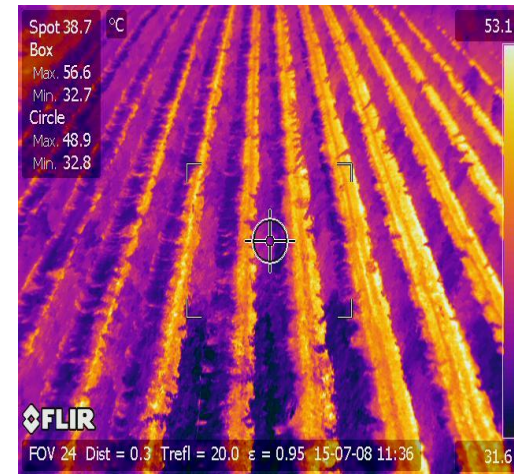


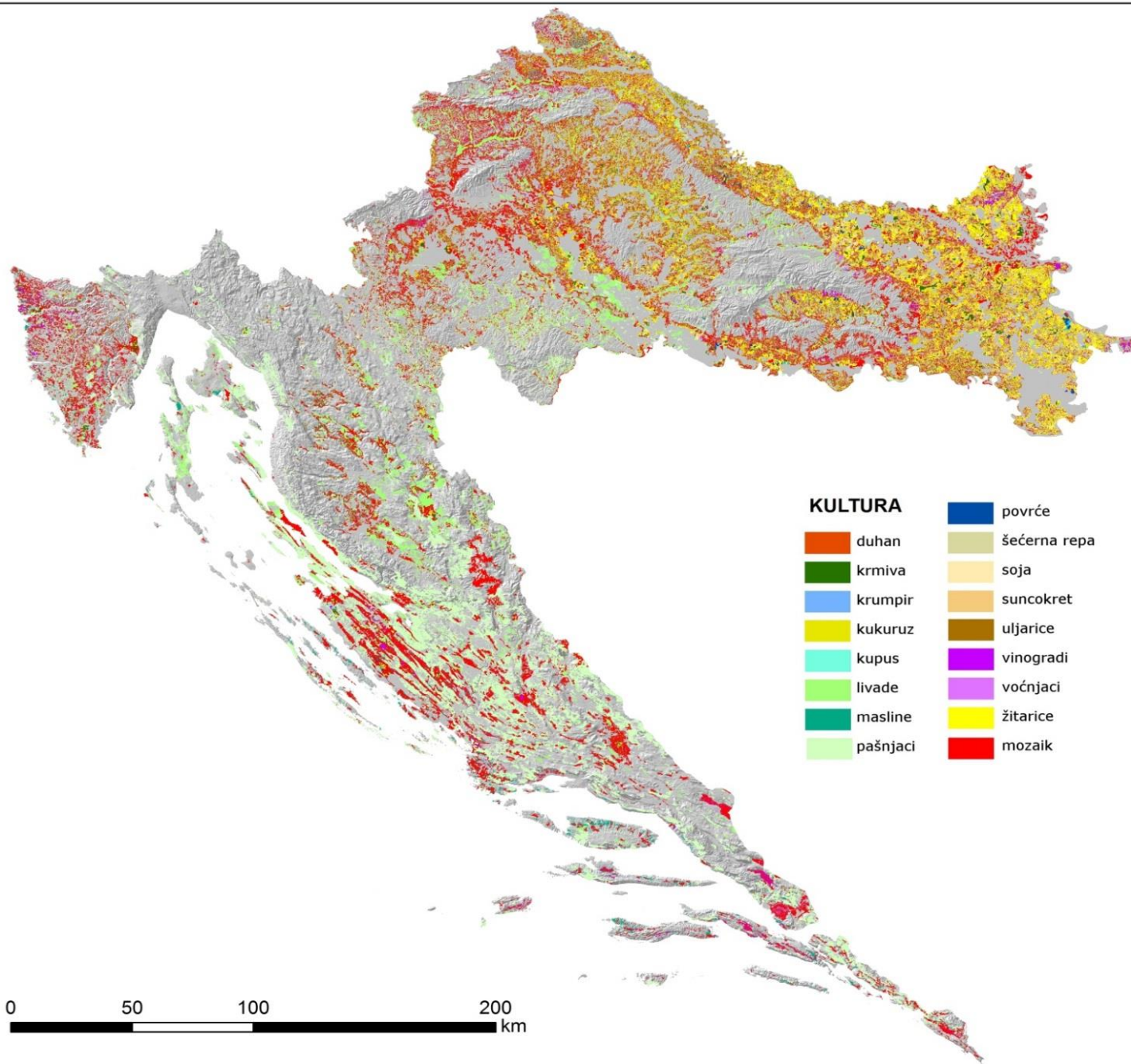


# NAPREDNE TEHNIKE U ZNANSTVENIM ISTRAŽIVANJIMA KAO TEMELJ ZA PRIMJENU U PRECIZNOJ POLJOPRIVREDI



Romić D. i sur.

# KAKVA JE DANAS POLJOPRIVREDNA PROIZVODNJA U RH?



# Korišteno poljoprivredno zemljište u RH za 2012. godinu

| Županija                    | ŽITARICE | KUKURUZ | KRMIVA  | DUHAN | ŠEĆERNA<br>REPA | SOJA   | SUNCOKRET | ULJARICE | KRUMPIR | KUPUS | POVRĆE | VINOGRADI | VOĆNJACI | MASLINIK | LIVADE  | PAŠNJACI | Nekorišteno | UKUPNO    |
|-----------------------------|----------|---------|---------|-------|-----------------|--------|-----------|----------|---------|-------|--------|-----------|----------|----------|---------|----------|-------------|-----------|
| Bjelovarsko-bilogorska      | 24.490   | 41.520  | 9.401   | 82    |                 | 1.811  | 83        | 1.080    | 747     | 28    | 704    | 547       | 2.032    |          | 17.974  | 4.083    | 32.335      | 136.920   |
| Brodsko-posavska            | 34.640   | 34.467  | 6.460   | 5     | 1.730           | 4.646  | 1.671     | 762      | 325     | 30    | 1.500  | 684       | 2.360    |          | 2.937   | 2.324    | 12.756      | 107.297   |
| Dubrovalčko-<br>neretvanska | 4        | 17      | 95      |       |                 |        |           |          | 150     | 290   | 516    | 2.987     | 1.302    | 6.950    | 1.337   | 22.697   | 50.128      | 86.472    |
| Grad Zagreb                 | 3.899    | 7.050   | 882     |       |                 | 31     |           | 13       | 44      | 39    | 296    | 233       | 184      |          | 4.251   | 3.211    | 3.199       | 23.334    |
| Istarska                    | 4.685    | 2.406   | 4.186   |       |                 |        | 25        | 95       | 500     | 480   | 1.792  | 5.845     | 370      | 5.990    | 10.990  | 21.368   | 47.026      | 105.757   |
| Karlovačka                  | 9.325    | 16.220  | 6.608   |       |                 | 166    |           | 226      | 748     | 132   | 289    | 308       | 879      |          | 24.591  | 29.143   | 27.018      | 115.652   |
| Koprivničko-križevačka      | 16.941   | 35.881  | 8.425   | 85    | 362             | 210    | 89        | 1.708    | 317     | 43    | 634    | 1.170     | 1.061    |          | 16.468  | 11.969   | 3.037       | 98.401    |
| Krapinsko-zagorska          | 8.681    | 23.162  | 5.152   |       |                 | 2      | 2         | 370      | 408     | 1     | 249    | 2.628     | 930      |          | 16.999  | 3.102    | 4.784       | 66.471    |
| Ličko-senjska               | 8.728    | 4.085   | 5.162   |       |                 |        |           |          | 1.025   | 22    | 182    | 30        | 590      | 344      | 56.072  | 34.176   | 42.191      | 152.608   |
| Međimurska                  | 8.332    | 12.090  | 2.010   |       | 825             | 289    | 28        | 2.069    | 5.100   | 70    | 2.474  | 952       | 1.116    |          | 10.481  | 1.700    | 4.578       | 52.115    |
| Osječko-baranjska           | 74.547   | 56.175  | 17.565  | 82    | 9.673           | 14.495 | 19.538    | 2.238    | 406     | 107   | 2.166  | 3.287     | 5.116    |          | 2.750   | 1.604    | 1.823       | 211.574   |
| Požeško-slavonska           | 20.966   | 18.820  | 4.643   | 1.900 | 936             | 5.723  | 268       | 2.545    | 424     | 105   | 1.203  | 1.951     | 2.017    |          | 9.752   | 4.728    | 81.809      | 157.790   |
| Primorsko-goranska          | 355      | 233     | 946     |       |                 |        |           | 21       | 17      | 11    | 44     | 241       | 51       | 1.897    | 12.131  | 31.583   | 28.696      | 76.225    |
| Sisačko-moslavačka          | 14.706   | 46.667  | 6.045   |       | 1               | 2.618  | 6         | 903      | 118     | 23    | 465    | 604       | 1.742    |          | 37.080  | 50.355   | 34.658      | 195.992   |
| Splitsko-dalmatinska        | 3.054    | 5.160   | 3.324   |       | 0               |        |           |          | 850     | 300   | 996    | 2.740     | 560      | 7.355    | 7.344   | 64.748   | 87.385      | 183.816   |
| Šibensko-kninska            | 1.907    | 998     | 1.565   |       |                 |        | 1         |          | 17      | 11    | 114    | 2.013     | 233      | 3.903    | 7.070   | 80.917   | 87.586      | 186.333   |
| Varaždinska                 | 9.119    | 23.286  | 1.318   | 2     | 122             | 7      | 11        | 694      | 840     | 470   | 585    | 2.323     | 569      |          | 10.345  | 7.781    | 8.944       | 66.416    |
| Virovitičko-podravska       | 23.142   | 28.076  | 6.862   | 4.483 | 1.800           | 8.275  | 2.906     | 2.135    | 269     | 121   | 4.438  | 476       | 2.071    |          | 11.146  | 2.824    | 9.534       | 108.556   |
| Vukovarsko-srijemska        | 42.227   | 31.498  | 8.722   | 20    | 9.115           | 19.712 | 10.358    | 622      | 742     | 97    | 1.924  | 2.407     | 2.049    |          | 1.342   | 1.532    | 18.235      | 150.603   |
| Zadarska                    | 924      | 1.059   | 1.630   |       |                 |        |           |          | 393     | 375   | 1.740  | 2.391     | 1.155    | 3.373    | 12.091  | 104.130  | 67.692      | 196.953   |
| Zagrebačka                  | 11.686   | 23.304  | 6.193   |       |                 | 1.065  | 40        | 564      | 271     | 51    | 885    | 2.134     | 1.393    |          | 15.301  | 2.552    | 93.320      | 158.759   |
| UKUPNO RH                   | 322.359  | 412.177 | 107.195 | 6.658 | 24.565          | 59.052 | 35.027    | 16.047   | 13.712  | 2.805 | 23.194 | 35.950    | 27.780   | 29.811   | 288.451 | 486.527  | 746.735     | 2.638.044 |

**UKUPNO RH**

**Ukupno poljoprivredno zemljište**

**2.638.044 ha**

**Nekorišteno**

**746.735 ha**

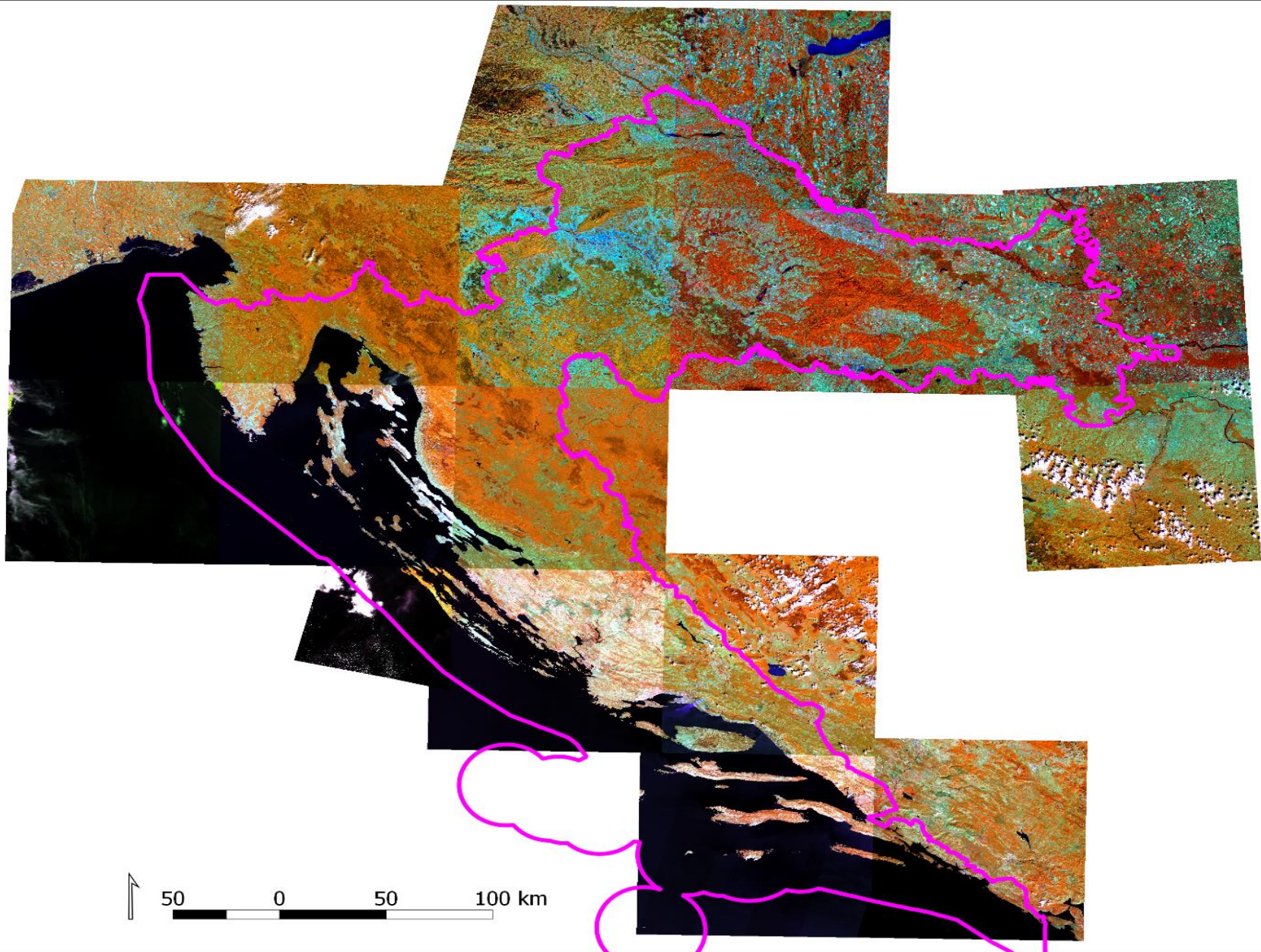
**Korišteno poljoprivredno zemljište**

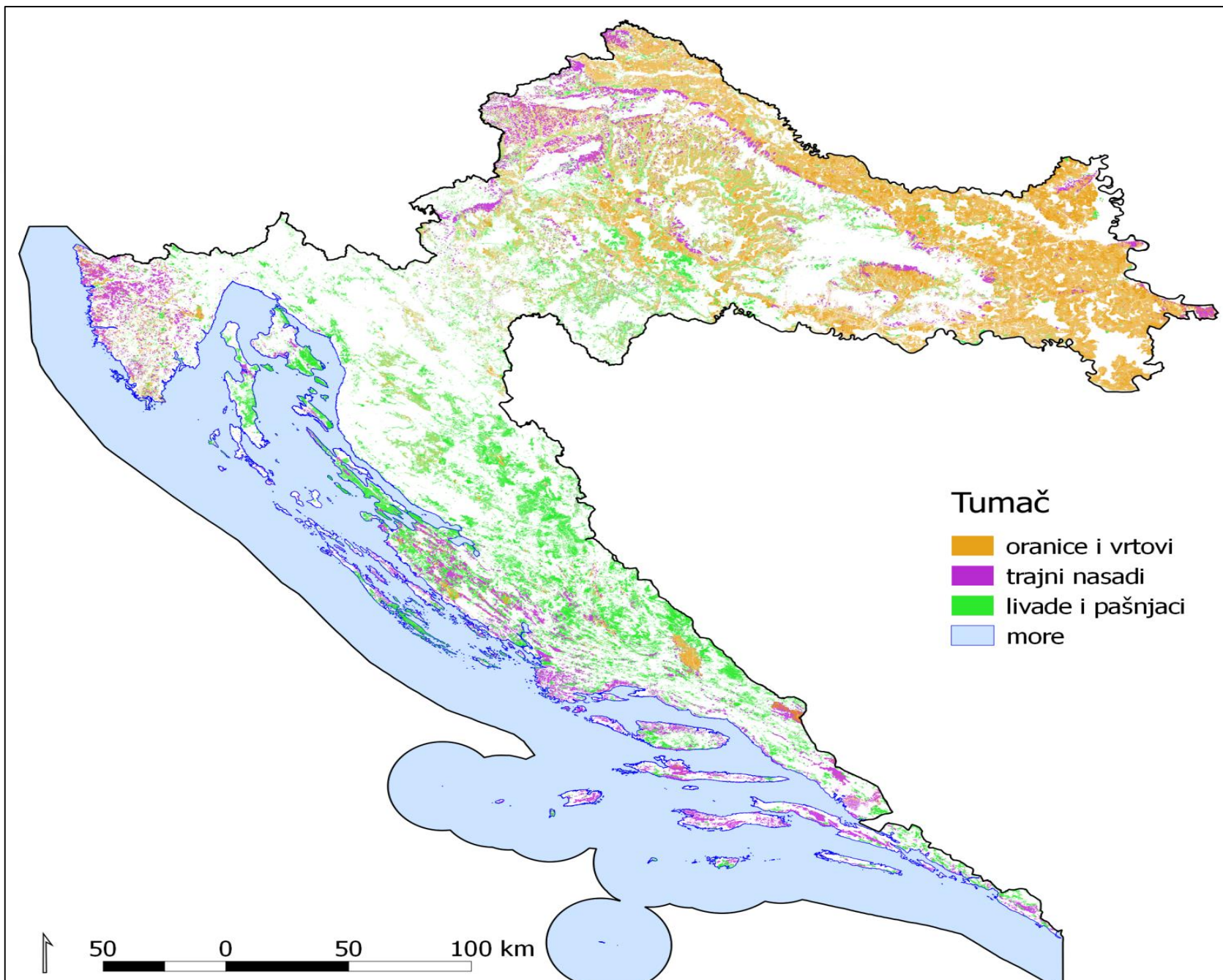
**1.891.309 ha**

**Obradivo poljoprivredno zemljište**

**1.116.331 ha**

# Pokrivenost teritorija RH Sentinel 2 snimkama 2017. godine





# Krš – veliki hrvatski resurs !?

1957.



# Krš – veliki hrvatski resurs !?

2012.



# Prostor u fazi pripreme površine za podizanje vinograda

Prosinac 2009.



# Prostor u fazi pripreme površine za podizanje vinograda

Prosinac 2009.



# Priprema površine za sadnju vinograda

Prosinac 2009.



# Posađen vinograd u Komarni

Travanj 2010.



# Vinogradi na Komarni - danas

Kolovoz 2017.



# Vinogradi u Komarni - danas

Kolovoz 2017.



# Posađen vinograd i postavljen sustav za navodnjavanje

2013.

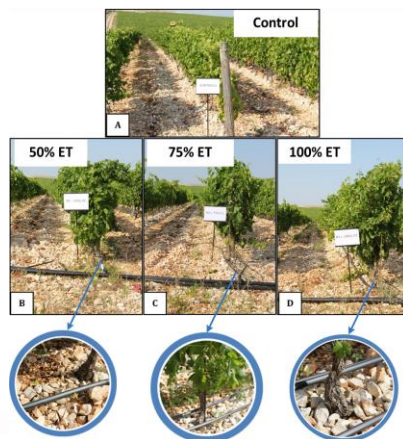


# ŠTO ZNANSTVENICI NA TOME RADE ?

HATZ



?



**POSTAVLJEN POKUS, INSTALIRANA OPREMA I PROVEDENA  
BROJNA MJERENJA**



# Izgleled grozdova sorte Babić ovisno o stupnju navodnjavanja neposredno pred punu zrelost

HATZ



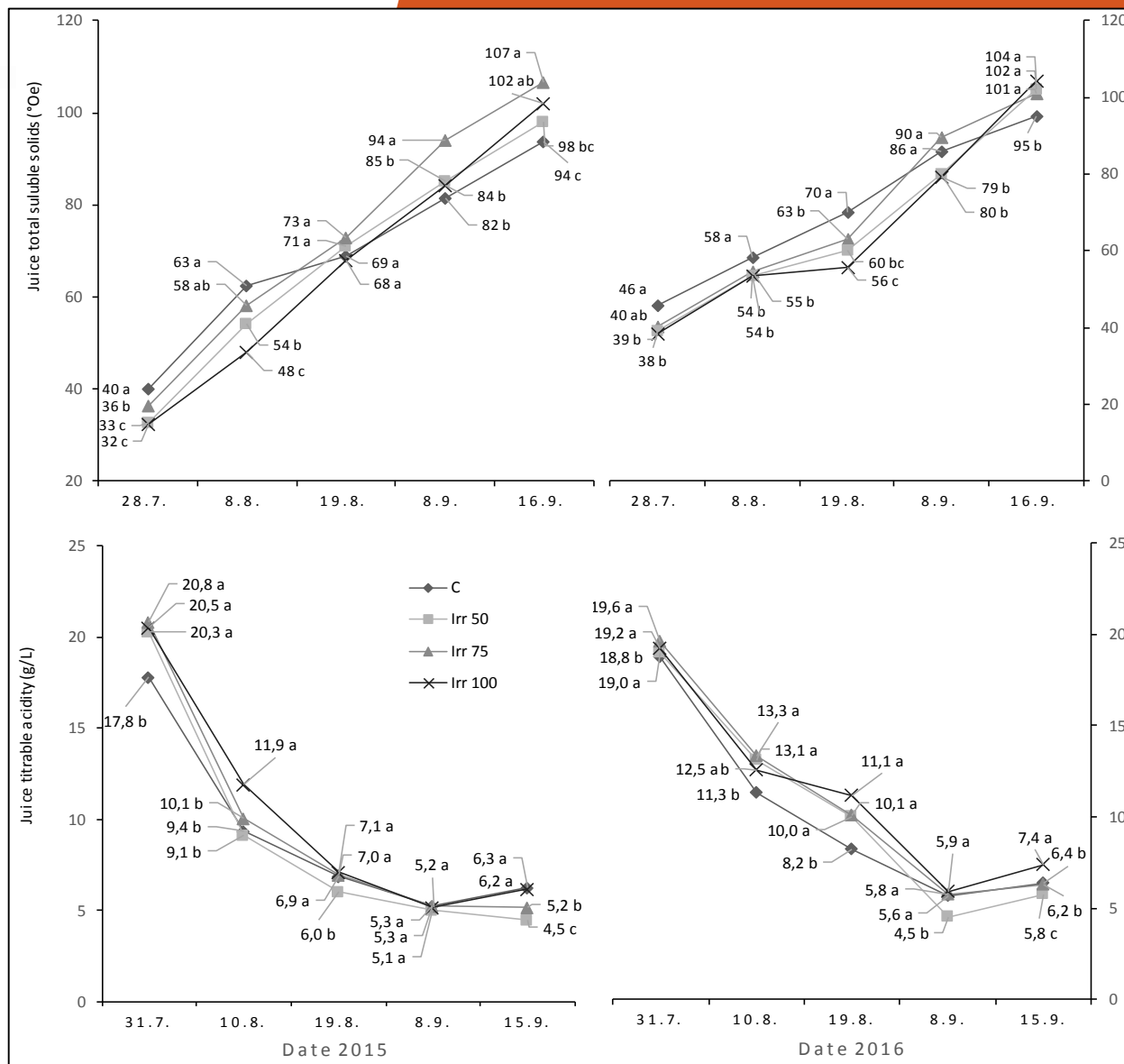
# Prinos i osnovne uvometrijske karakteristike sorte Babić u dvogodišnjem istraživanju sa tri razine navodnjavanja

HATZ

| Godina | Varijanta          | Prinos po trsu (kg) | Broj grozdova po trsu | Prosječna masa grozda | Prosječna masa bobice |
|--------|--------------------|---------------------|-----------------------|-----------------------|-----------------------|
| 2015.  | K                  | 1,28 c              | 6,30 a                | 193,6 b               | 1,91 c                |
|        | ET-50              | 1,81 b              | 6,43 a                | 294,8 a               | 3,30 ab               |
|        | ET-75              | 2,19 ab             | 7,01 a                | 336,1 a               | 3,24 b                |
|        | ET-100             | 2,41 a              | 7,05 a                | 345,3 a               | 3,46 a                |
|        |                    |                     |                       |                       |                       |
| 2016.  | K                  | 1,79 c              | 7,22 b                | 284,2 c               | 2,29 d                |
|        | ET-50              | 2,76 b              | 7,78 ab               | 393,9 b               | 2,53 c                |
|        | ET-75              | 3,01 ab             | 8,44 ab               | 491,6 a               | 2,88 b                |
|        | ET-100             | 3,39 a              | 8,76 a                | 446,8 ab              | 3,12 a                |
|        |                    |                     |                       |                       |                       |
| ANOVA  | Varijanta          | ***                 | **                    | ***                   | ***                   |
|        | Godina             | ***                 | ***                   | ***                   | n.s.                  |
|        | Varijanta x godina | n.s.                | n.s.                  | n.s.                  | n.s.                  |

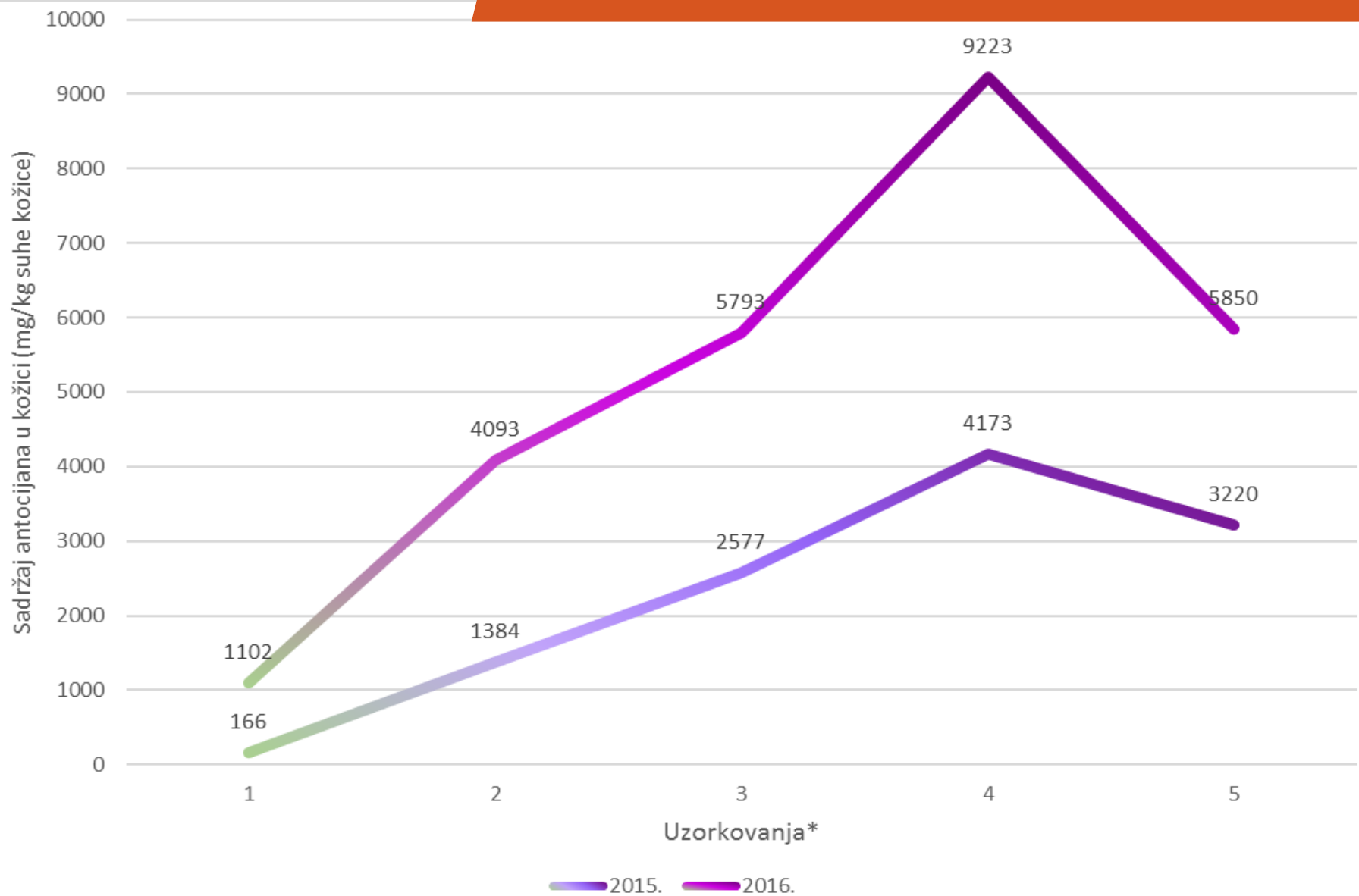
# Promjene sadržaja šećera i titracijske kislosti mošta tijekom dozrijevanja grožđa - prosjek dvije godine

HATZ



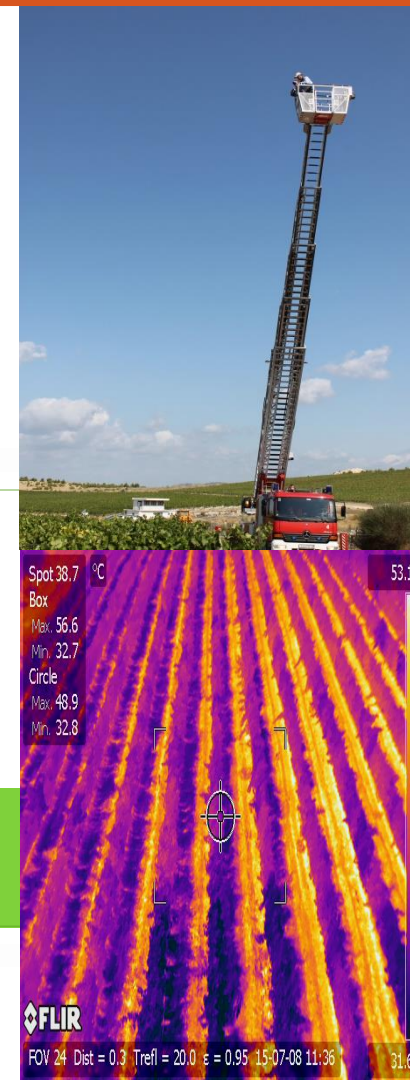
# Dinamika antocijana – usporedba dvije godine (prosjek svih varijanti)

HATZ



# Velika heterogenost tla

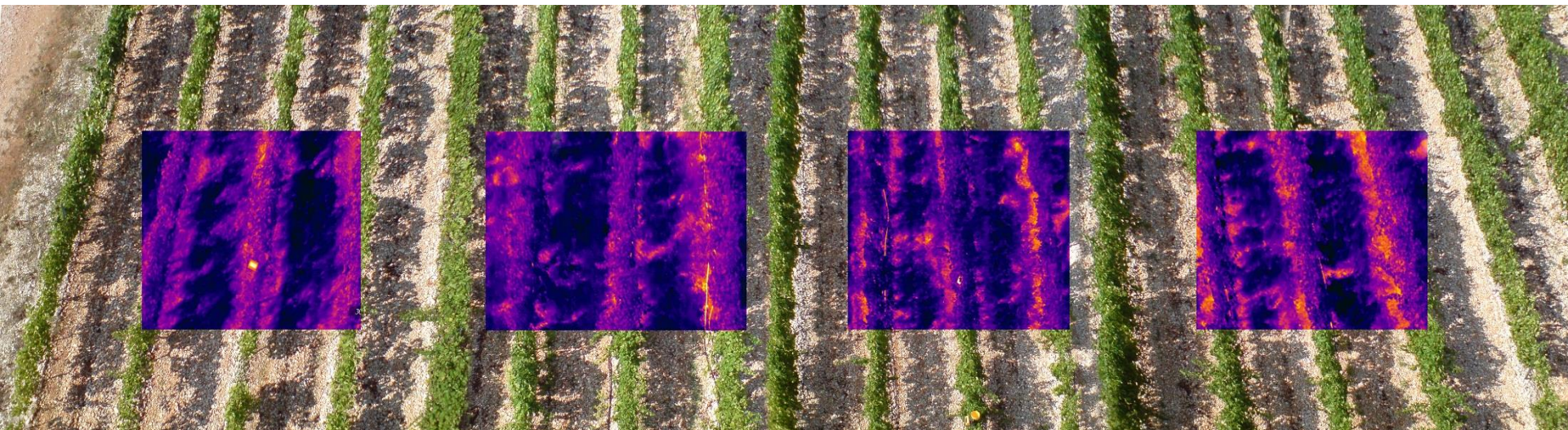




## PRIMJENA DALJINSKIH ISTRAŽIVANJA - TERMOGRAFIJE

# Termogramami na varijantama pokusa

HATZ

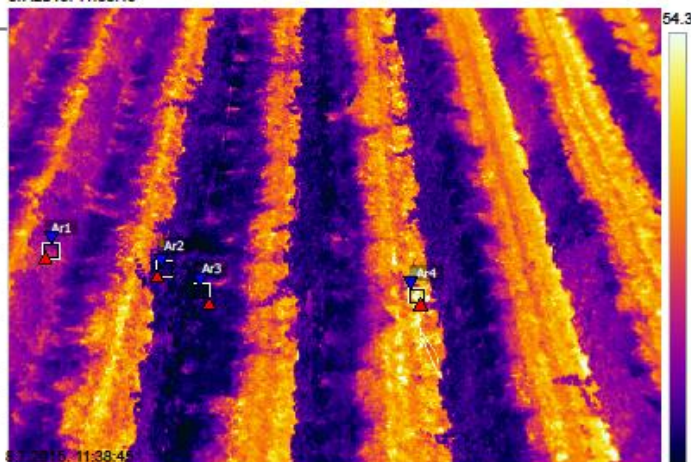


# Rezultati primjene termalnih snimaka na istraživanim varijantama



HATZ

8.7.2015. 11:38:45



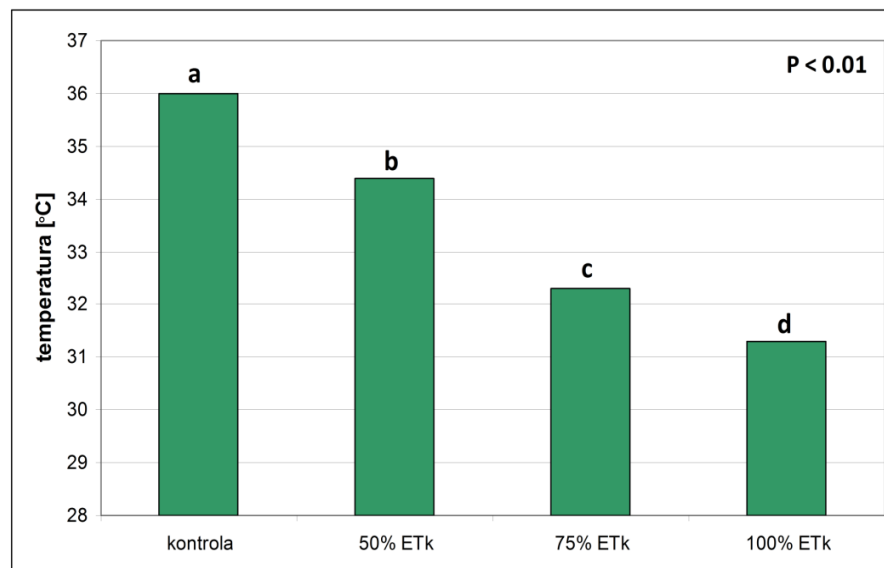
| Measurements |         |      | °C |
|--------------|---------|------|----|
| Ar1          | Max     | 42.8 |    |
|              | Min     | 35.6 |    |
|              | Average | 38.3 |    |
| Ar2          | Max     | 35.3 |    |
|              | Min     | 30.2 |    |
|              | Average | 32.8 |    |
| Ar3          | Max     | 33.2 |    |
|              | Min     | 30.5 |    |
|              | Average | 31.5 |    |
| Ar4          | Max     | 60.5 |    |
|              | Min     | 38.5 |    |
|              | Average | 51.5 |    |

| Parameters |       |
|------------|-------|
| Emissivity | 0.95  |
| Ref. temp. | 20 °C |



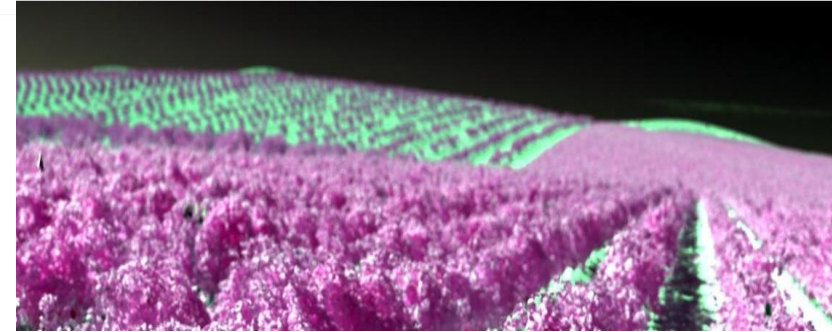
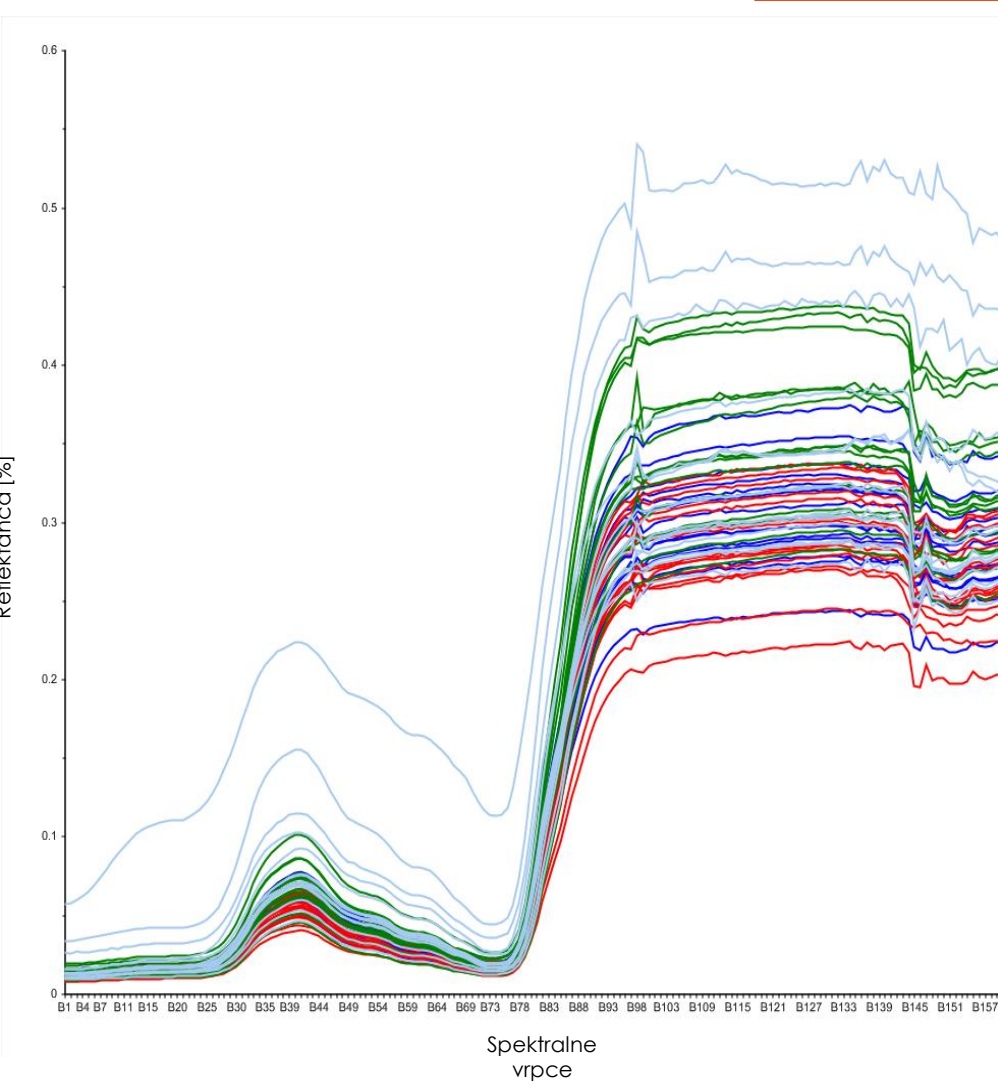
DC\_2015-07-08\_0046.jpg

## Temperatura lista na varijantama pokusa

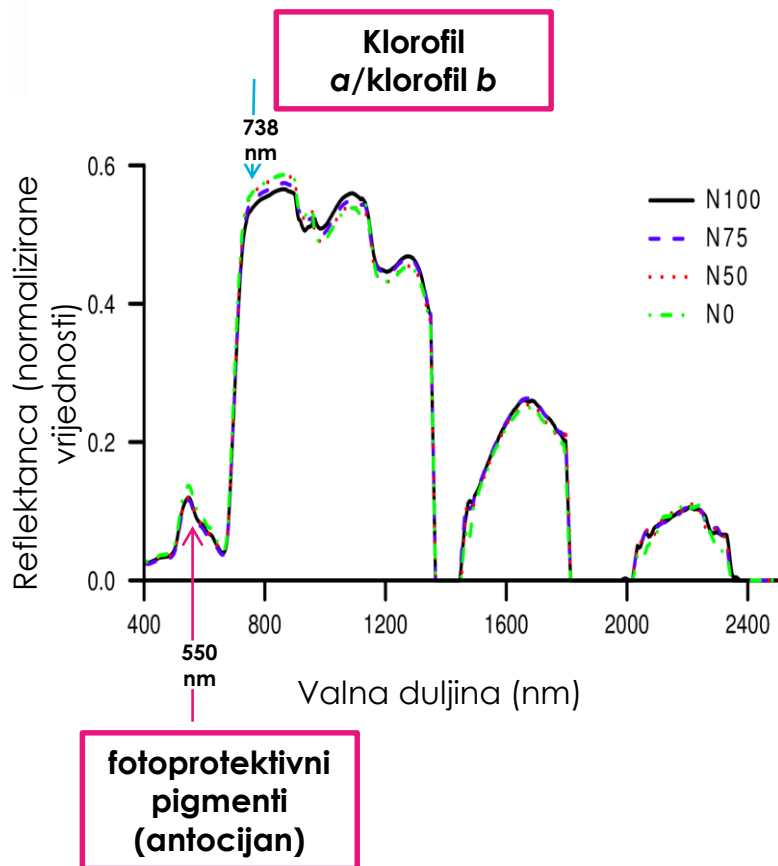


# Primjena daljinskih istraživanja - spektroskopije

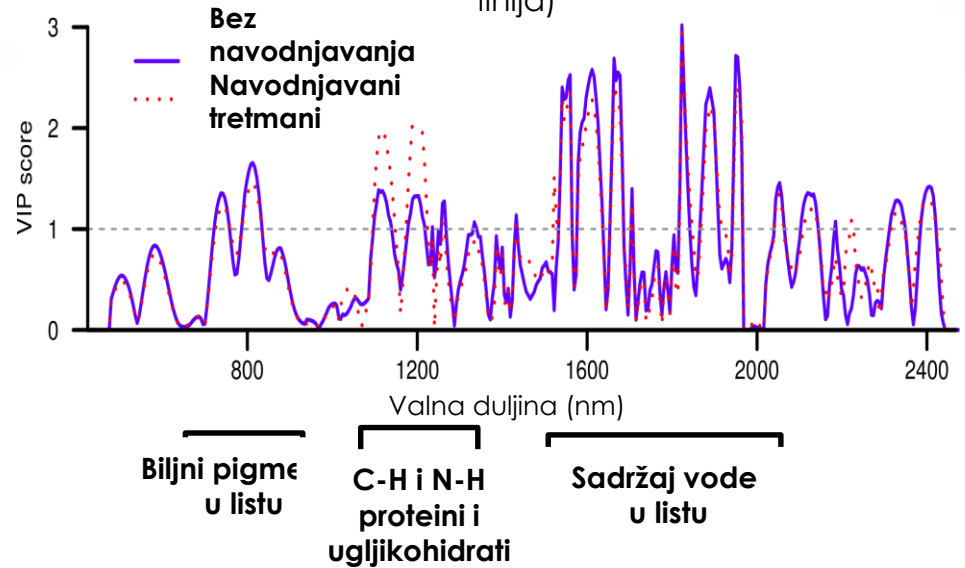
HATZ



SWIR-384 (spektralno područje od 950 do 2500 nm,) (Norsk Elektro Optikk, Norway),  
prikupljeno **448 spektralnih vrpce** u rasponu od 400 do 2500 nm



Projekcijski važne varijable (VIP) za statističku ocjenu prediktora s obzirom na valne duljine spektra - uz graničnu vrijednost 1 (isprekidana linija)





## **PRIMJENA SUVREMENIH GEOFIZIČKIH METODA - SEIZMIČKE REFRAKCIJE U ISTRAŽIVANJU HETEROGENOSTI PROSTORA**

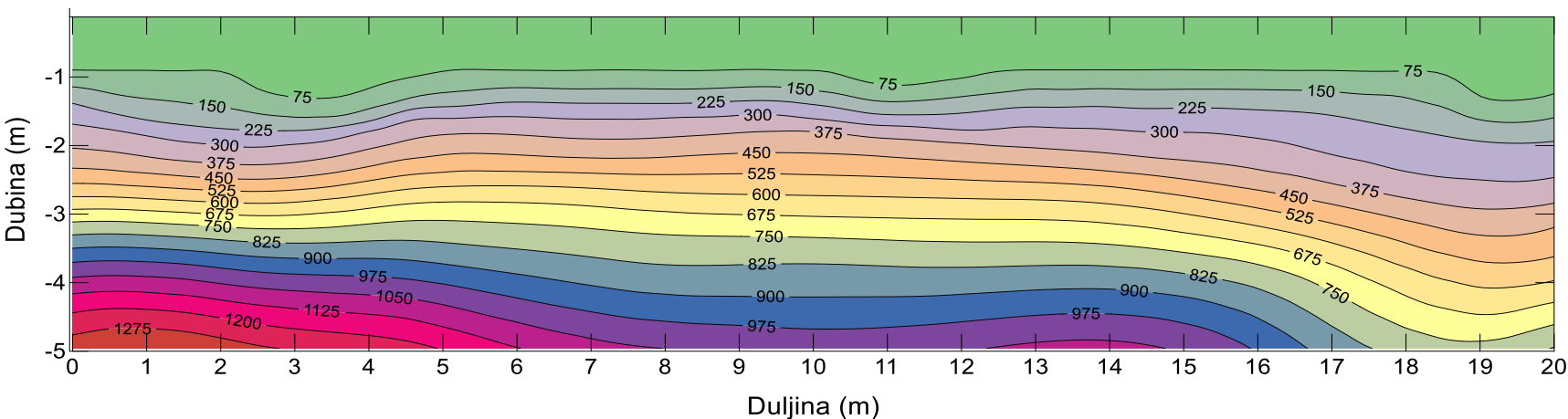


# Rezultati geofizickih istraživanja - seizmičke refrakcije do 2 m dubine

## Results of geophysical studies – seismic refraction to 2 m depth

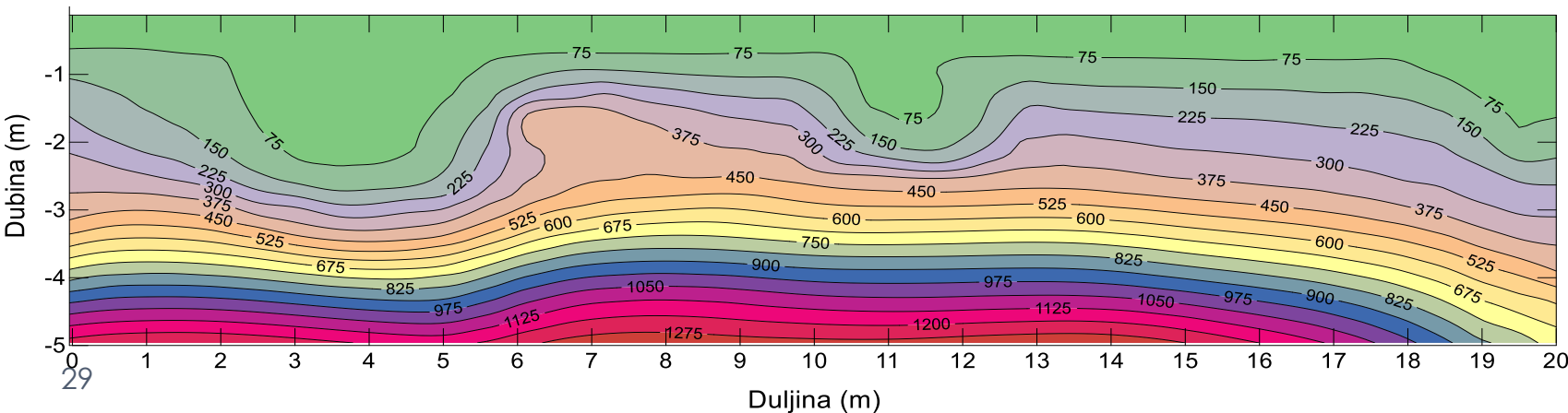
### *Profil 1*

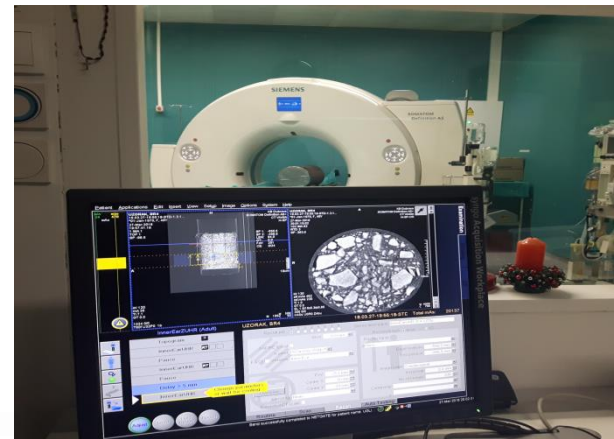
Brzine širenja posmičnih valova (m/s)



### *Profil 2*

Brzine širenja posmičnih valova (m/s)



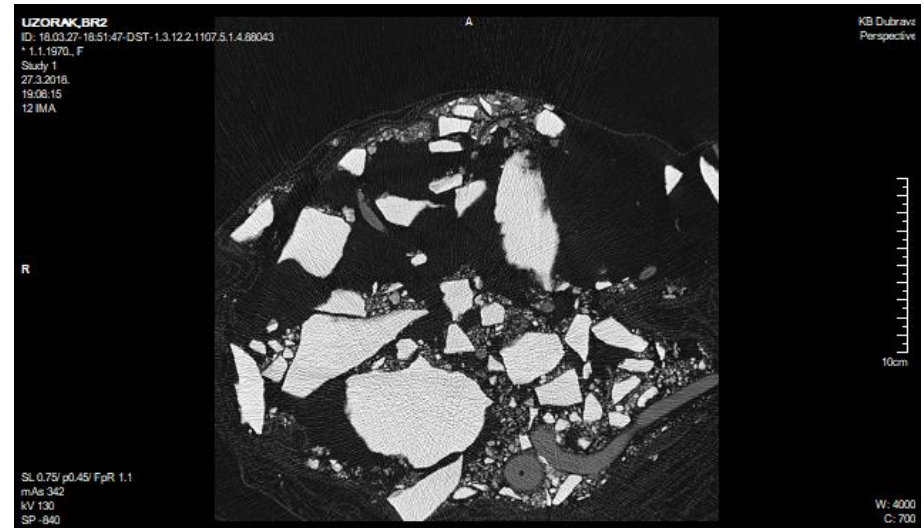
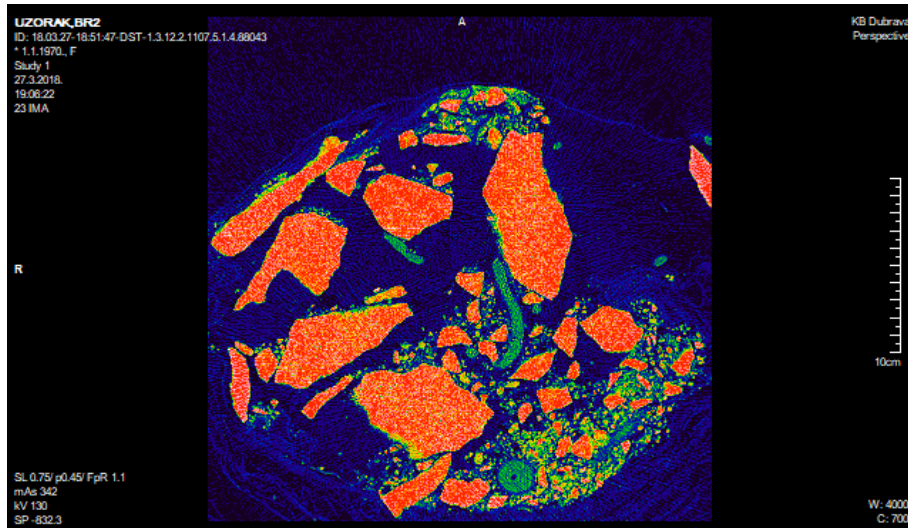
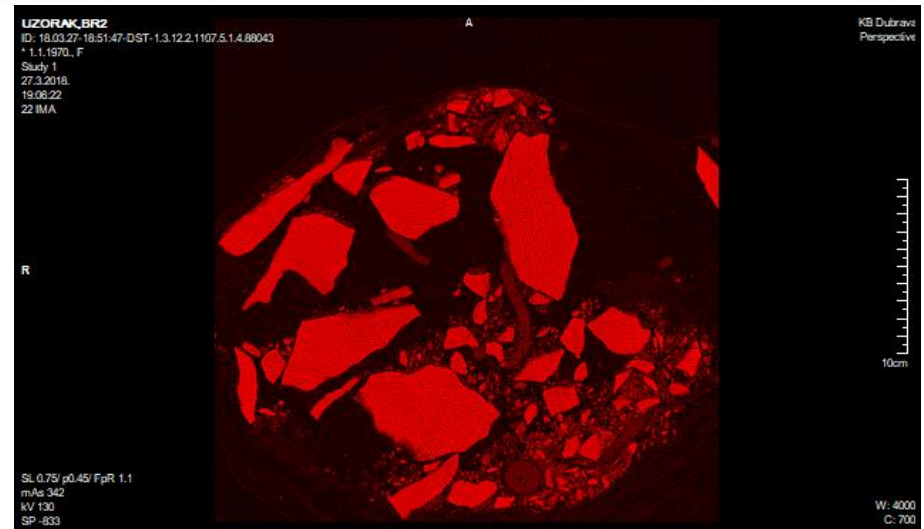
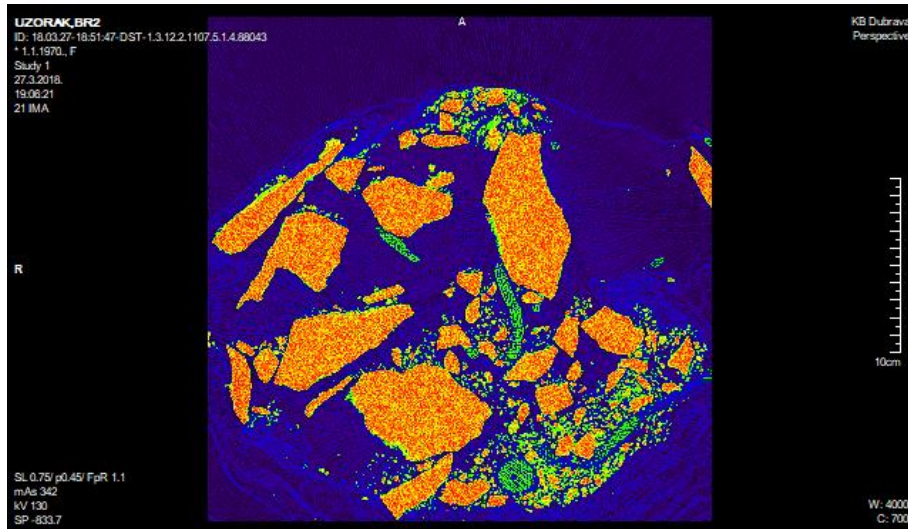


**PRIMJENA X-RAY COMPUTED TOMOGRAPHY**  
**APPLICATION OF X-RAY COMPUTED TOMOGRAPHY**



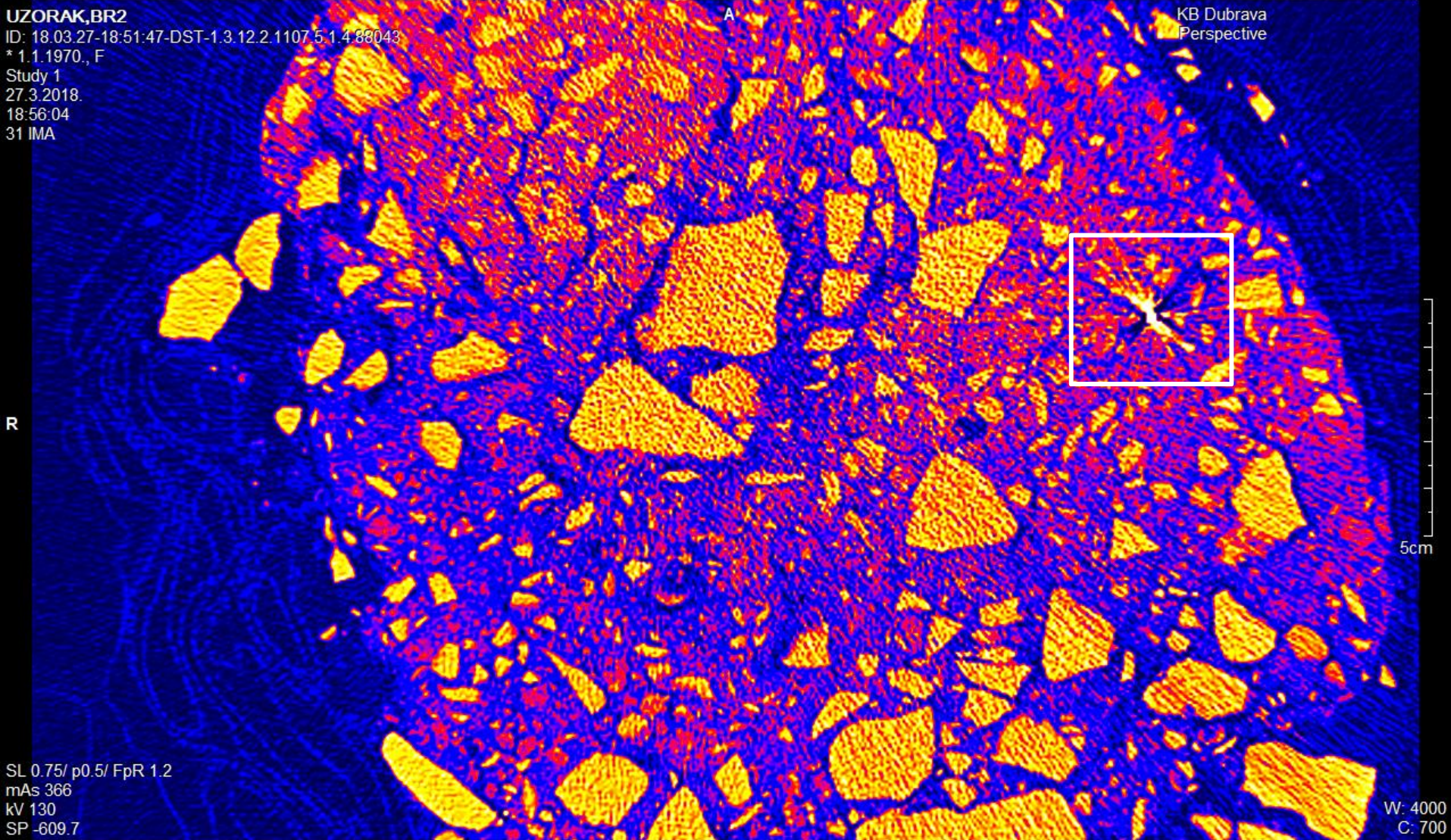
# Rezultati snimanja x-ray Computed Tomography

## X-ray Computed Tomography images



# Rezultati snimanja x-ray Computed Tomography

## X-ray Computed Tomography images - artefacts



# Rezultati snimanja x-ray Computed Tomography

## X-ray Computed Tomography images -3D model produced



# Rezultati snimanja x-ray Computed Tomography

## X-ray Computed Tomography images -3D model produced

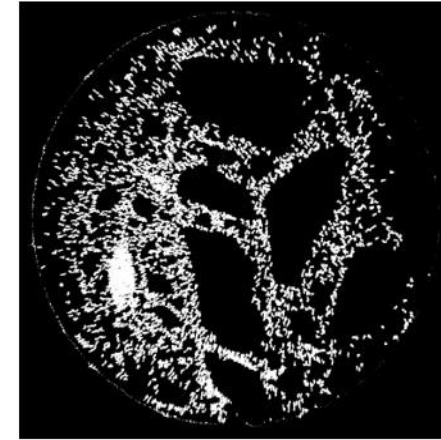
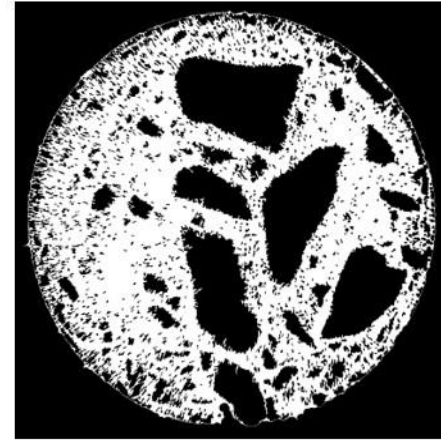
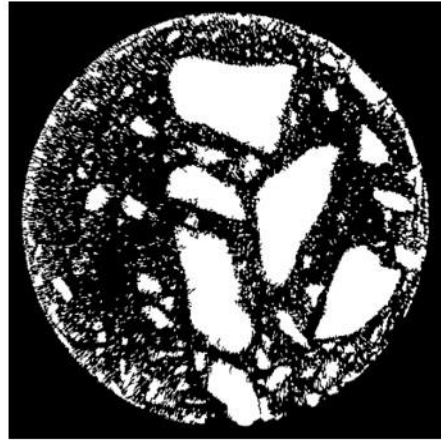
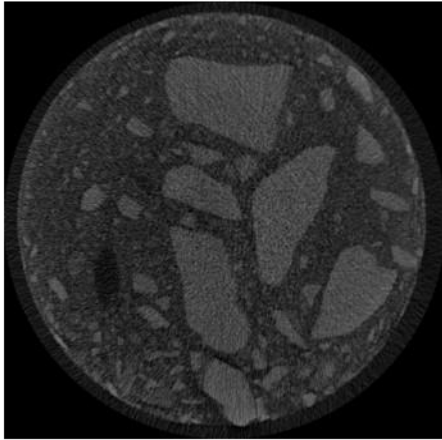
Micro CT

Rock

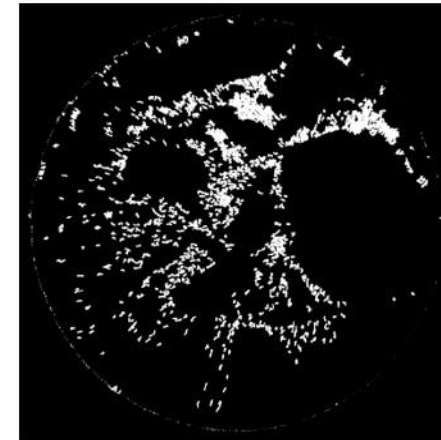
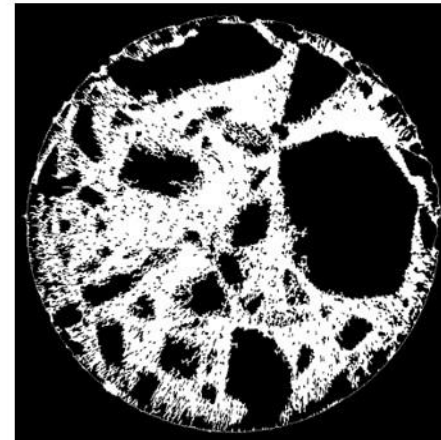
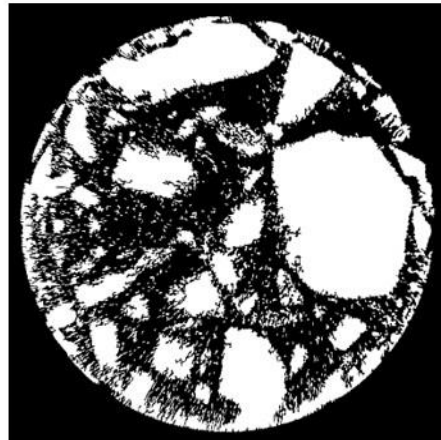
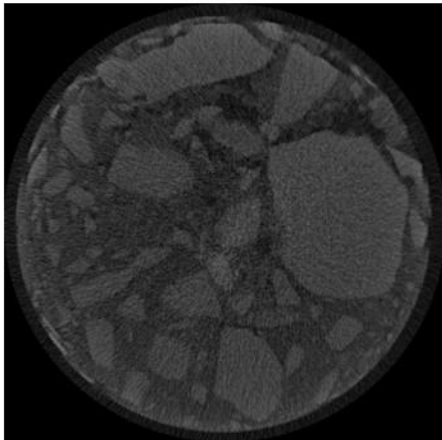
Earth + Air

Air

Sample 1



Sample 4



# Pokusi u kolonama



# Granulometrijski sastav kolonama



$\geq 8$  mm



8 - 5 mm



5 - 4 mm



4 - 2 mm



2 - 1 mm



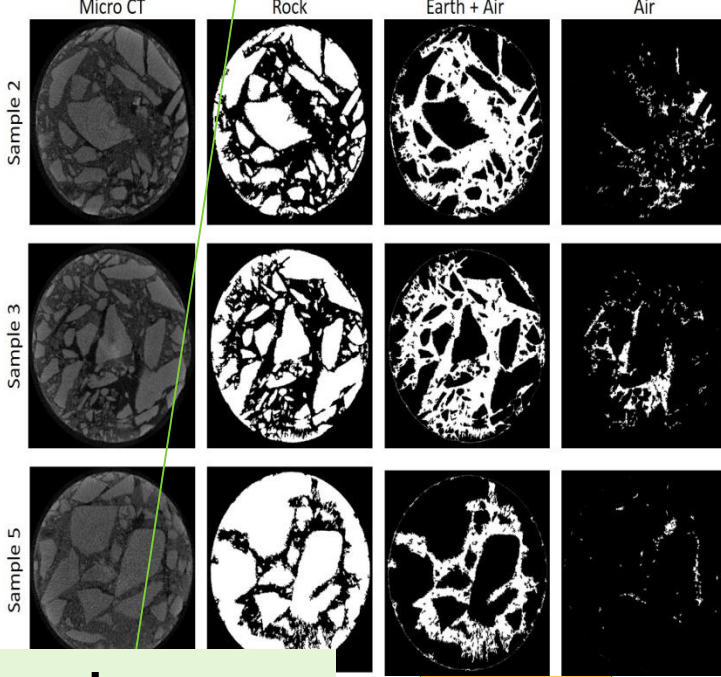
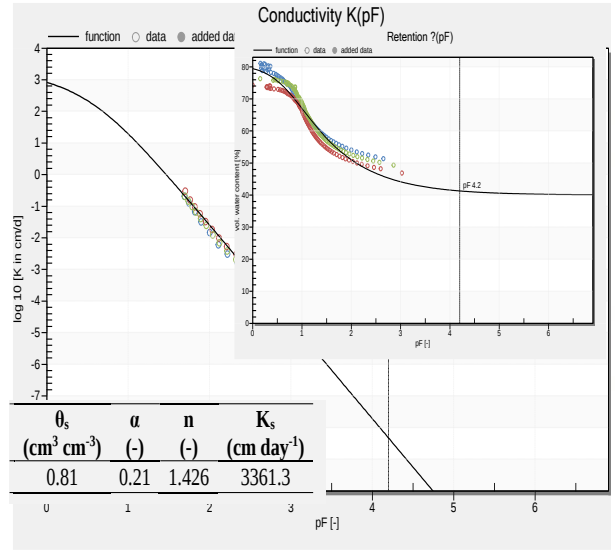
1 - 0.5 mm



0.5 - 0.25 mm

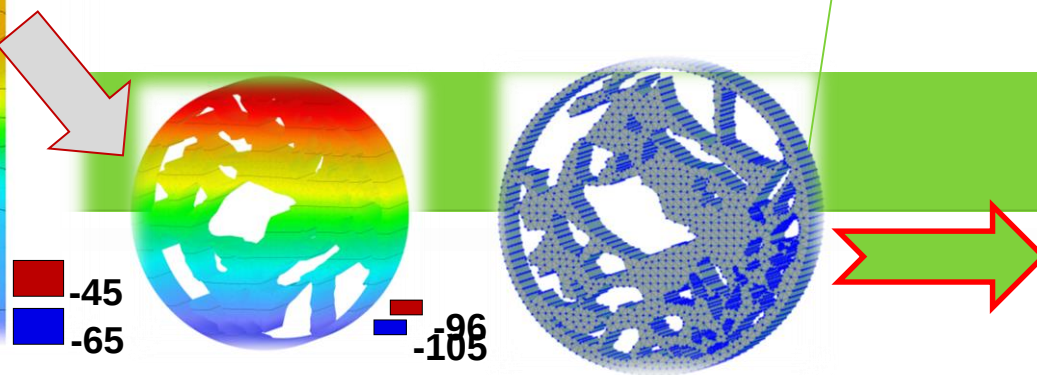
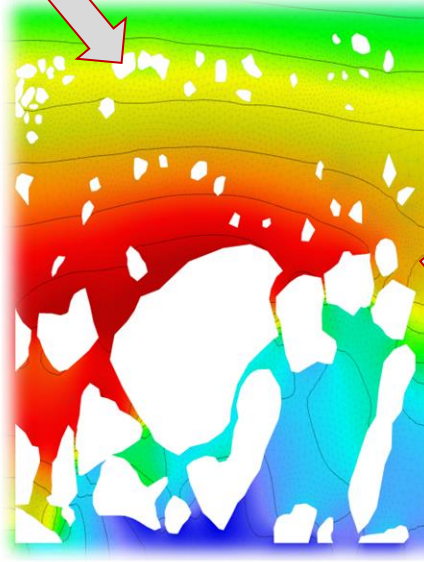


0.25 - 0 mm



1. Terenska istraživanja    2. Laboratorijska istraživanja

**Cilj: kvantificirati tok vode i vodnu bilancu u danim uvjetima primjenom novih tehnologija**



3. Modeliranje toka vode 2D  
distribucija u kompleksnim uvjetima

4. Modeliranje toka vode 3D  
distribucija u kompleksnim uvjetima

**HVALA VAM**

