

Estimation of remotely sensed vegetation indices for spruce stands in the Ukrainian Carpathians and in the Black Forest

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Work package WP3: Satellite database - WP-Leader P2 UNFU-LV (Ukraine)

Task description (keywords): Satellite database (collection of data, data quality, data preprocessing, compilation of database).

Task description: Collection of satellite images from different sensors (MODIS, Landsat and Sentinel-2) according to areas of interests of different regions of investigation (Western Ukraine, Northwest Russia and Southwest Germany). All available satellite data from the beginning of surveying (for example for Landsat from the 1980ies, MODIS from 2000 and Sentinel-2 from 2015) without cloud cover (less than 10%) within 5-years periods will be collected. For these images pre-processing algorithms (atmospheric corrections, stacking images, etc.) and database will be developed. For the images NDVI-indexes will be calculated for detecting relations with growth data. For all three model regions the dynamics of coniferous wood cover will be estimated in 5-year periods.

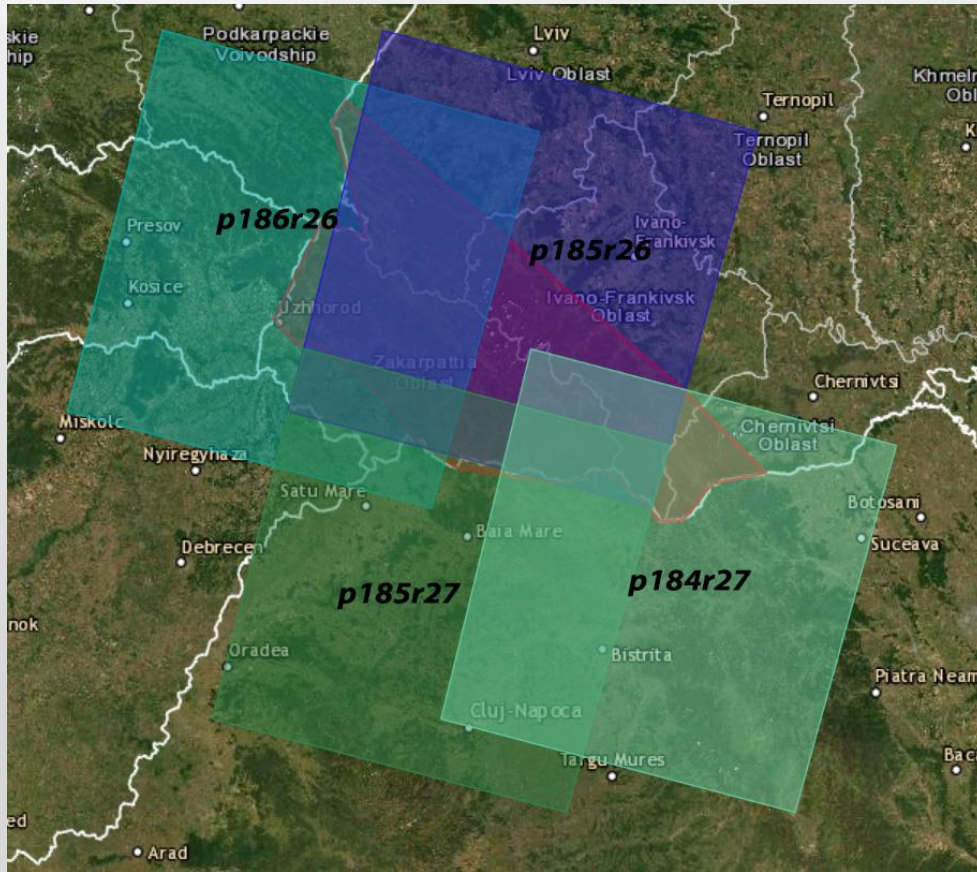
Work package milestones (MS):

- MS 3.1-1 Monitoring of existing images from different satellites (Landsat, MODIS and Sentinel-2) on USGS Earthexplorer Hub for 5-year periods and download of files according to their quality for all regions (duration: 4 months, due: month 10)
- MS 3.1-2 Quality assessment of images (duration: 2 months, due: month 12)
- MS 3.1-3 Preprocessing images (layer stacking, atmospheric correction etc.) depending on satellite features and relief (duration: 4 months, due: month 16)
- MS 3.1-4 Forming of NDVI (EVI) images (duration: 2 months, due: month 18)
- MS 3.1-5 Interpretation of images using available algorithms for spruce stands detection using field sample plots (duration: 4 months, due: month 22)
- MS 3.1-6 Change detection on thematic maps for 5-year periods (duration: 2 months, due: month 24).

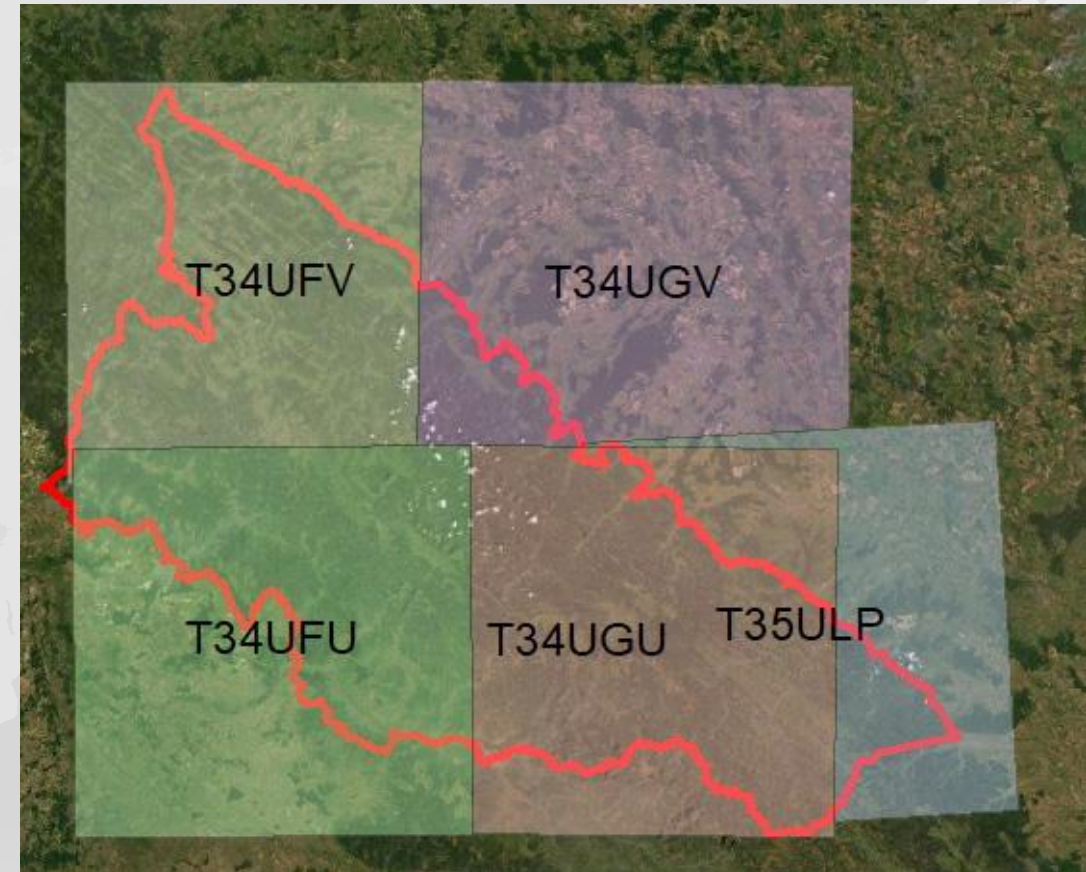
Work package deliverables (DE):

- DE 3.1-1 Downloaded satellite images (Landsat, MODIS and Sentinel-2) for available 5-years periods for area of interests of all regions (Western Ukraine, Northwest Russia and Southwest Germany) with their quality assessment (due: month 16)
- DE 3.1-2 Formed images for analyzing, additionally including NDVI (and EVI) images for areas of interest (due: month 18)
- DE 3.1-3 Creation of thematic maps as a result of image interpretation for detection forest cover, including spruce stands (due: month 22)
- DE 3.1-4 Change detection of spruce stands on thematic maps for 5-year periods (due: month 24).

Ukrainian Carpathians (area appx. 24 thou. ha)

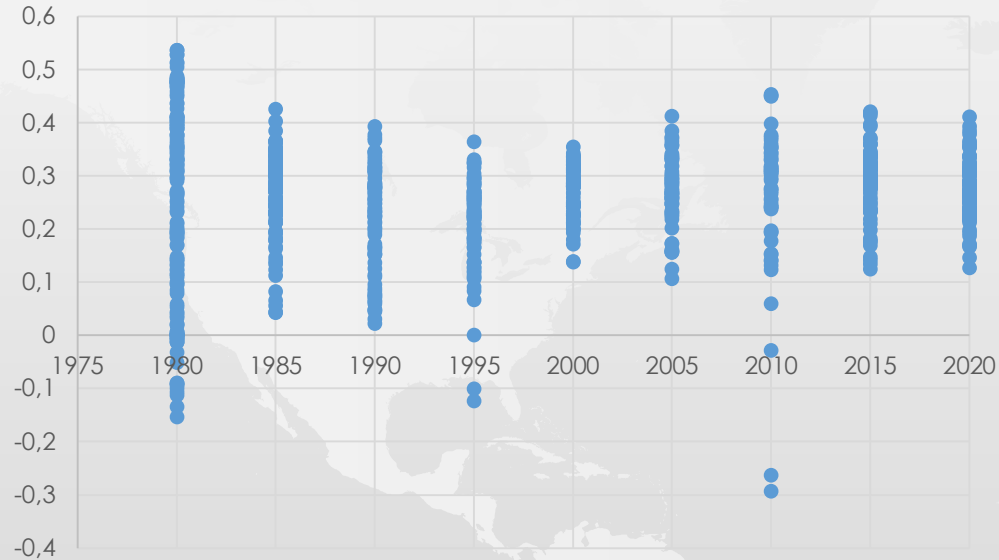


Landsat mission



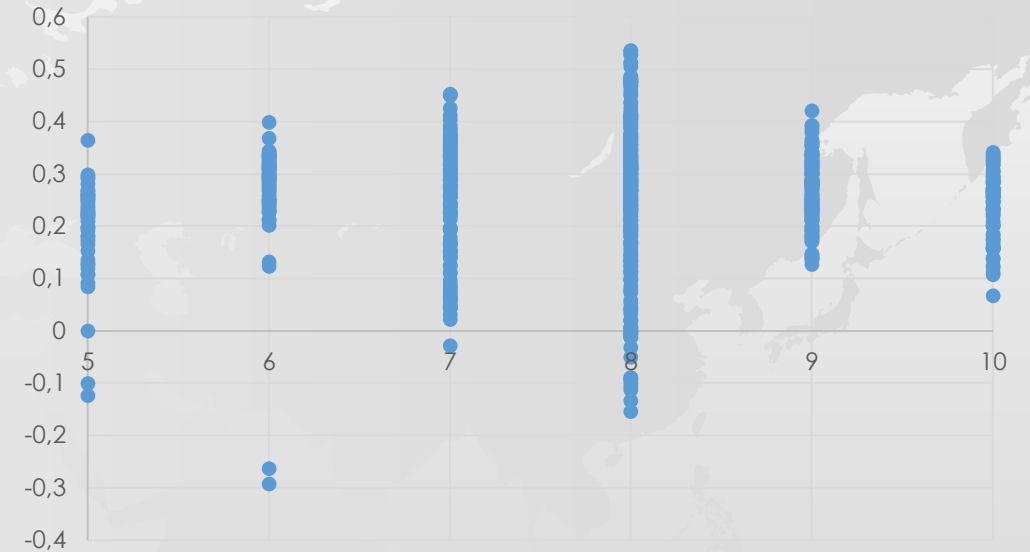
Sentinel-2 mission

Mean



Mean values of NDVI indexes due to the
5 year periods

Mean



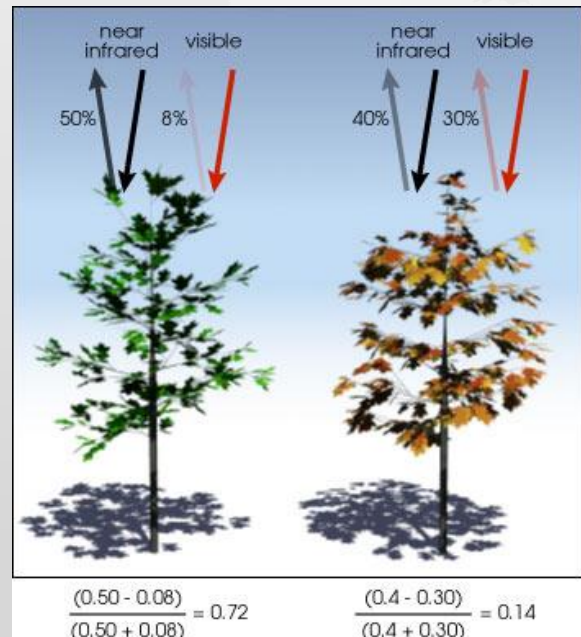
Mean values of NDVI indexes due to the
month of the acquisition

$$NDVI = \frac{NIR - RED}{NIR + RED}$$

$$EVI = G \frac{NIR - RED}{NIR + C_1 \cdot RED - C_2 \cdot BLUE + L}$$

G – gain factor ($G=2,5$); **L** – canopy background adjustment that addresses non-linear, differential *NIR* and red radiant transfer through a canopy ($L=1$);

C₁, **C₂** - are the coefficients of the aerosol resistance term, which uses the blue band to correct for aerosol influences in the red band ($C_1=6$; $C_2=7,5$)



$$EVI = 2,5 \frac{NIR - RED}{NIR + 6 \cdot RED - 7,5 \cdot BLUE + 1}$$

Google Earth Engine

Search places and datasets...

Scripts Docs Assets

Filter scripts...

Owner (2)

- users/serhiihavryliuk/SURGE-Pro
 - Ukraine
 - +++L5_DE_Schwarzwald
 - +++L5_UA_Carpathians
 - +++L8_DE_Schwarzwald
 - +++L8_UA_Carpathians
 - +++S2_DE_Schwarzwald
 - +++S2_UA_Carpathians
- +++S2_UFV
- +++S2_workflow
- +01.Filtering_L5-SR+TOA
- +01.Filtering_L8-SR+TOA
- +01.Filtering_S2-TOA
- +01.Filtering_S2-TOA_SIAC
- +02.L5-SR_Month_Clouds
- +02.L8-SR_Month_Clouds
- 01.Filtering Image Collection-L5-2010
- 01.Filtering Image Collection-L8-2020
- 01.Filtering Image Collection-S2-2020
- UA_Carpathians
- UA_Carpathians_L8_test
- UA_Carpathians_test

users/serhiihavryliuk/test1database1visual

Writer

No accessible repositories. Click Refresh to check again.

Deador (5)

+++L5_DE_Schwarzwald

Get Link Save Run Reset Apps

```

Imports (1 entry)
var imageVisParam: ndvi

//Add area of interest from the border of Carpathians
var DE_Schwarzwald = ee.FeatureCollection("projects/ee-serhiihavryliuk/assets/Schwarzwald");
// Show the state polygon with a blue outline
var outline = ee.Image().byte().paint({
  featureCollection: DE_Schwarzwald,
  color: 1,
  width: 1
});
Map.addLayer(outline, {palette: ['blue']}, 'AOI');
////////////////////////////////////
var Sample_Plots = ee.FeatureCollection("projects/ee-serhiihavryliuk/assets/DE_SP_merged");
var points = Sample_Plots.map(function(feature) {
  return ee.Feature(feature.geometry(), {'id': feature.get('label')}); // 'id': feature.id(), 'lab
});
print(points);
Map.addLayer(points, {color: 'red'}, 'SP_Ukraine');
Map.centerObject(points, 7);

var startDate = '1985-01-01';
var endDate = '1985-12-31';

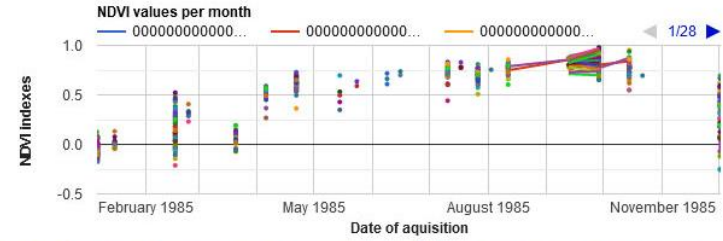
// Function to remove cloud and snow pixels
function maskCloudAndShadows(image) {
  var qaMask = image.select('QA_PIXEL').bitwiseAnd(parseInt('11111', 2)).eq(0);
  var saturationMask = image.select('QA_RADSAT').eq(0);
  var opticalBands = image.select('SR_B_').multiply(0.0000275).add(-0.2);
  var thermalBands = image.select('ST_B_').multiply(0.00341802).add(149.0);
  return image.addBands(opticalBands, null, true)
    .addBands(thermalBands, null, true)
    .updateMask(qaMask);
}
          
```

Inspector Console Tasks

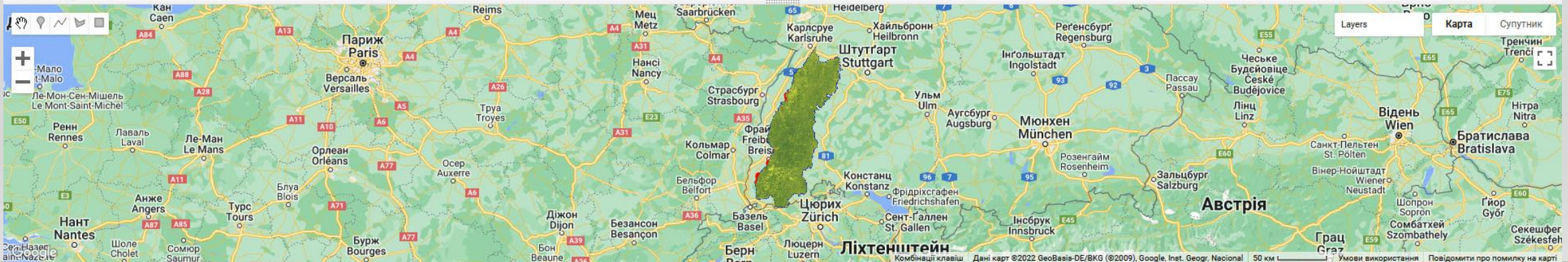
Use print(...) to write to this console.

- FeatureCollection projects/ee-serhiihavryliuk/assets/DE_SP_merged (84 elements, ... JSON
- ImageCollection LANDSAT/LT05/C02/T1_L2 (81 elements) JSON
- ImageCollection LANDSAT/LT05/C02/T1_L2 (81 elements) filtered JSON
- Image (1 band) NDVI_median JSON
- FeatureCollection projects/ee-serhiihavryliuk/assets/DE_SP_merged (84 elements, ... JSON
- test JSON

NDVI values per month

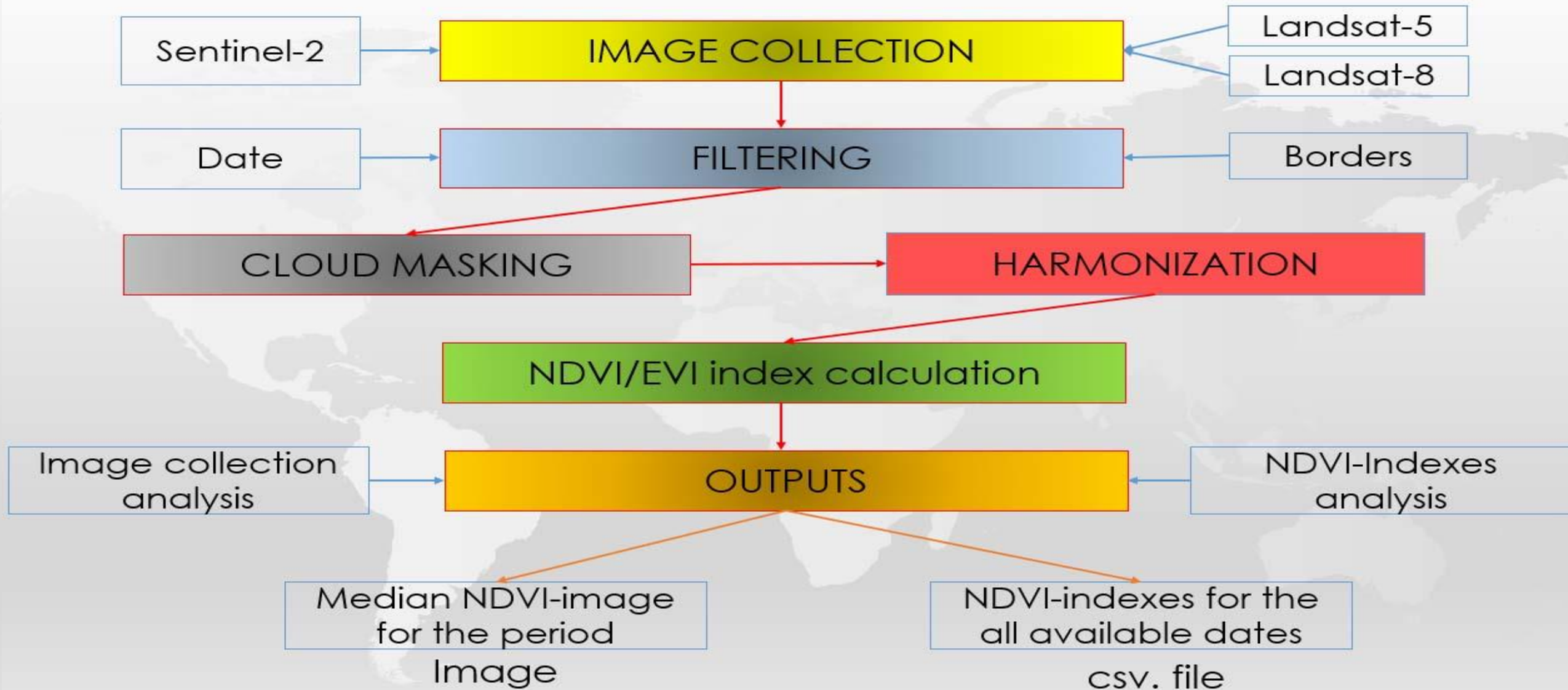


Date of acquisition



	A year duration image analysis from Landsat program																																						
Years	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	
Ukraine																																							
Germany																																							
	Landsat-8											Landsat-5																											

A year duration image analysis from Sentinel-2 program					
Years	2022	2021	2020	2019	2018
Ukraine					
Germany					





Article

Harmonization of Landsat and Sentinel 2 for Crop Monitoring in Drought Prone Areas: Case Studies of Ninh Thuan (Vietnam) and Bekaa (Lebanon)

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Abstract: Proper satellite-based crop monitoring applications at the farm-level often require near-daily imagery at medium to high spatial resolution. The combination of data from different ongoing satellite missions Sentinel 2 (ESA) and Landsat 7/8 (NASA) provides this unprecedented opportunity at a global scale; however, this is rarely implemented because these procedures are data demanding and computationally intensive. This study developed a robust stream processing for the harmonization of Landsat 7, Landsat 8 and Sentinel 2 in the Google Earth Engine cloud platform, connecting the benefit of coherent data structure, built-in functions and computational power in the Google Cloud. The harmonized surface reflectance images were generated for two agricultural schemes in Bekaa (Lebanon) and Ninh Thuan (Vietnam) during 2018–2019. We evaluated the performance of several pre-processing steps needed for the harmonization including the image co-registration, Bidirectional Reflectance Distribution Functions correction, topographic correction, and band adjustment. We found that the misregistration between Landsat 8 and Sentinel 2 images varied from 10 m in Ninh Thuan (Vietnam) to 32 m in Bekaa (Lebanon), and posed a great impact on the quality of the final harmonized data set if not treated. Analysis of a pair of overlapped L8-S2 images over the Bekaa region showed that, after the harmonization, all band-to-band spatial correlations were greatly improved. Finally, we demonstrated an application of the dense harmonized data set for crop mapping and monitoring. An harmonic (Fourier) analysis was applied to fit the detected unimodal, bimodal and trimodal shapes in the temporal NDVI patterns during one crop year in Ninh Thuan province. The derived phase and amplitude values of the crop cycles were combined with max-NDVI as an R-G-B false composite image. The final image was able to highlight croplands in bright colors (high phase and amplitude), while the non-crop areas were shown with grey/dark (low phase and amplitude). The harmonized data sets (with 30 m spatial resolution) along with the Google Earth Engine scripts used are provided for public use.

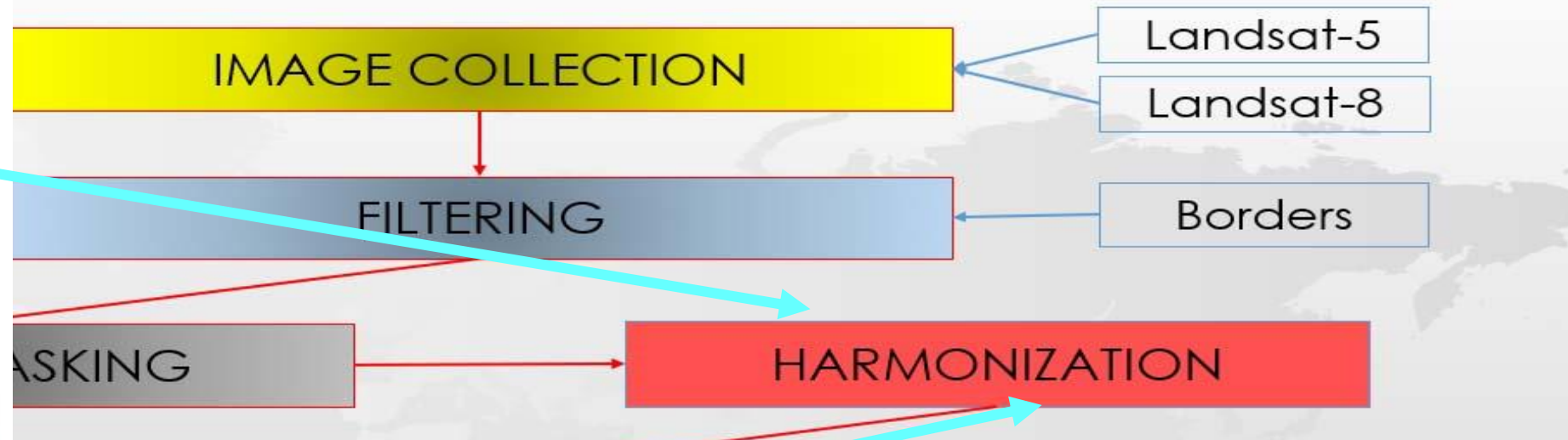
Keywords: Landsat; Sentinel 2; harmonization; crop monitoring; Google Earth Engine

1. Introduction

In recent decades, advances in technology and algorithms have allowed remote sensing to play an important role in crop monitoring [1,2] which relies on continuous and dense time series. However,

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www.mdpi.com/journal/remotesensing



Remote Sensing of Environment 221 (2019) 274–285



Contents lists available at ScienceDirect

Remote Sensing of Environment

journal homepage: www.elsevier.com/locate/rse



Empirical cross sensor comparison of Sentinel-2A and 2B MSI, Landsat-8 OLI, and Landsat-7 ETM+ top of atmosphere spectral characteristics over the conterminous United States

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^a RedCastle Resources, Inc., Contractor to: USDA Forest Service Geospatial Technology and Applications Center (GTAC), 2222 W 2300 S, Salt Lake City, UT 84119, United States of America

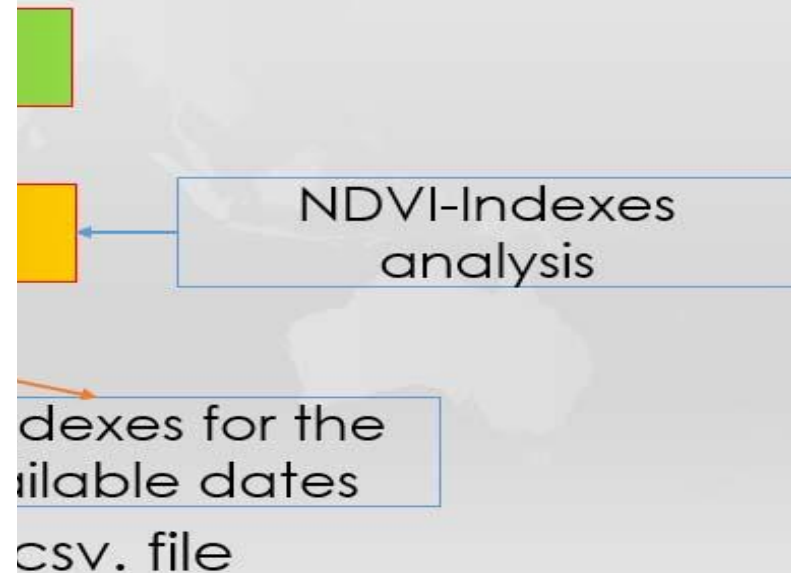
^b Spatial Informatics Group 2529 Yolanda Ct. Pleasanton, CA 94566, United States of America

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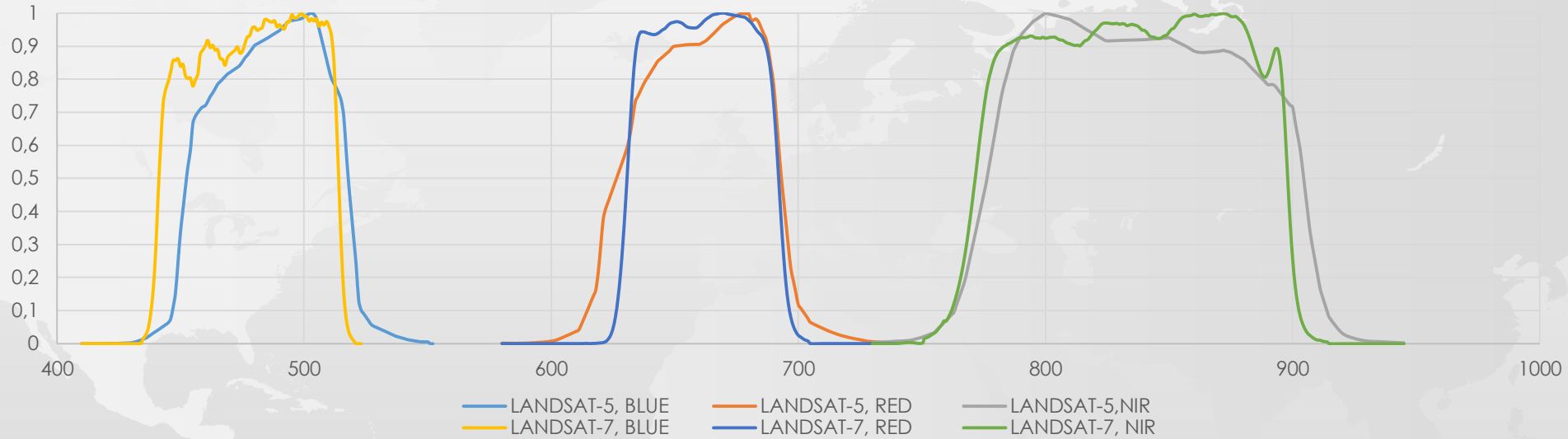
Keywords:
Landsat
OLI

ABSTRACT

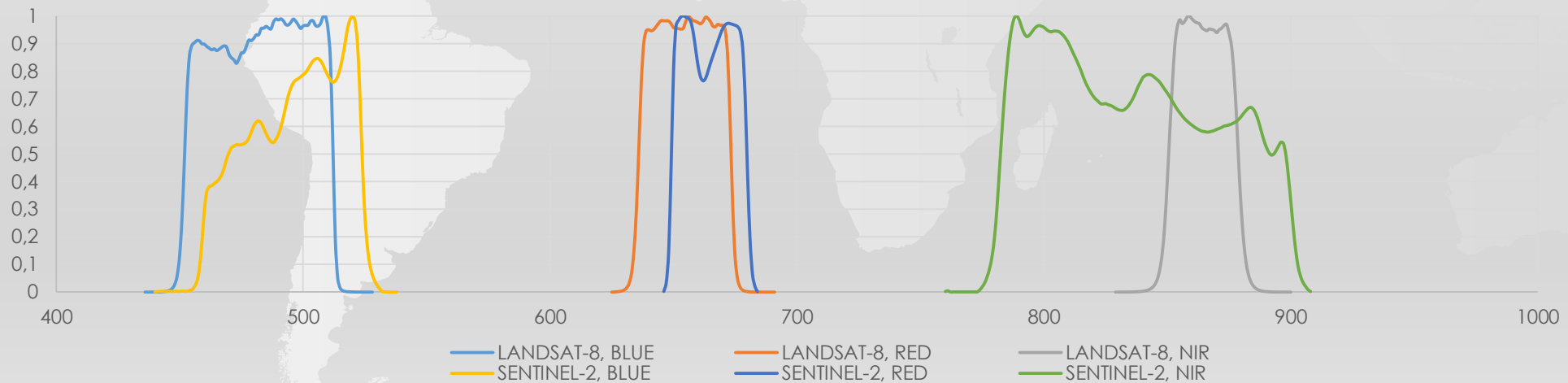
Remote sensing landscape monitoring approaches frequently benefit from a dense time series of observations. To enhance these time series, data from multiple satellite systems need to be integrated. Landsat image data is a valuable 30-meter resolution source of spatial information to assess forest conditions over time. Together both

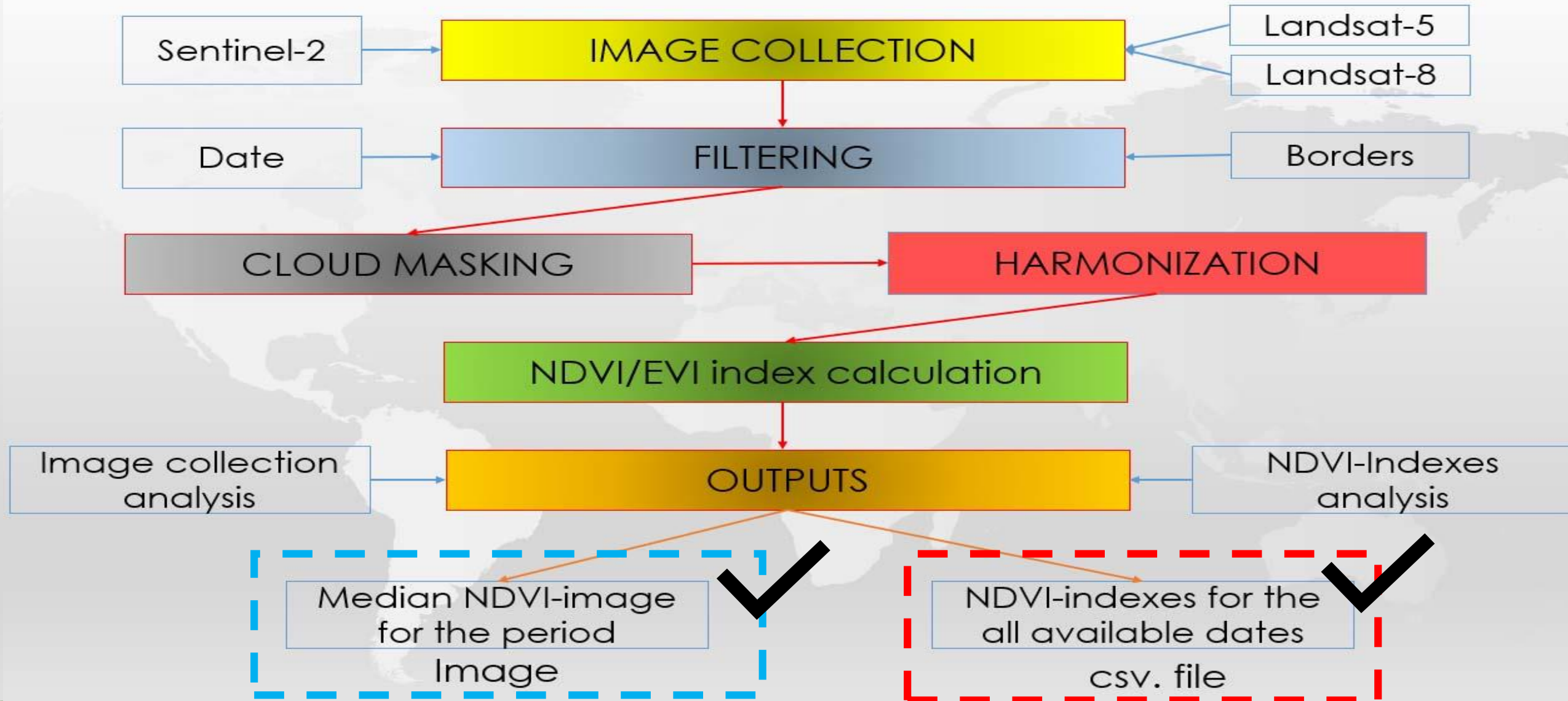


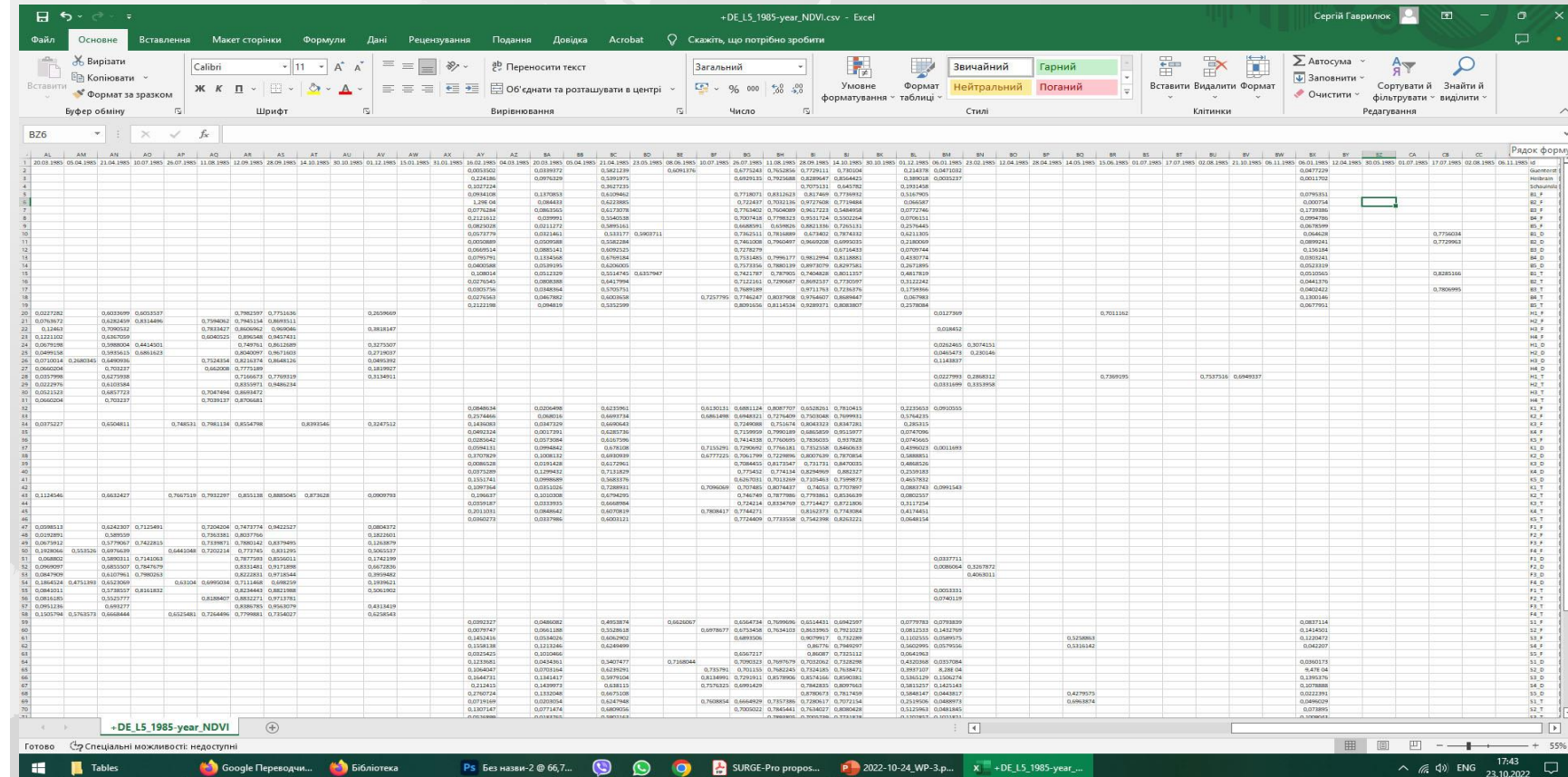
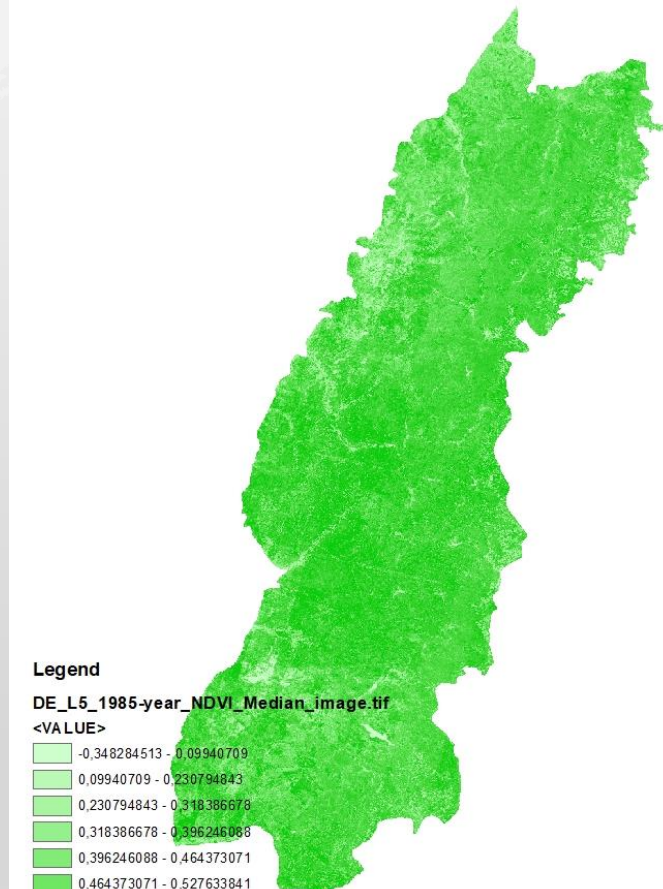
LANDSAT-5+LANDSAT-7

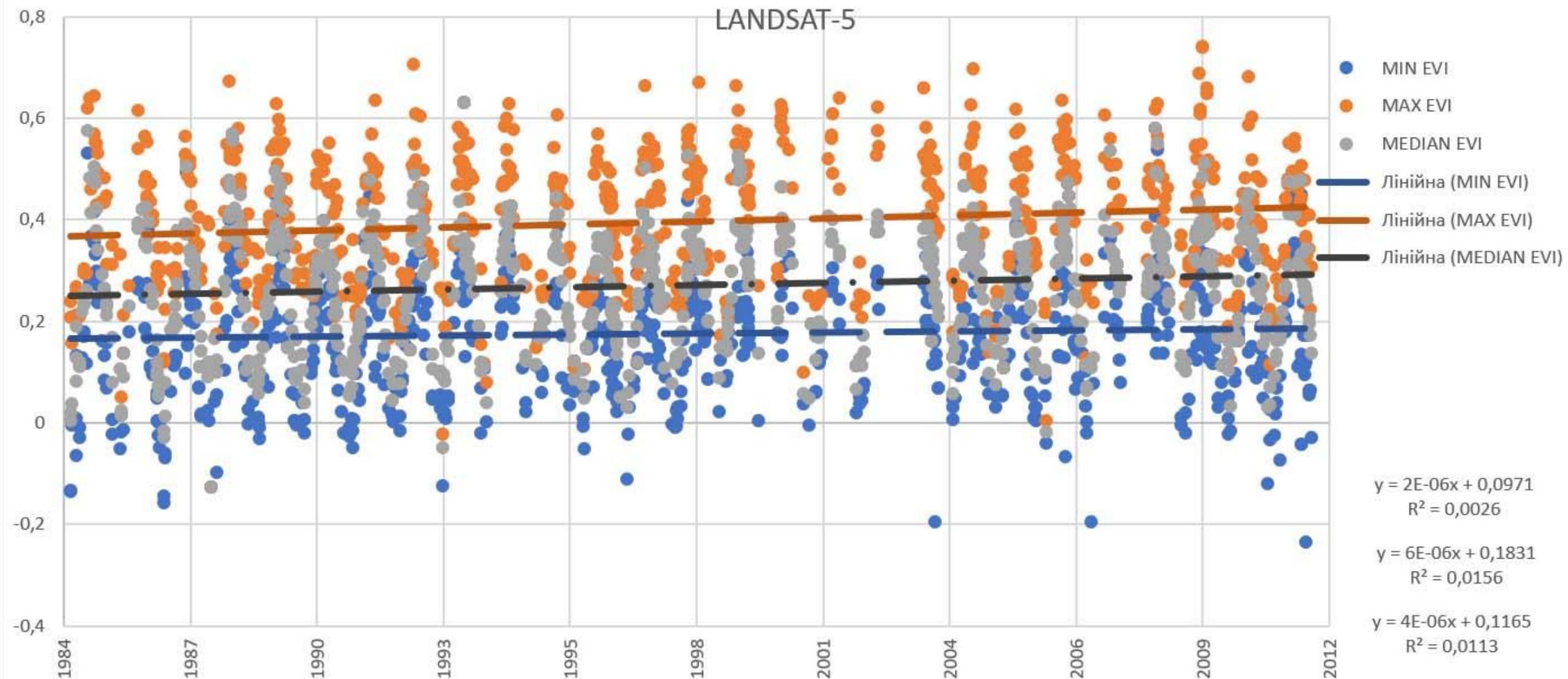


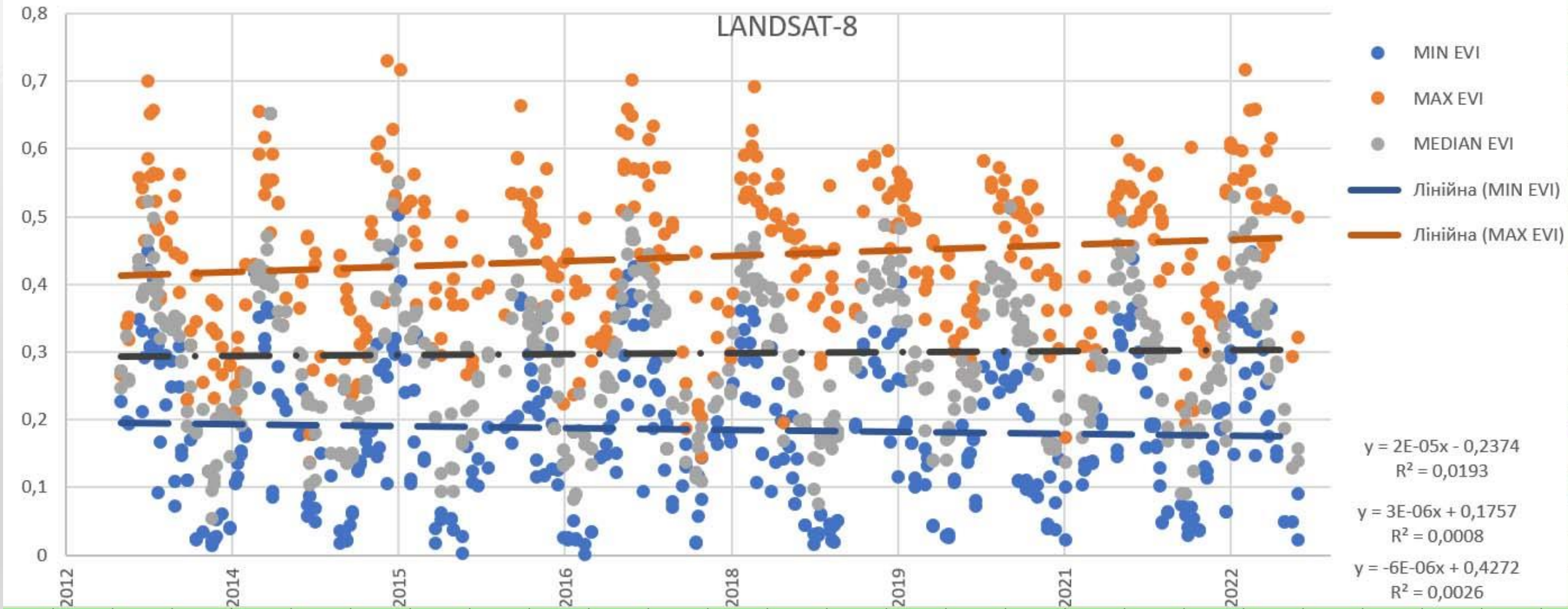
LANDSAT-8+SENTINEL-2

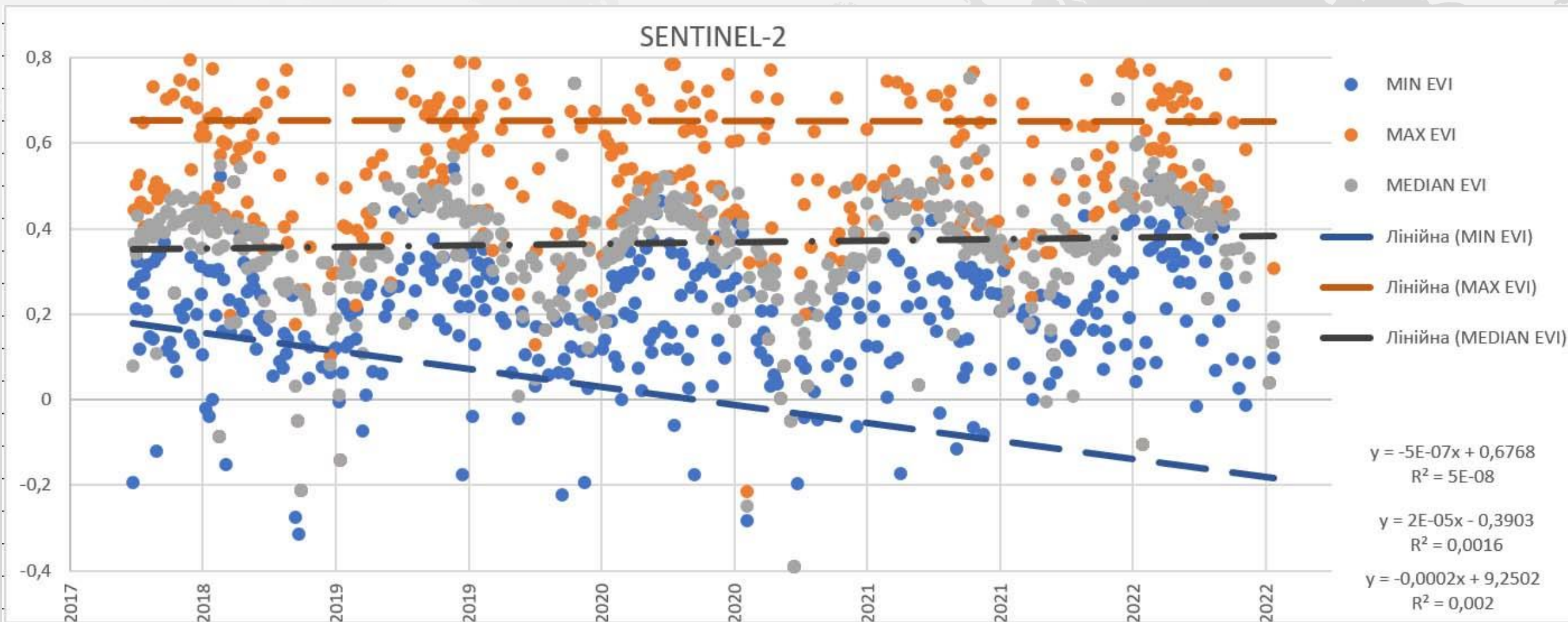




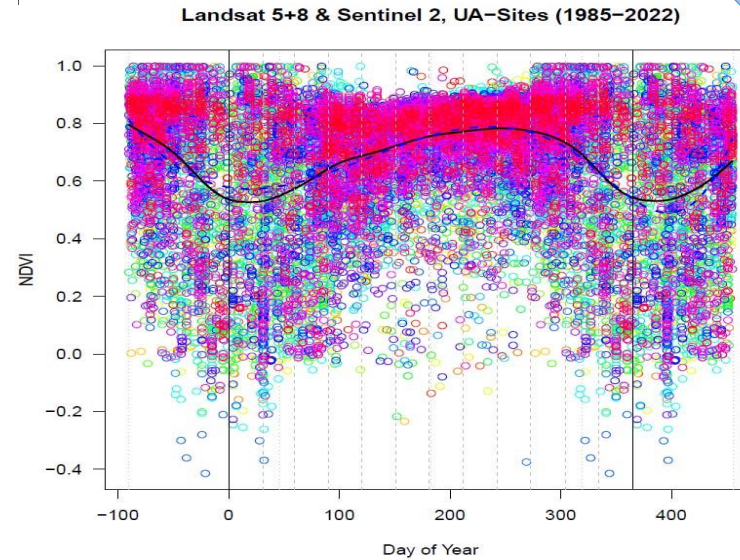
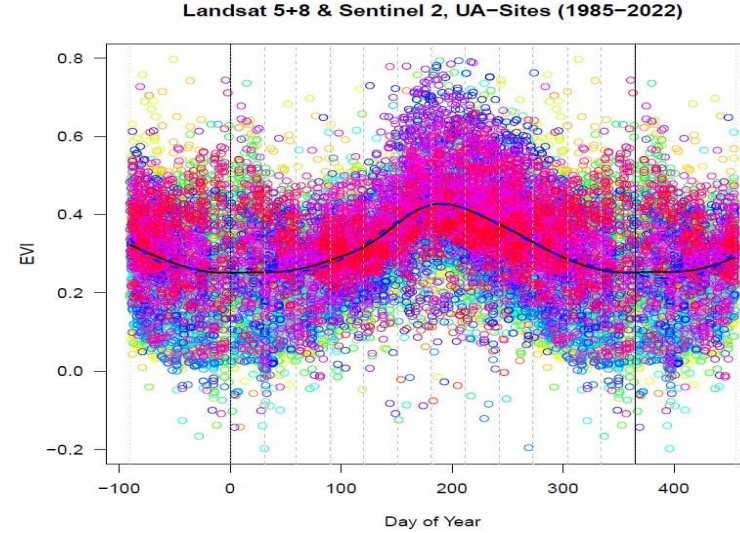
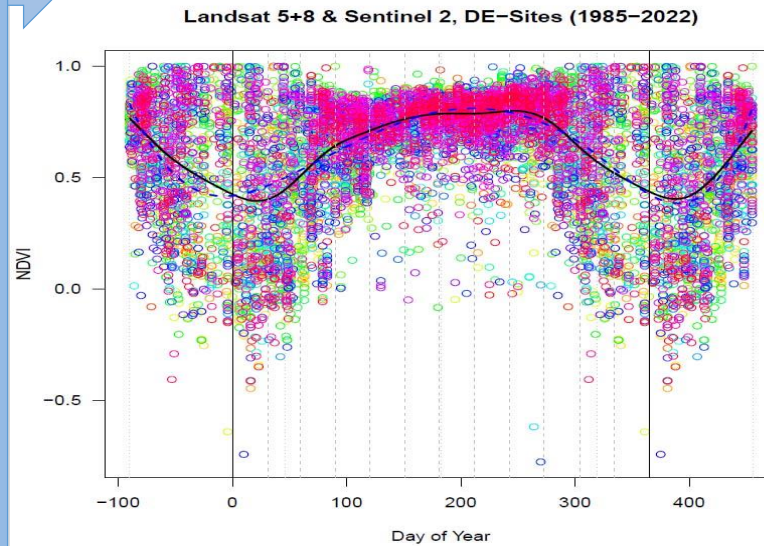
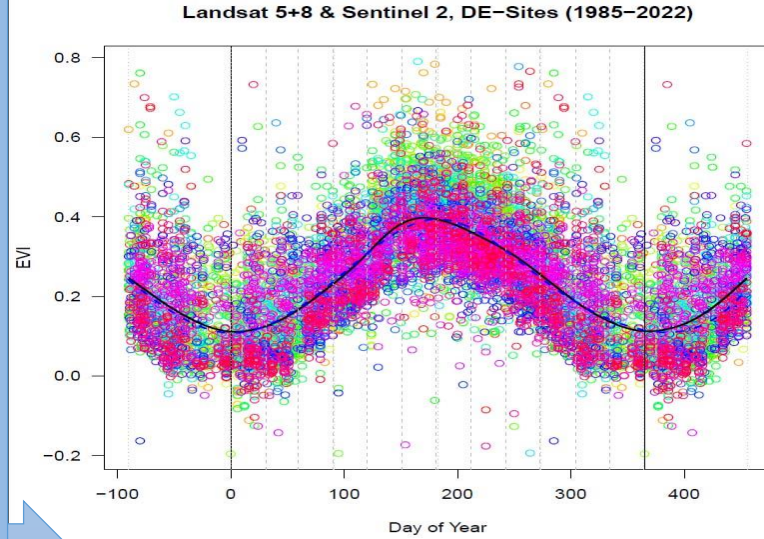




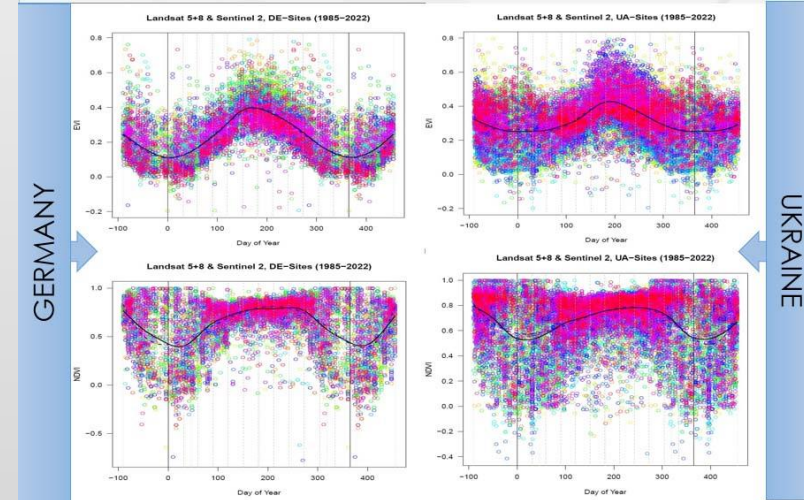




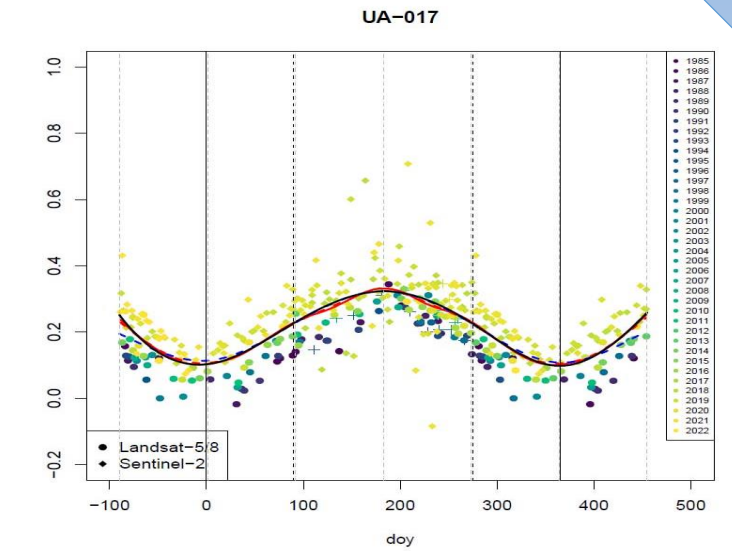
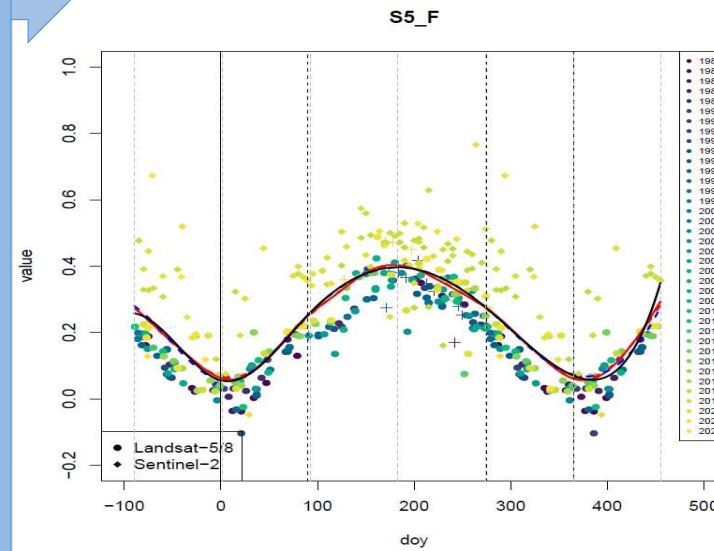
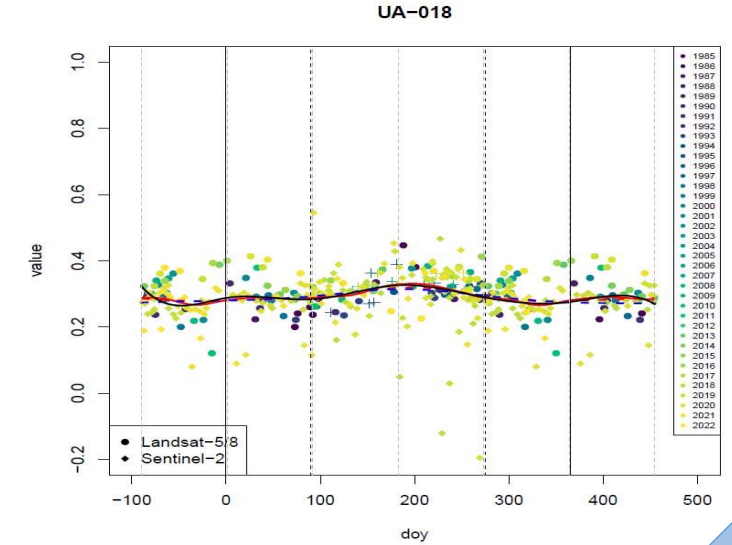
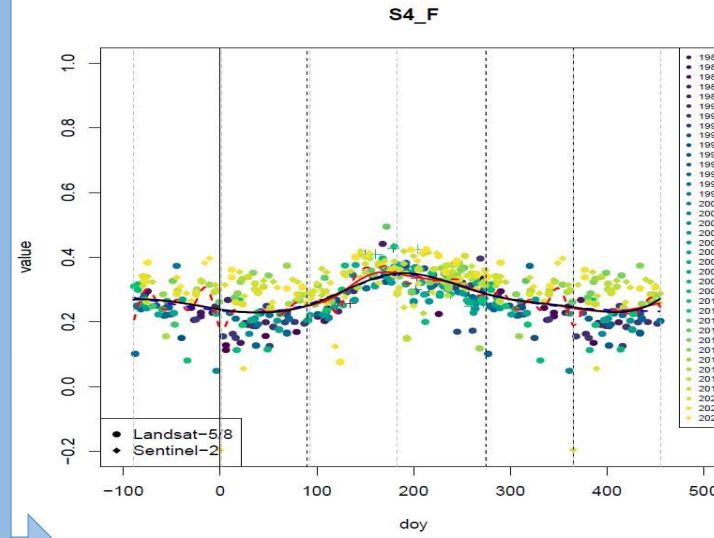
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