

# Practical

## Data:

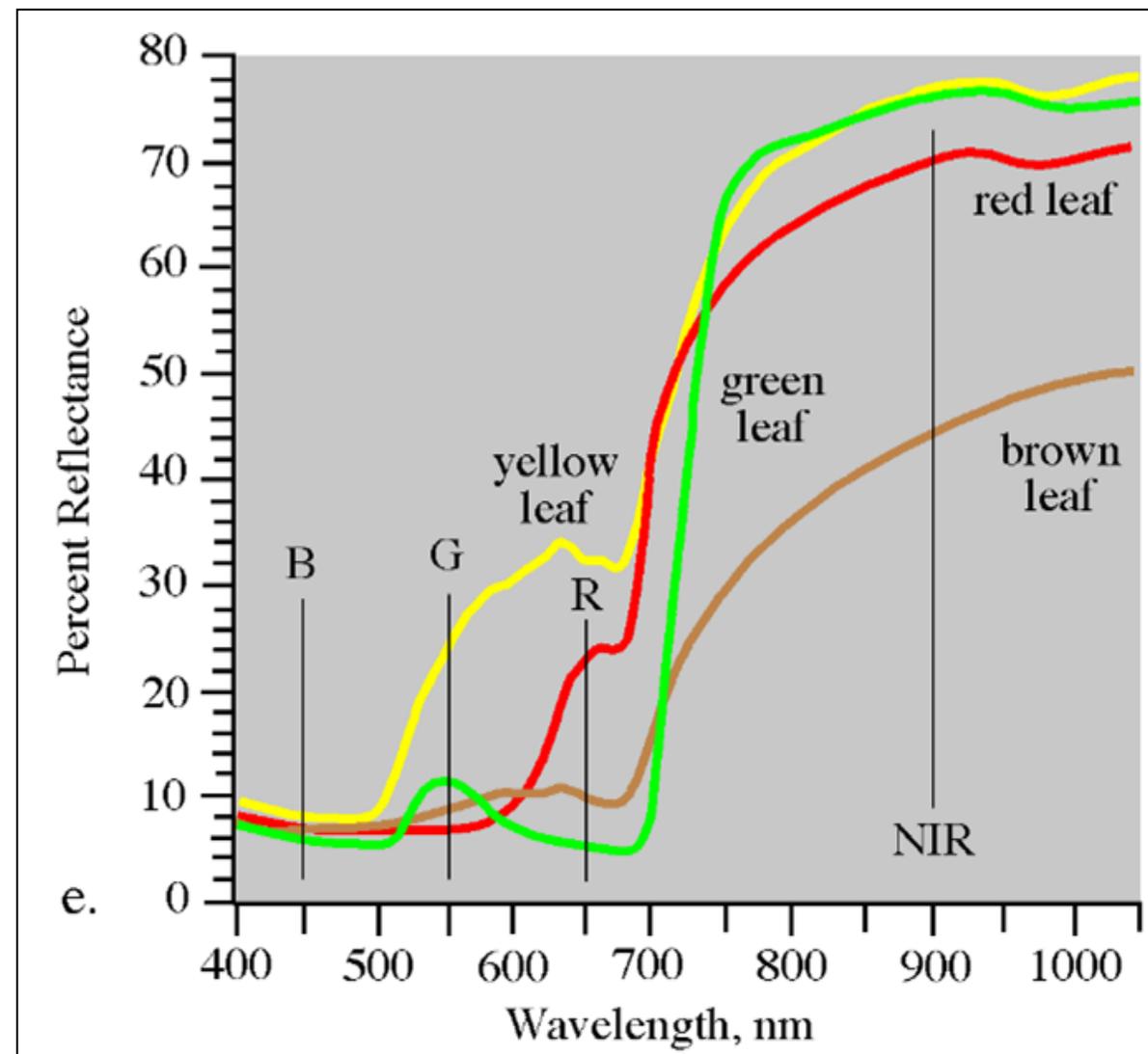
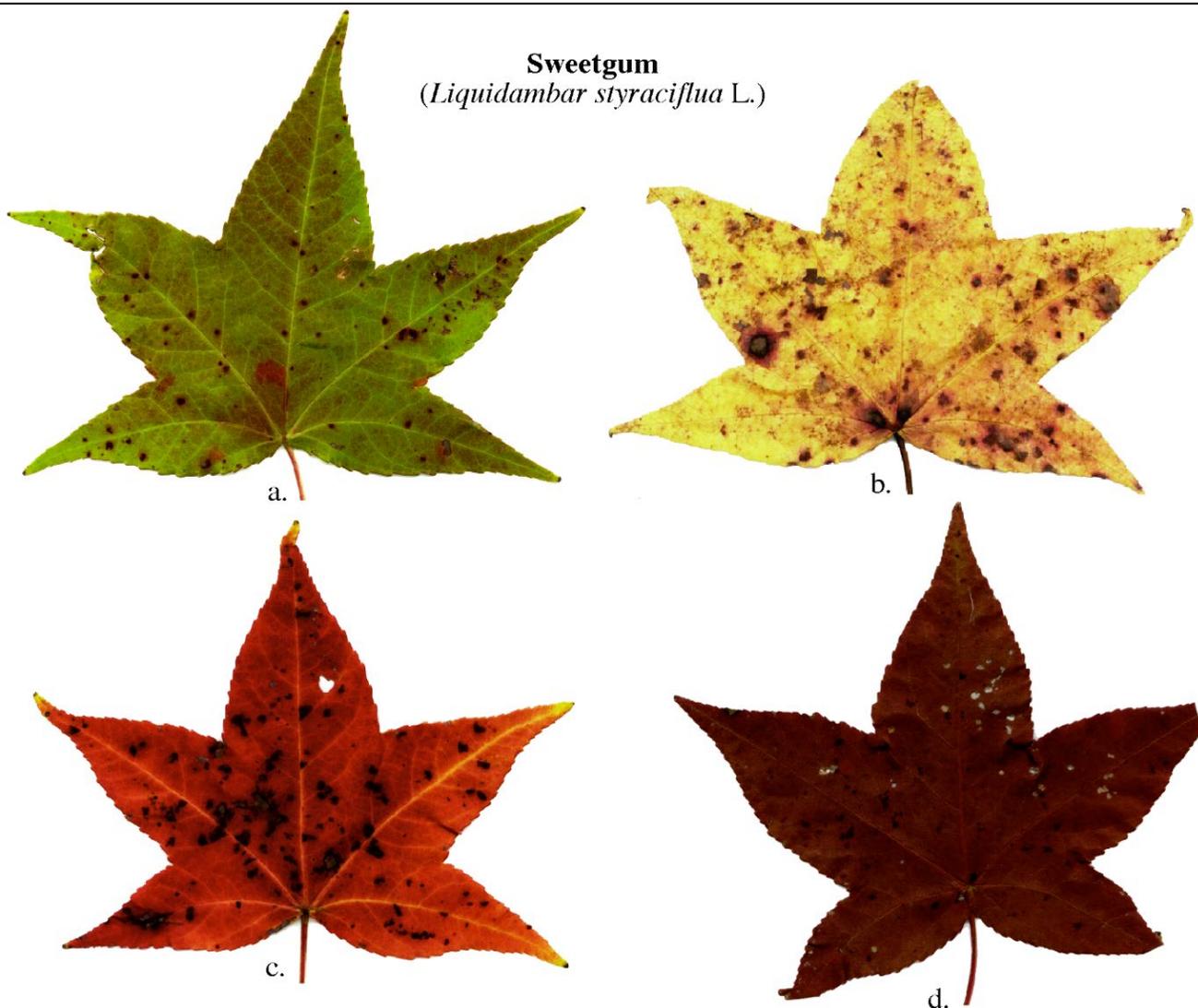
1. Reflectance of leaf samples
2. Corn reflectance under varying nitrogen treatments (0 no N / 100 optional), simulated with SCOPE model
3. AVIRIS NG reflectance of various land covers (SHIFT campaign, CA, 2022)

## Tools - calculators:

1. Vegetation indices (Vis), formulas – <https://www.indexdatabase.de/db/i.php>
  - Derivative calculation, Derivative properties of vegetation
  - NDVI, others
  - Pigments, Water, and others
2. Using Sensor Response Function (SRF) to estimate the signal for all band
  - Convolving hyperspectral to multispectral
3. Free image processing software

# Measuring Spectral Reflectance Characteristics

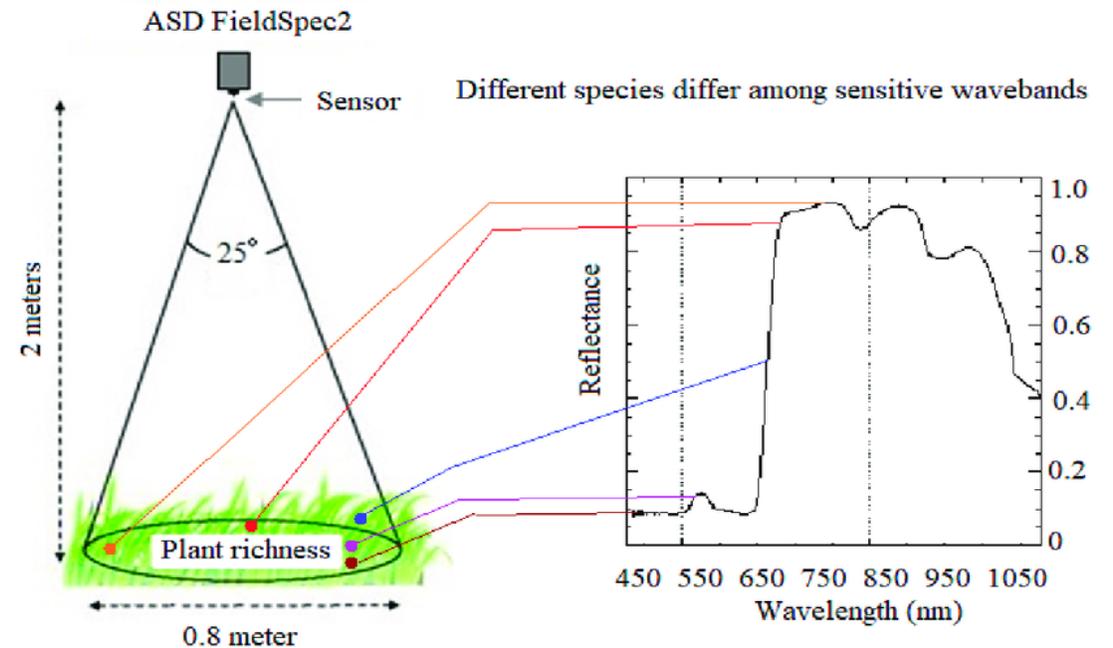
EXAMPLE: Sweetgum Leaves (*Liquidambar styraciflua* L.)



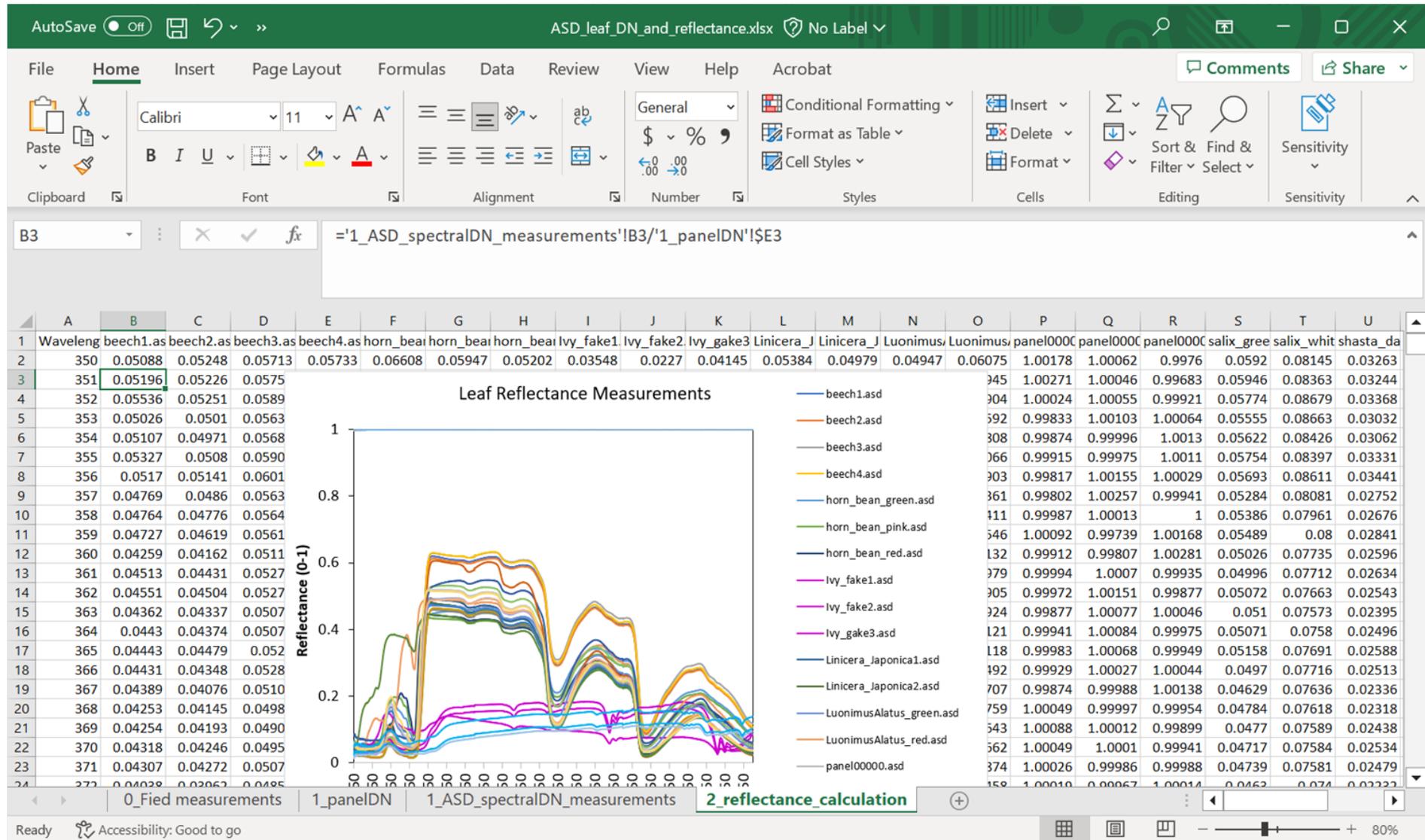
# Filed measurements of reflectance



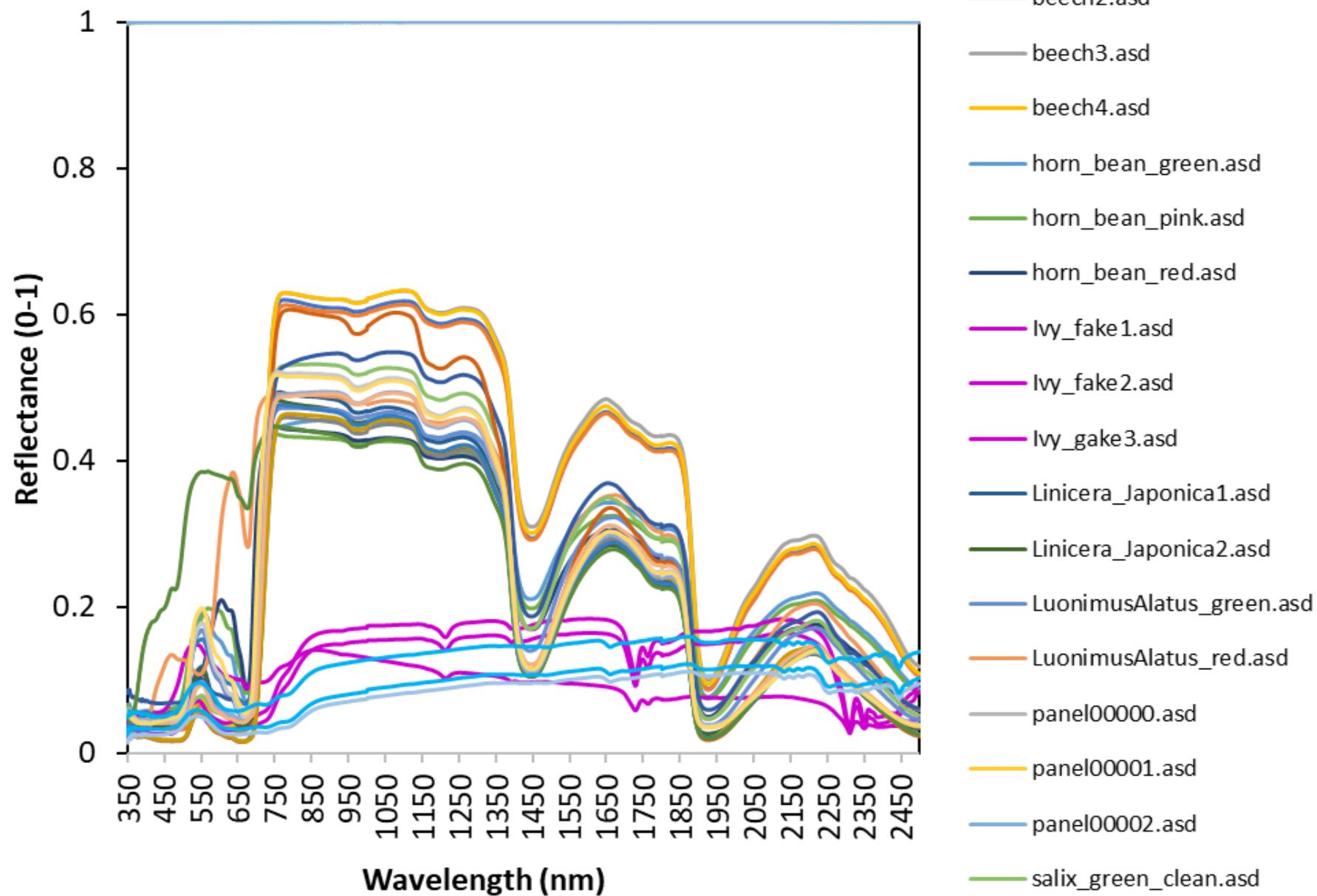
Reflectance ( $R_\lambda$ ) =  
reflected off target per  $\lambda$  / incoming radiation per  $\lambda$



# ASDleaf\_DN\_and\_reflectance.xlsx



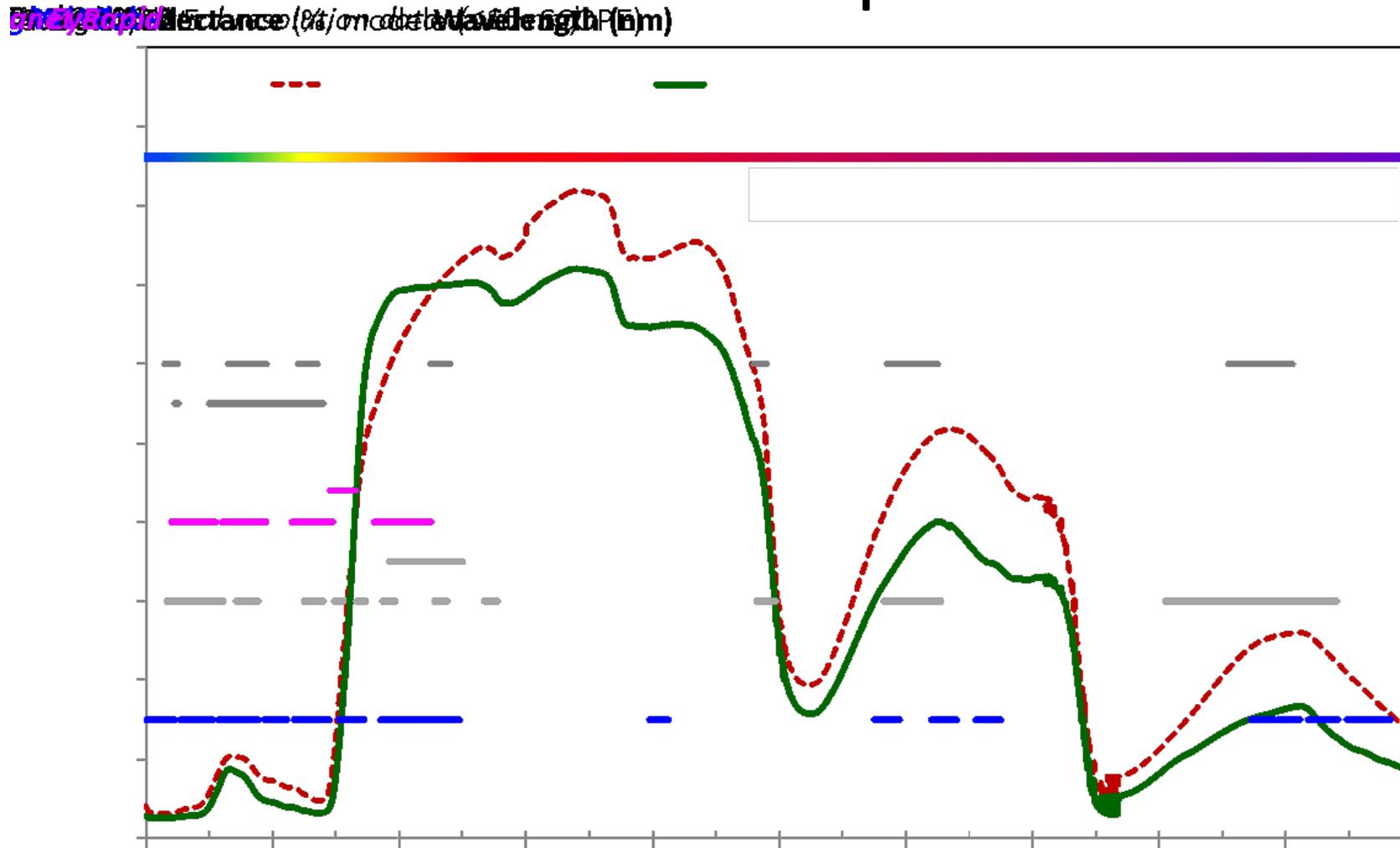
# REFLECTANCE



- Convolving hyperspectral to multispectral

[Sat\\_RSR\\_Calc.xlsx](#)

# Estimating Multispectral Sensor Response from Reflectance Spectra





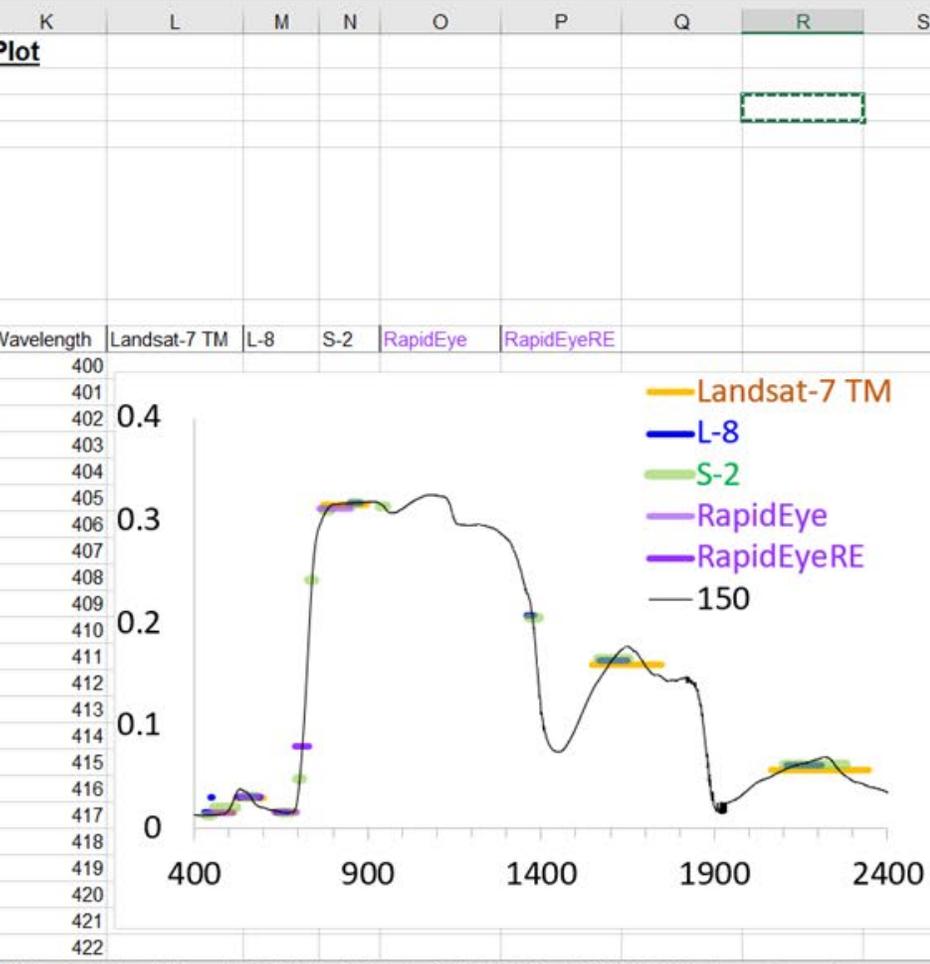
File Home Insert Draw Page Layout Formulas Data Review View Help PDFelement

Clipboard Font Alignment Number Styles Cells Editing Analysis

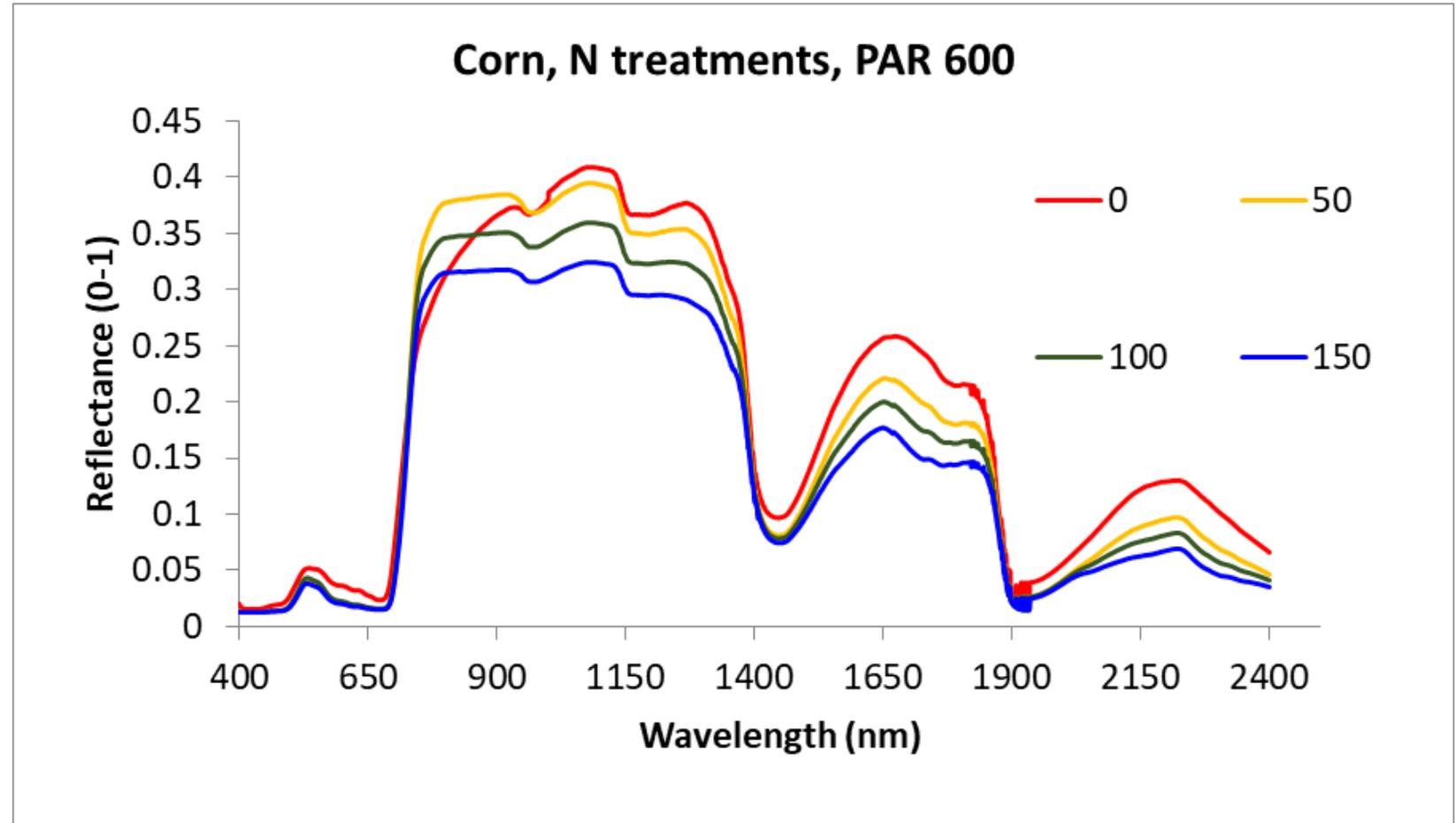
R3

Data Input		Output Data		
Input spectra - 1 nm resolution and wavelengths must line up with values in Wavelength column		approx band \ Band Reflectance		
Wavelength	Spectra	Landsat-7 TM		Notes
400	0.01315	band 1 441-514	0.016	
401	0.01303	band 2 520-600	0.030	
402	0.01292	band 3 631-692	0.016	
403	0.01285	band 4 772-898	0.315	
404	0.01279	band 5 1547-1748	0.160	
405	0.01275	band 7 2064-2346	0.057	
406	0.01272			
407	0.0127	ASTER		
408	0.01268	band 1 513-600	0.030	
409	0.01266	band 2 628-691	0.018	
410	0.01264	band 3n 754-860	0.310	
411	0.01263	band 3b 750-861	0.309	
412	0.01261			
413	0.01261	MISR		
414	0.0126	Band 1 429-456	0.013	
415	0.0126	Band 2 548-565	0.034	
416	0.01259	Band 3 663-679	0.017	
417	0.01259	Band 4 852-879	0.312	
418	0.01259			
419	0.01259	MODIS		
420	0.01259	band 1 620 - 670	0.016	Land
421	0.01259	band 2 841 - 876	0.317	Land
422	0.01259	band 3 459 - 479	0.013	Land

VIs	
VIs site	<a href="https://www.indexdatabase.de/search/?s=NDWI">https://www.indexdatabase.de/search/?s=NDWI</a>
NDVI	0.90
EVI	
MOD NDVI=	0.90
MOD EVI=	0.57
NDWI	0.037



# Reflectance of corn under varying nitrogen treatments simulated with SCOPE (RTM) model



[ReflectanceVis\\_Calculator.xlsx](#)

Nitrogen (N)	0	50	100	150
Cab	24.07	47.68	44.74	52.54
Vcmo	23.15	23.15	23.15	23.15
LAI	3.207	3.977	3.993	4.167

- Calculating vegetation indices

[ReflectanceVIs\\_Calculator.xlsx](#)

# Calculating Vegetation Indices

ReflectanceVIs\_Calculator.xlsx

Vegetation Index	Species	corn	corn	corn	corn
	Treatment	0	50	100	150
	Repetition	1	1	1	1
	Sample ID	1	2	3	4
Simple ratio	R750/R700	0.48	0.69	0.67	0.72
Anthocyanin(ARI1)	$(1/R550 - 1/R700)$	4.19	-0.41	-0.48	-0.81
Stress (TM5/TM4)	broad band (NIR/RED)	0.73	0.54	0.53	0.51
NDVI	$(NIR-RED)/(NIR+RED)$	0.84	0.91	0.90	0.90
Red Edge min	Ro	0.02	0.02	0.02	0.02
Dmax	Dmax	0.47	0.77	0.70	0.64
Red Edge Inflection Point	REIP	717	730	727	728
Derivative RE ratio	D714/D704	1.04	1.44	1.37	1.41
Phytochrome (Phyt)	$R730/(R730+R665)$	0.89	0.93	0.93	0.92
Normalized Difference Water Index 1 (NDWI1)	$(R860-R1240)/(R860+R1240)$	-0.03	0.04	0.04	0.04
Normalized Difference Water Index 2 (NDWI2)	$(R1700-R1240)/(R1700+R1240)$	-0.19	-0.25	-0.27	-0.30
Water Band Index (WBI)	R972/R895	1.01	0.96	0.96	0.97
MERIS terrestrial chlorophyll index (MTCI)	$(R754 - R709)/(R709 - R681)$	2.79	5.22	4.83	5.92
Photochemical Reflectance Index (PRI)	$(R531-R570)/(R531+R570)$	0.08	0.18	0.18	0.18
Chlorophyll (Chlre)	$(1/R705-1/R790)*R790$	8.15	15.29	14.15	16.40
Carotenoids (Car)	$(1/R515-1/R700)*R790$	2.53	2.24	1.89	1.85

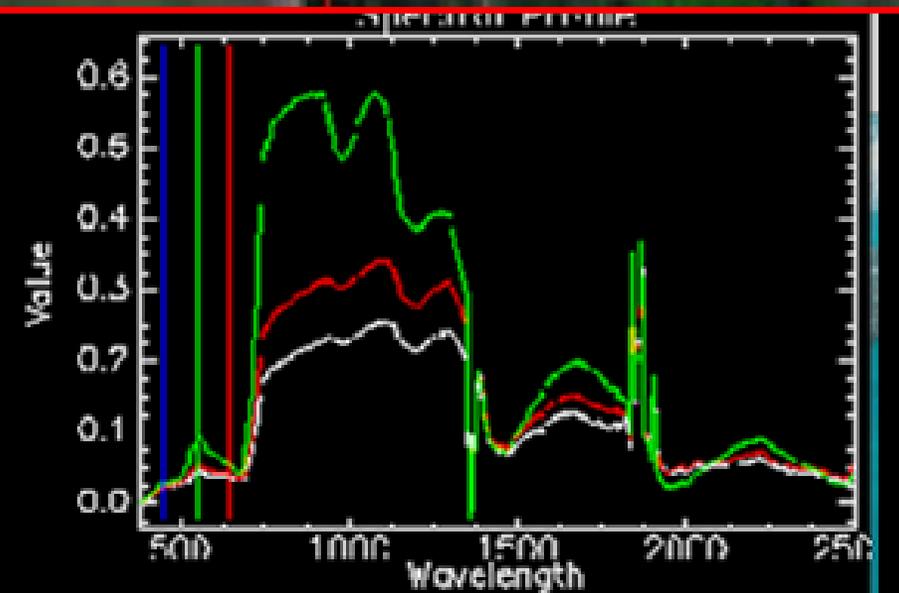
# AVIRIS

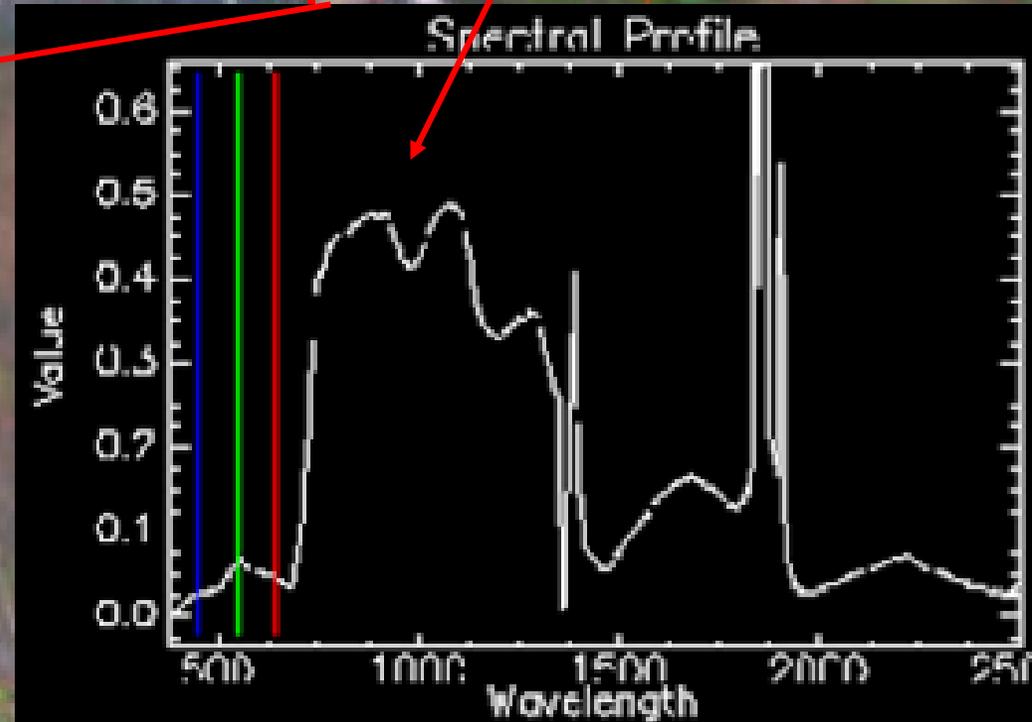
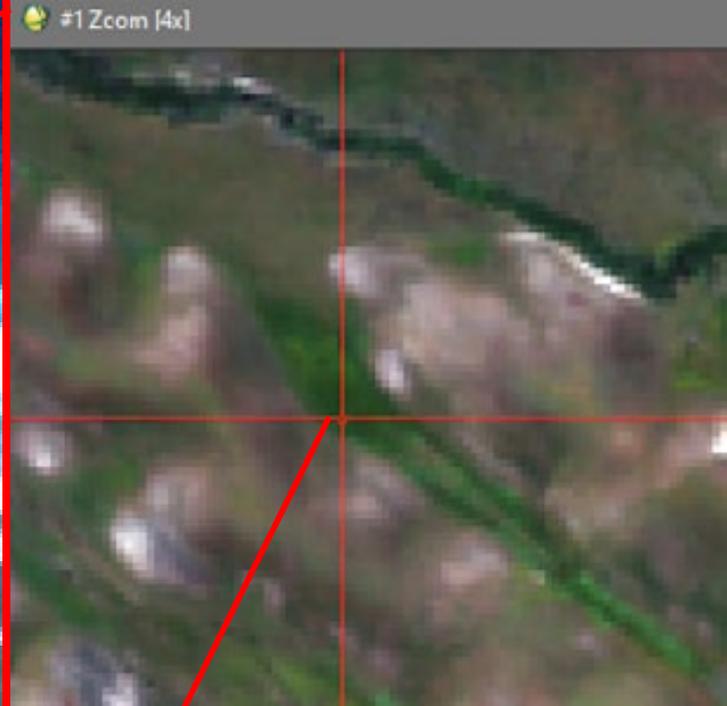
<https://avirisng.jpl.nasa.gov/dataportal/>

<https://aviris.jpl.nasa.gov/dataportal/>

## AIRBORNE VISIBLE / INFRARED IMAGING SPECTROMETER

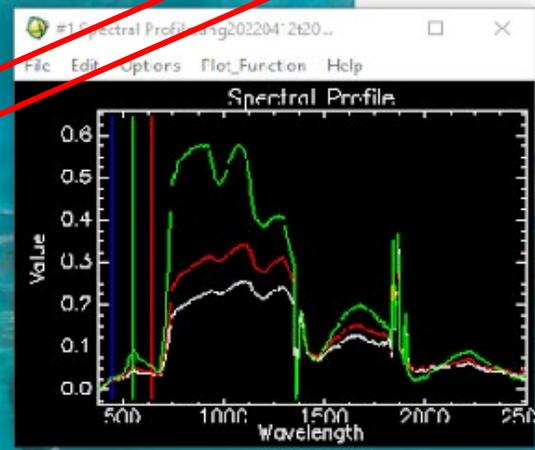




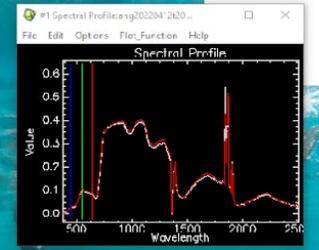


ENVI Classic  
File Basic Tools Classification Transform Filter Spectral Map Vector Topographic Radar Window PRISM Help

#1 (R:Band 54,G:Band 36,B:Band 15):ang20220412t202527\_rfl  
File Overlay Enhance Tools Window



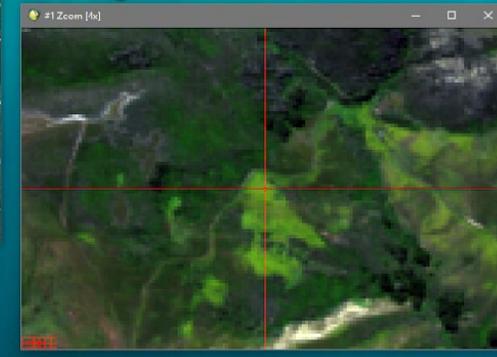
Transform Filter Spectral Map Vector Topographic Radar Window PRISM Help



#1 Zoom [fx]  
File Edit Options Plot Function Help

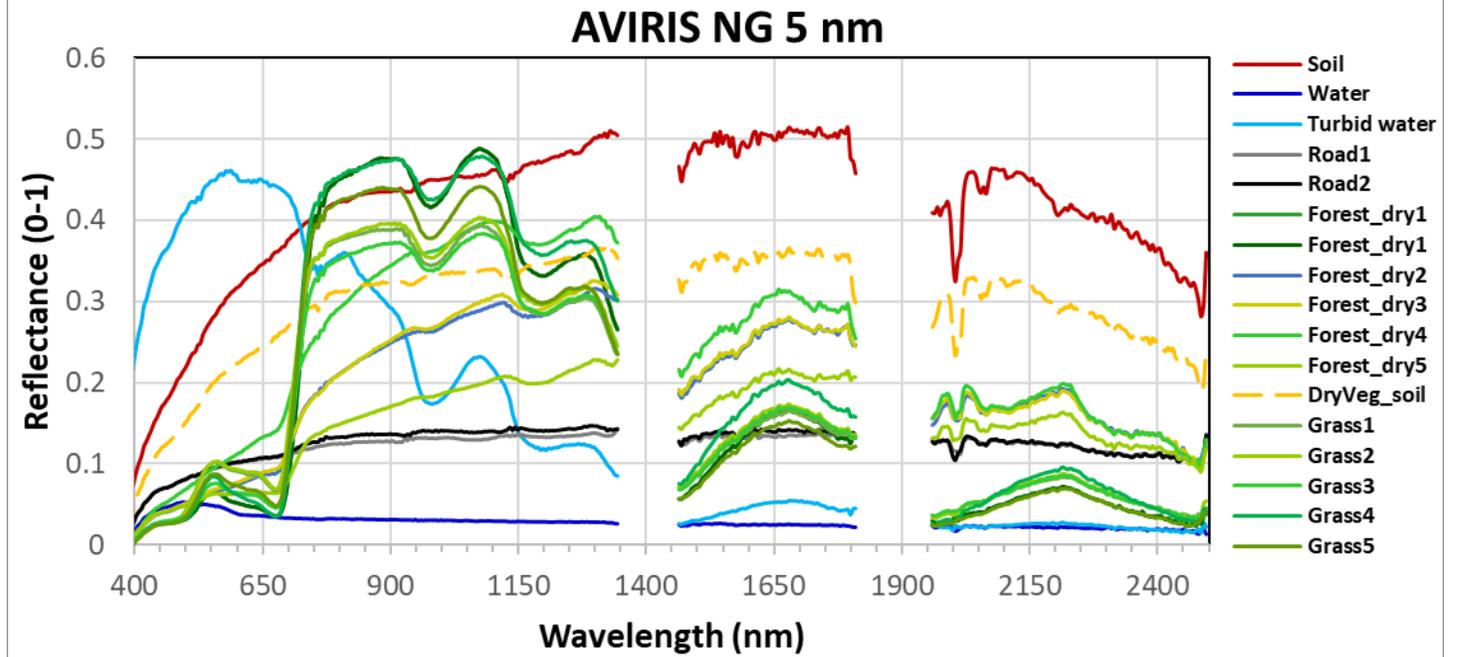


remctesens... AGU\_Fall... WinContr...  
ENVI Classic remctesens... AGU\_Fall... WinContr...  
ENVI Classic 5.6 (64-bit)

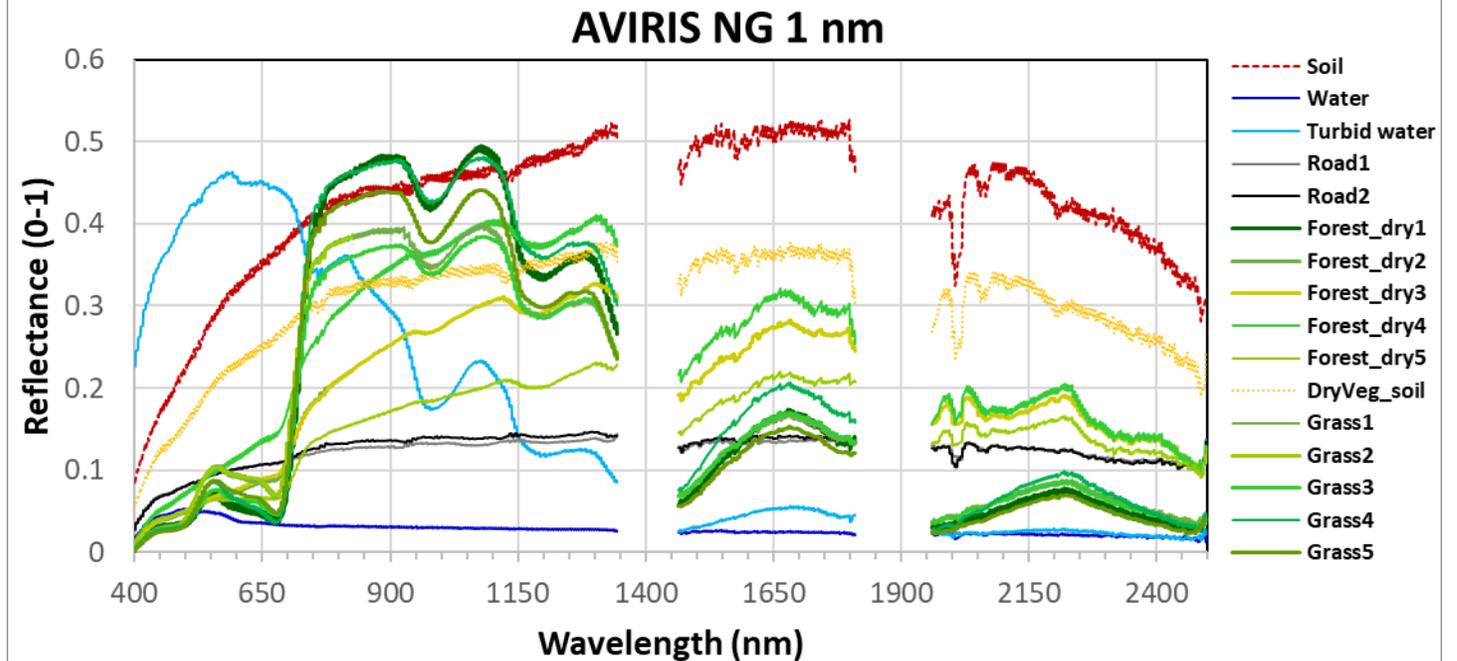


ENVI Classic

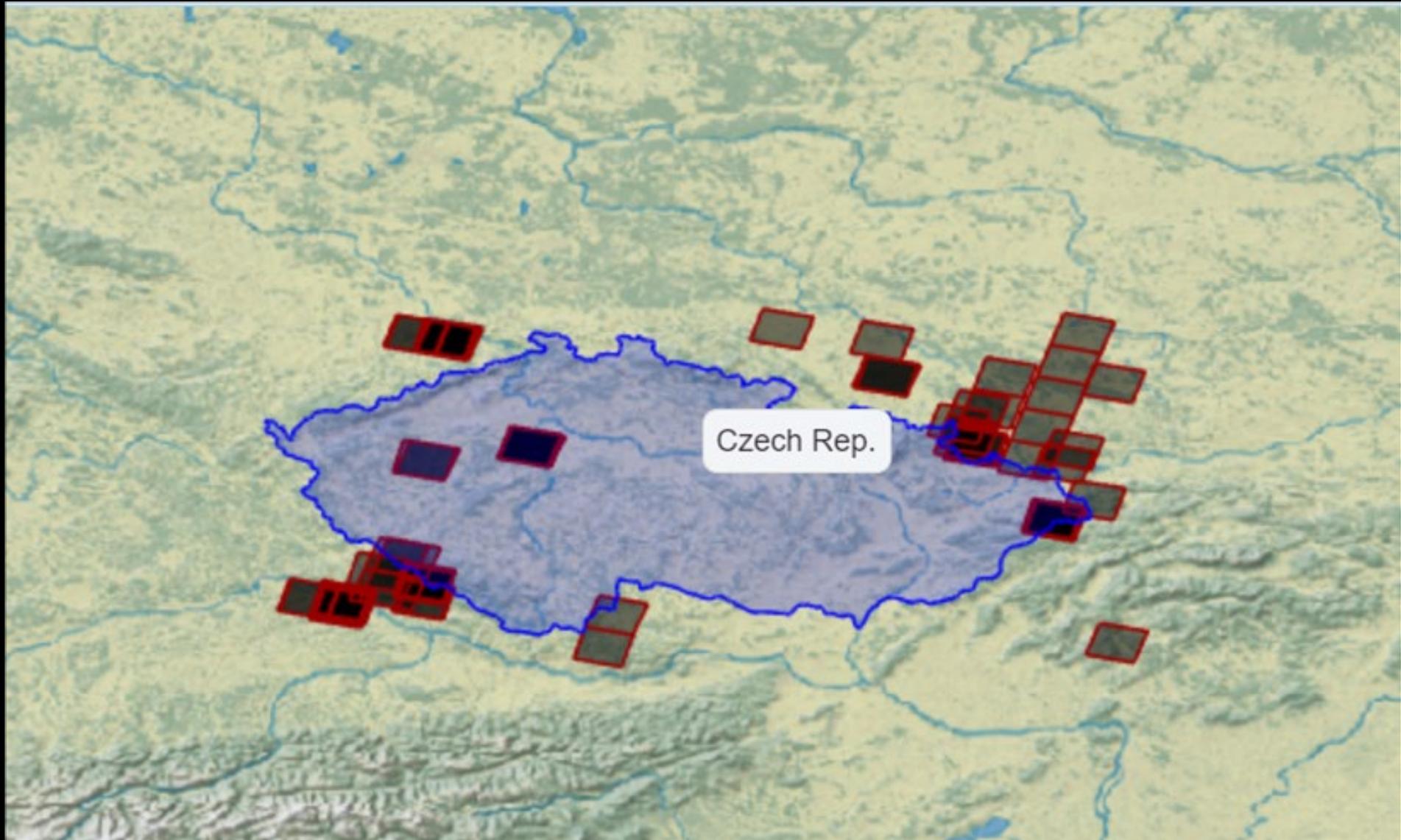
- AVIRIS NG data original 5 nm resolution



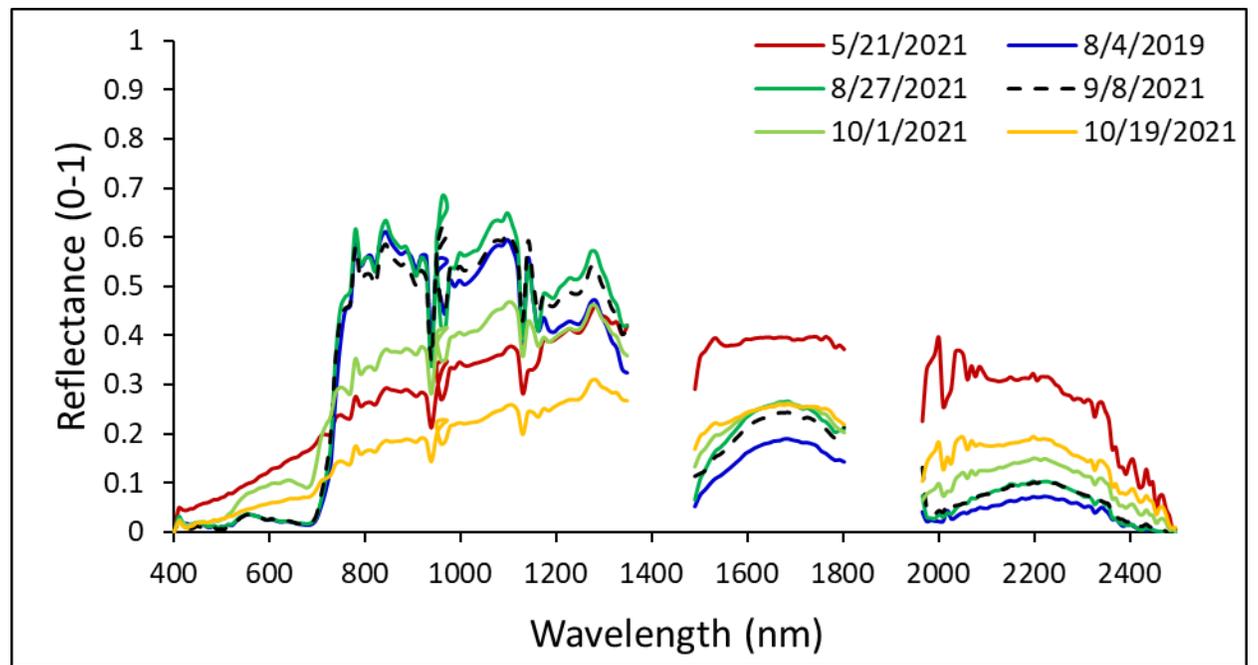
- AVIRIS NG data oversampled to 1 nm



# PRISMA - <http://prisma.asi.it/js-cat-client-prisma-src/>

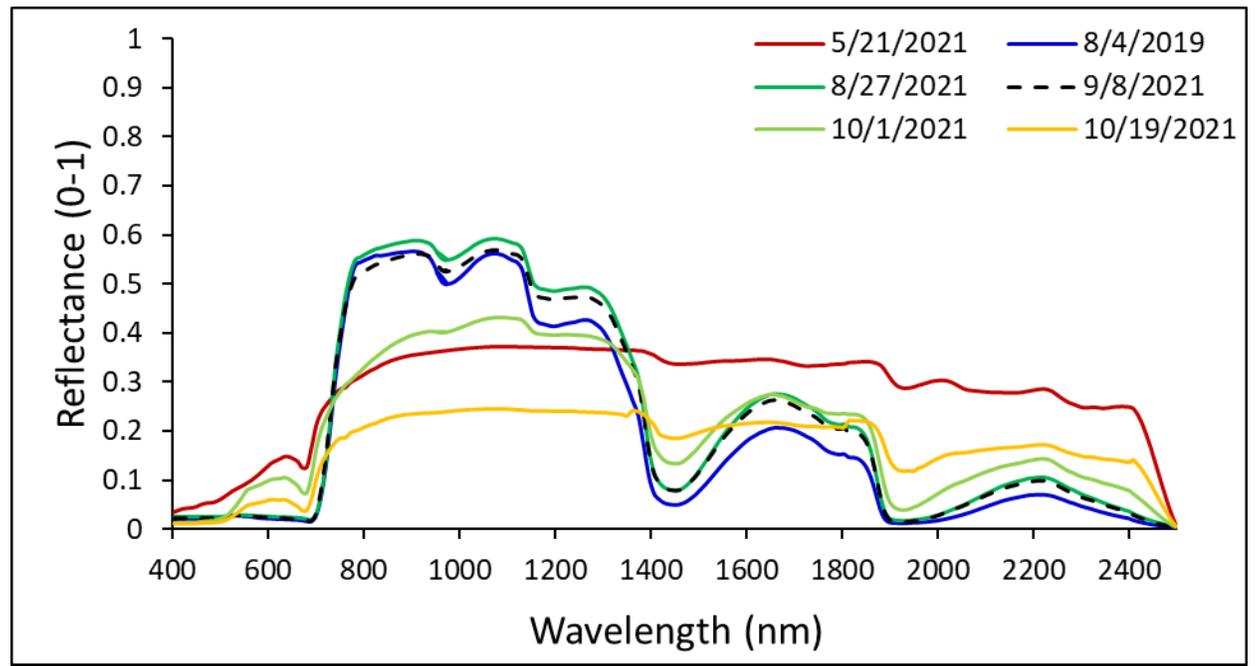


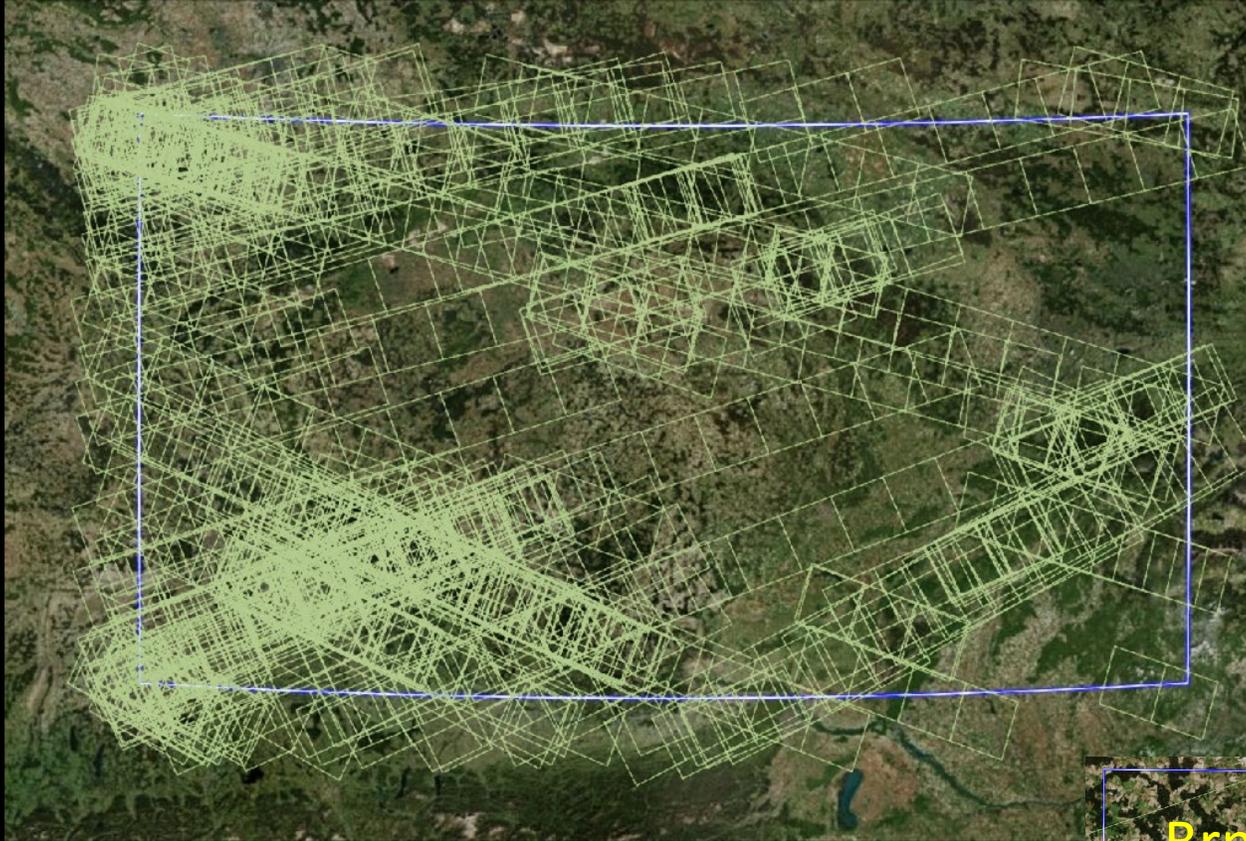
- PRISMA  
original 10 nm



- PRISMA – use for VIs and derivatives

smoothed 10 nm  
Savitzky–Golay filter

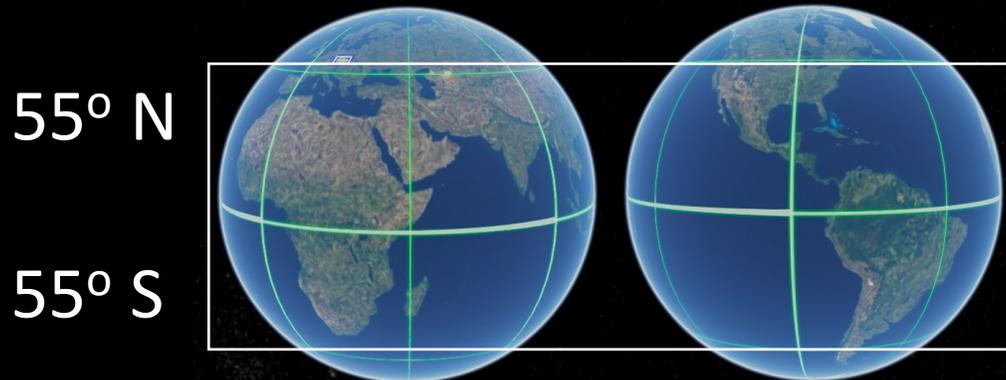




Chechia 1092 images



Brno 2 images



# EMIT

# Earth Surface Mineral Dust Source Investigation

<https://lpdaac.usgs.gov/products/emitl2arflv001/>



EMIT\_L1B\_RAD\_001\_20230613T124036\_2316408\_006

START 2023-06-13 12:40:36  
END 2023-06-13 12:40:56

EMIT\_L1B\_RAD\_001\_20230612T115239\_2316308\_001 Search Time: 0.3s

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**Děkuji ☺ !**

*E-mail with questions*  
petya@umbc.edu