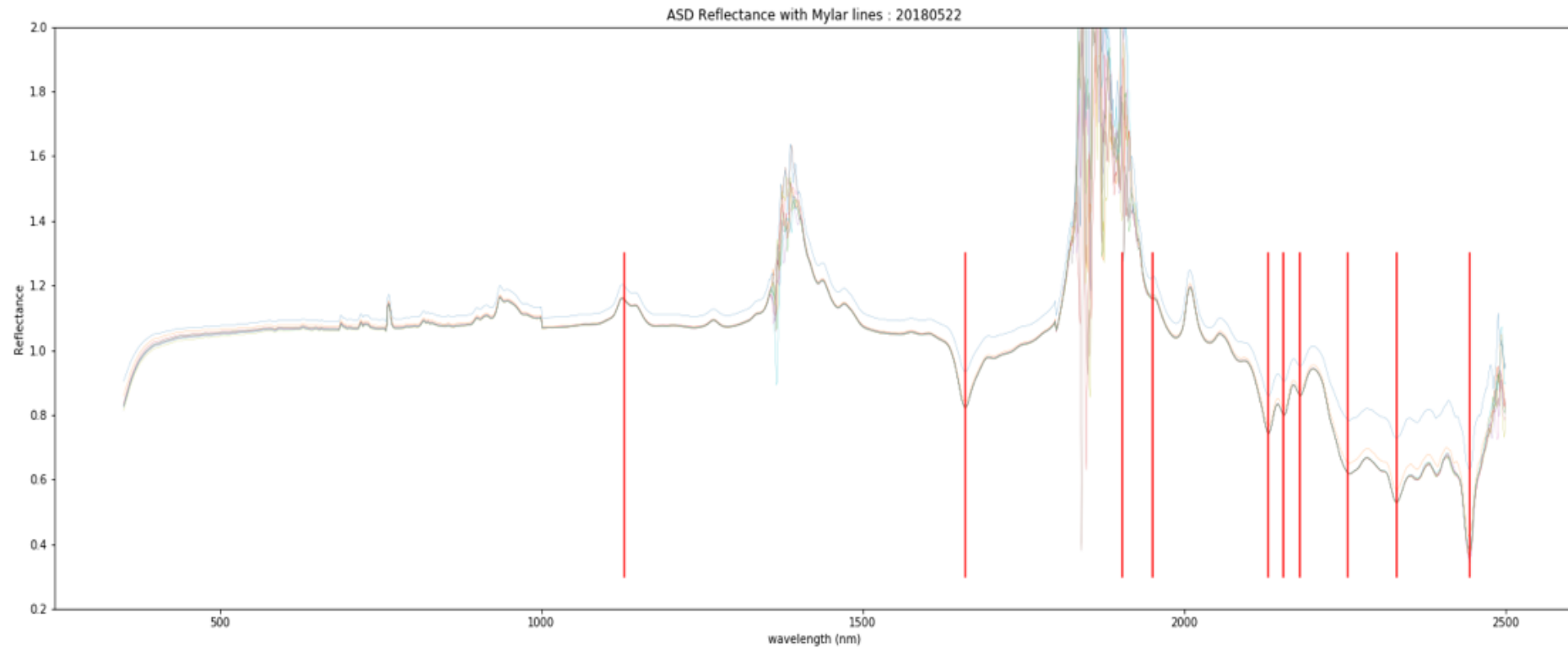Mylar Transmission, Unit FSFR 650 9/25/96
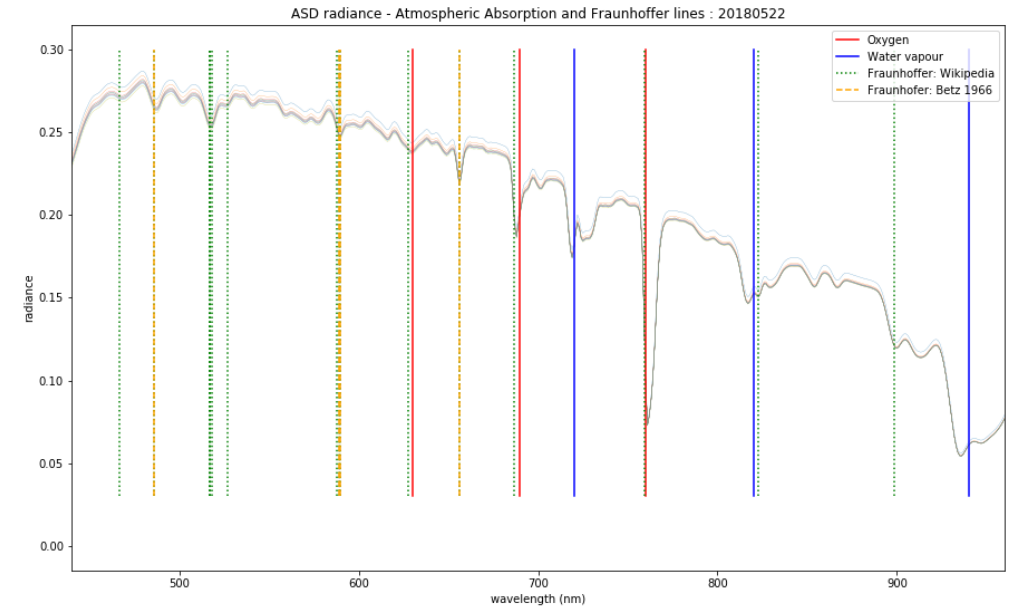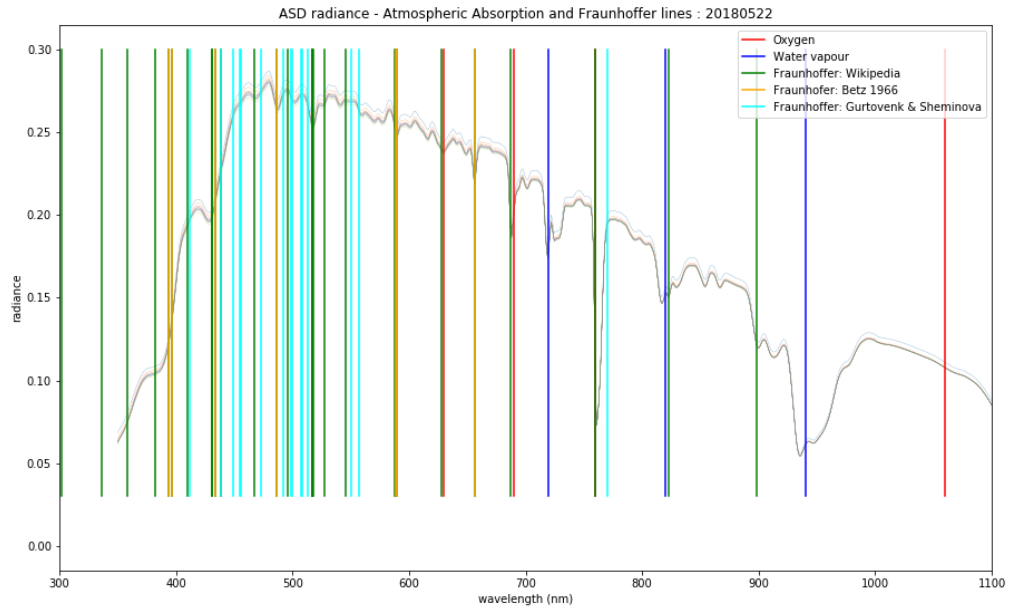
Mercury-Argon Emission Spectrum

Field-measured reflectance through Mylar

ASD Reflectance with Mylar lines : 20180522

ASD radiance - Atmospheric Absorption and Fraunhoffer lines : 20180522

Oxygen	630, 690, 760
Water vapour	720,820,940
Atmospheric and Fraunhofer	466.814, 486.134, 516.733, 516.891, 517.27, 518.362, 527.039, 587.5618, 588.995, 589.592, 627.661, 656.281, 686.719, 759.37, 822.696, 898.765

Monitoring wavelength stability through time
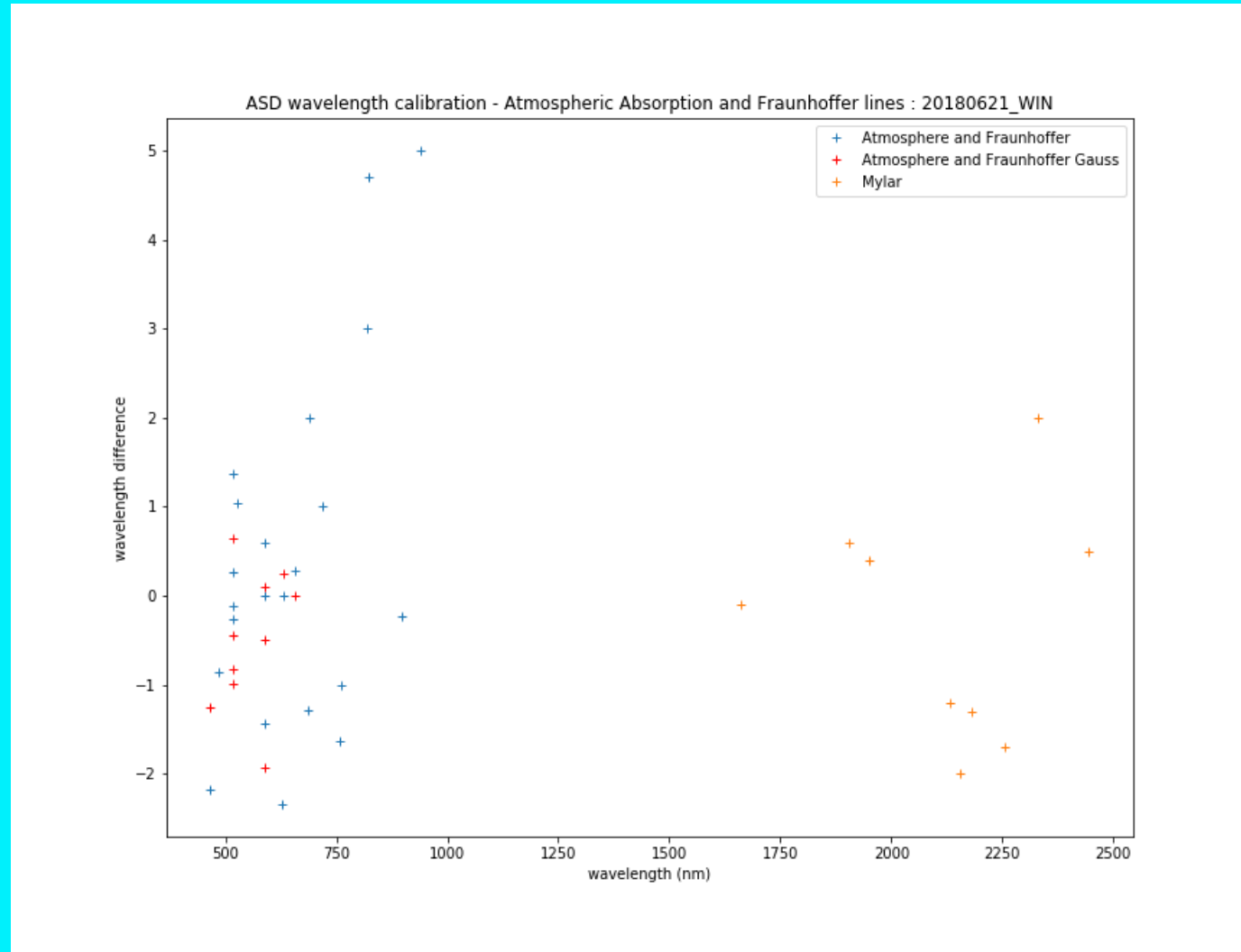
Differences between spectral calibration wavelengths and absorption features identified in an ASD spectrum.
Orange: Mylar.
Blue: Wavelength of minimum radiance.
Red: Minimum wavelength of a Gaussian function

Monitoring wavelength stability through time

Monitoring wavelength stability through time
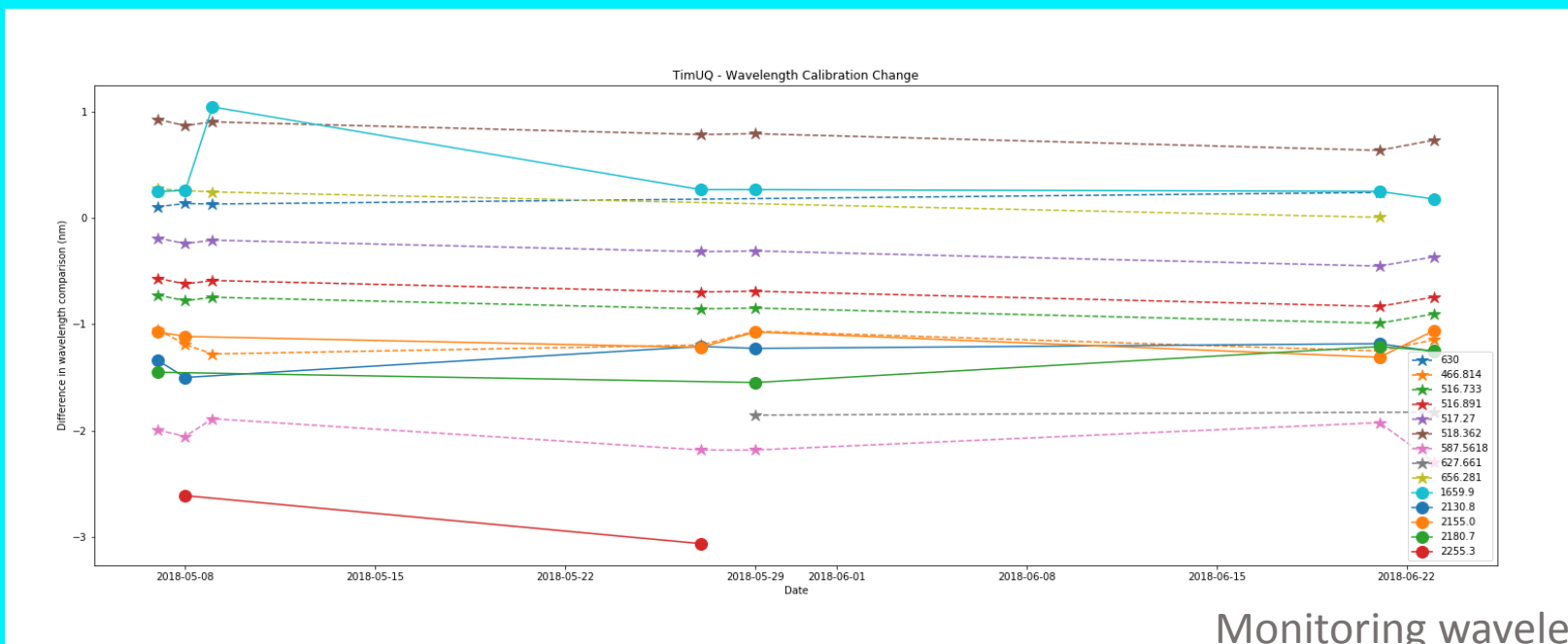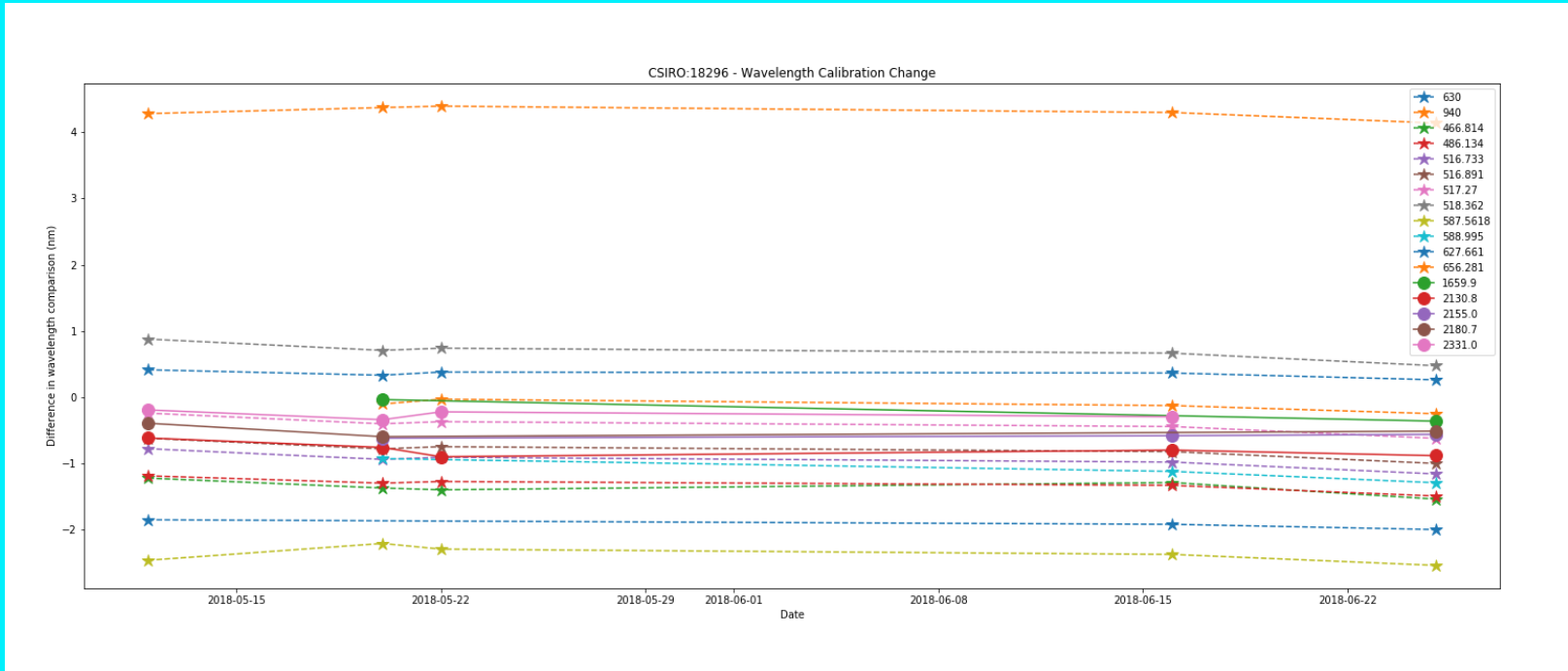
Uncertainties

All uncertainties are estimated as individual values. Selected uncertainties are ultimately combined and reported as campaign wide values, both as **spectral quantities** and as a spectrally averaged **Mean Total Uncertainty**.

$$u_c = \sqrt{u_{tilt}^2 + u_{BRFtilt}^2 + u_{BRFcal}^2 + u_{MPV}^2}$$

The factors included in the Mean Total Uncertainty are;
effect of **panel tilt** on total illumination flux (u_{tilt}),
panel **BRF uncertainty due to panel tilt** ($u_{BRFtilt}$),
panel **BRF calibration uncertainties** (u_{BRFcal}), and
a factor called "**Mean panel variability**" (u_{MPV}) which includes effects of spread in panel measurement data, misalignment of the panel throughout the campaign, and changing atmospheric conditions.

Change in measured irradiance for a 1 degree tilt in a horizontal reference plate

Uncertainties
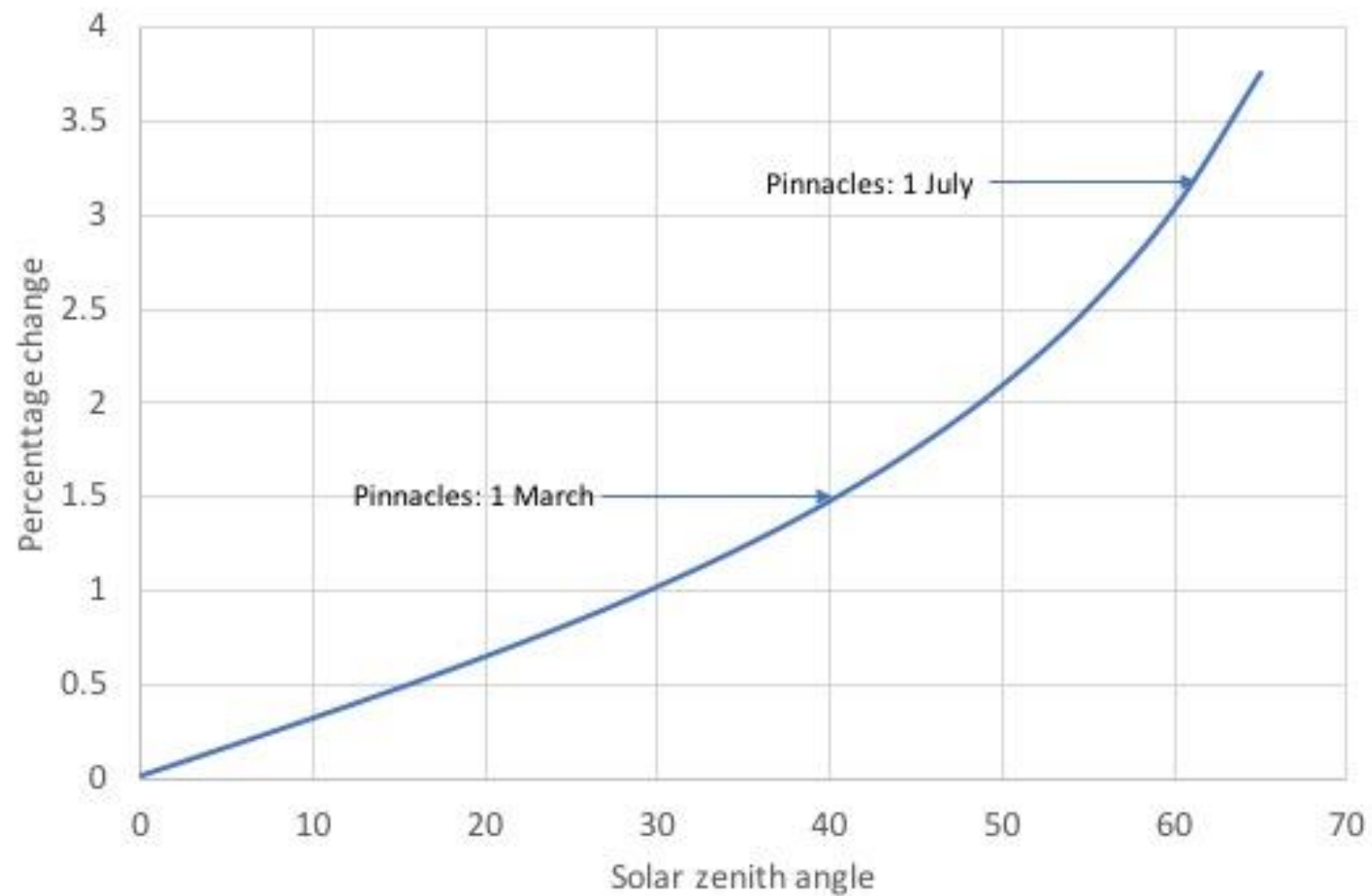
Campaign overview.
Radiance at 500 nm.

Overview of 20180412_ : Radiance at 500.0 nm
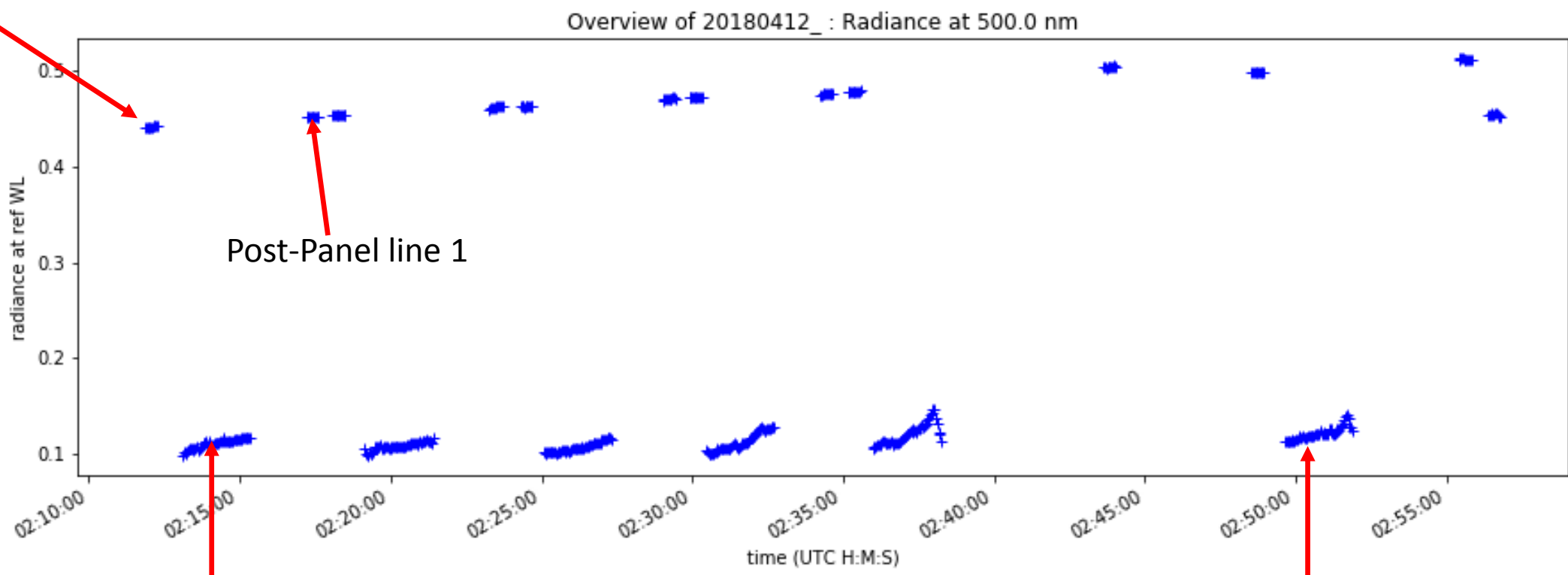
Pre-Panel line 1

Post-Panel line 1

Ground line 1

Ground line 6

Uncertainties

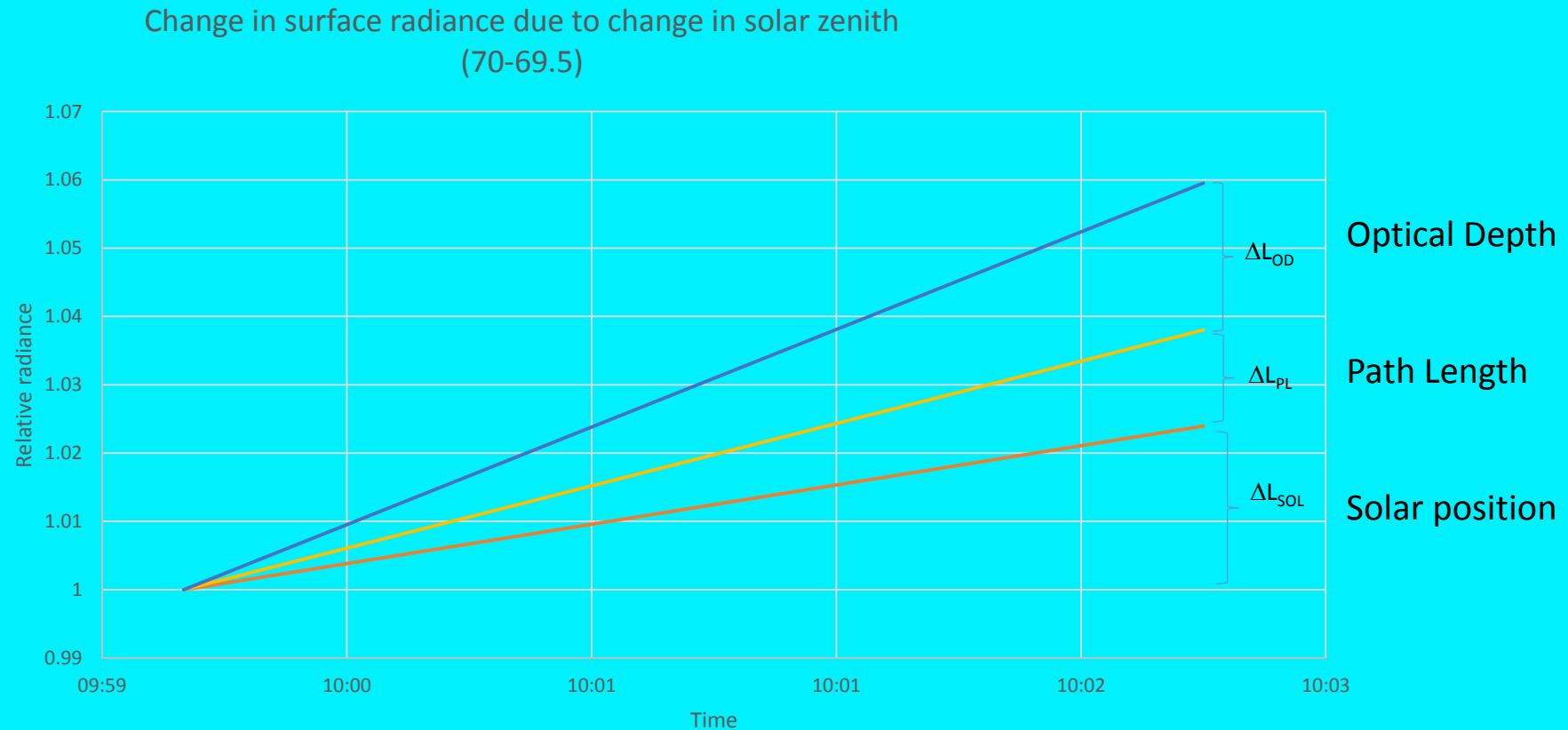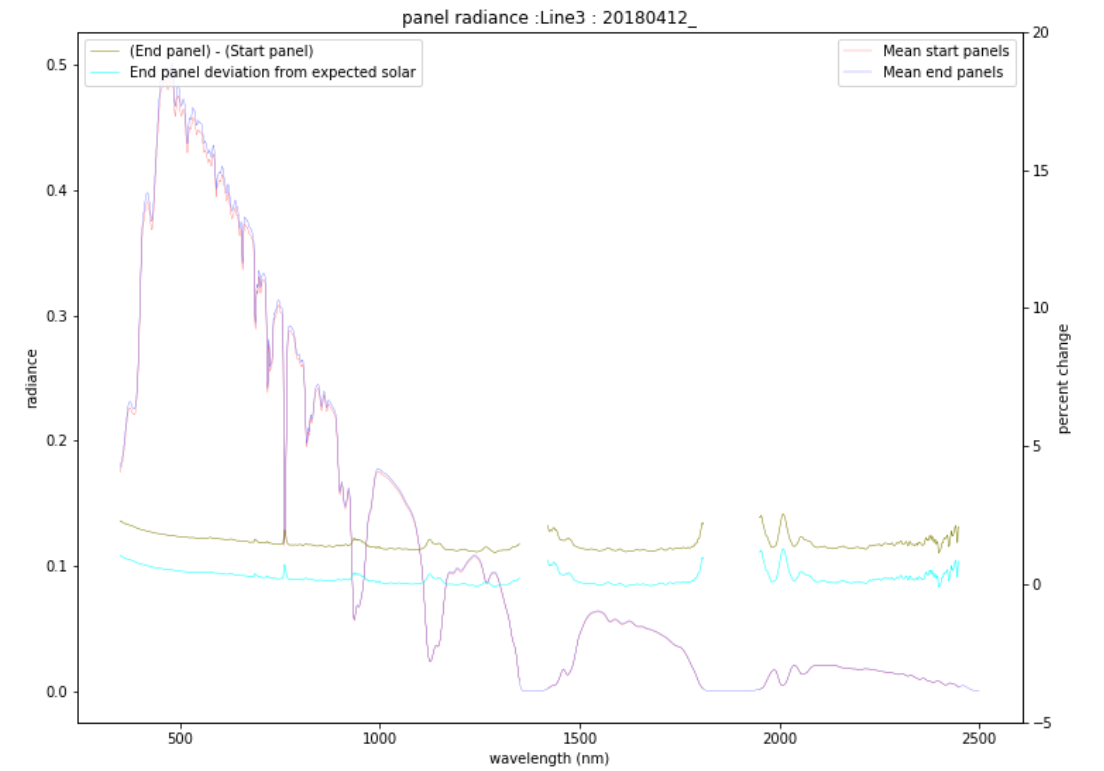# Ground Line 3
Radiance at 500 nm

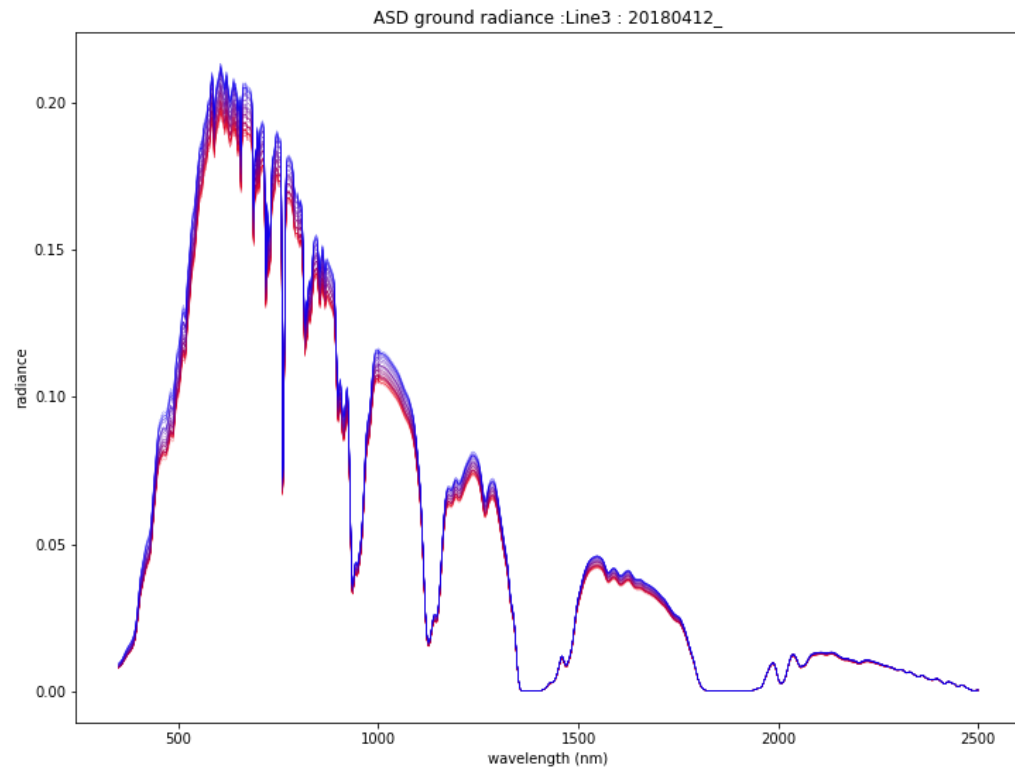## Why is the curve not straight and flat?

ASD radiance at 500.0 nm : Line3 : 20180412_
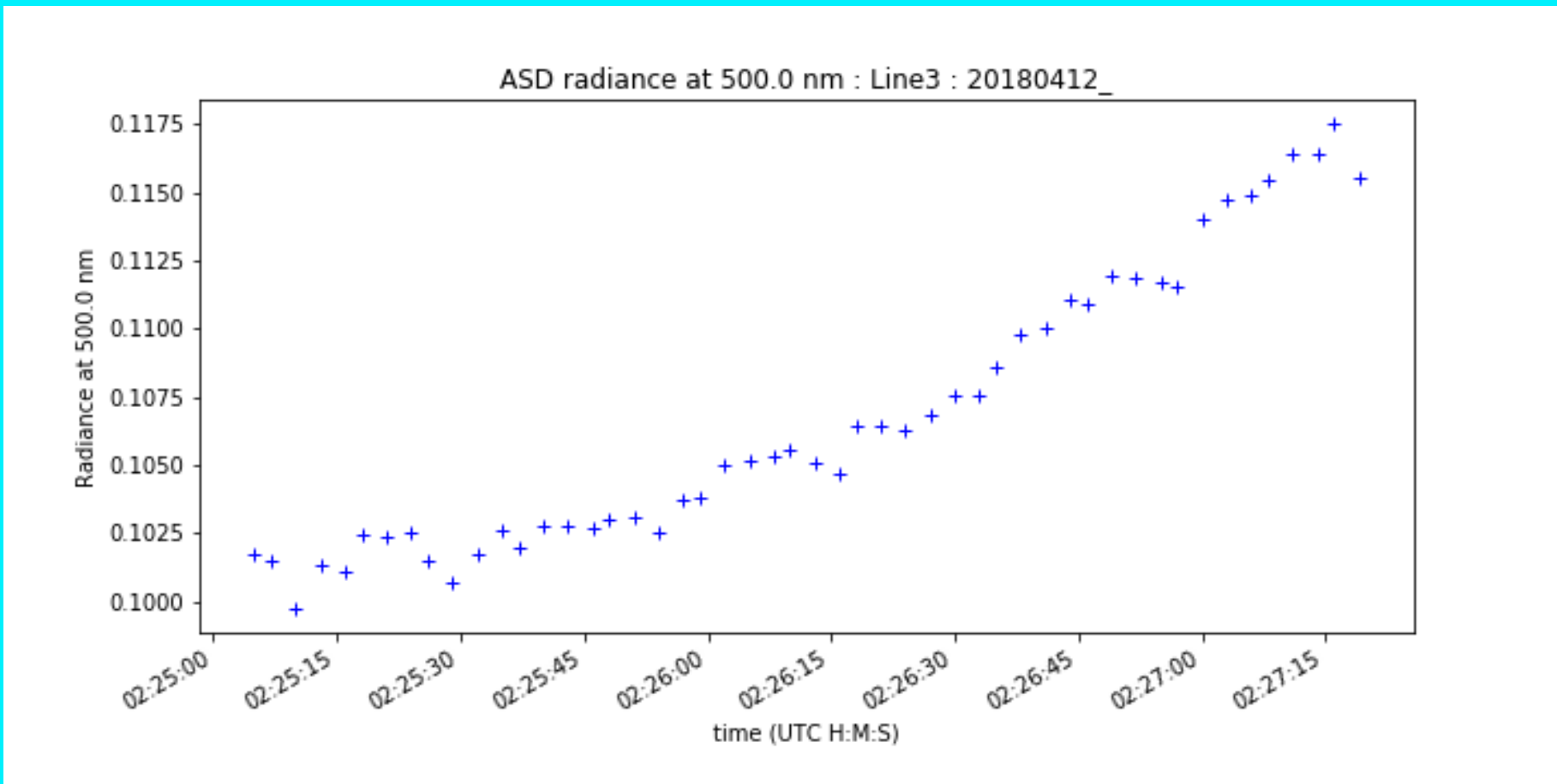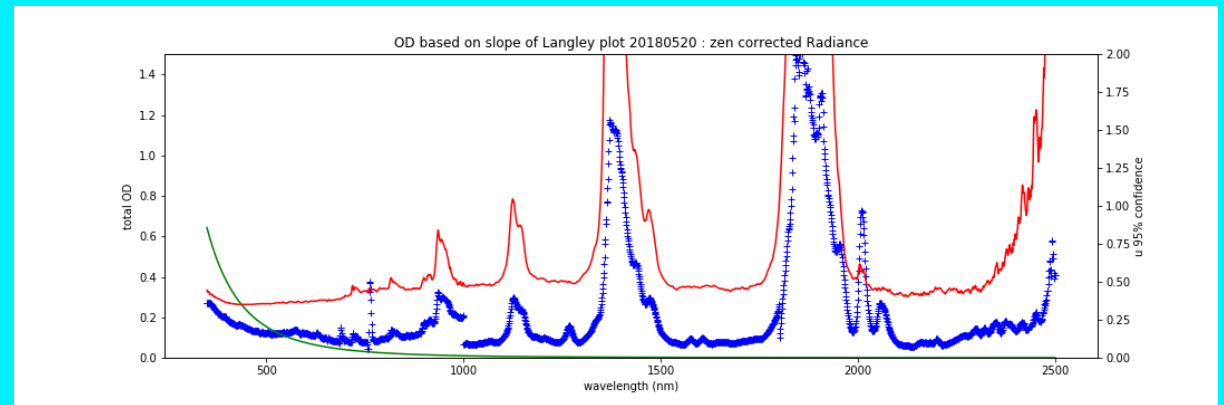
Interpolate panel data to calculate ground reflectance.
Sun position changes.
Path length changes.
Has the atmosphere changed?

Change in surface radiance due to change in solar zenith
(70-69.5)

ΔL_{OD} Optical Depth

ΔL_{PL} Path Length

ΔL_{SOL} Solar position

Uncertainties

Simple overview of radiance change during a ground line.

Uncertainties

Estimating uncertainty in panel data due to "field conditions"
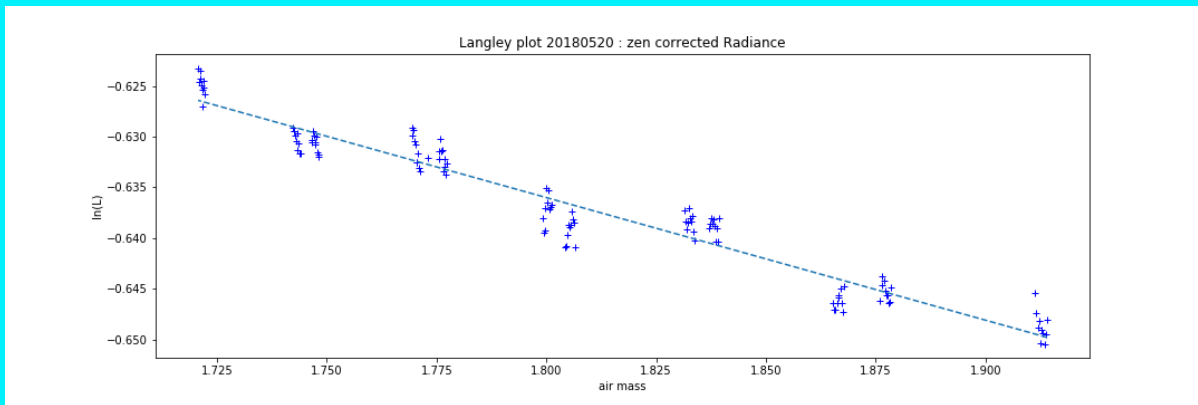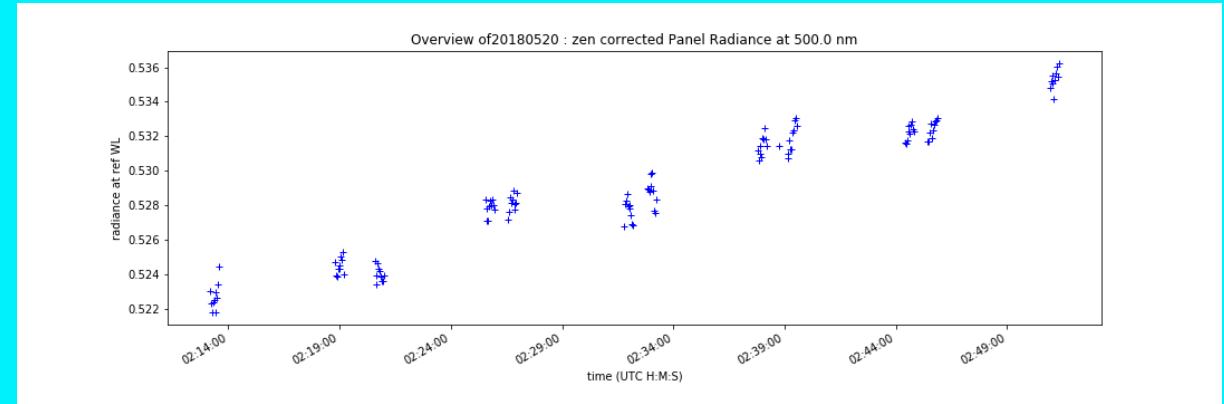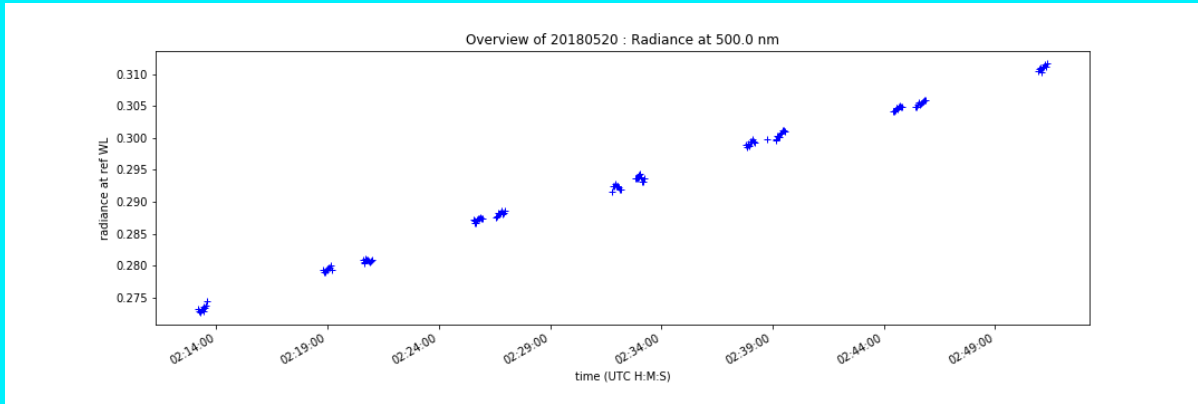
We end up with uncertainties spectrally

Uncertainties

And a campaign overview

ASD ground Reflectance : 20180520_PIN_GA

Panel File: SRT_GA_NEW.csv

Percentage Uncertainties (95% confidence)
Mean Total Uncert.   4.9
Mean BRF generic error 2.3
Mean RF error (+-1.0 deg) 1.0
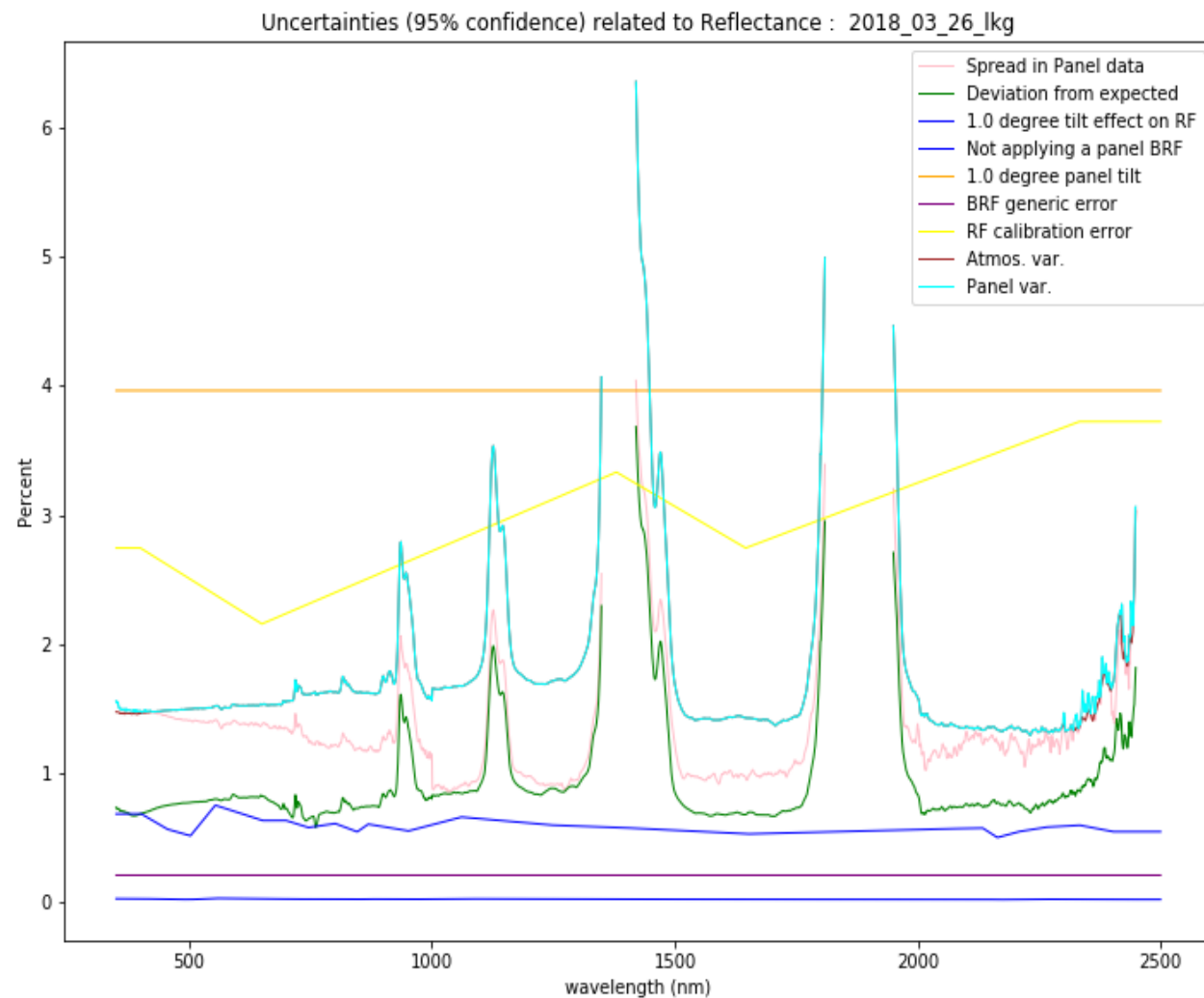Mean Panel Tilt (+1.0 deg) 2.4
Mean RF calibration error 3.0
Mean_panel_variability_95 2.0

Other Info.
Mean Ground Deviation   11.8
BRF not corrected for   5.1
Mean Atmos. var.   1.8
Mean Panel Spread   0.8
Mean Solar Deviation   1.4

Legend:
— Mean Ground Reflectance, local panel, no BRF
— Mean Ground Reflectance, local panel, adopted BRF
■ 95% interval

Uncertainties