

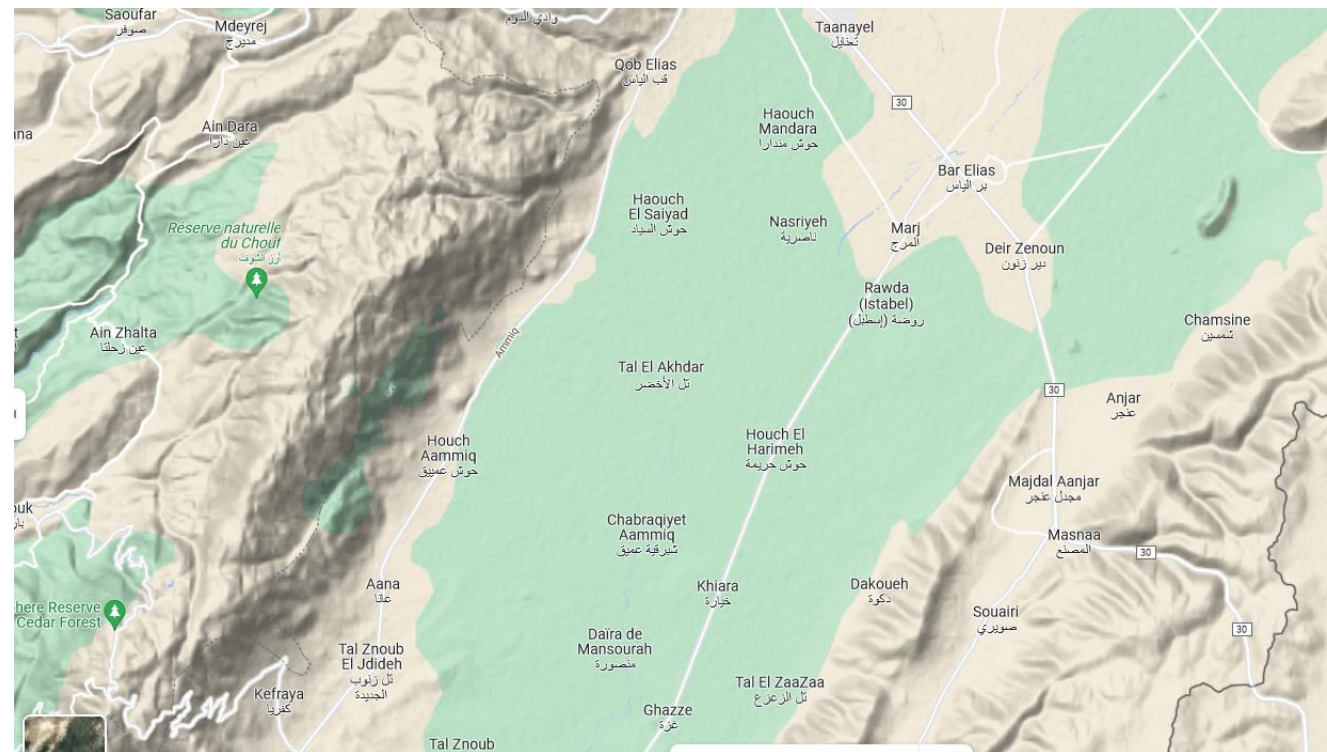
Flood mapping based on Sentinel 2

Herve YESOU

June 2022



NORMA STORM



Liban: neiges et pluies s'abattent sur les camps de réfugiés

Par Le Figaro.fr avec AFP

Publié le 08/01/2019 à 18:20, mis à jour le 08/01/2019 à 18:33

Plusieurs dizaines de camps de réfugiés syriens au Liban ont été touchés aujourd'hui de plein fouet par des chutes de neige ou des pluies torrentielles, les ONG s'inquiétant pour des milliers de personnes "à risque".

Des inondations font des ravages dans les installations de réfugiés syriens au Liban

Un mort et plus de 11 000 personnes touchées après plusieurs jours de fortes pluies et de vents violents lors du passage de la tempête Norma. Des centaines de réfugiés ont été forcés d'abandonner leurs abris.

Une réfugiée syrienne tient l'un de ses sept enfants devant l'abri familial inondé dans l'installation informelle de Dalhamiya, plaine de la Bekaa, au Liban.
© HCR/Diego Ibarra Sánchez

Par Edith Champagne et Houssam Hariri dans la vallée de la Bekaa, Liban | 11 janvier 2019 | [English](#) | [Español](#) | [عربي](#)

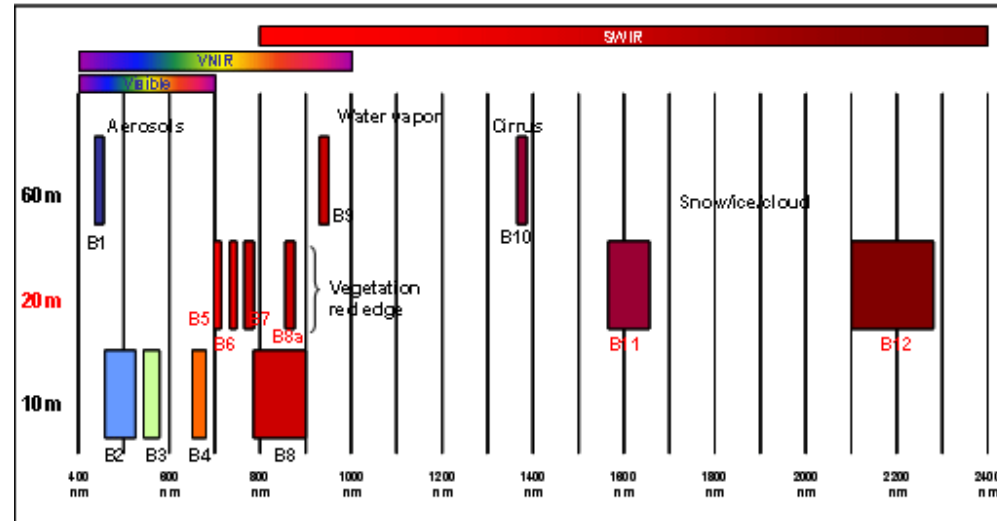


Sentinel 2



Sentinel 2

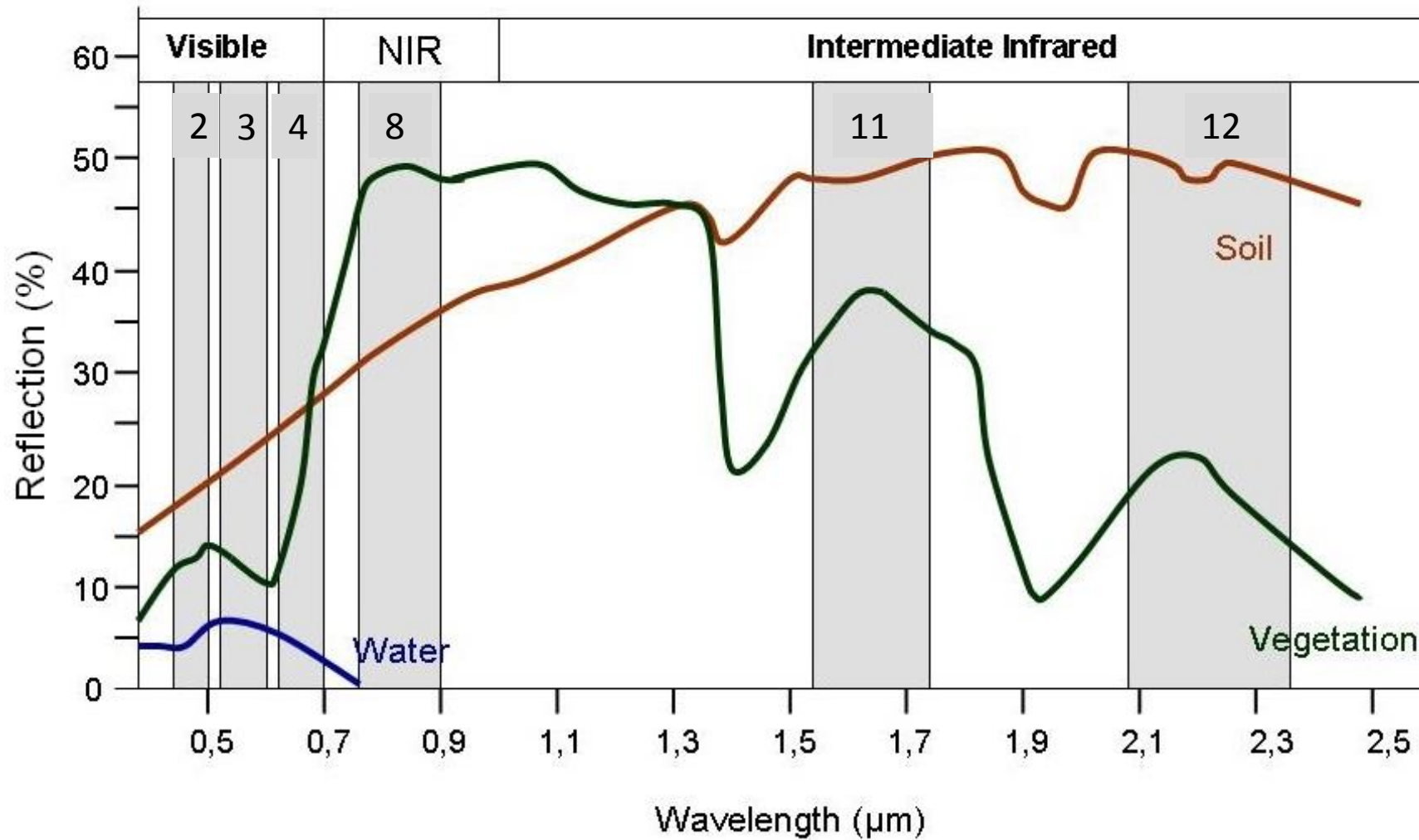
- Highest Resolution same as SPOT5 (10m)
- Presence of two SWIR bands (heritage of landsat)
- Large swath (MERIS heritage)
- Revisiting time 10 – 5 days
- Free access



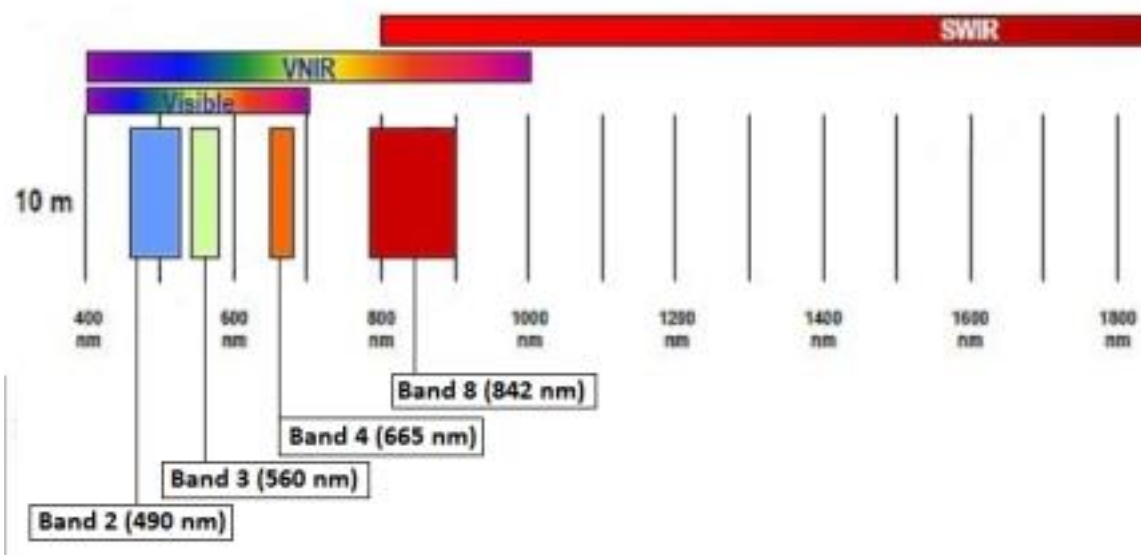
Sentinel-2A : on 23 June 2015
Sentinel-2B : on 7 march 2017



Sentinel 2



Sentinel 2 A/B:

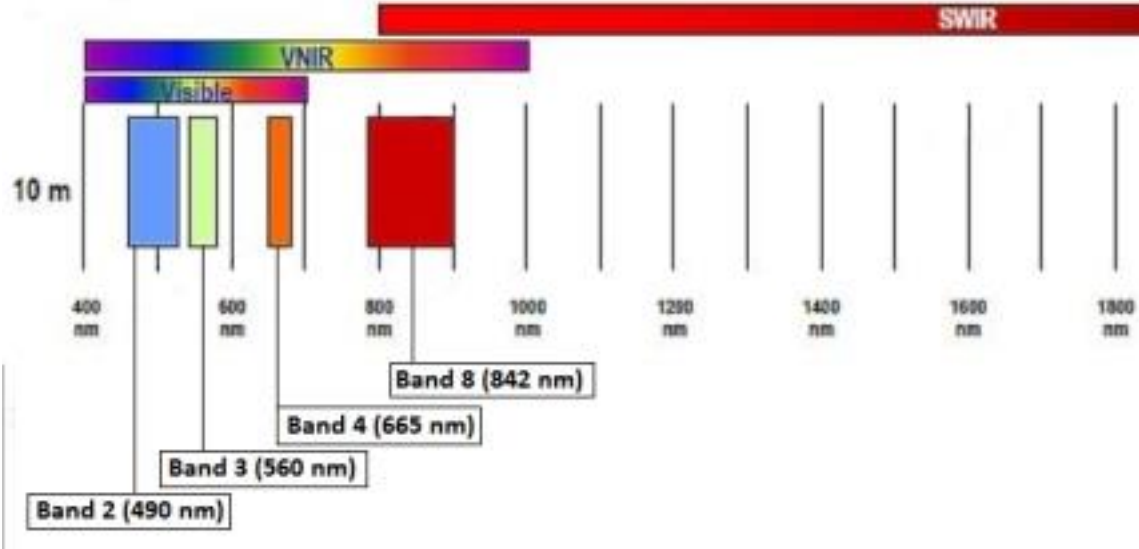


Natural color composite 10m

B4, B3, B2 in RGB



Sentinel 2 A/B:







False color composite 10m

B8, B4, B3 in RGB



Data access: Sentinel 2





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<https://scihub.copernicus.eu>

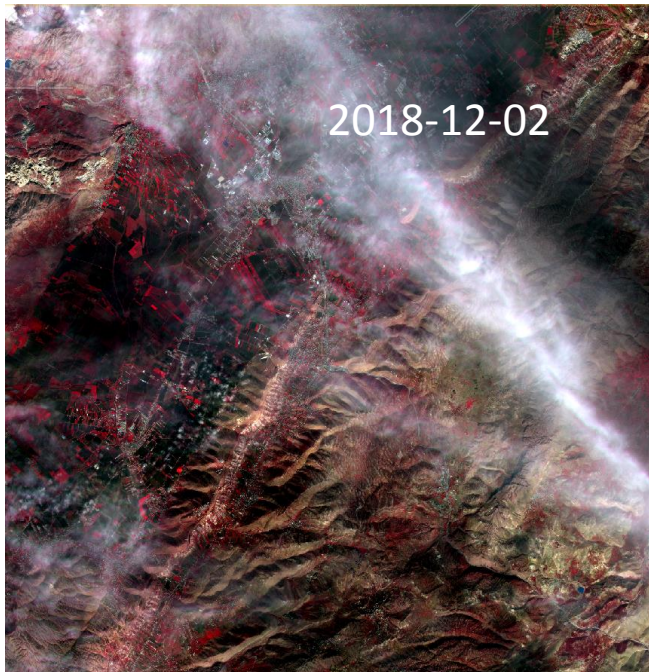
Welcome to the Copernicus Open Access Hub

The Copernicus Open Access Hub (previously known as Sentinels Scientific Data Hub) provides complete, free and open access to [Sentinel-1](#), [Sentinel-2](#) and [Sentinel-3](#) user products, starting from the In-Orbit Commissioning Review (IOCR).

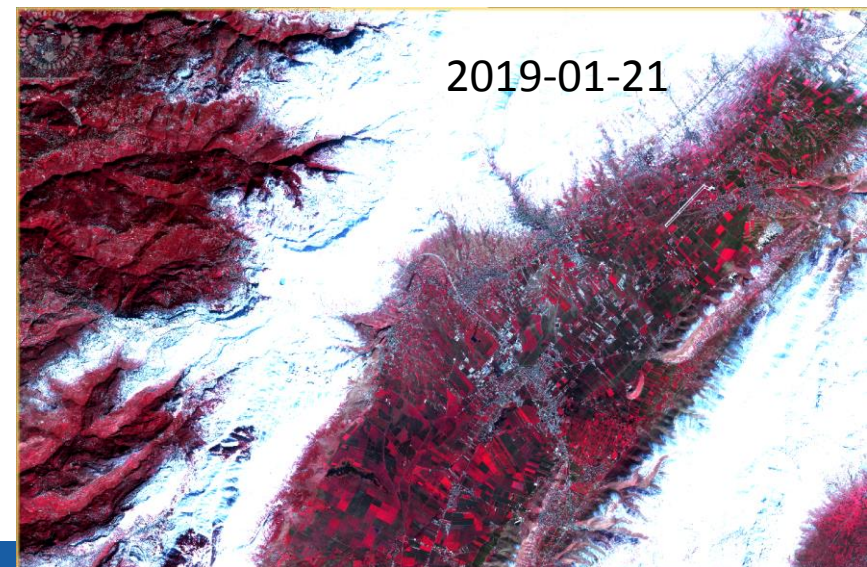
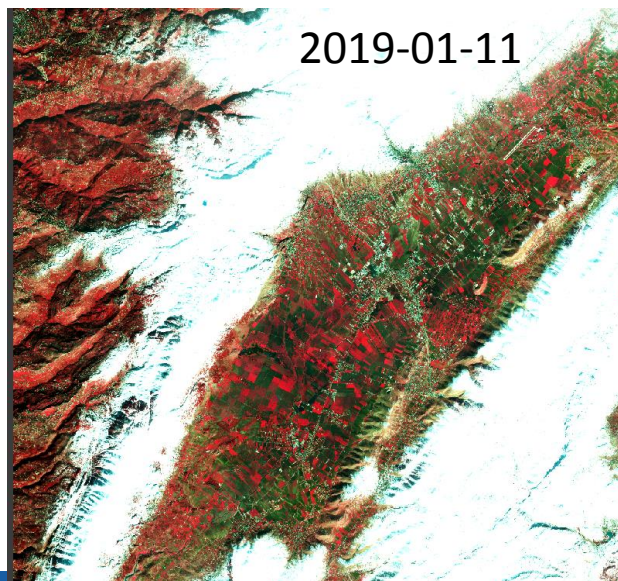
 **Open Hub**  **API Hub**  **S-3 PreOps Hub**  **GNSS Hub**

 **User Guide**  **Open Source Portal**  **Reports & Stats**

Research Unit, Institute of Ecology, Training, November 2017

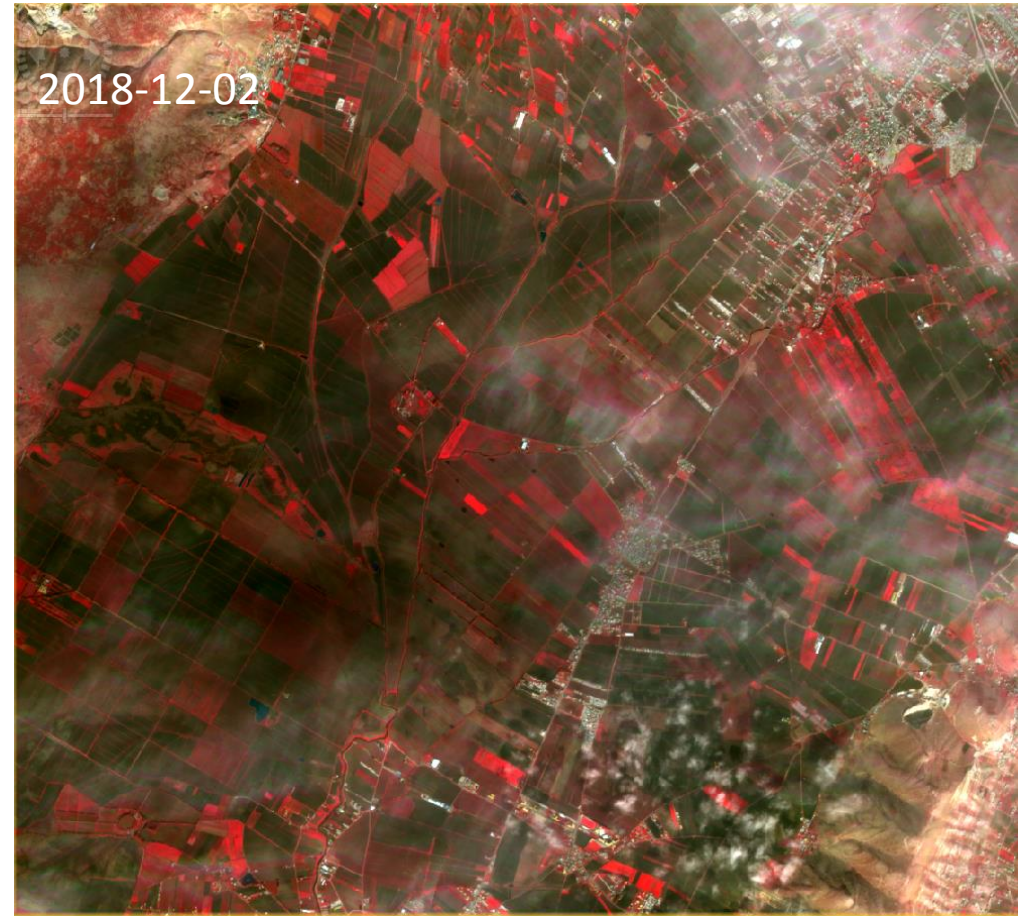
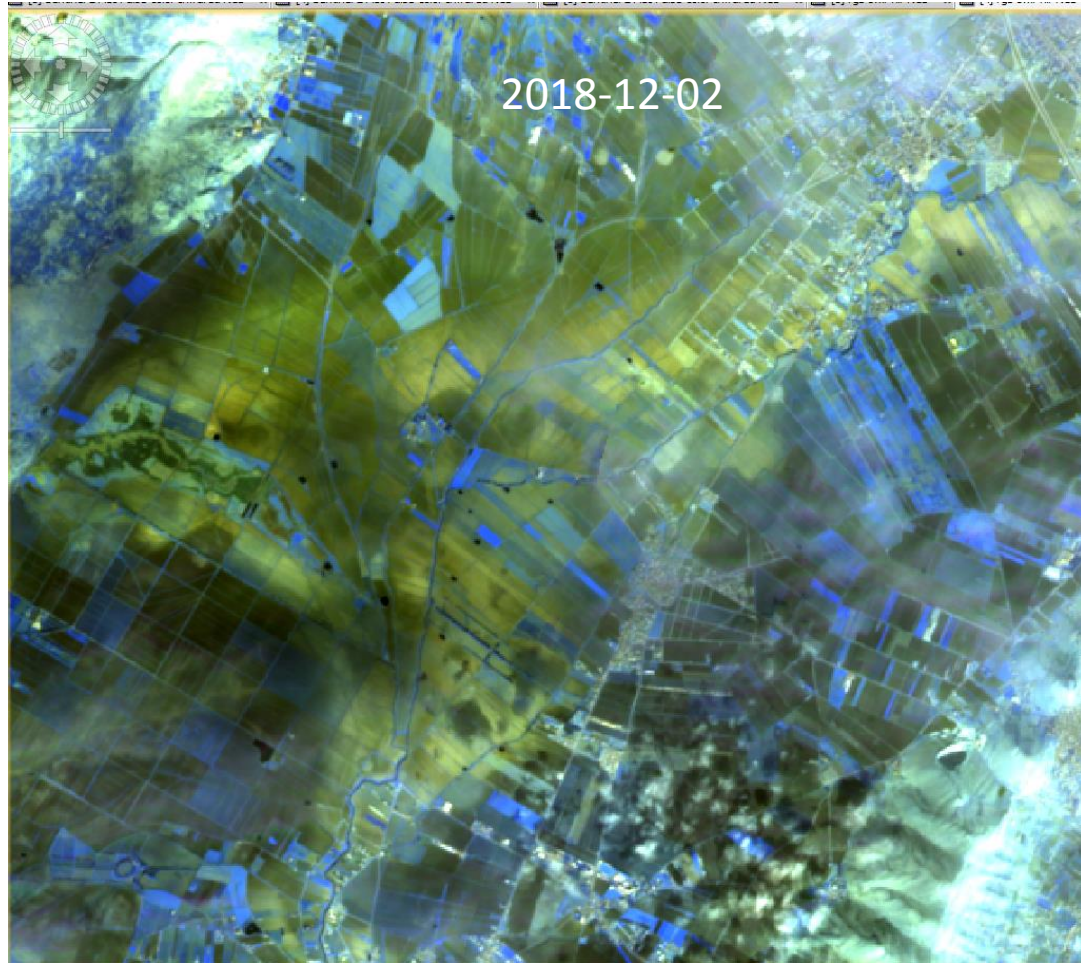


- S2A_MSIL1C_20181202T082311_N0207_R121_T37SBT_20181202T094648
- S2A_MSIL1C_20190111T082311_N0207_R121_T36SYC_20190111T094647
- S2A_MSIL1C_20190121T082241_N0207_R121_T36SYC_20190121T084611

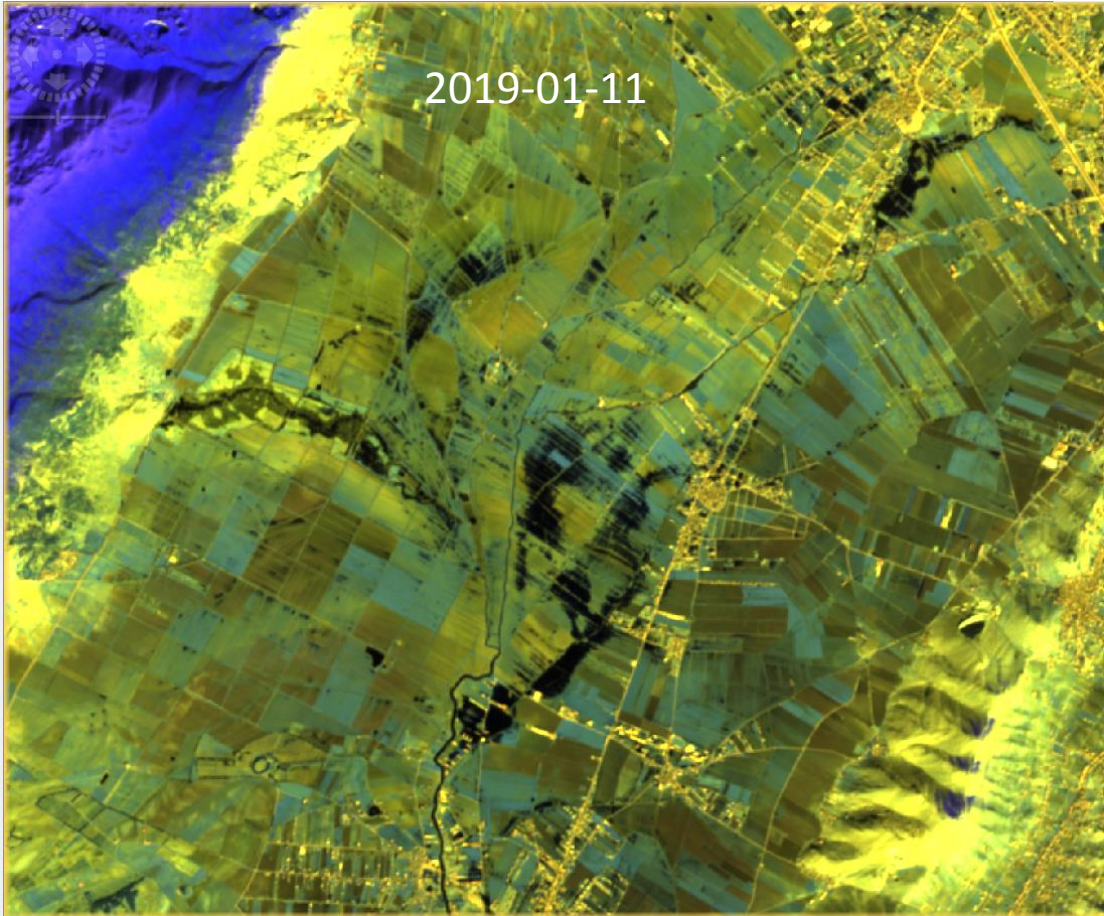


- Analyse the Three images.
- Decide which one is the best informative one in terms of water presence

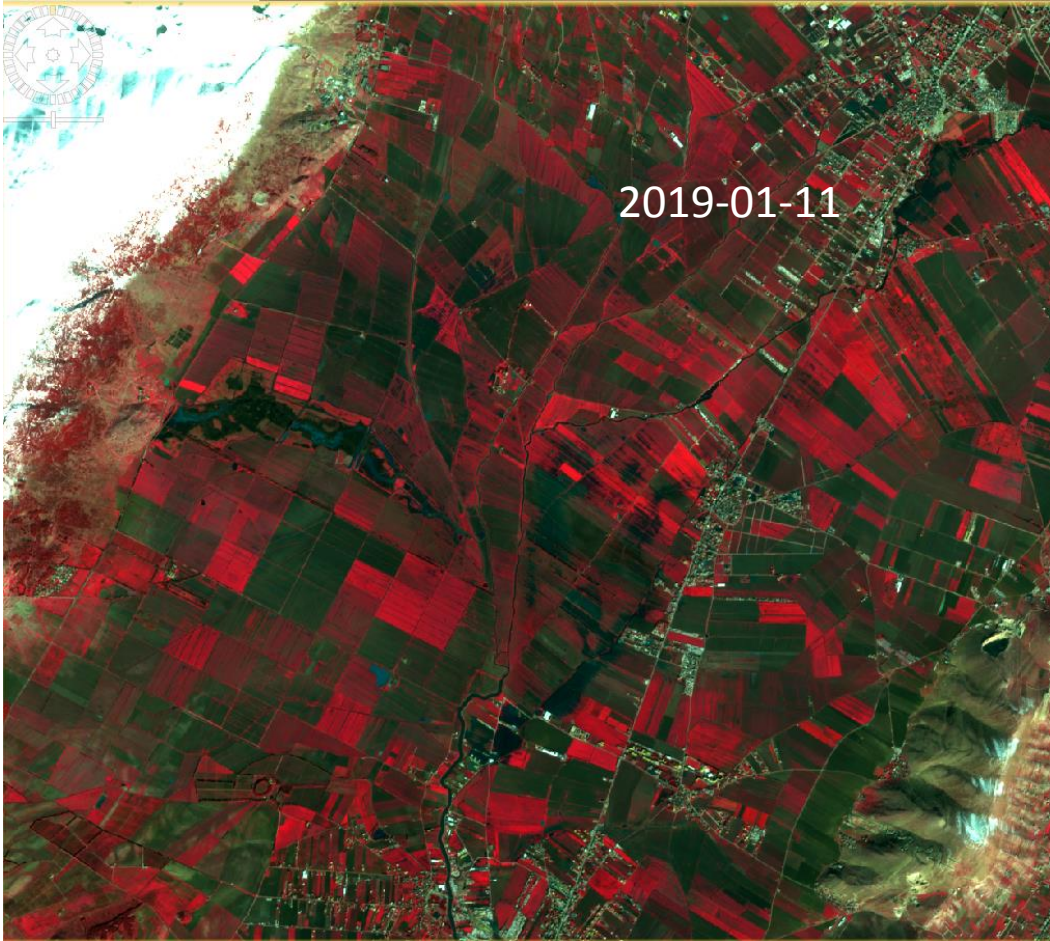


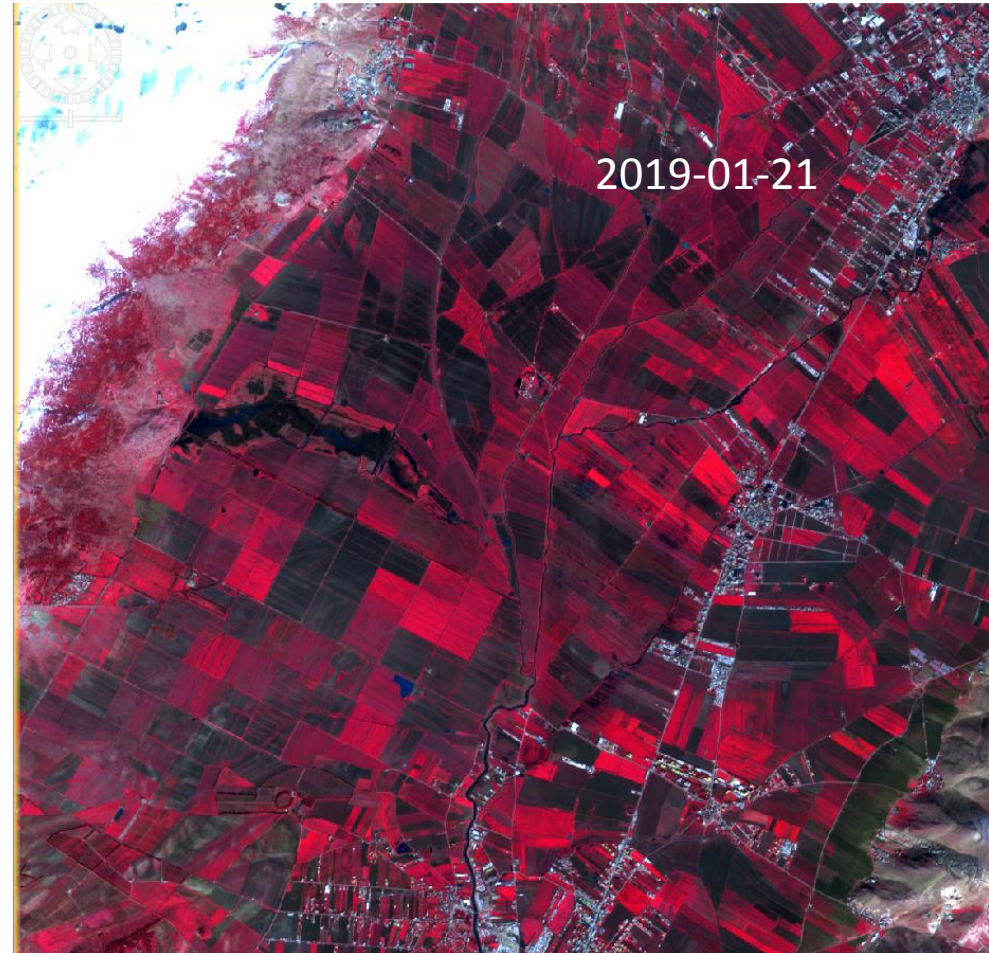
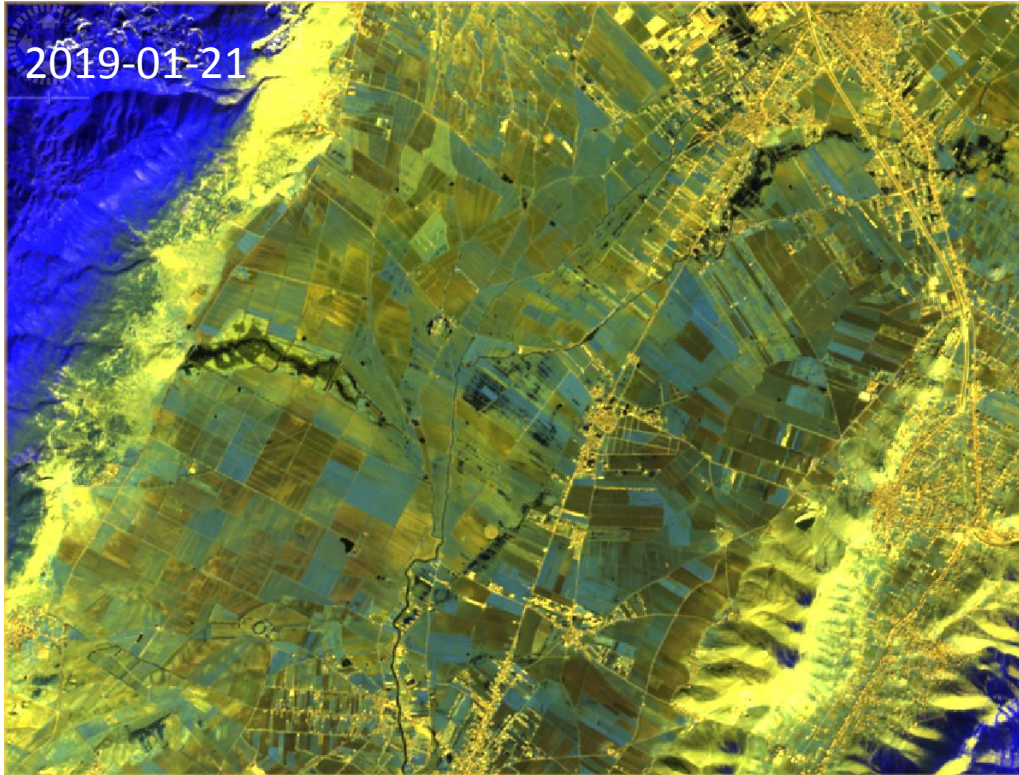


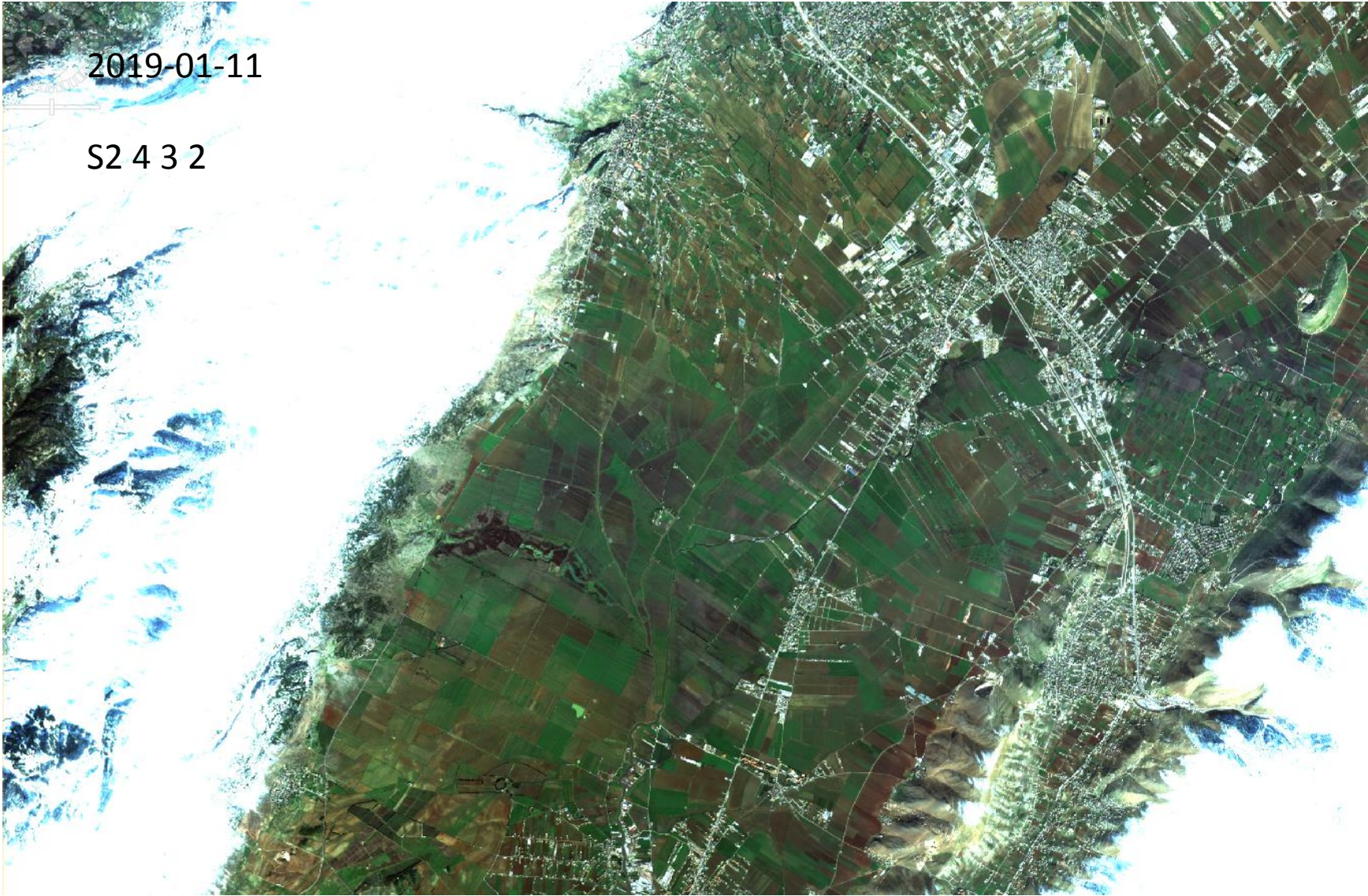
2019-01-11



2019-01-11



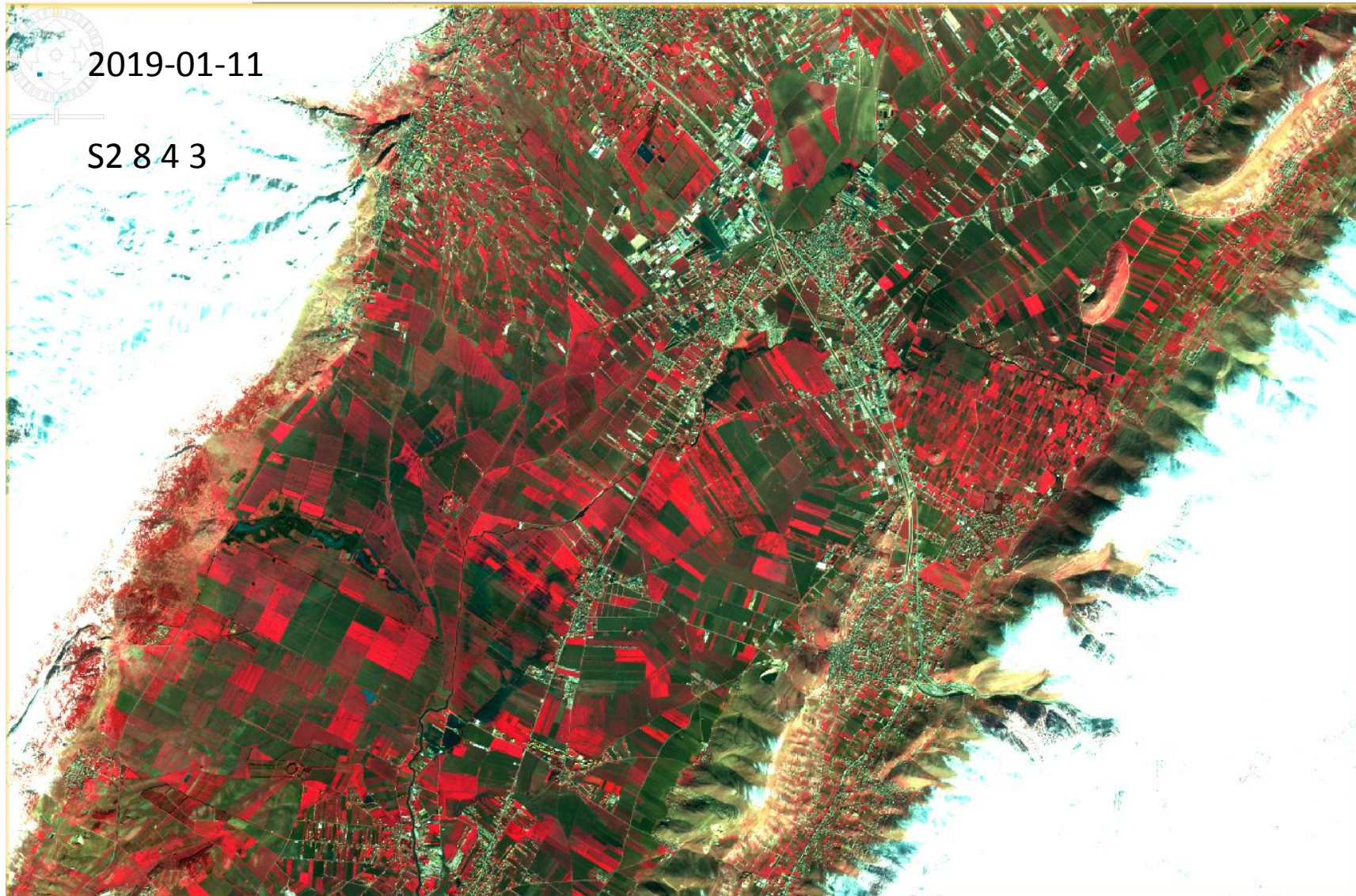


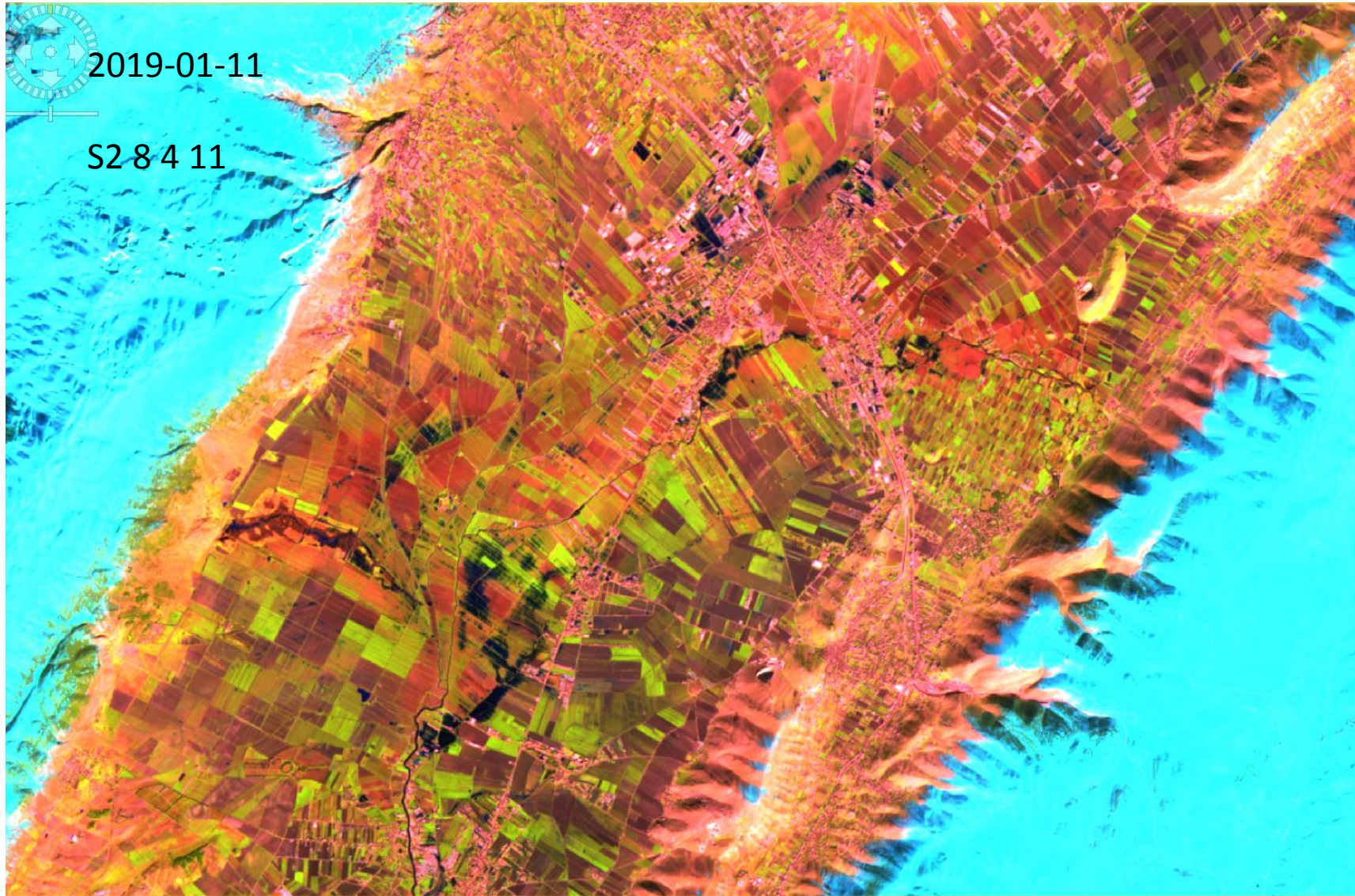


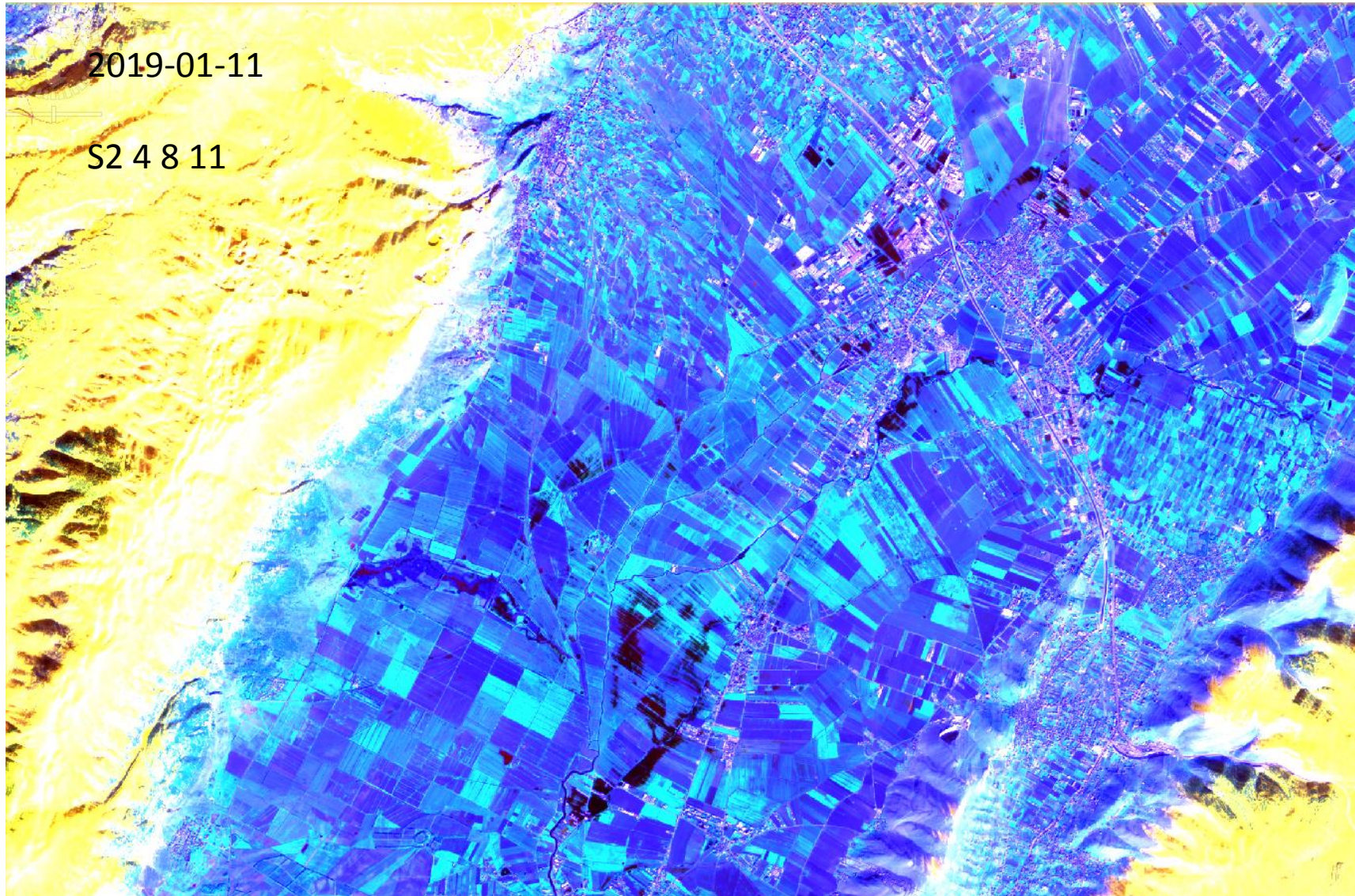
2019-01-11

S2 4 3 2





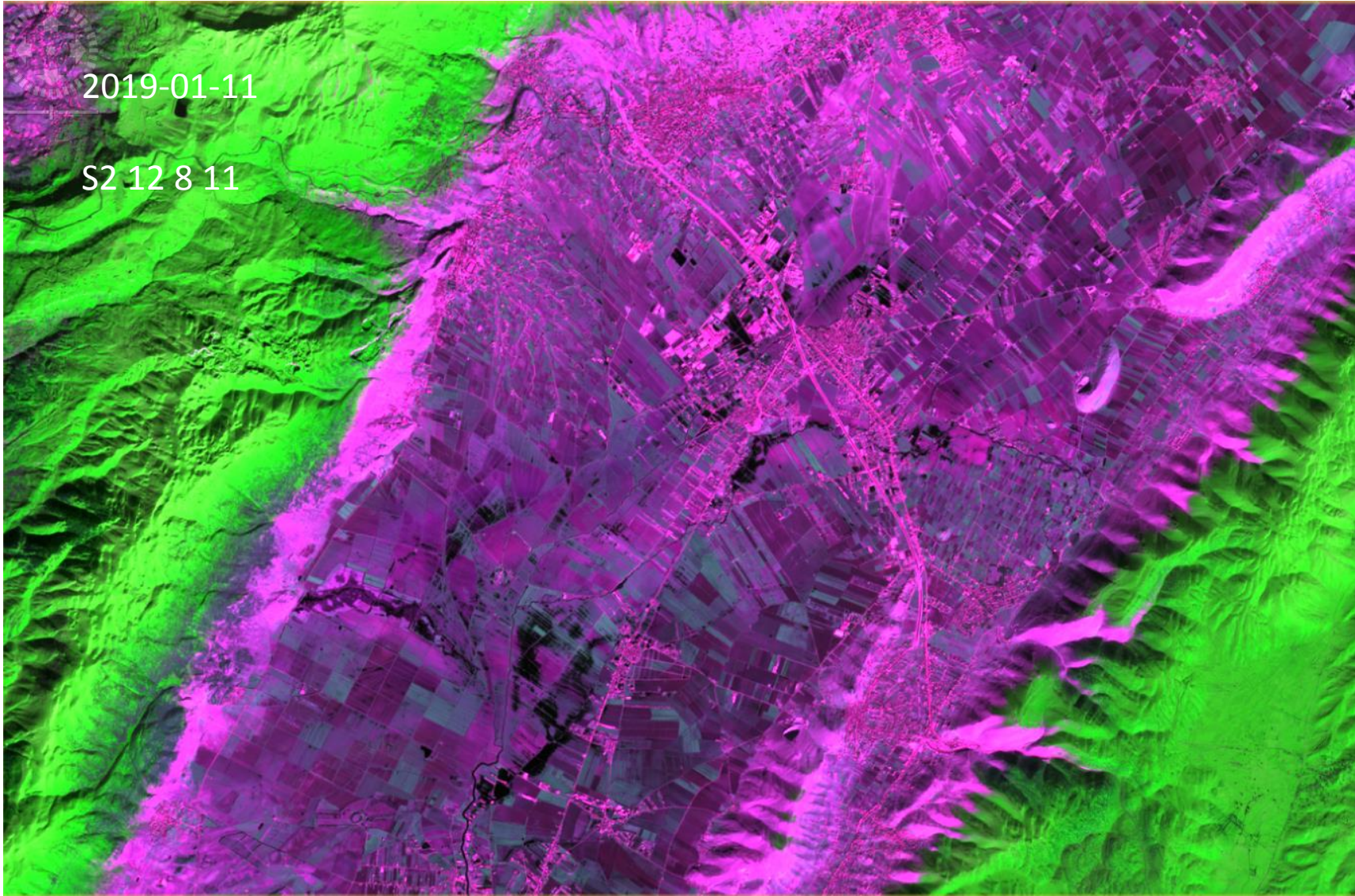


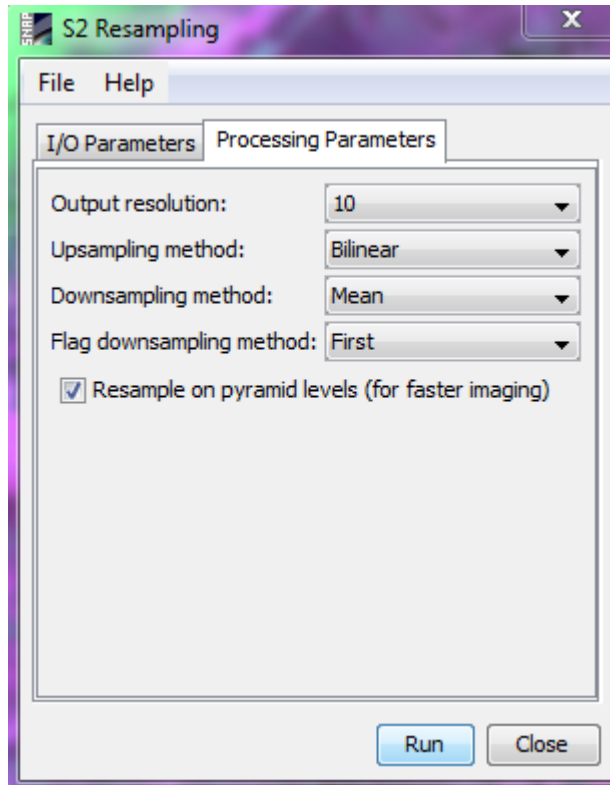


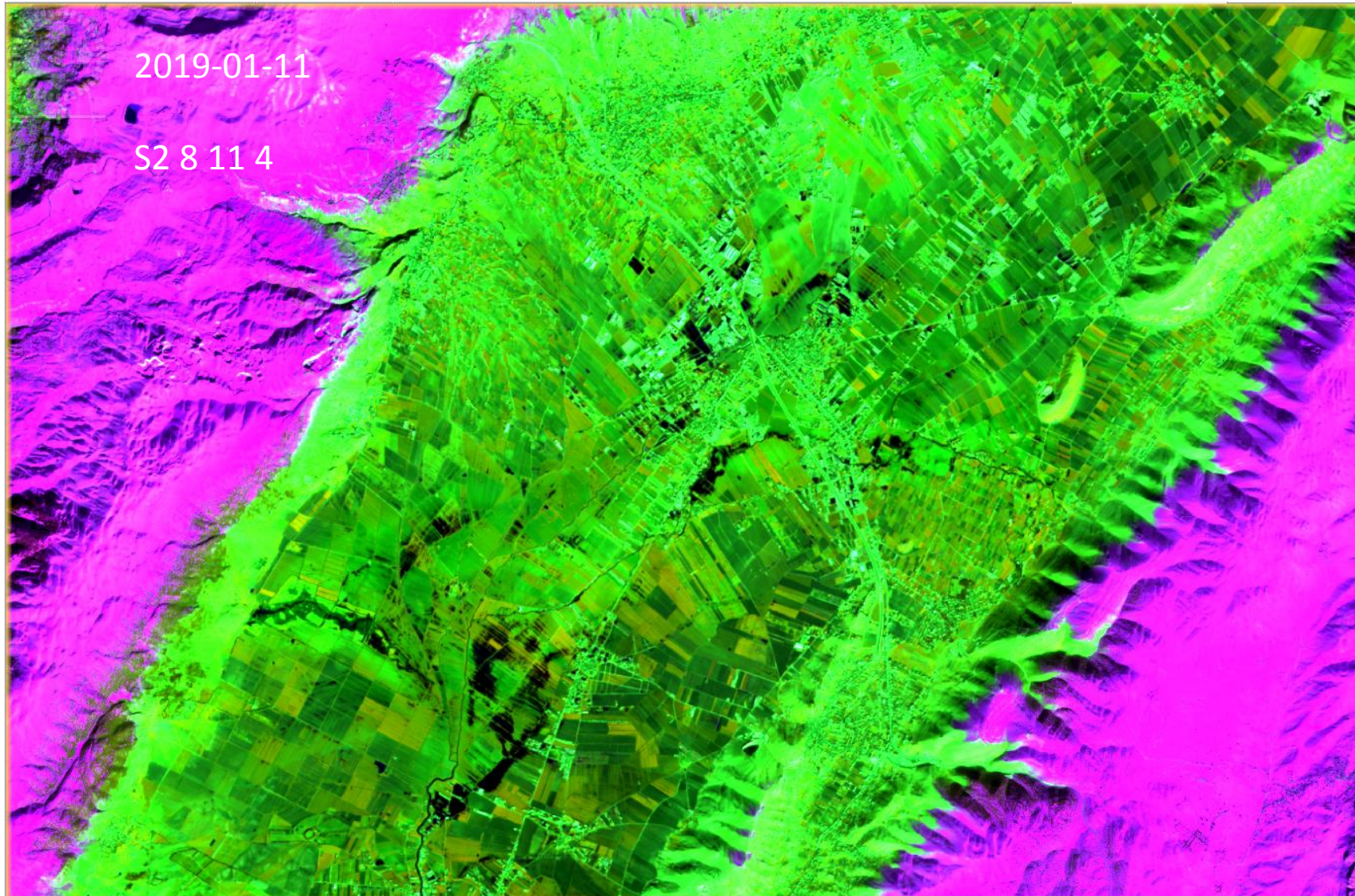
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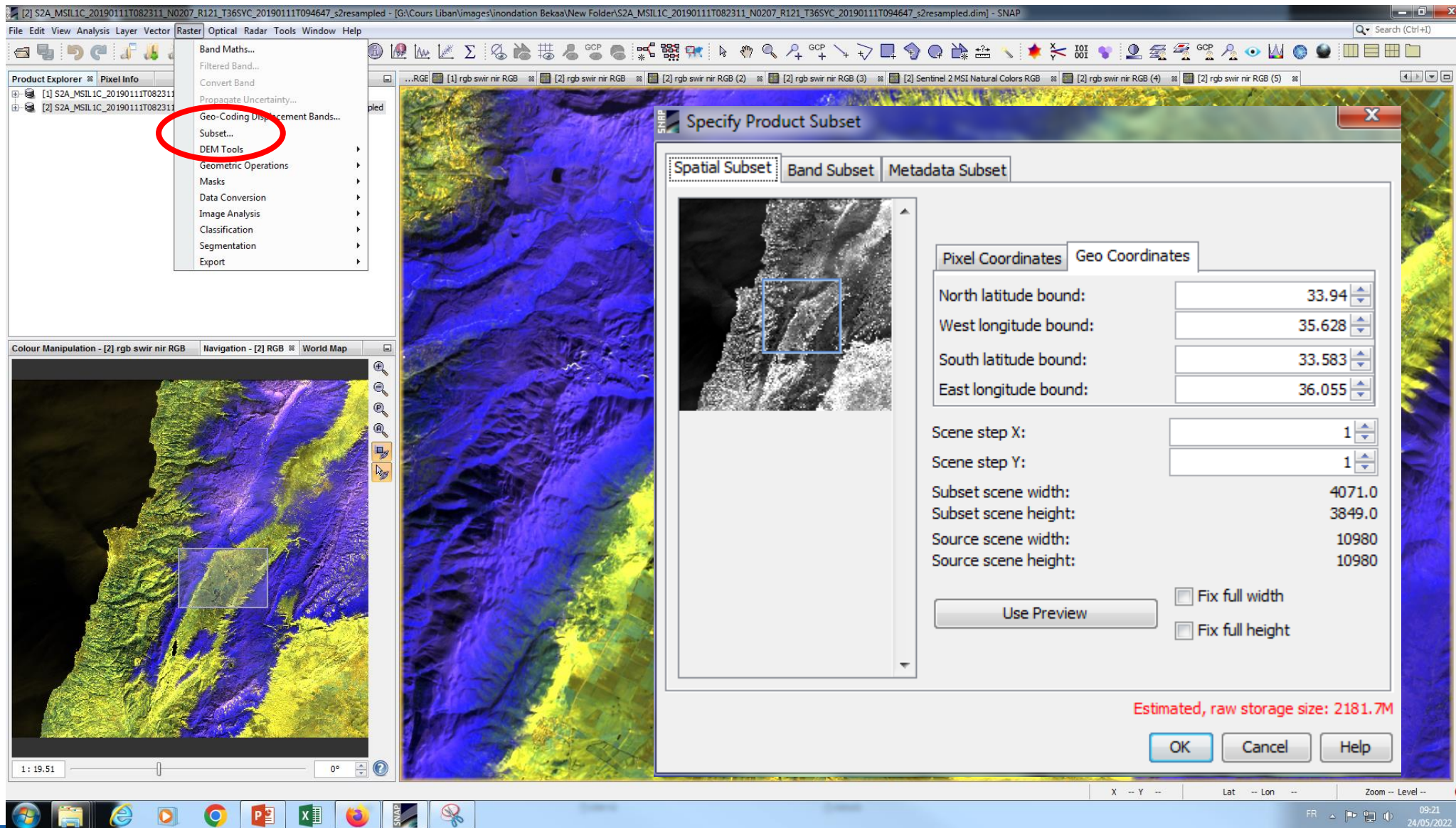
S2 4 8 11

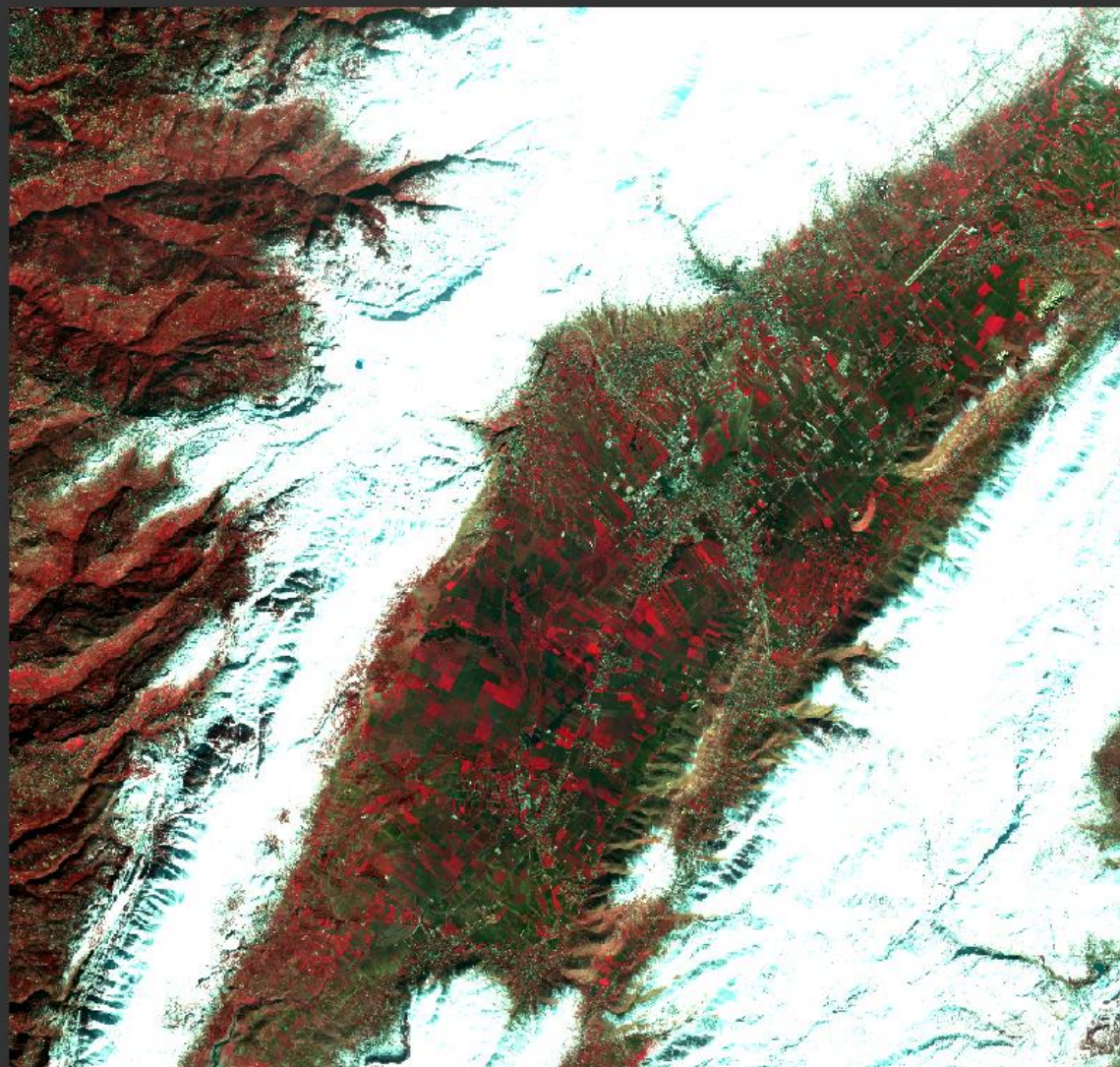


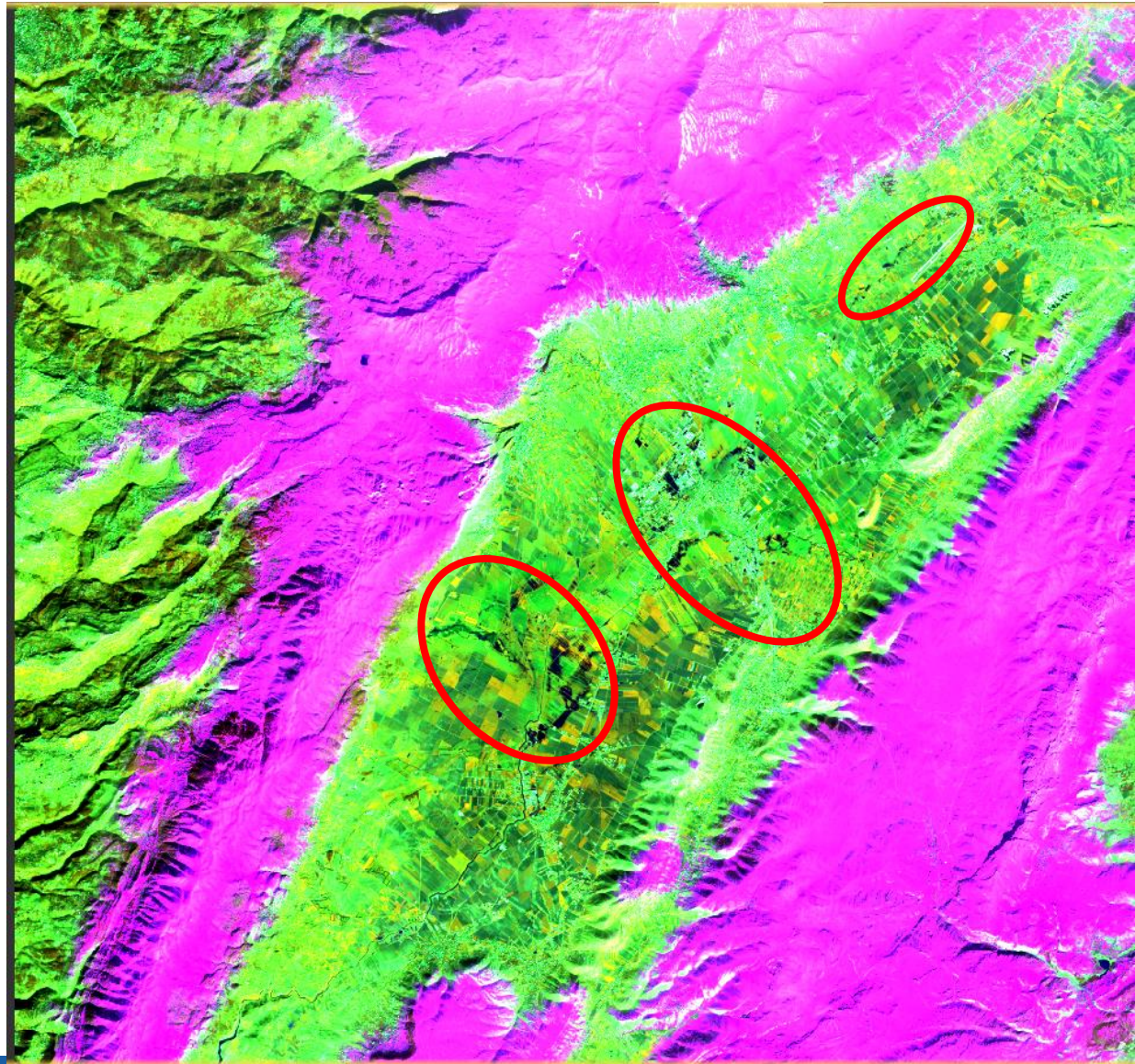




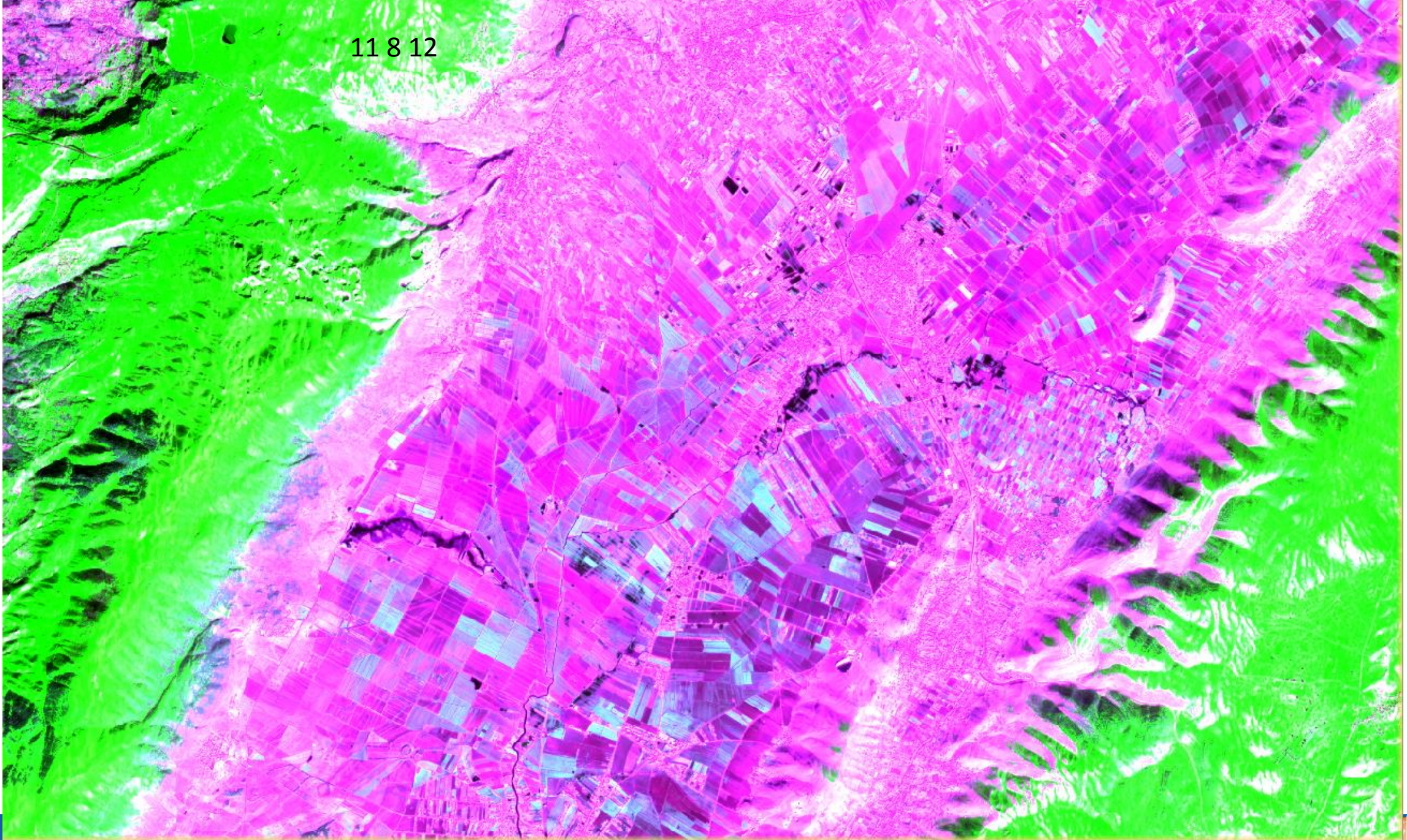


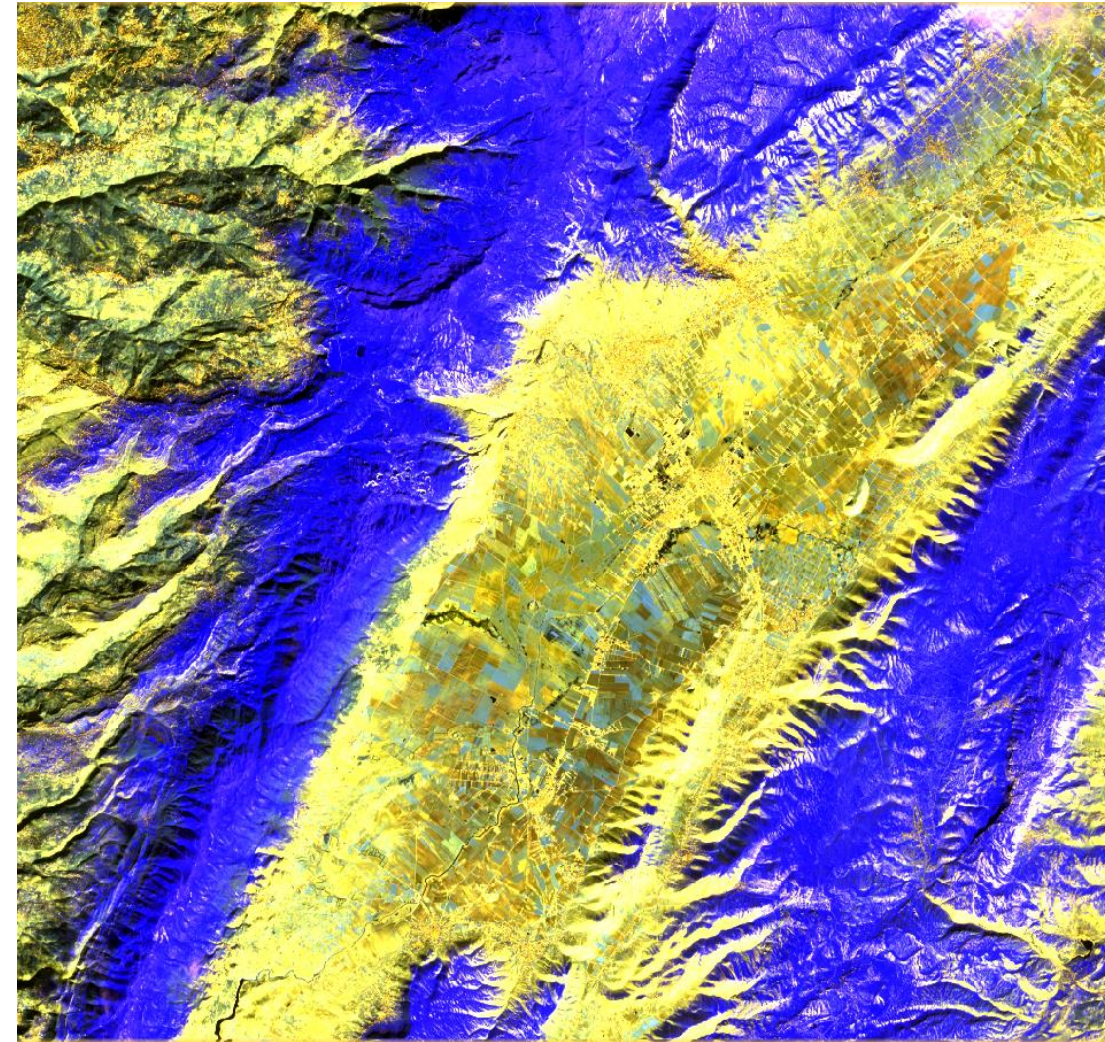
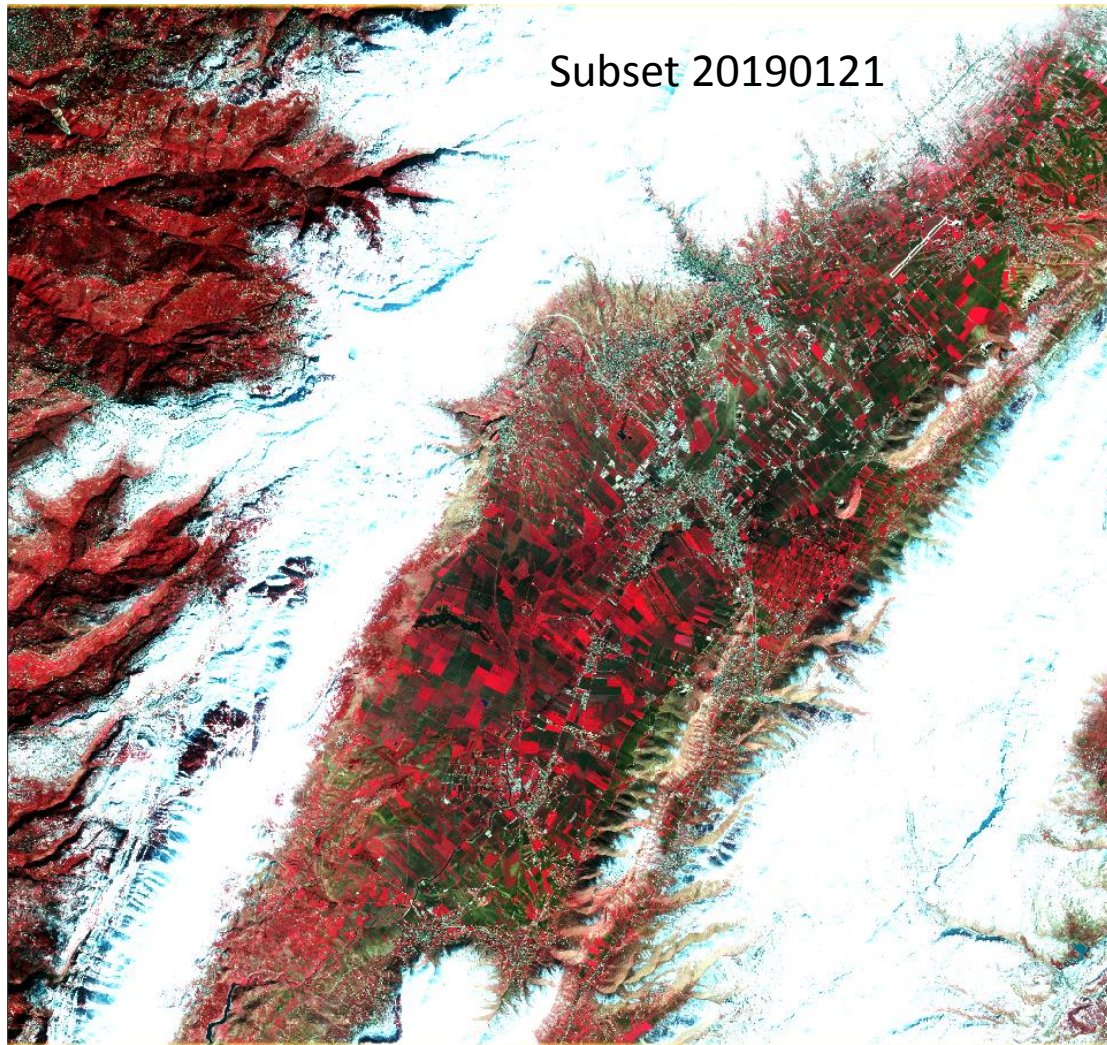




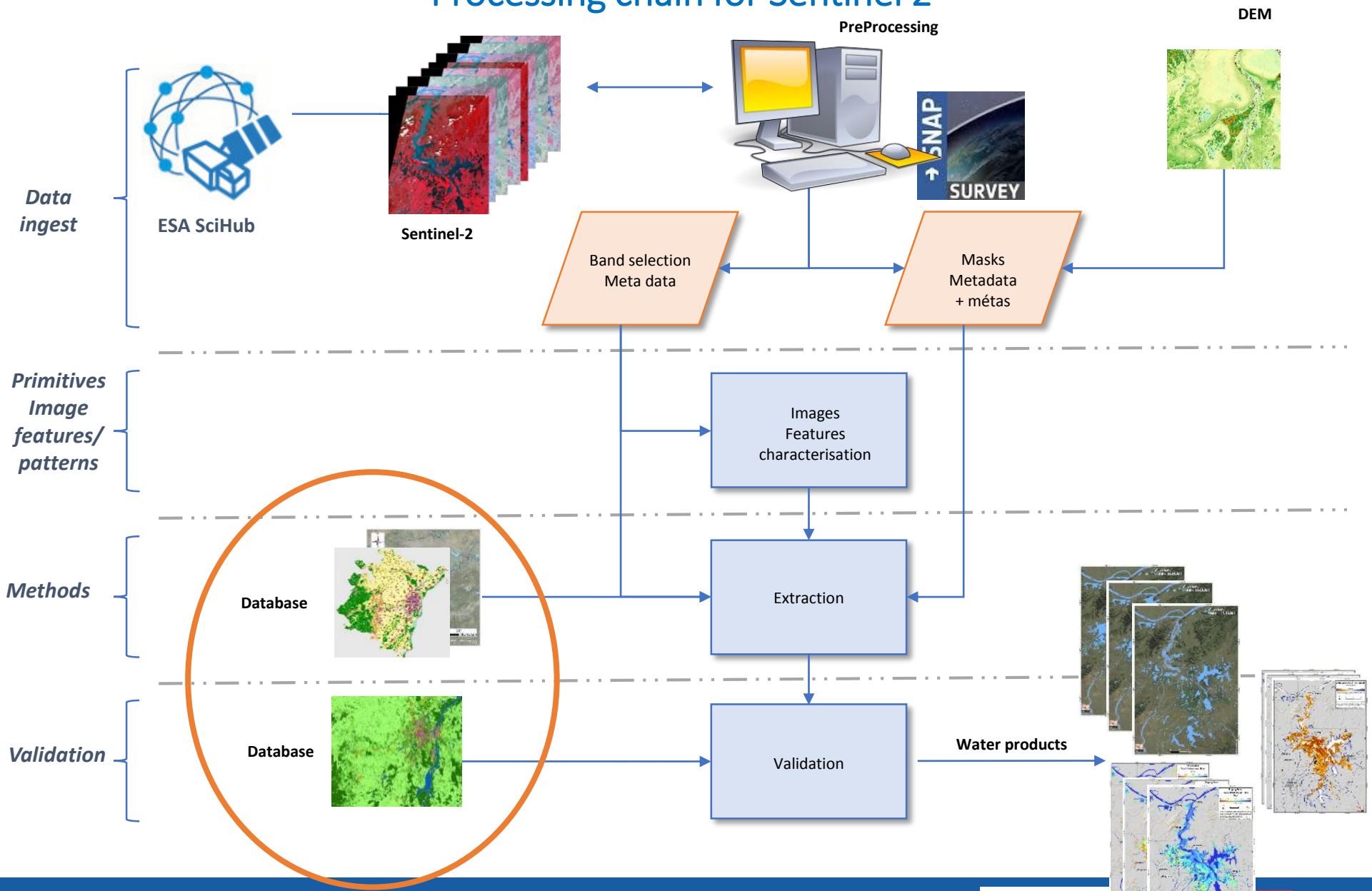


11 8 12



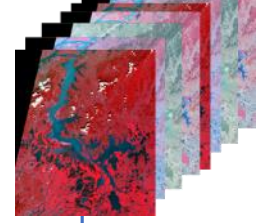


Processing chain for Sentinel 2





False friend
of SWIR
signatures



S2 primitives' image extraction

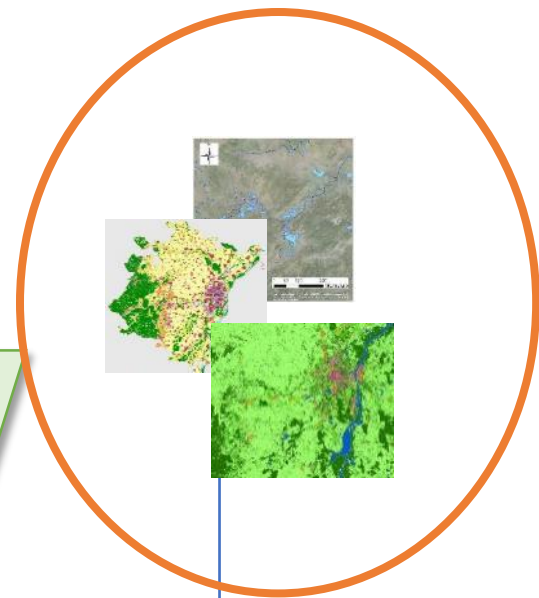
Indices:
NDVI, NDWI, ,
AWEI, INH, SBI

Spectral space
IHS,

Binary mask
+ métras
(GeoTiff)

Primitives,
features

Binary mask
+ métras
(GeoTiff)



Simple or
multiple
thresholds

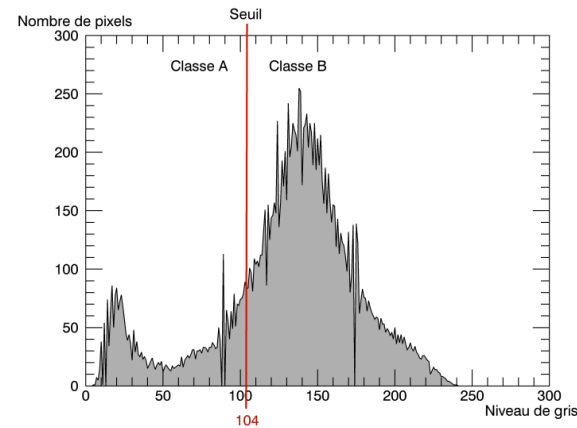
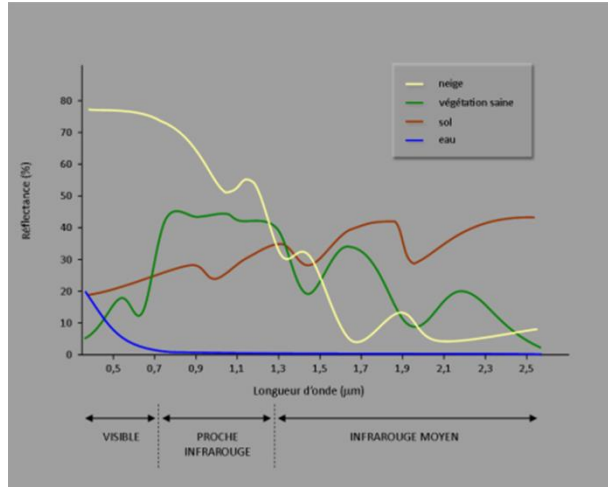
SVM,
classification

Thematic extraction

Water mask
+ metadata



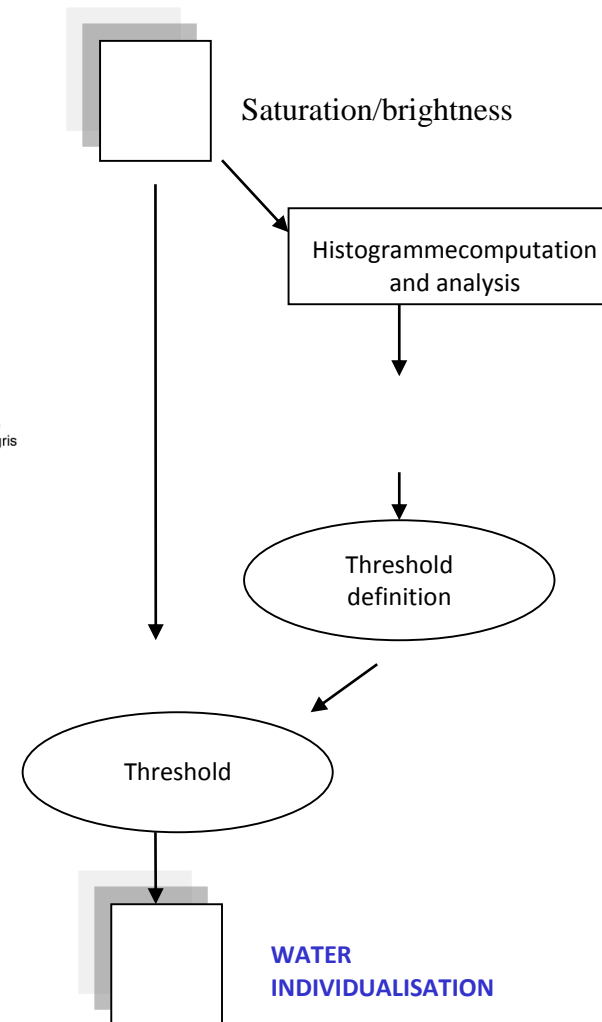
Flood mapping based on thresholding of raw channel and /or indice



Fundamentals: : water areas can be very bright if containing suspended materials

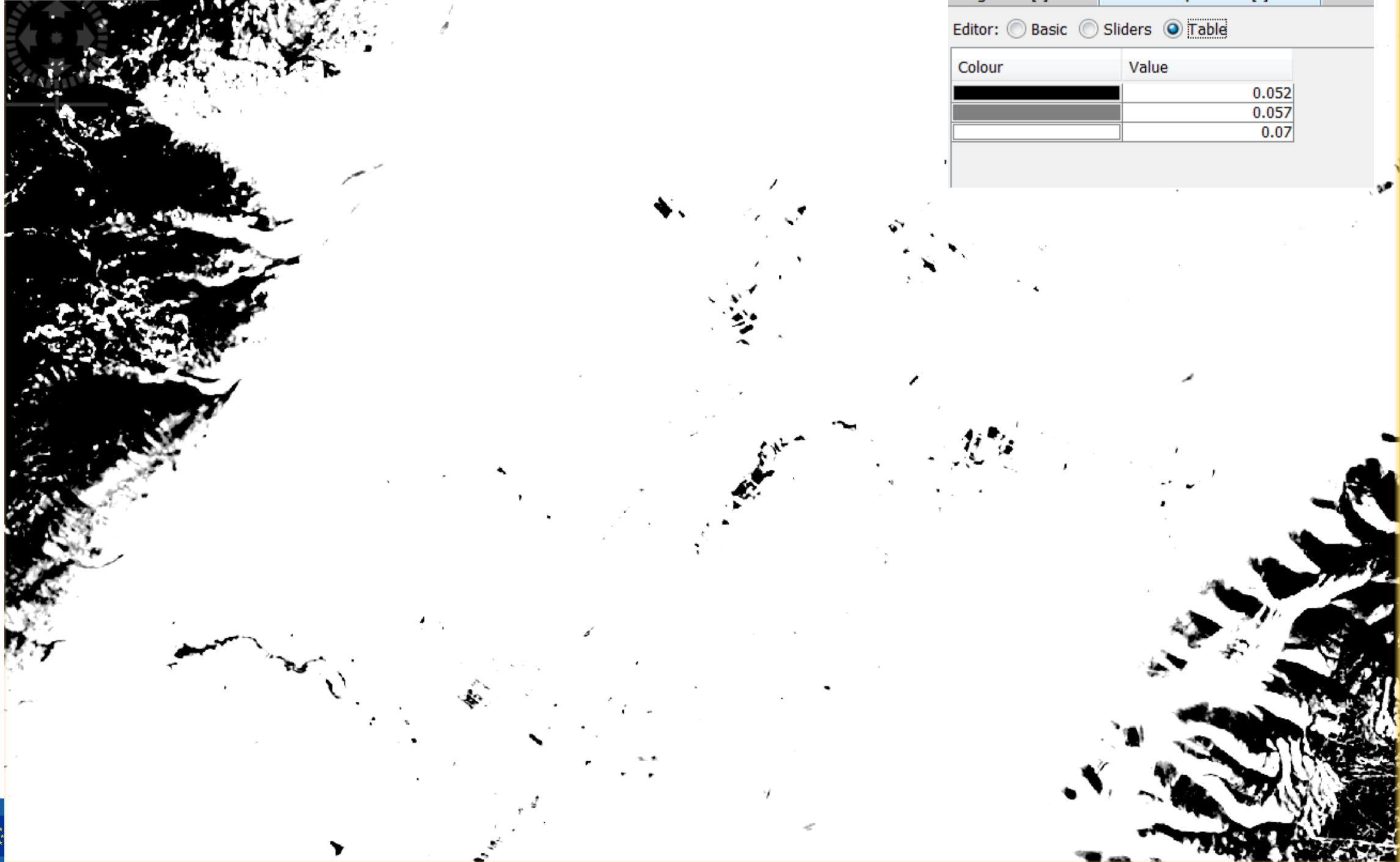
Extraction of water bodies from:

- Brightness Standard or Tasseled Cap
- First component of a PCA,
- Saturation indices of a HIS transformation



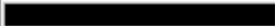


Band 11 SWIR 1)

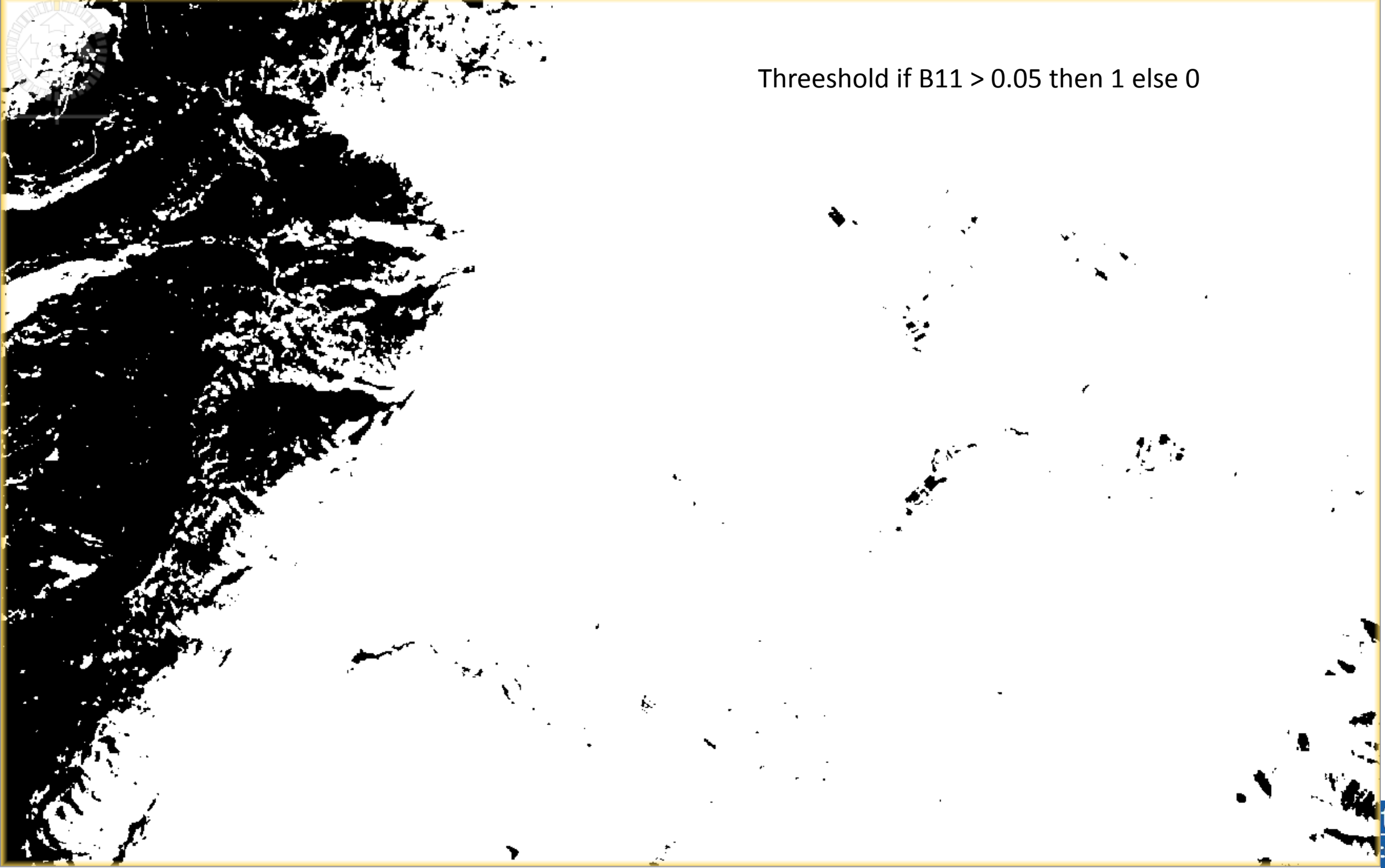




Navigation - [1] B11 Colour Manipulation - [1] B11 World V

Editor: Basic Sliders Table

Colour	Value
	0.052
	0.057
	0.07



Threshold if $B11 > 0.05$ then 1 else 0

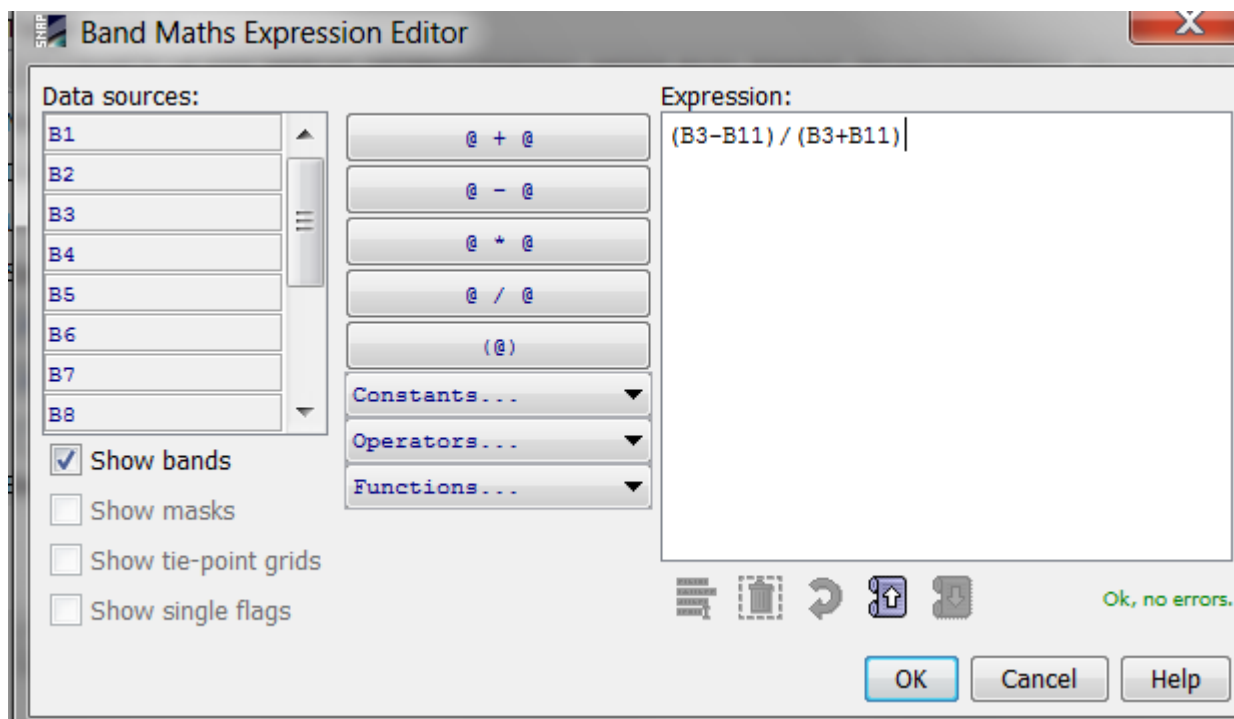
Classical water bodies related indices

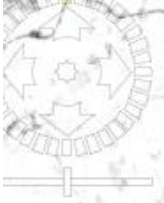
Index	Equation	Remark
Normalized Difference Water Index	$NDWI = (Green - NIR)/(Green + NIR)$	Water has positive value
Normalized Difference Moisture Index	$NDMI = (NIR - MIR)/(NIR + MIR)$	Water has positive value
Modified Normalized Difference Water Index	$MNDWI = (Green - MIR)/(Green + MIR)$	Water has positive value
Water Ratio Index	$WRI = (Green + Red)/(NIR + MIR)$	Value of water body is greater than 1
Normalized Difference Vegetation Index	$NDVI = (NIR - Red)/(NIR + Red)$	Water has negative value
Automated Water Extraction Index	$AWEI = 4 \times (Green - MIR) - (0.25 \times NIR + 2.75 \times SWIR)$	Water has positive value

Selected indices: AWEI indice

Modified Normalized
Difference Water Index

$$\text{MNDWI} = (\text{Green} - \text{MIR}) / (\text{Green} + \text{MIR})$$





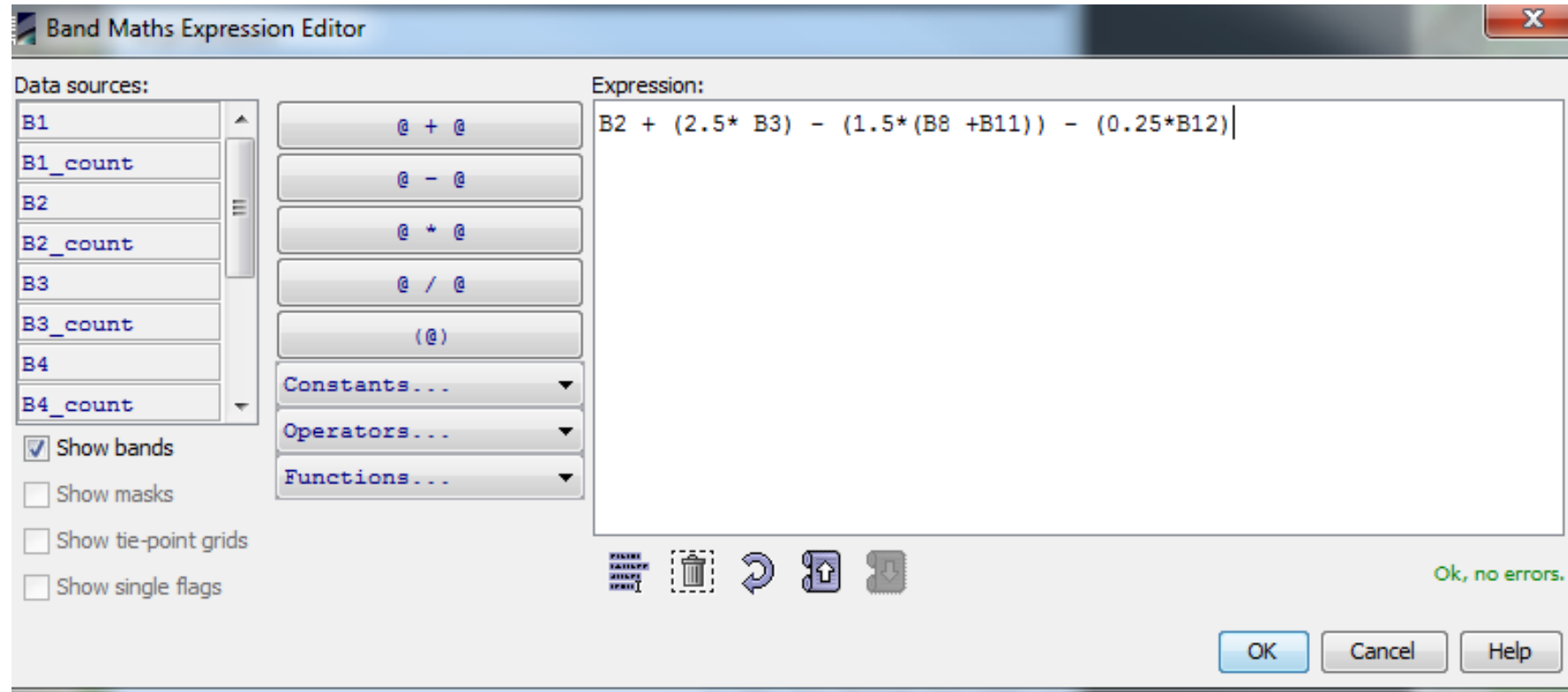
NDWI

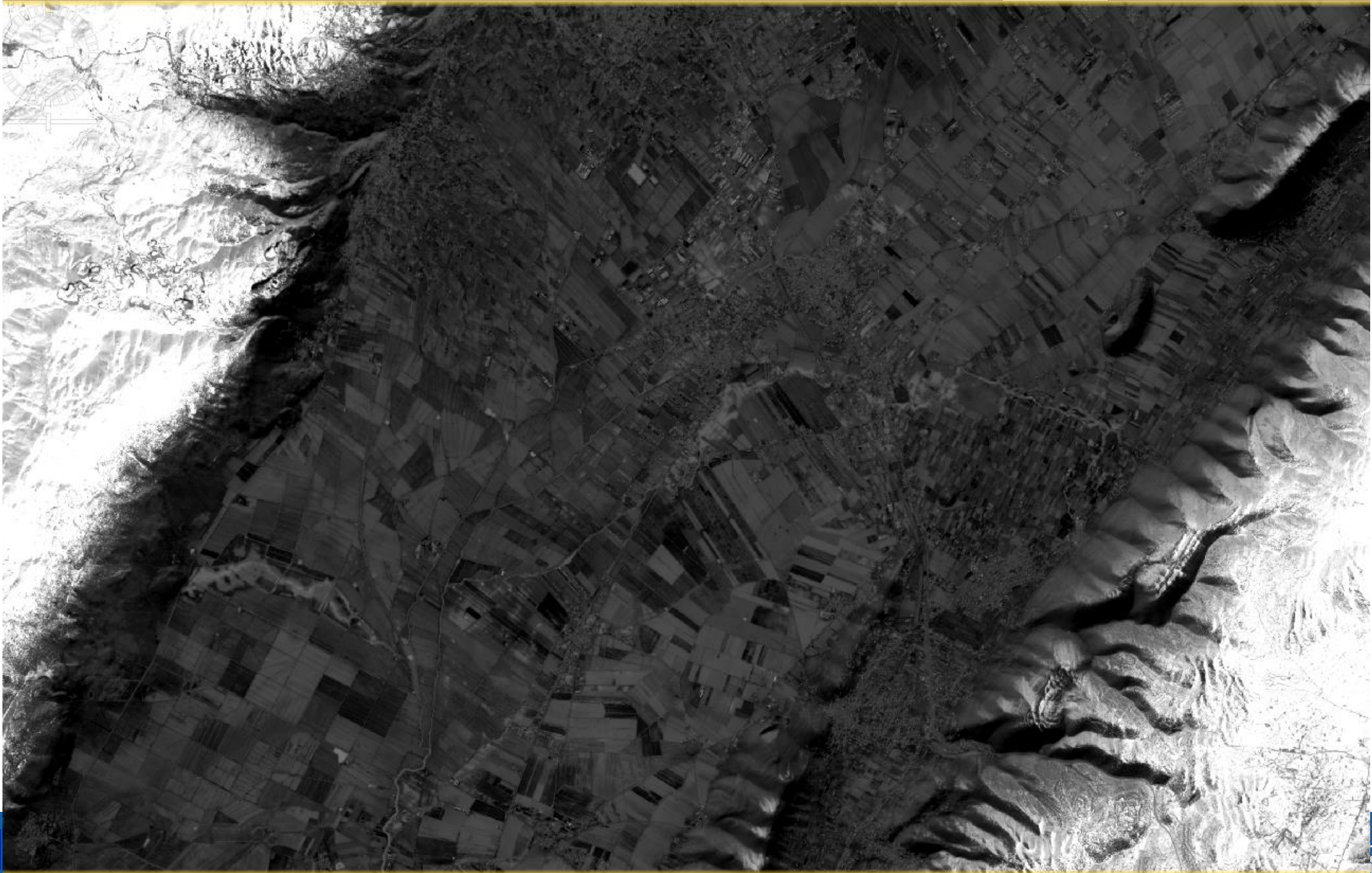


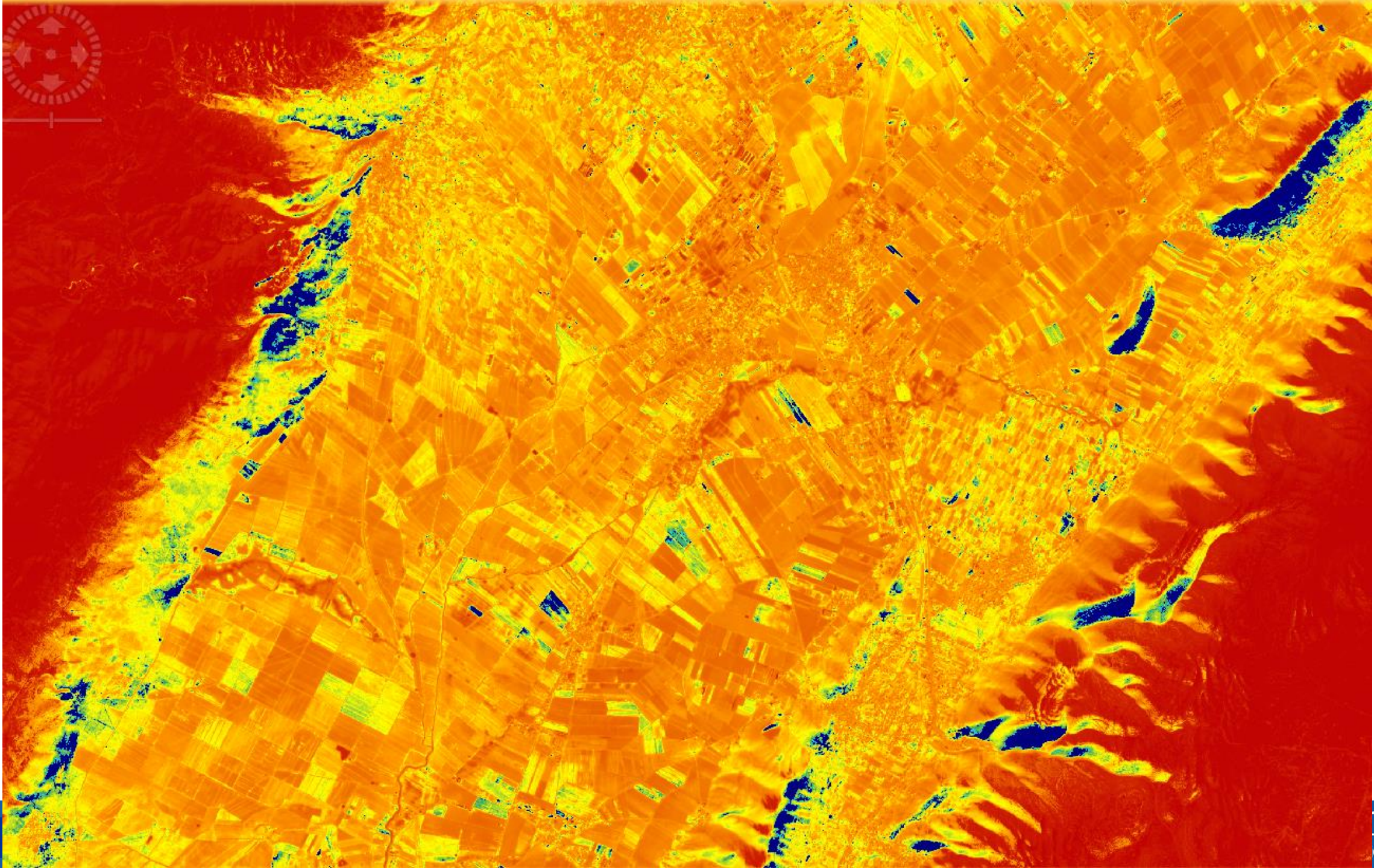
Selected indices: AWEI indice

$$AWEI_{sh} = Blue_{band} + (2.5 * Green_{band}) - 1.5 * (NIR_{band} + SWIR1_{band}) - (0.25 * SWIR2_{band})$$

$$\mathbf{B2 + (2.5 * B3) - (1.5 * (B8 + B11)) - (0.25 * B12)}$$







Water bodies mapping based on optical data : combination of indices

Fundamentals: water areas
can be very bright if
containing suspended
materials

Extraction of water bodies
from:

- Brightness Standard or Tasseled Cap
- First component of a PCA,
- Saturation indices of a HIS transformation
- Indices

