Hungarian Space Office

SZENT ISTVÁN UNIVERSITY

esa

→ 7th ADVANCED TRAINING COURSE ON LAND REMOTE SENSING

4–9 September 2017 | Szent István University | Gödöllő, Hungary

WATER PONDING IN HUNGARY: COLLECTION OF GROUND AND DRONE DATA – GROUND REFLECTANCES

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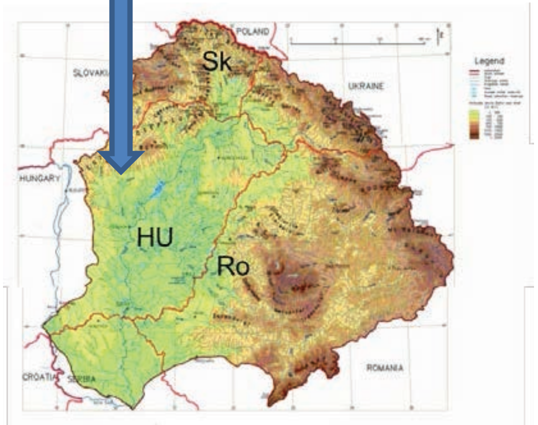
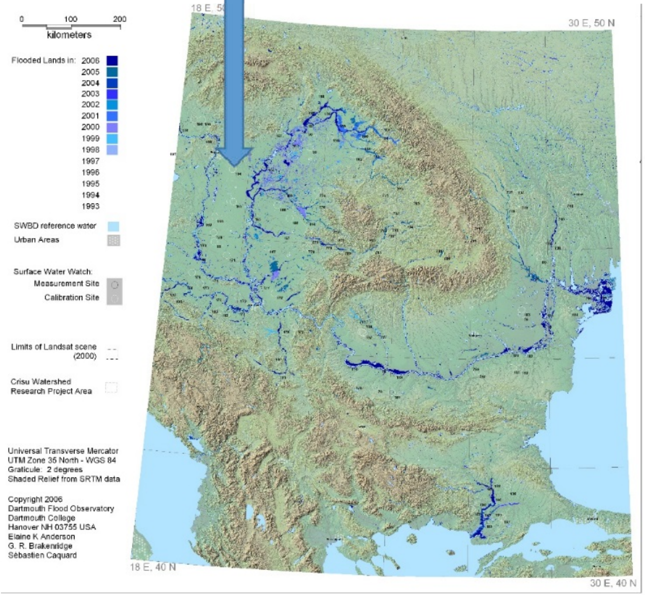
The Tisza River Basin

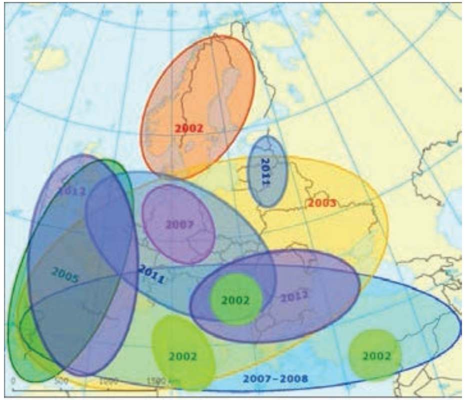
Csány, test site



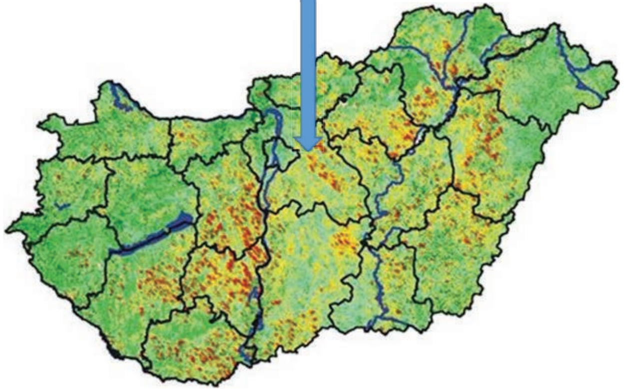
Flood Risk –
Remote sensing TSA data



Drought risk in Europe



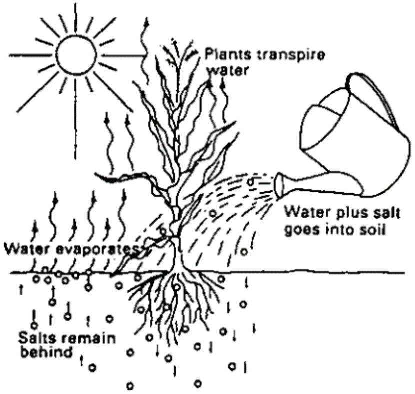
Csány, test site



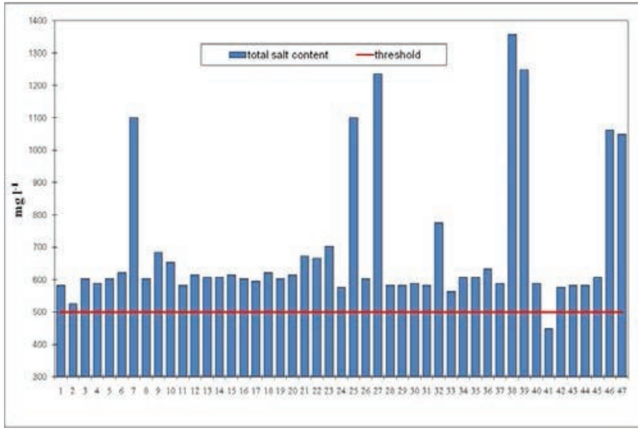
NDVI map - Source: FOMI. 2007. August

The Tisza River Basin is the largest sub-basin in the Danube River Basin, covering 157,186 km² (19.5%) of the Danube Basin

Secondary salinization - Soil degradation

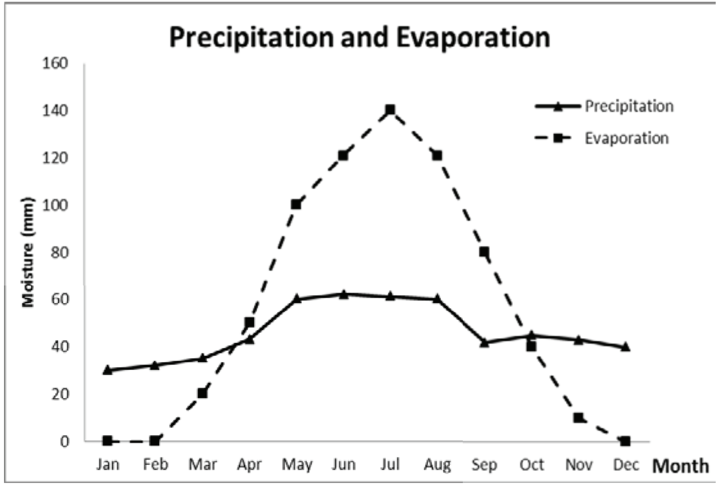


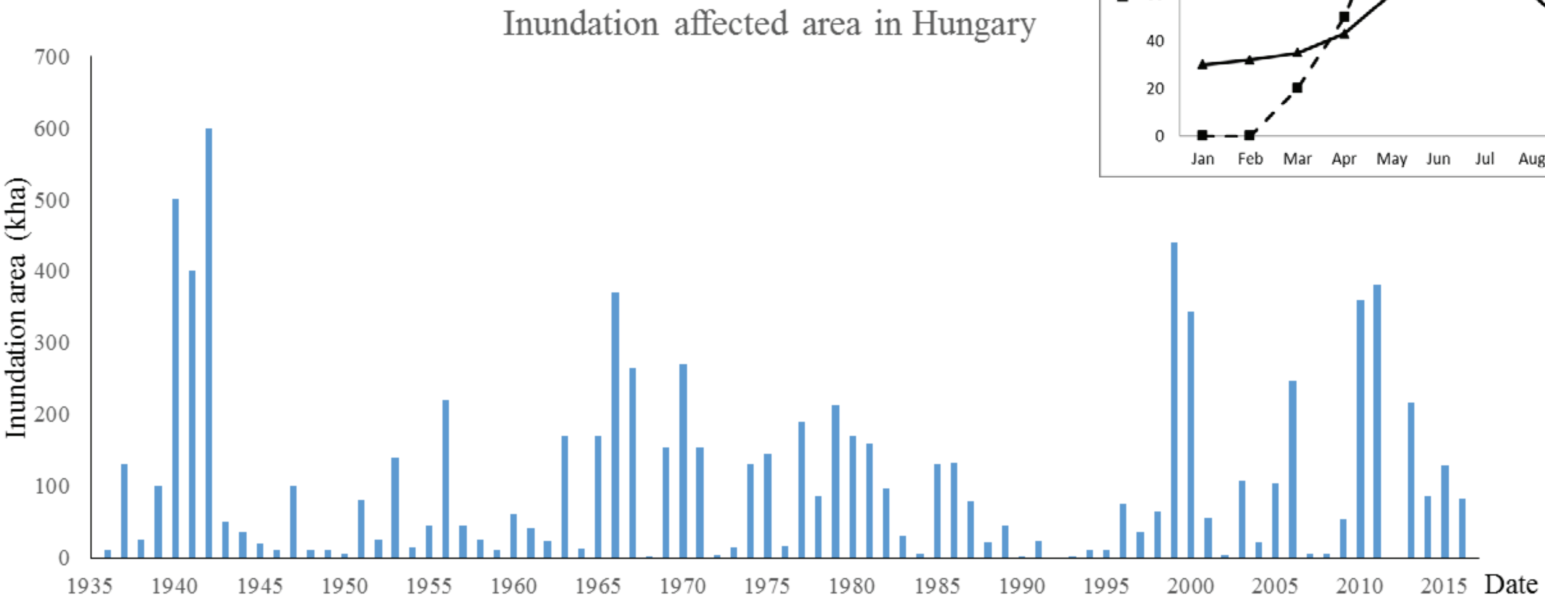
The total salt content of the aquifers in the centre of the Great Hungarian Plain varying in the range of 550-600 mEq l-1.



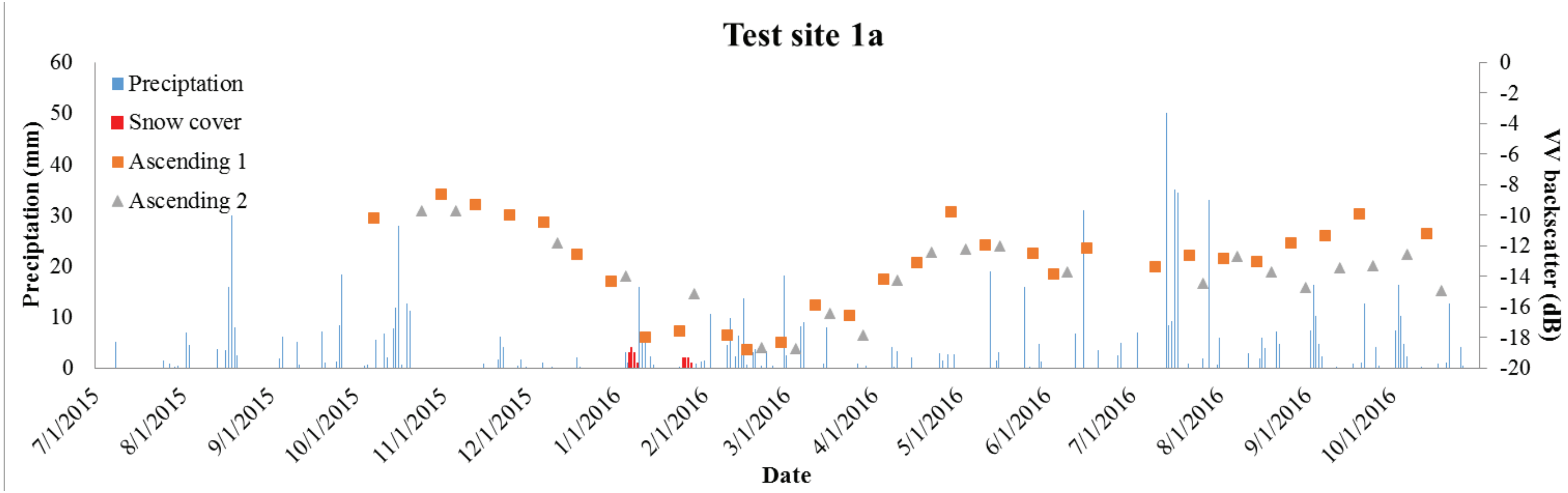
Water sampling of Karcag region
Source: Zsembeli. J. 2016. BWS

Excess water ponding in Hungary

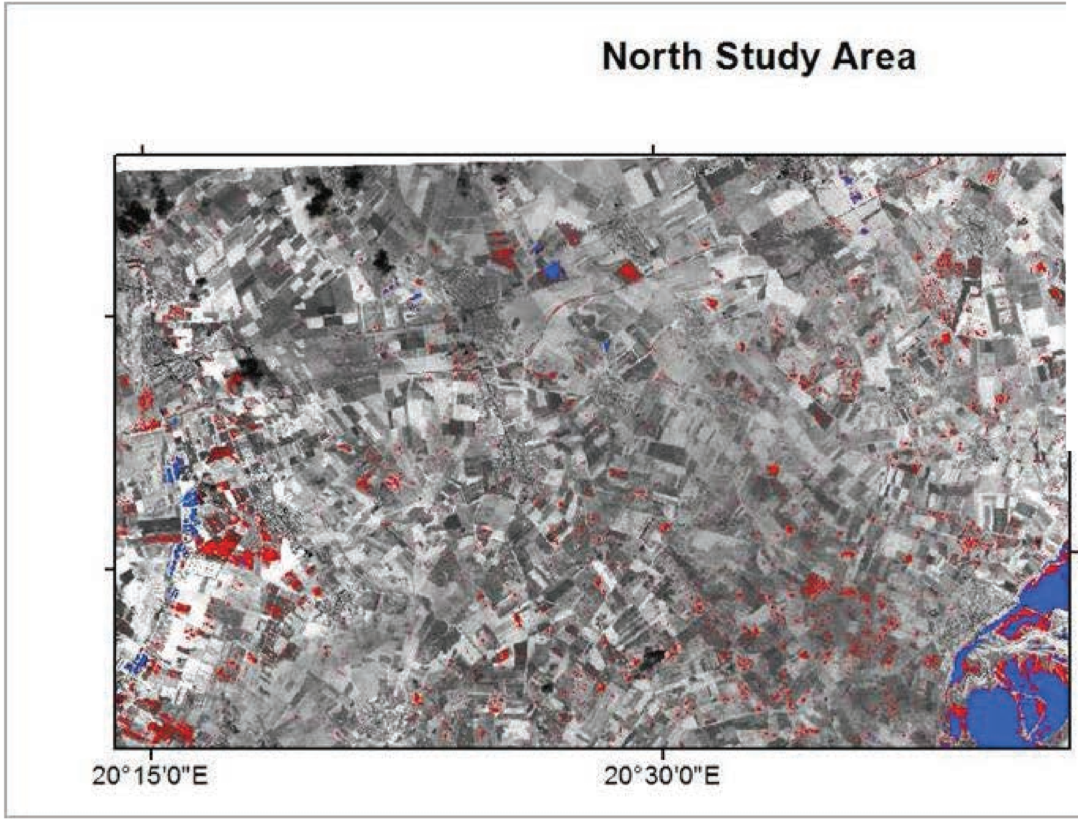


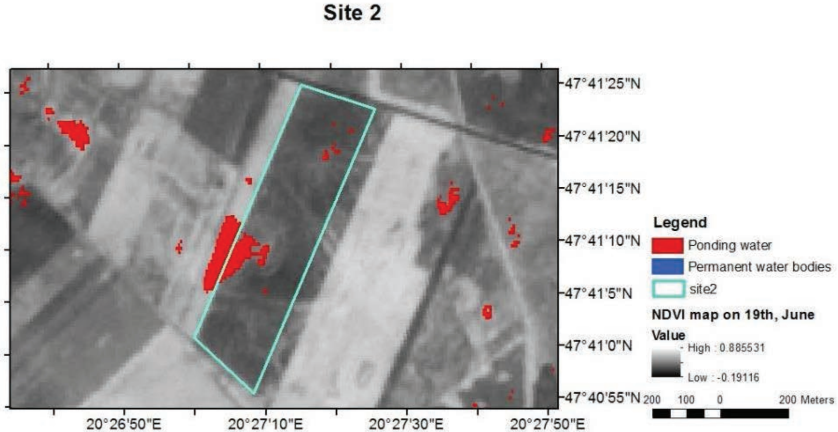


Sentinel-1 SAR backscatter time series

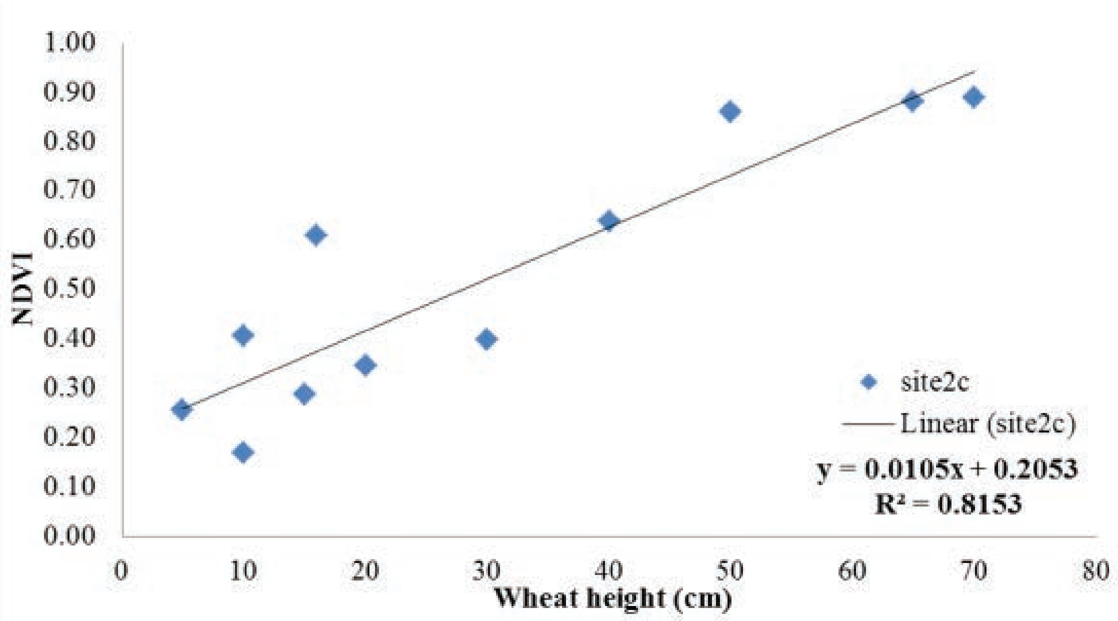


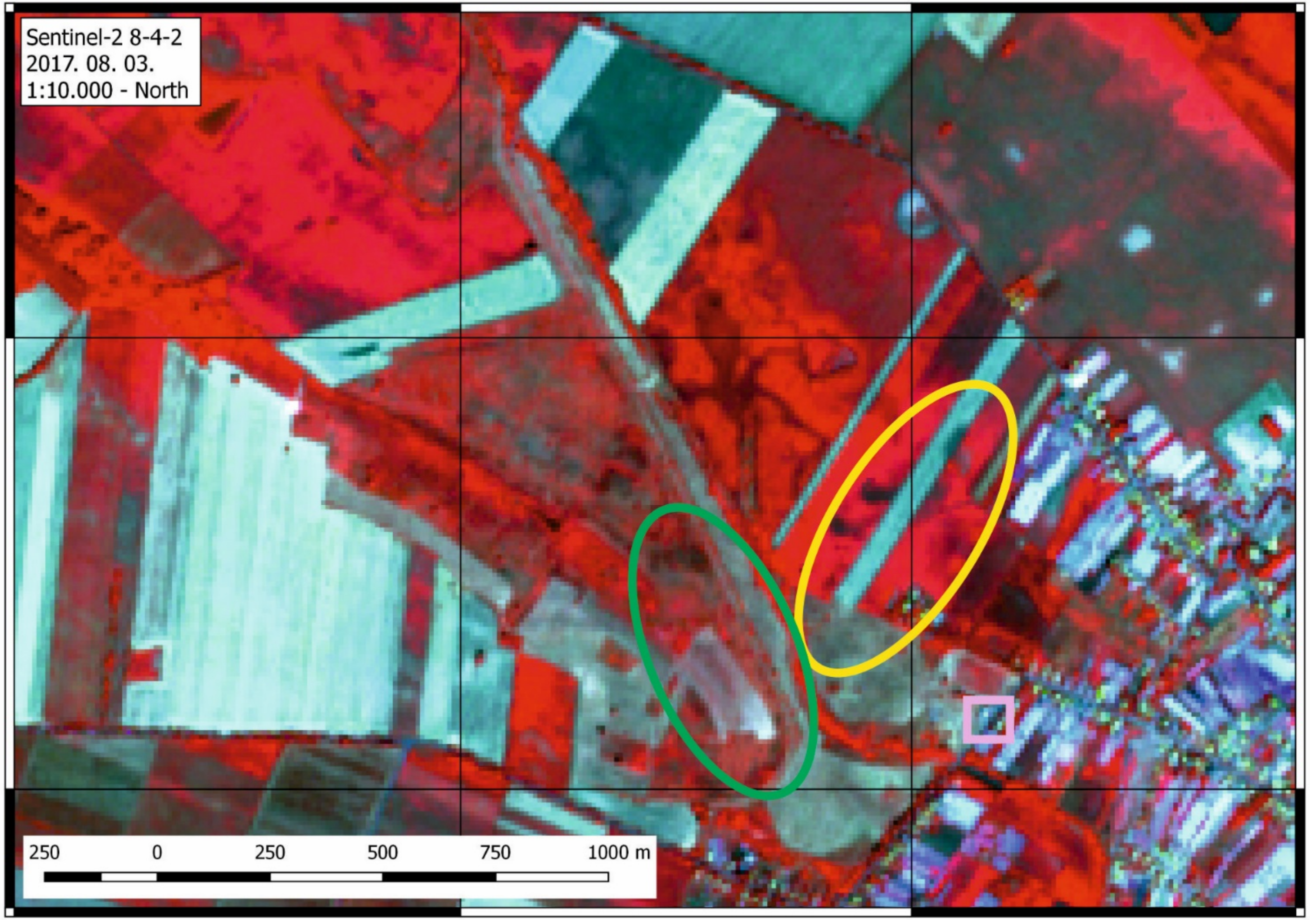
Temporary ponding water and permanent water bodies





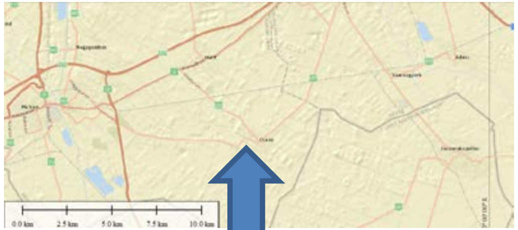
Vegetation and NDVI





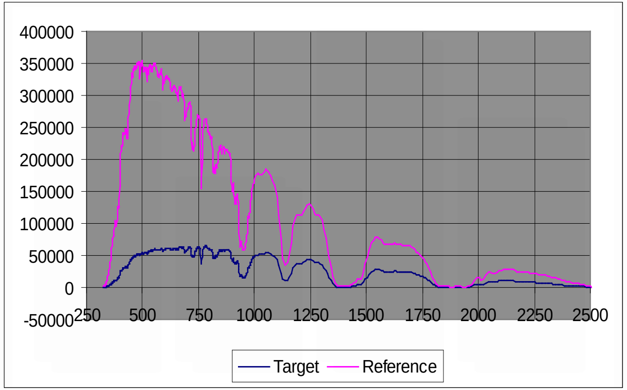
Sentinel-2 8-4-2
2017. 08. 03.
1:10.000 - North
250 0 250 500 750 1000 m

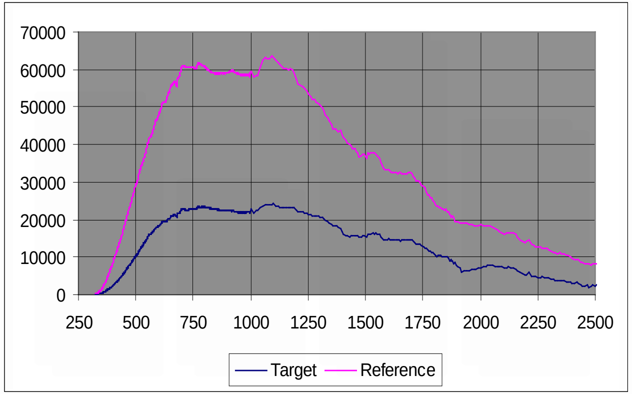
Test site - Csány



Google Time Series
Csany –North
Yellow pinpoint
Lat: 47°39'7.71"N
Long: 19°48'26.09"E

Field and laboratory spectrometry



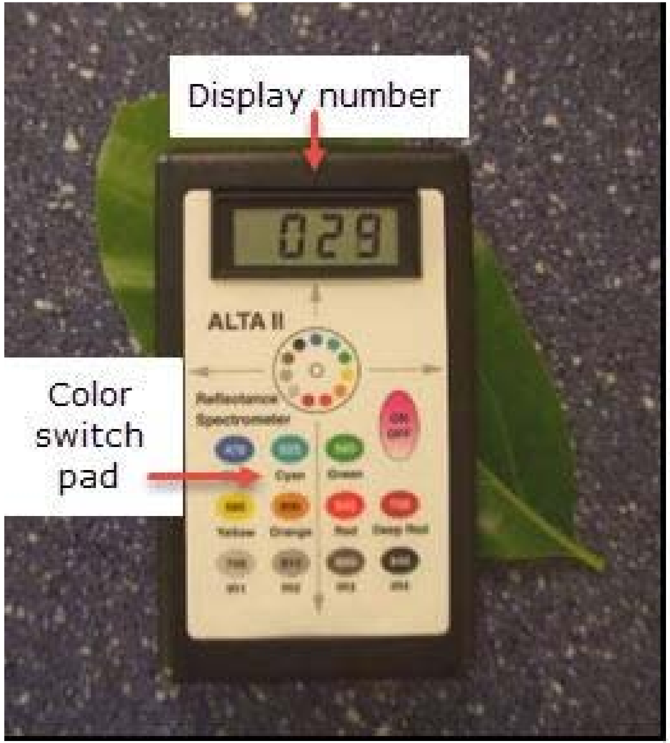


ALTA® II Reflectance Spectrometer

- The patented number US # 6,043,893 technology of the ALTA uses light in visible colors (blue through red in seven wavelengths) and in four infrared wavelength ranges.
- The results are good models of spectra from NASA probes like Mars Pathfinder and environmental satellites like LANDSAT.

Photo: Vernier

The ALTA consists of three basic elements: colored lamps, a photo-detector, and a digitizer and digital display.



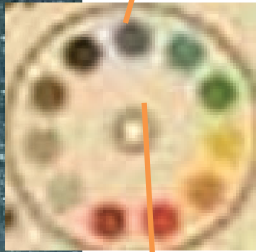


Photo: Extension

Implementation

- The Alta II meters are relatively simple gadgets that measure the reflectance of different colors from a given surface. The meter operates by shining a small LED light (from Deep Blue up to Deep Red and Infrared).
- A photo sensor records the amount of light bouncing back into the meter. The value that the meter gives is then divided by the particular color’s wavelength (in nm) minus the “dark value” (value of meter when no color buttons are pushed).
- So it does take some simple division to actually arrive at the reflectance percentage once you have your readings.
- These can be graphed (see jack example blow) and then compared to standard values.

Photo: Extension

ALTA II. Photo-Detector:

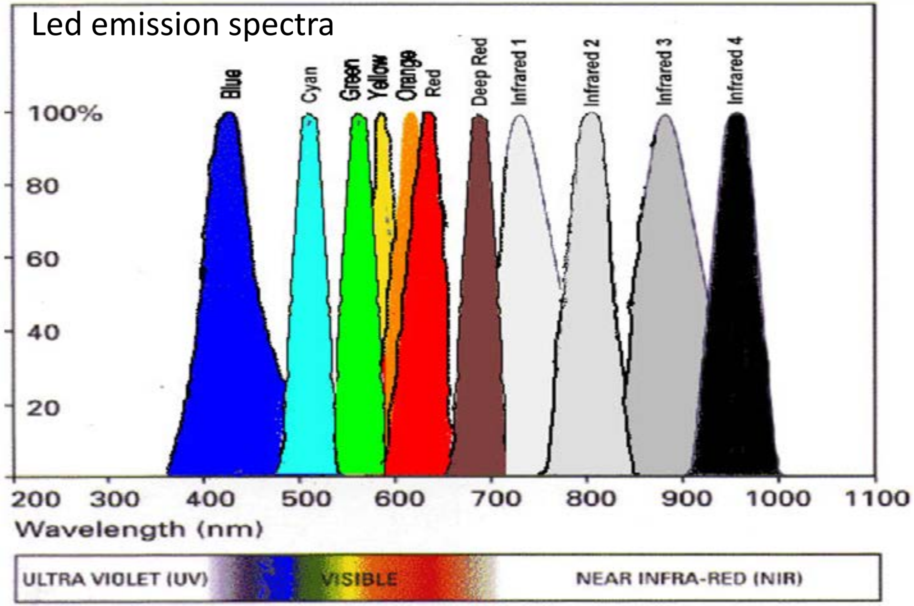


Photo: Lunar and Planetary Institute

The ALTA senses reflected light with a silicon photodiode. Light from an LED lamp interacts with the sample, and the reflected (scattered) portion is detected by a silicon photodiode positioned among the lamps. The diode is most sensitive in the infrared near 1000-nm wavelength. To produce comparable output readings from the ALTA in all wavelength bands, the intensity of each lamp is adjusted in the factory.

The eleven lamps are light-emitting diodes (LEDs) in the colors blue (470 nm), cyan (525 nm), green (560 nm), yellow (585 nm), orange (635 nm), red (660 nm), deep red (700 nm), infrared 1 (735 nm), infrared 2 (810 nm), infrared 3 (880 nm), and infrared 4 (940 nm).

Band of Sentinel-2 images	Wavelength (μm)	Bandwidth (μm)	ALTA II Wavelength (μm)
Band1 Coastal/Aerosol	0.443	0.02	
Band2 Blue (VIS)	0.49	0.065	0.470 Blue 0.525 Cyan
Band3 Green (VIS)	0.56	0.035	0.560 Green 0.585 Yellow
Band4 Red (VIS)	0.665	0.03	0.635 Orange 0.660 Red
Band5 (VIS)	0.705	0.015	0.700 Deep red 0.735 Infra1
Band6 (VIS)	0.74	0.015	
Band7 (VIS)	0.775	0.02	
Band8 Near Infrared	0.842	0.115	0.810 Infra2
Band8a Near Infrared	0.865	0.02	0.880 Infra3
Band9 Near Infrared	0.94	0.02	0.940 Infra4
Band10 SWIR	1.375	0.02	
Band11 SWIR	1.61	0.09	
Band12 SWIR	2.19	0.18	

Measurement and calibration

- When the switch is turned on, the lamps in the bottom of the ALTA® will *not* turn on. However, the numerical display should show a number between 1 and 1999.
- Each lamp is controlled by its own color-coded switch pad on the top face of the ALTA®.
- The light detector is centered among the colored lamps.
- With the ALTA® turned on, place it on the object to be measured so that the hole in the bottom is facing the object. Flat, matte-surface objects work best; *do not* let objects project into the hole.
- With no lamps illuminated, the display will show a number less than 150. This is the dark voltage.
- Press **and hold** a colored switch pad on the ALTA® top face to turn on a colored lamp.

The amount of light represented by display numbers of the ALTA® is *not* calibrated. To calibrate this number, take reflectance measurements (as above) on an object with known reflectance values as a standard, e.g., a Spectralon® panel.

% Reflectance

With the "Standard" data, we can now calculate the percentage of light reflected by the leaf. For each color, simply divide the display voltage number for the leaf by the display voltage number for the white paper and multiply by 100. This value is called the reflectance.

% Reflectance = [(Display number for sample) ÷ (Display number for white paper)] × 100.

To get a real reflectance value, you should subtract the dark voltage from the measured voltages, and then divide the sample by standard and convert to a percent value.

% Reflectance = (Display voltage for sample – dark voltage)/(Display voltage for standard – dark voltage) × 100

Graph your standardized reflectance data (as proportions) on suitable graph paper

Worksheets

Record the location of the collected sample (ϕ, λ)!

Lesson 5: Worksheet for Calculating Reflectance.
(Simple)

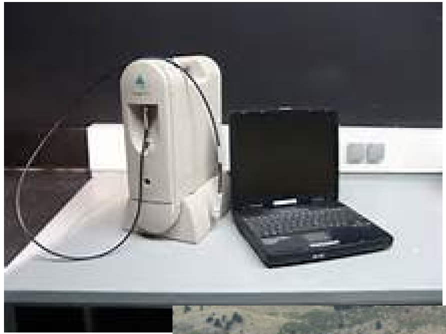
Class: ______________________ Date: ____________

Scientist(s): ______________________________________

____

Color	Light Wavelength	Voltage (mV) Sample:	Voltage (mV) Standard: White Paper	% Reflectance (Sample Voltage ÷ Standard Voltage) × 100
Blue	470 nm			
Cyan	525 nm			
Green	560 nm			
Yellow	585 nm			
Orange	600 nm			
Red	645 nm			
Deep Red	700 nm			
Infrared 1	735 nm			
Infrared 2	810 nm			
Infrared 3	880 nm			
Infrared 4	940 nm			

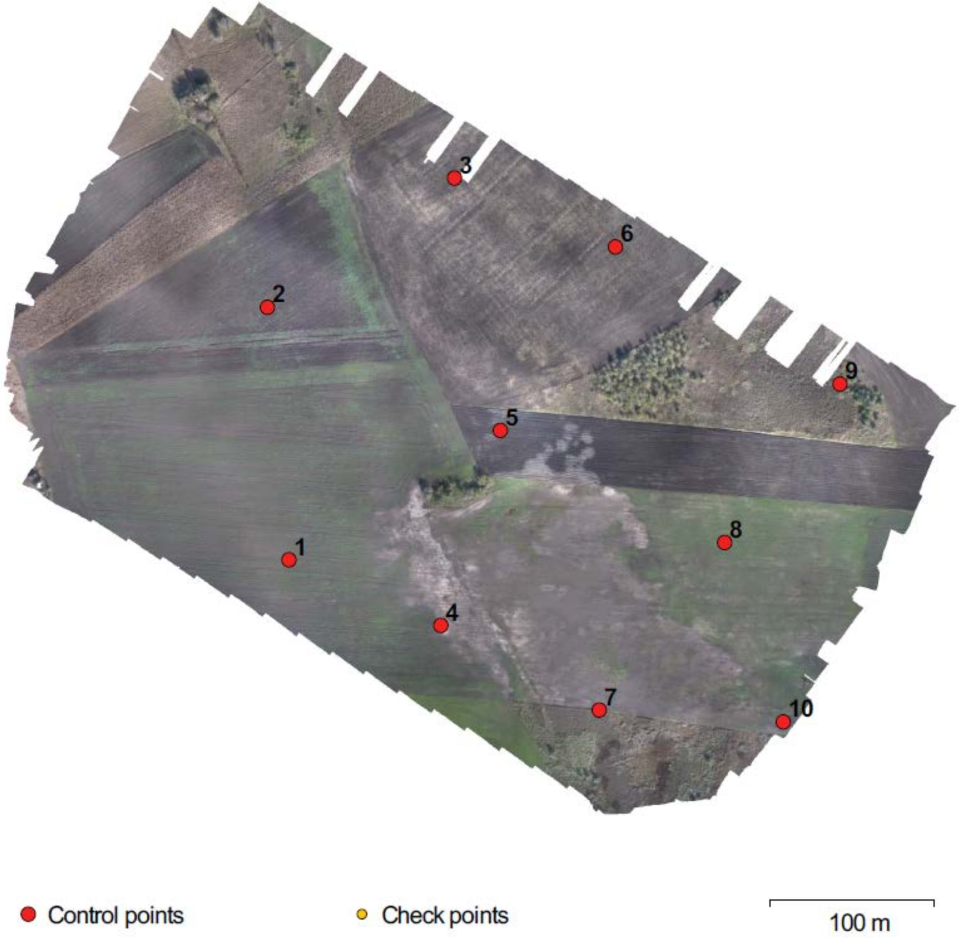
Field spectrometry – ASD FieldSpec



Spectral Range	350-2500 nm
Spectral Resolution	3 nm @ 700 nm 10 nm @ 1400/2100 nm
Sampling Interval	1.4 nm @ 350-1050 nm 2 nm @ 1000-2500 nm
Scanning Time	100 milliseconds
Detectors	One 512 element Si photodiode array 350-1000 nm Two separate, TE cooled, graded index InGaAs photodiodes 1000-2500 nm
Input	1.5 m fiber optic (25º field of view) Optional foreoptics available
Noise Equivalent Radiance (NEdL)	UV/VNIR 1.1 x 10-9 W/cm2/nm/sr @700 nm NIR 2.4 x 10-9 W/cm2/nm/sr @ 1400 nm NIR 4.7 x 10-9 W/cm2/nm/sr @ 2100 nm
Weight	12 lbs (5.2 kg)
Calibrations	Wavelength, reflectance, radiance*, irradiance* All calibrations are NIST traceable (*radiometric calibrations are optional)

Drones

RGB camera
GPS
Control unit
Laptop



References:

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Warning: allergy risk!

THE FIELDWORK REGION IS UNFORTUNATELY INFECTED WITH THE ALLERGENIC **COMMON RAGWEED** (AMBROSIA ARTEMISIIFOLIA), A STRONGLY INVASIVE SPECIES. IF YOU ARE ALLERGIC TO ITS POLLEN, PLEASE TAKE PREVENTIVE MEASURES IF APPLICABLE, OR DO NOT HESITATE CONTACTING THE ORGANIZERS FOR SOLUTIONS TO AVOID THE INFECTED AREAS.

WE ARE SORRY FOR THE POSSIBLE INCONVENIENCE.