Regional training workshop for satellite crop monitoring using the CropWatch system

07 - 10 August 2023, Palmar Conference Center, Ambre Hotel, Mauritius

Introduction to CropWatch Explore

Dr. Hongwei Zeng, Dr. Miao Zhang, Prof. Bingfang WU

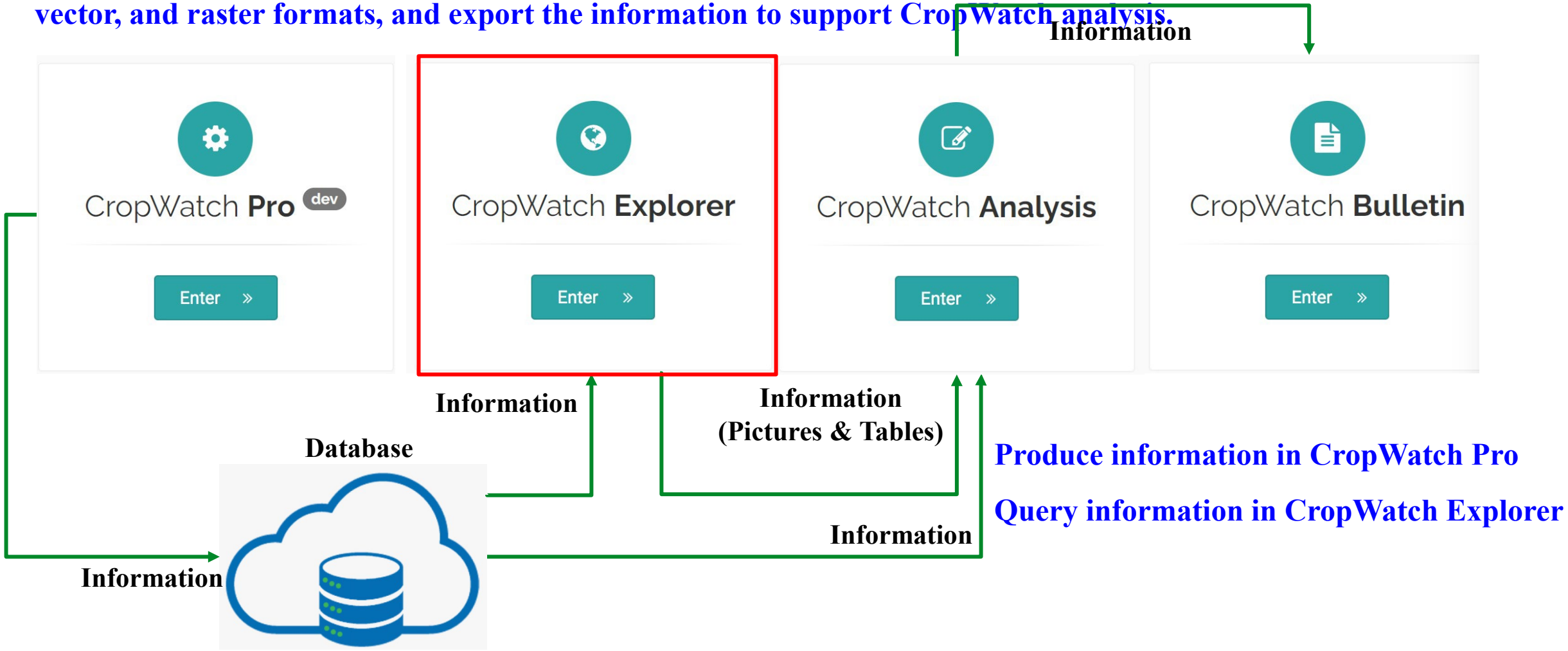
On behalf of CropWatch Team of AIR CAS

Outline

- **What’s the CropWatch Explorer**
- Special products within CropWatch Explorer
- Information at MPZ level
- Information at MRU level
- Information at Countries level
- Customize information for special Country
- Conclusion and Outlook

CropWatch Explorer

- CropWatch Explorer is an agricultural information display and query system based on Web-GIS technology.
- Users can use CropWatch Explorer to read the information generated by CropWatch Pro, display it in tabular, vector, and raster formats, and export the information to support CropWatch analysis.



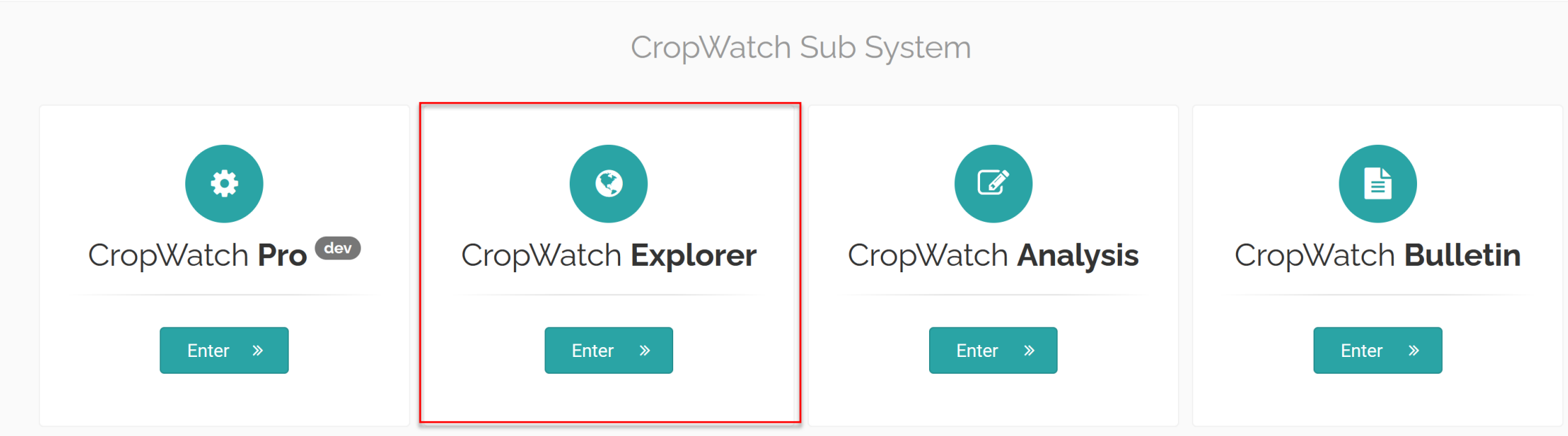
CropExplorer's mission

1. Provide data-based service for agricultural analysis of CropWatch Bulletins
2. Provide customized agricultural information (information + knowledge) for users' decision making
3. Change from information provider to food security solution provider

CropWatch Explorer

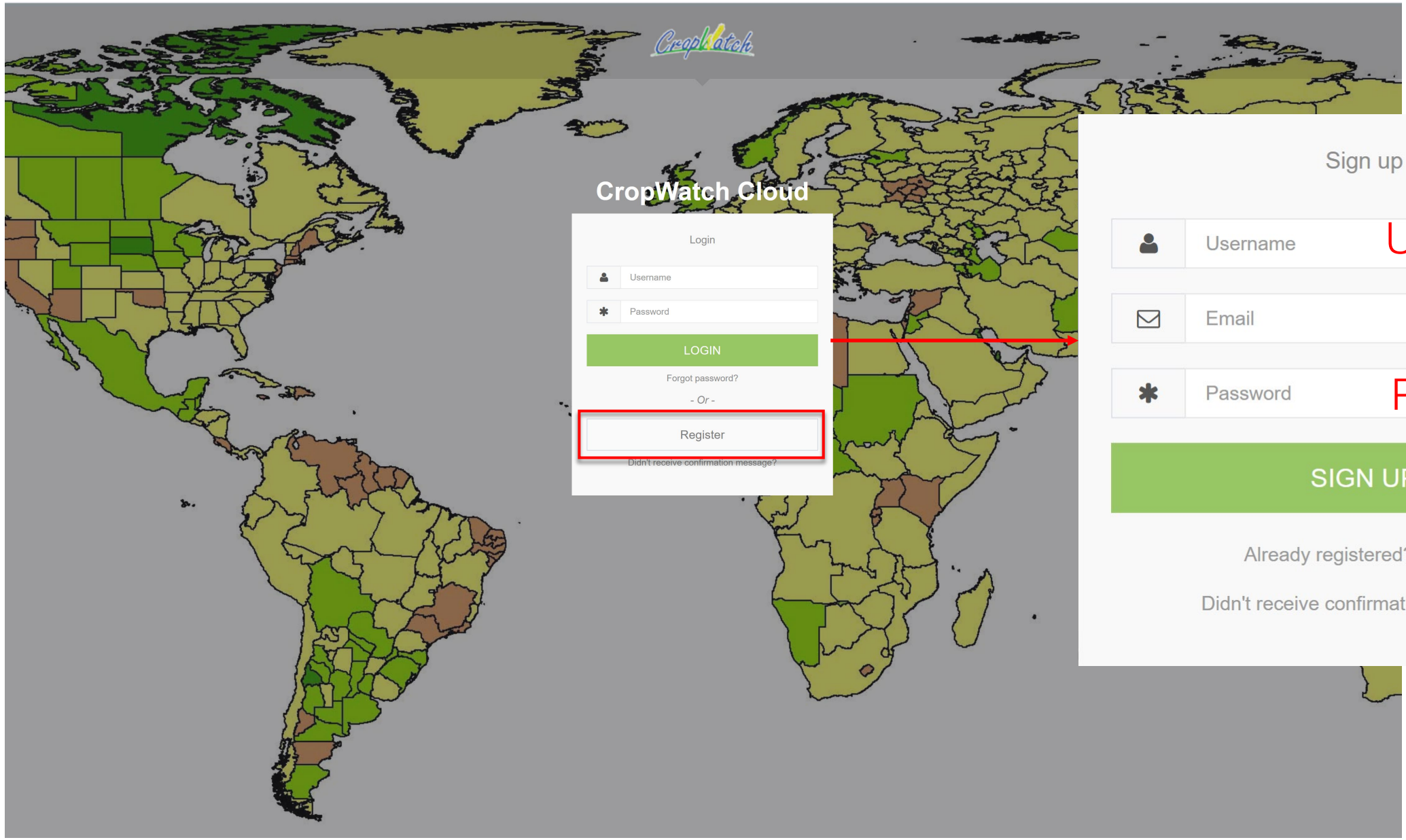
- **Visiting address[Training Course]**

  http://cloud.cropwatch.com.cn/

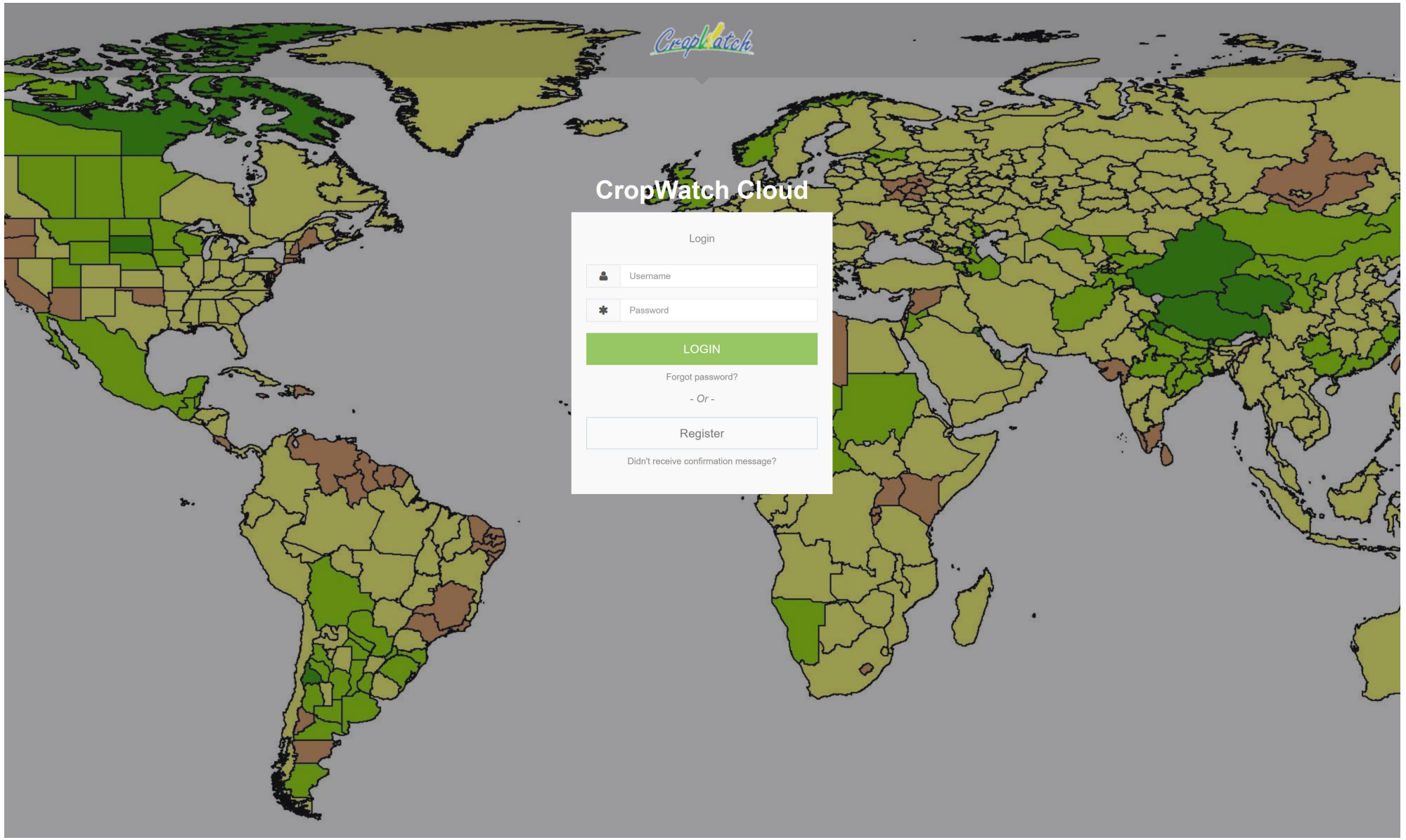


Click

CropWatch Explorer-Register



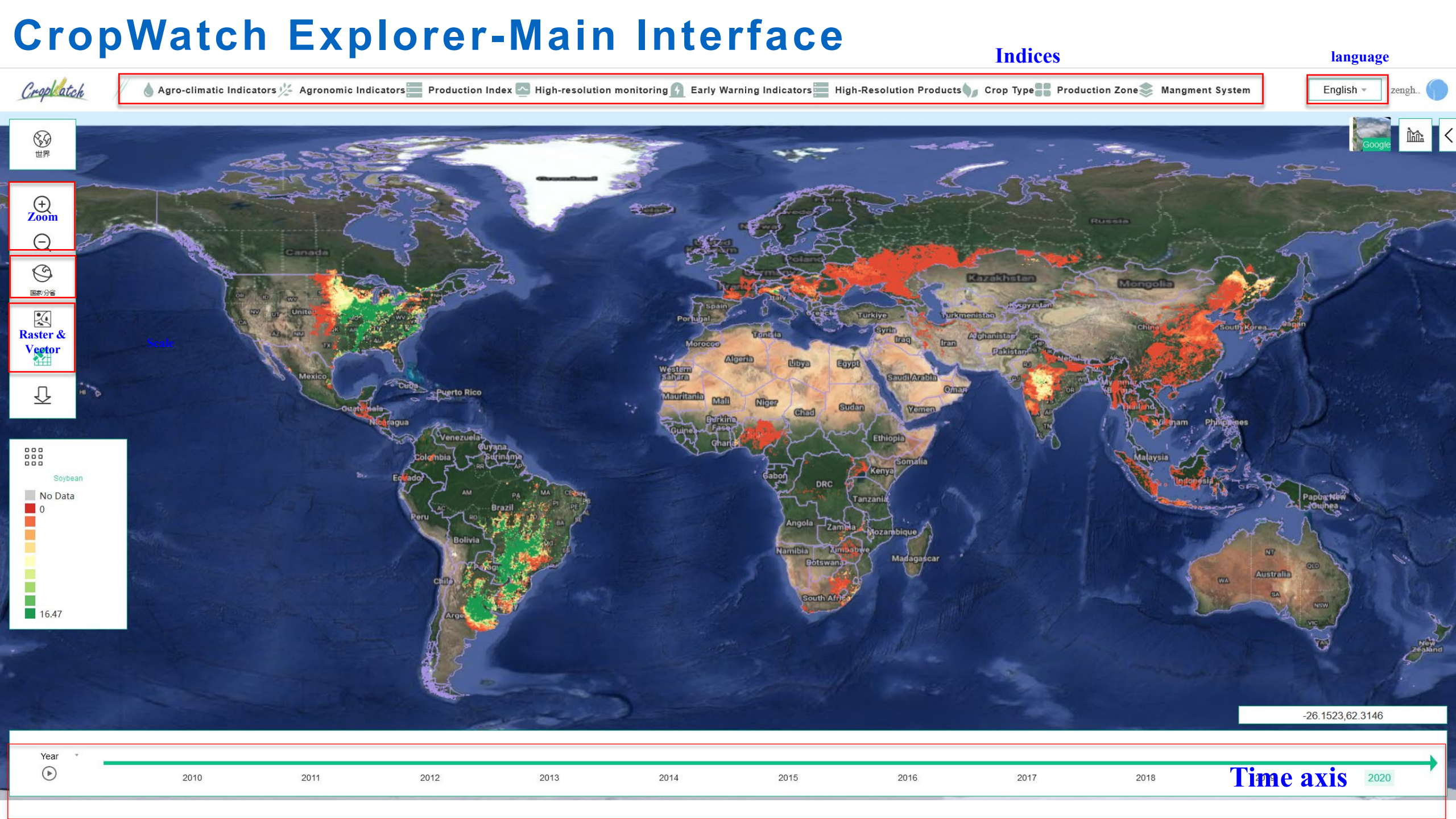
CropWatch Explorer-Log in



Username

Password

CropWatch Explorer-Main Interface

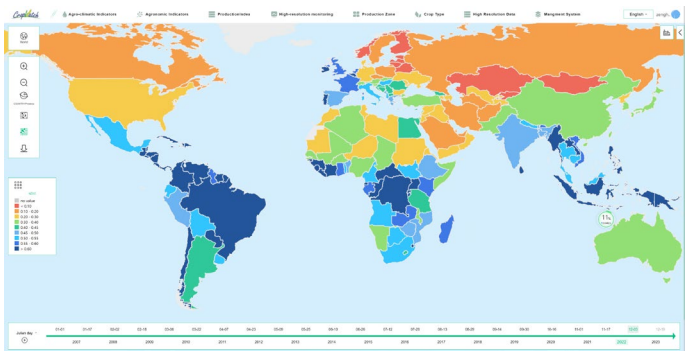


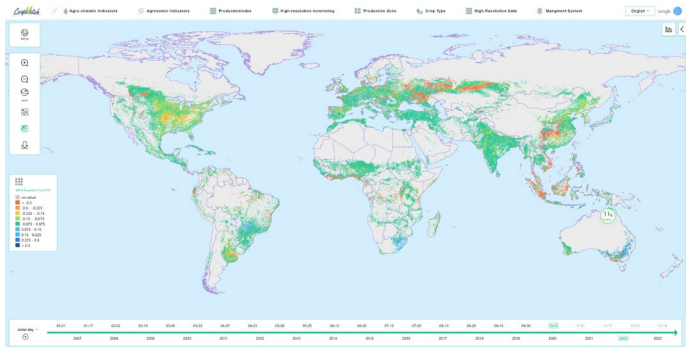
Information types of CropWatch-Explorer

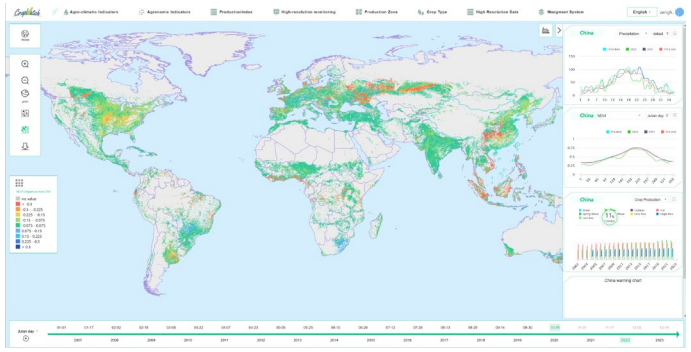
Information categories: agri-climatic, agronomic, production

Type of information visualization: vector, raster, cluster

4 spatial scale: major production zones, map reporting unit, countries, sub-countries







CropWatch-Explore

Scale Type

Crop Type

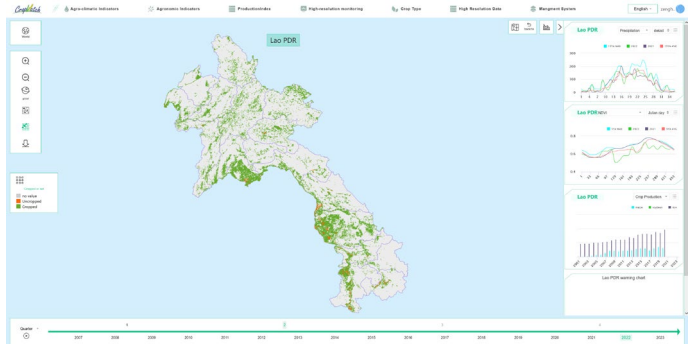
Visual Type

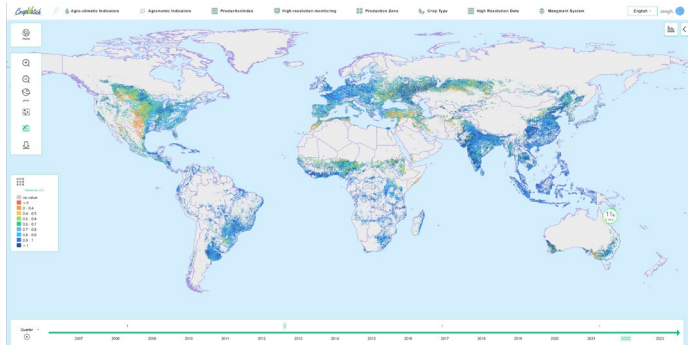
MPZ | MRU | Country | Sub-Country | Wheat | Maize | Rice | Soybean | Vector | Raster | Cluster

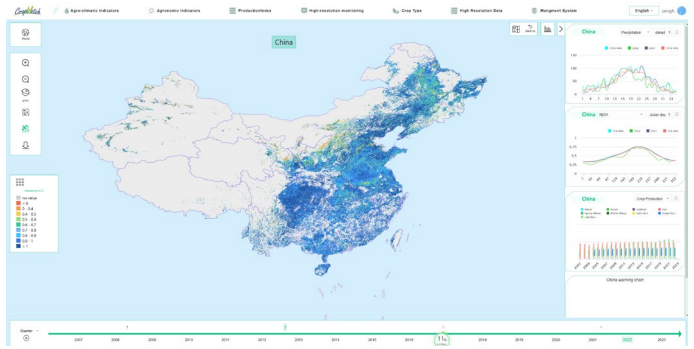
RAIN | TEMP | PAR | BIOMASS

NDVI | VCIx | VHI | CALF | CI

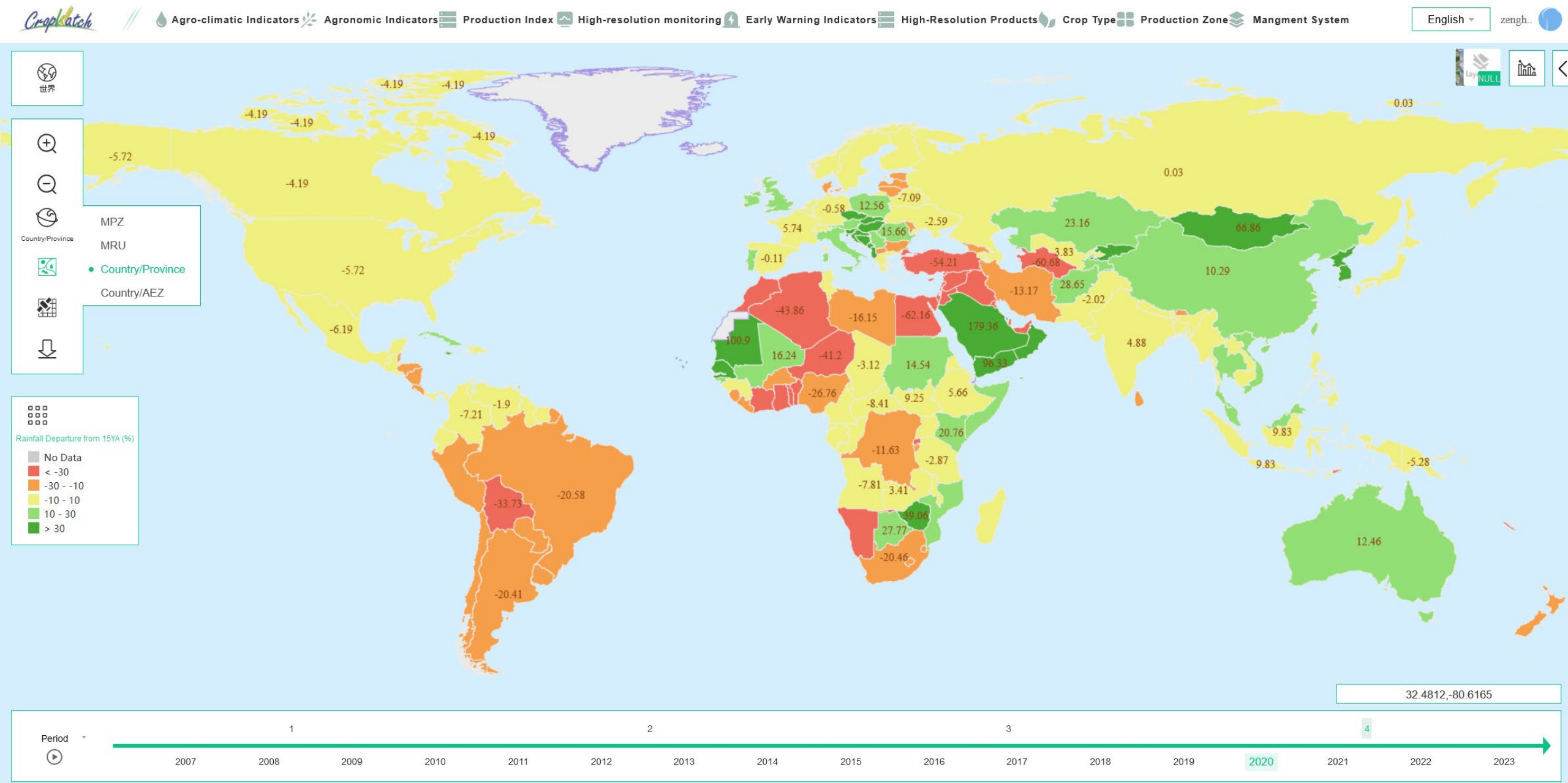
Area | Yield | Production | Early warning | Price



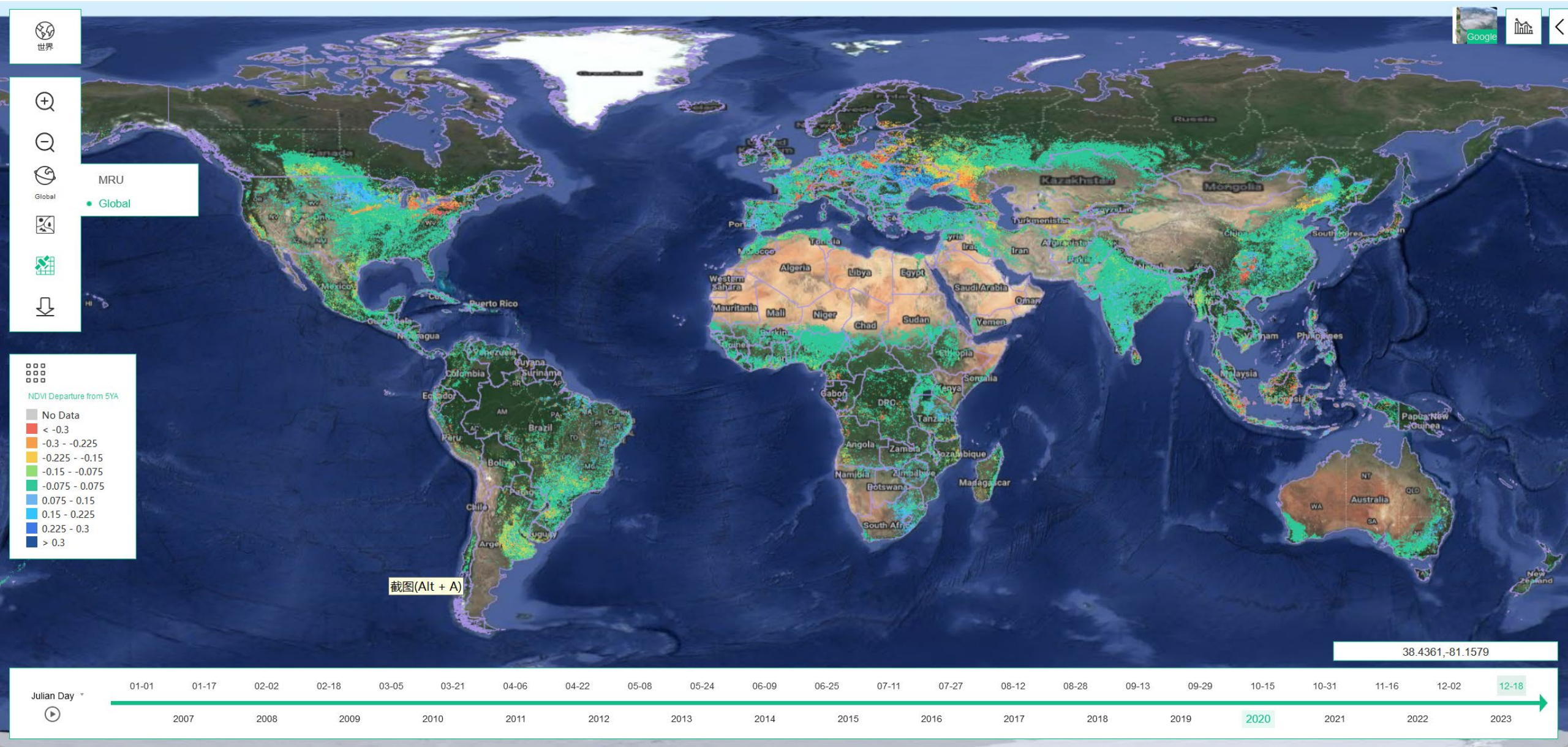




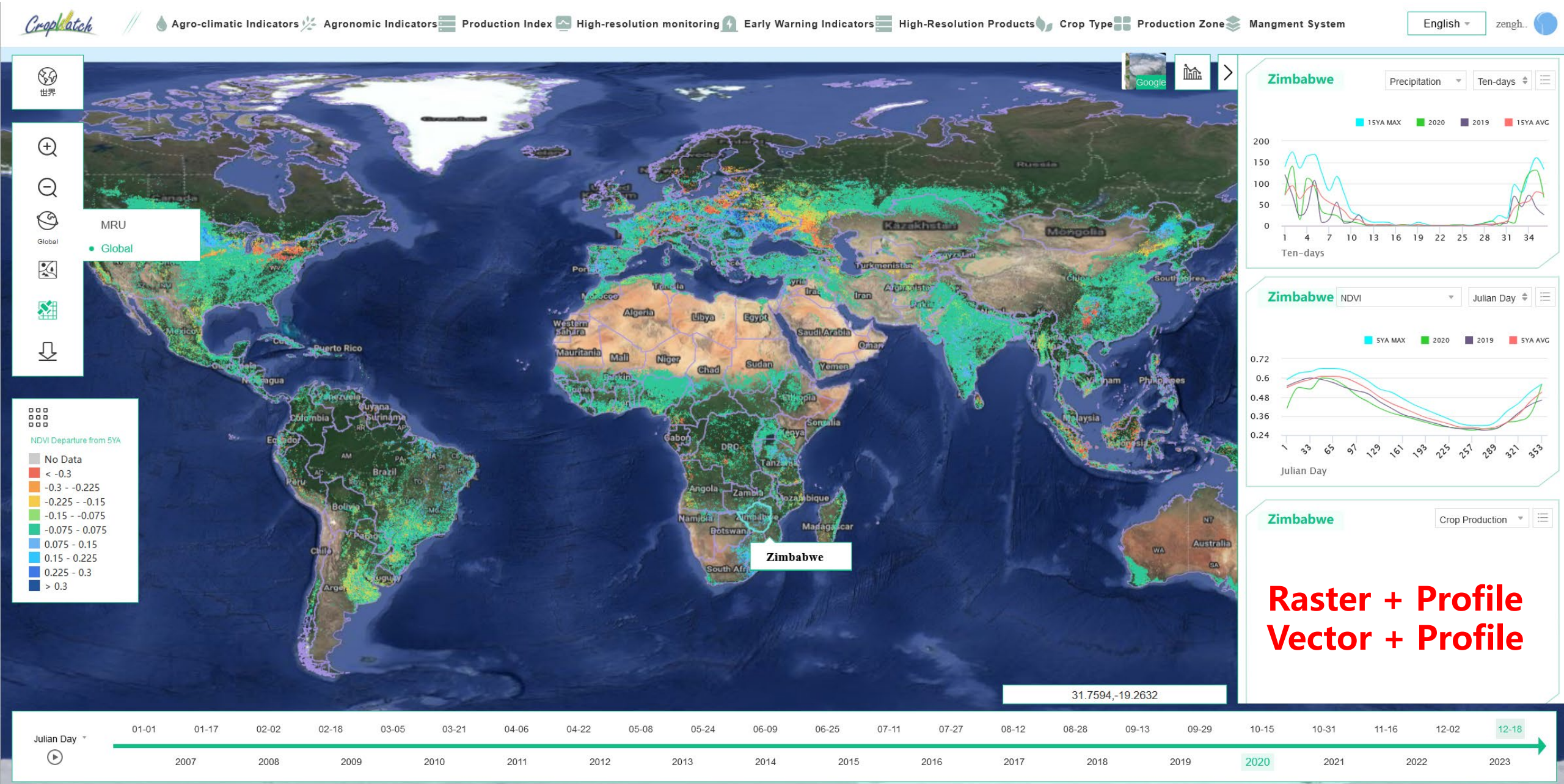
CropWatch Explorer-Vector(Polygon)



CropWatch Explorer-Raster(Pixel)

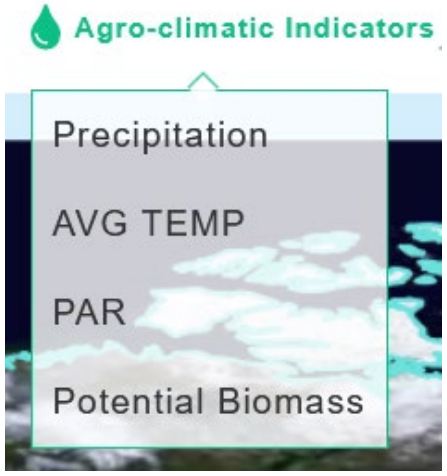


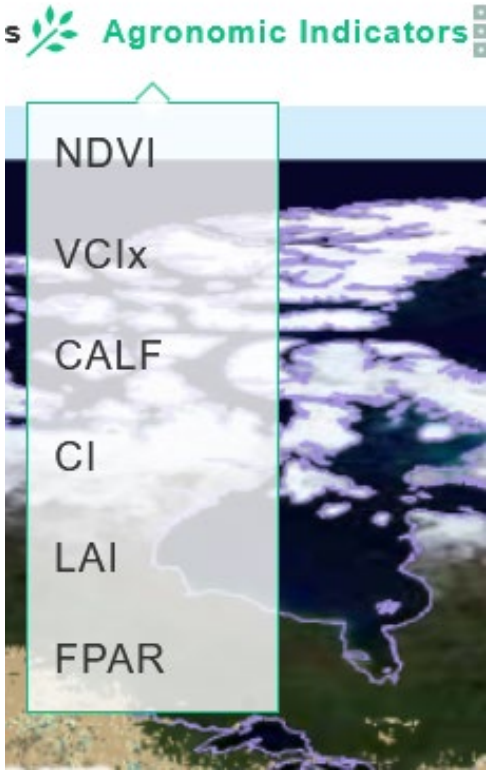
CropWatch Explorer-Cluster

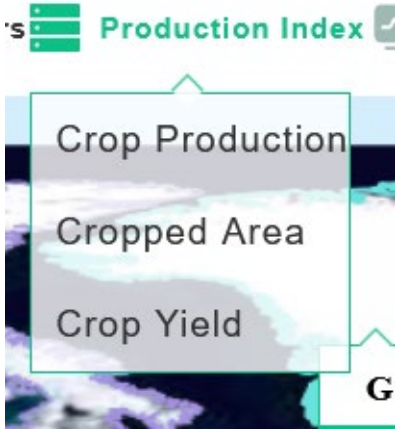


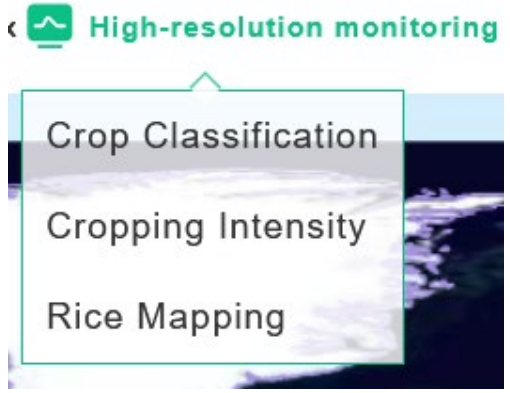
Summary of Indicators

- Agri-climatic Indicators: RAIN, TEMP, PAR, BIOMASS
- Agronomic Indicators: NDVI, VCIx, CALF, CI, LAI, FPAR
- Production Index: Crop production, cropped area, crop yield
- Early Warning Indicators: CPI
- High-resolution monitoring: crop classification, cropping intensity, rice mapping









Agri-climatic indicators

RAIN: accumulated rain within reporting period, departure of the rain is percent departure of the value for the reporting period compared to the recent 15 years average.

- Departure > 10%, meaning wet condition
- Departure < 10%, meaning dry condition
- Departure is between -10% and 10%, meaning close to normal

$$Rain_{Dep} = \frac{Rain_{cur\_season} - Rain_{15years\_avg}}{Rain_{15years\_avg}} \times 100\%$$

TEMP: average temperature (℃) within reporting period, departure of temp is the difference between TEMP value over the reporting period compared with the average of the recent 15 years average.

- Departure > 0.5℃, meaning heat stress
- Departure < 0.5℃, meaning cold stress
- Departure is between -0.5℃ and 0.5℃, meaning abnormal

$$TEMP_{Dep} = TEMP_{cur\_season} - TEMP_{15years\_avg}$$

RADPAR : accumulated PAR within reporting period (W/m^2,) departure of PAR is the percent departure of the RADPAR value for the reporting period compared to the recent 15 years average. [ENERGY stress]

$$PAR_{Dep} = \frac{PAR_{cur\_season} - PAR_{15years\_avg}}{PAR_{15years\_avg}} \times 100\%$$

Biomass: accumulated Biomass (dry gram, g/m^2), is shown as the percent departure of the Biomass value for the reporting period compared to the recent 15 years average.

$$BIO_{Dep} = \frac{BIO_{cur\_season} - BIO_{15years\_avg}}{BIO_{15years\_avg}} \times 100\%$$

Agronomic indicators

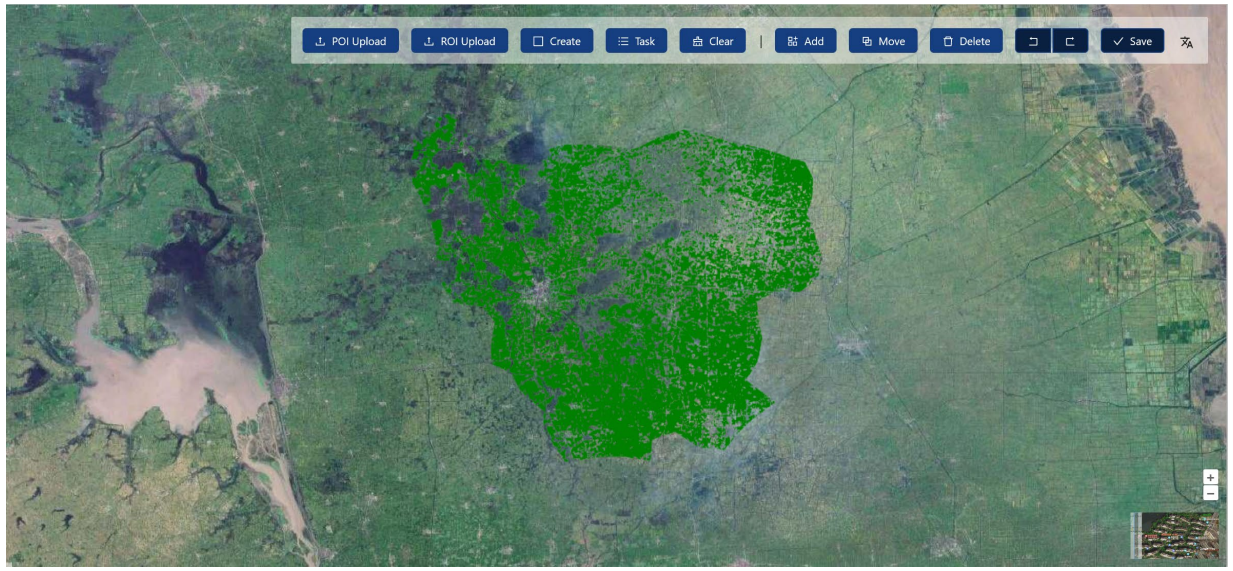
- **Normalized Difference Vegetation Index (NDVI):** An estimate of the density of living green biomass, it is widely used as indicator for crop condition.
- **Maximum Vegetation Condition Index (VCIx):** Vegetation condition of the current season compared with historical data. Values usually are [0, 1], where 0.5 is "NDVI as bad as the average" and 1 is "NDVI as good as the best recent year."
- **Cropped Arable Land Fraction (CALF):** The area of cropped arable land as fraction of total (cropped and uncropped) arable land. Whether a pixel is cropped or not is decided based on NDVI.
- **Cropping Intensity (CI):** CI describes the extent to which arable land is used over a year. It is the ratio of the total crop area of all planting seasons in a year to the total area of arable land.
- **Leaf area index (LAI) :** LAI is a dimensionless quantity that characterizes plant canopies. It is defined as the one-sided green leaf area per unit ground surface area (LAI = leaf area / ground area, m2 / m2) in broadleaf canopies.
- **The fraction of absorbed photosynthetically active radiation (FAPAR):** FAPAR is the fraction of the incoming solar radiation in the photosynthetically active radiation spectral region that is absorbed by a photosynthetic organism, typically describing the light absorption across an integrated plant canopy.

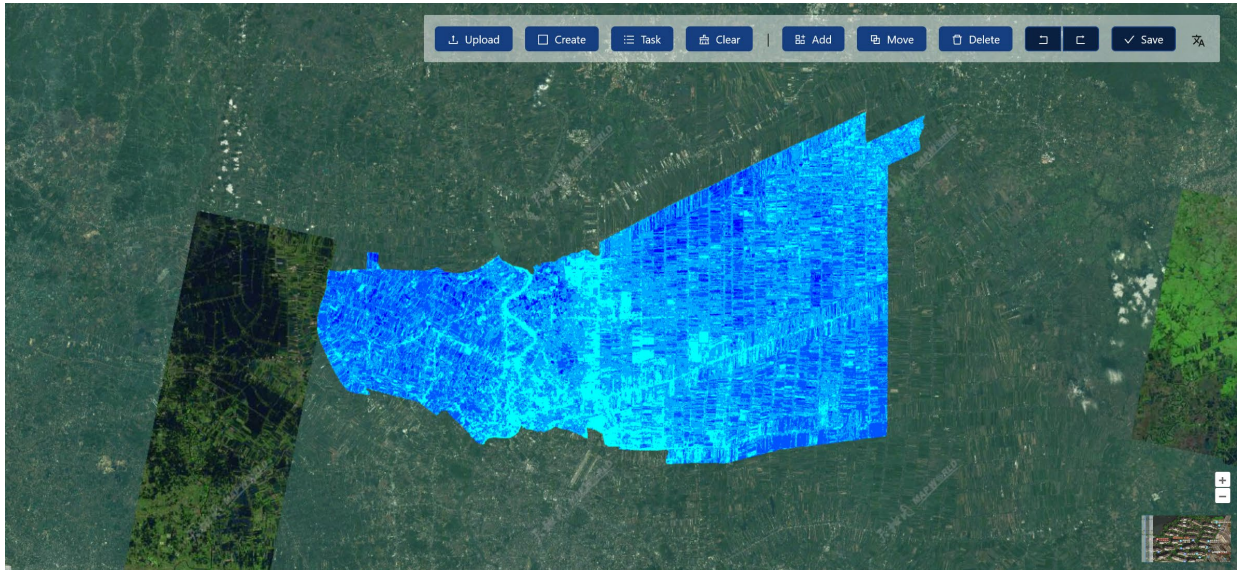
Production Index & Early Warning indicator

- **Cropped area:** It is a surface of land on which a crop is grown
- **Crop yield:** Crop yield is a standard measurement of the amount of agricultural production harvested—yield of a crop—per unit of land area.
- **Crop production:** the result of cropped area multiply crop yield.
- **CPI:** The average crop production situation for the same period in the past five years was used as a benchmark to make an overall estimate of the current season's agricultural production situation. A value of 1.0 represents the basic normal crop production situation in the current period for the spatial unit, and the higher the value, the better the crop production situation in the current period. Conversely, the lower the value, the worse the crop production situation for the spatial unit in the current period.

Indicators of High-resolution monitoring

- Crop classification
- Cropping intensity
- Rice mapping

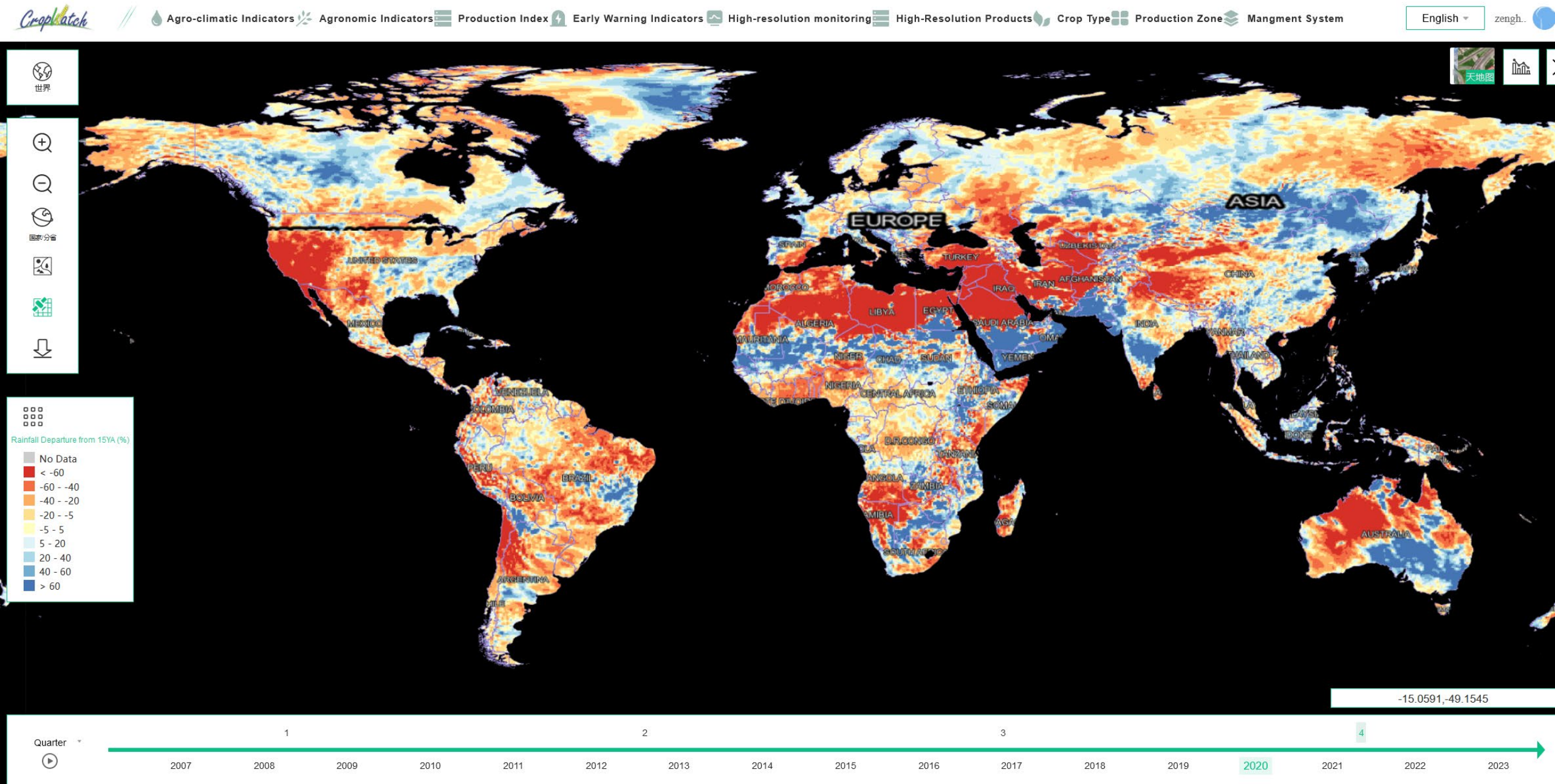




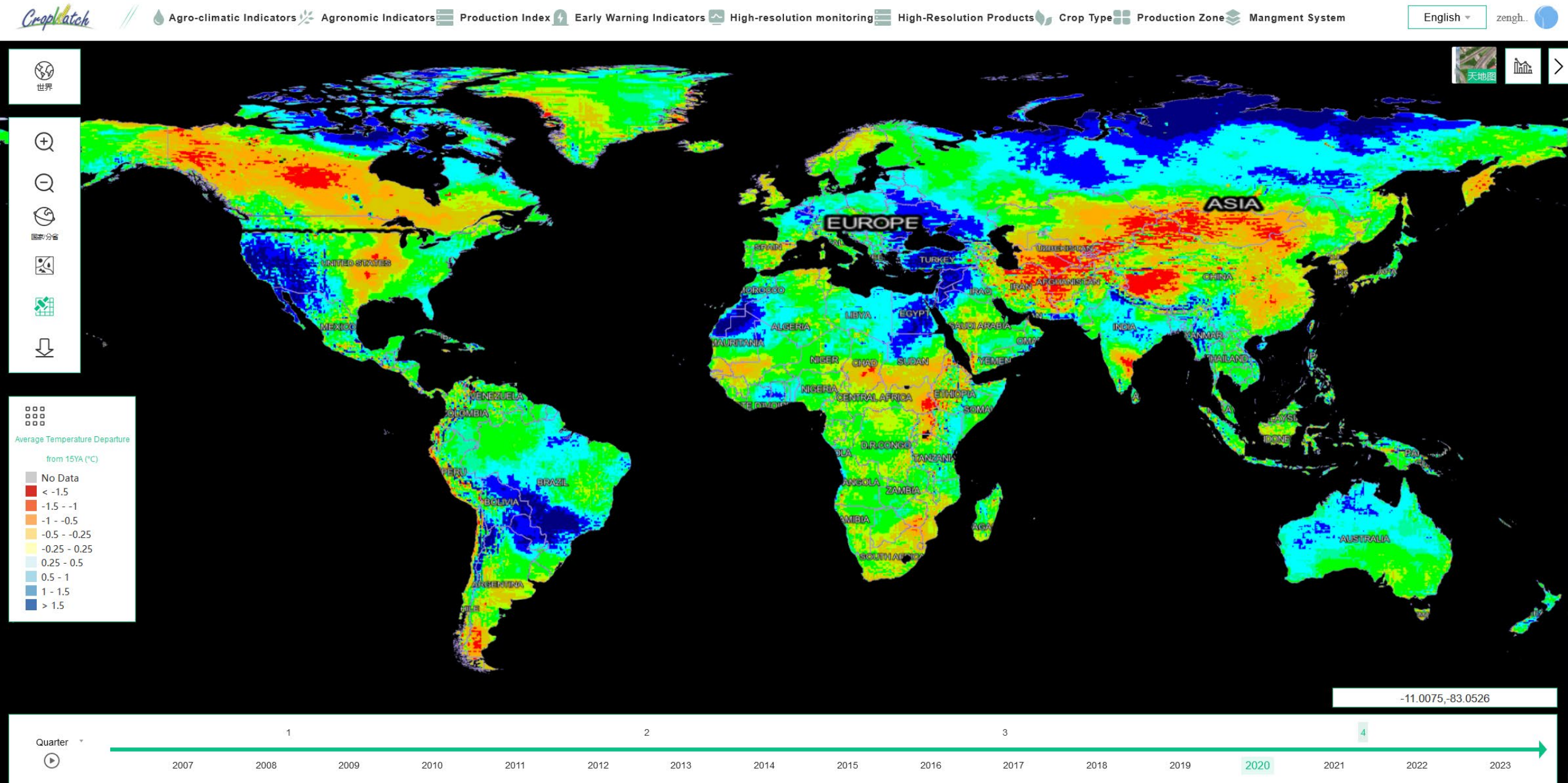
Outline

- What’ s the CropWatch Explorer
- **Special products within CropWatch Explorer**
- Information at MPZ level
- Information at MRU level
- Information at Countries level
- Customize information for special Country
- Conclusion and Outlook

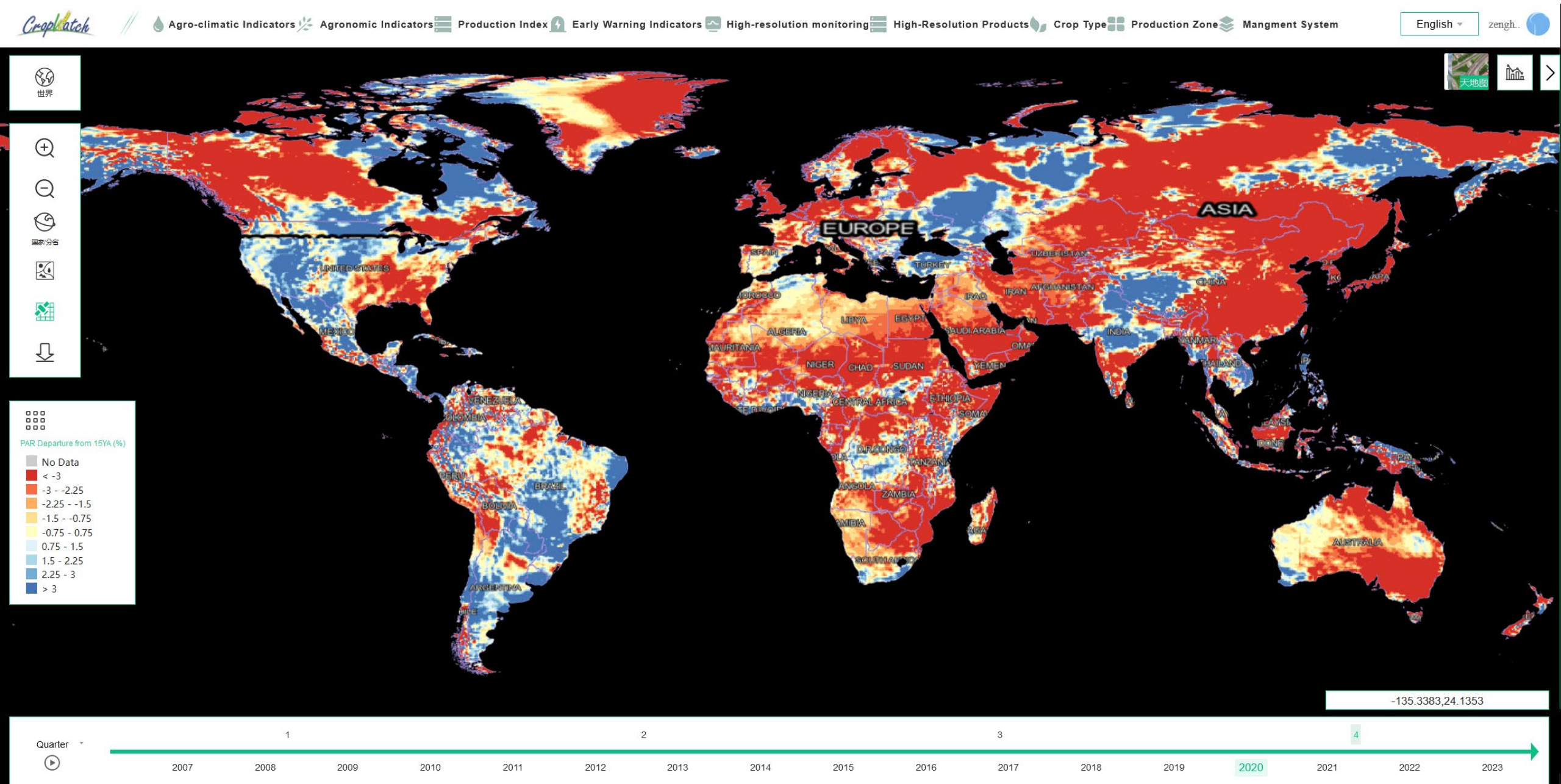
Products-Precipitation



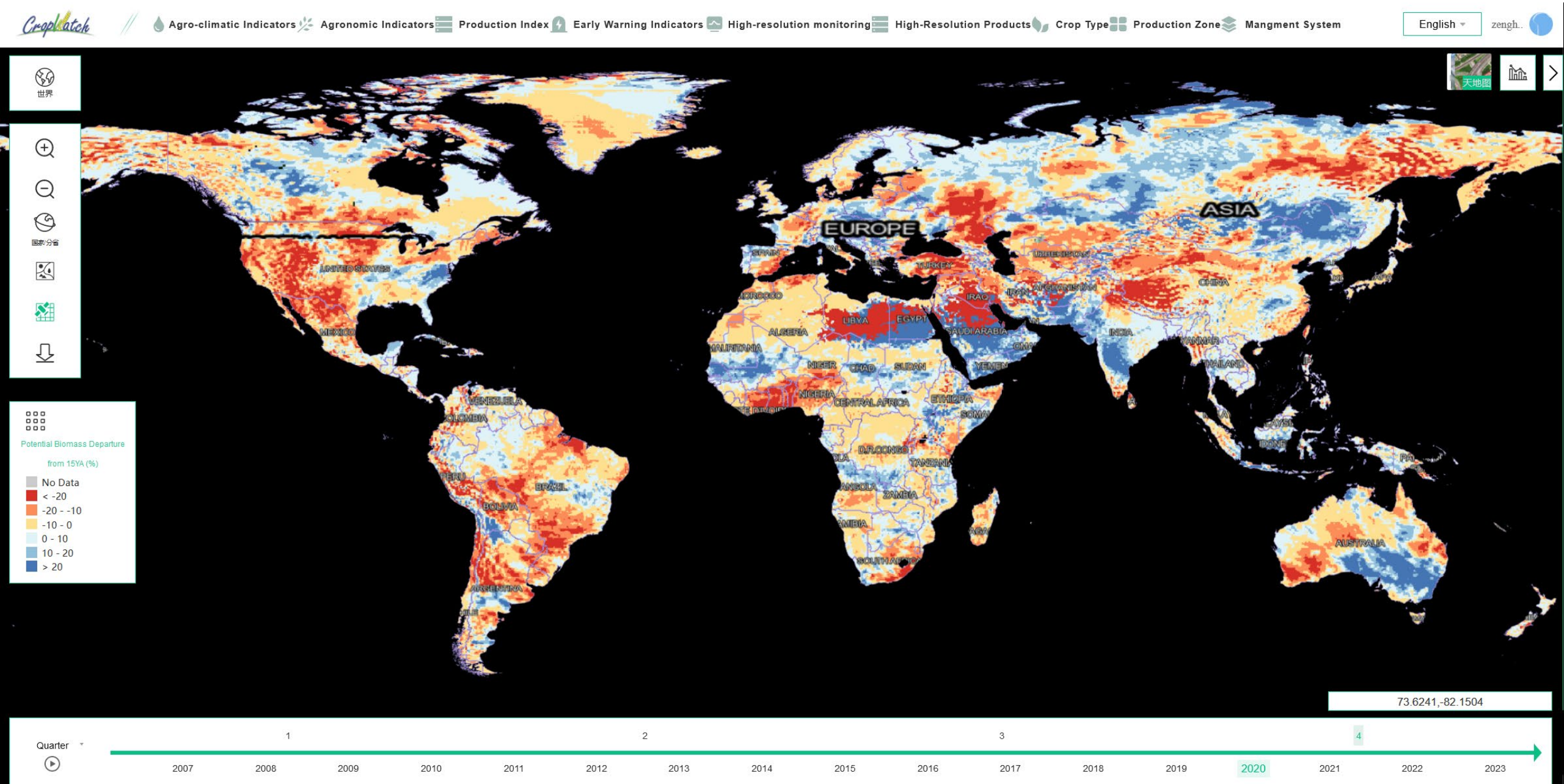
Products-TEMP



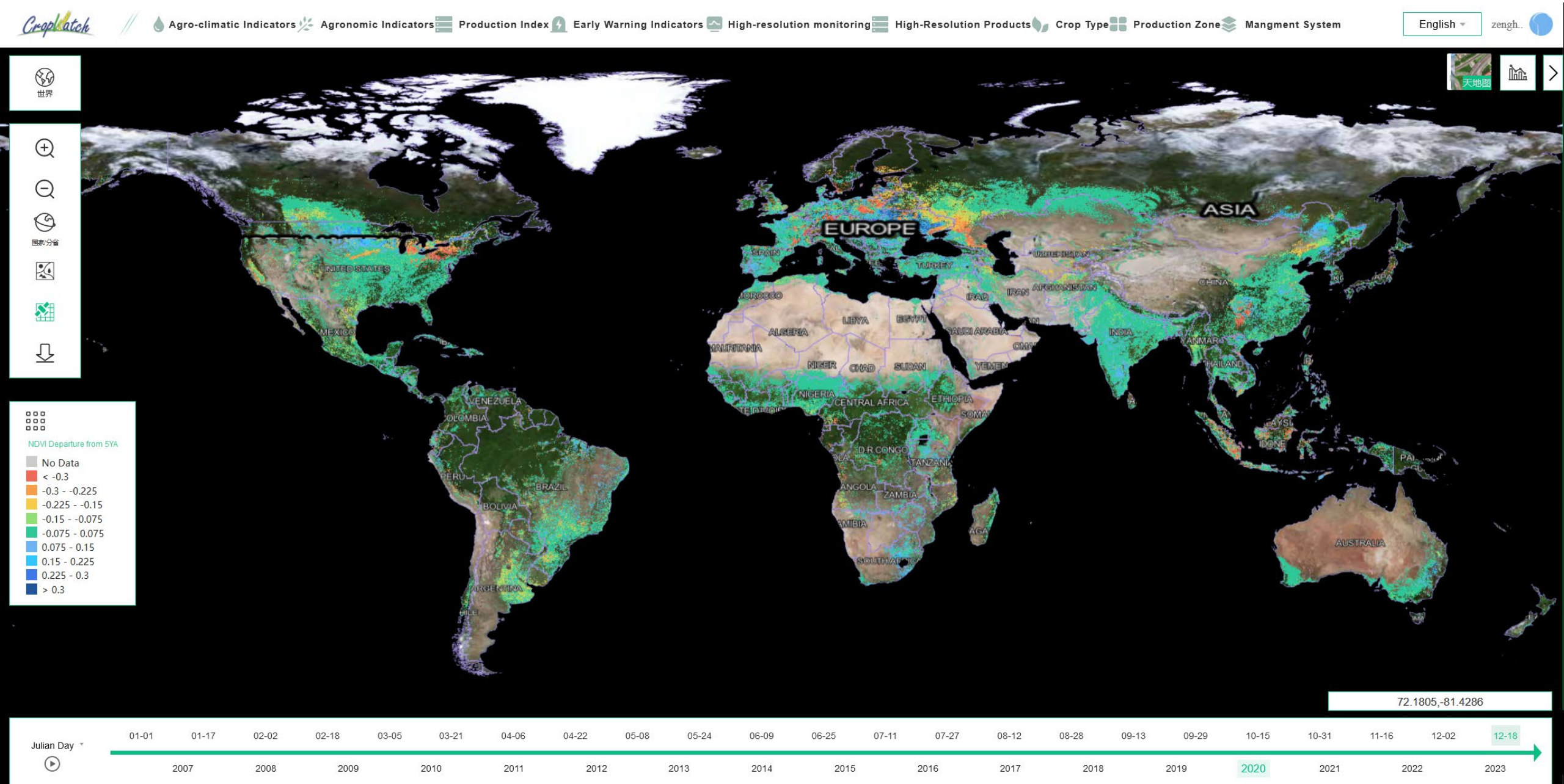
Products-PAR



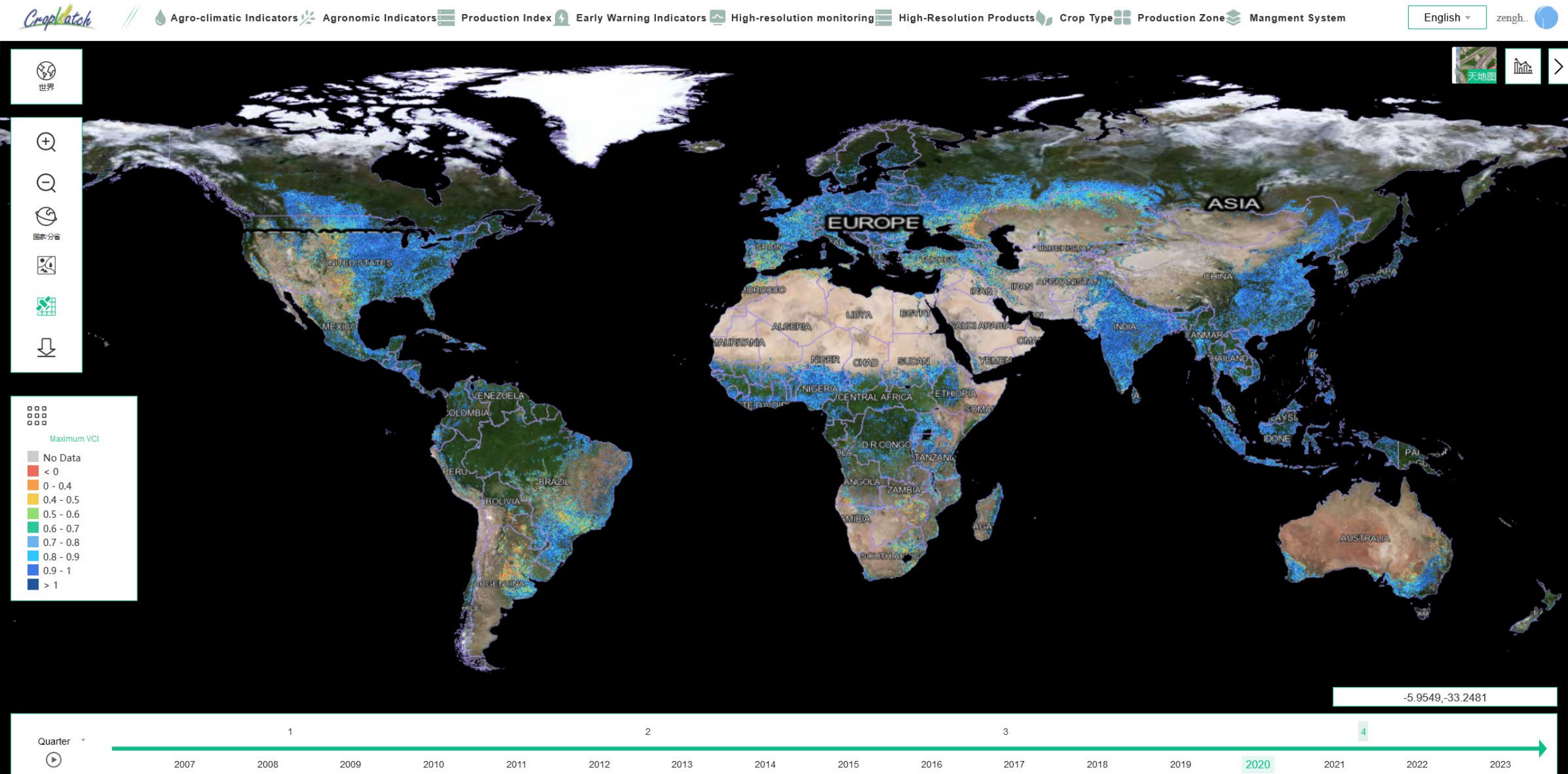
Products-Potential Biomass



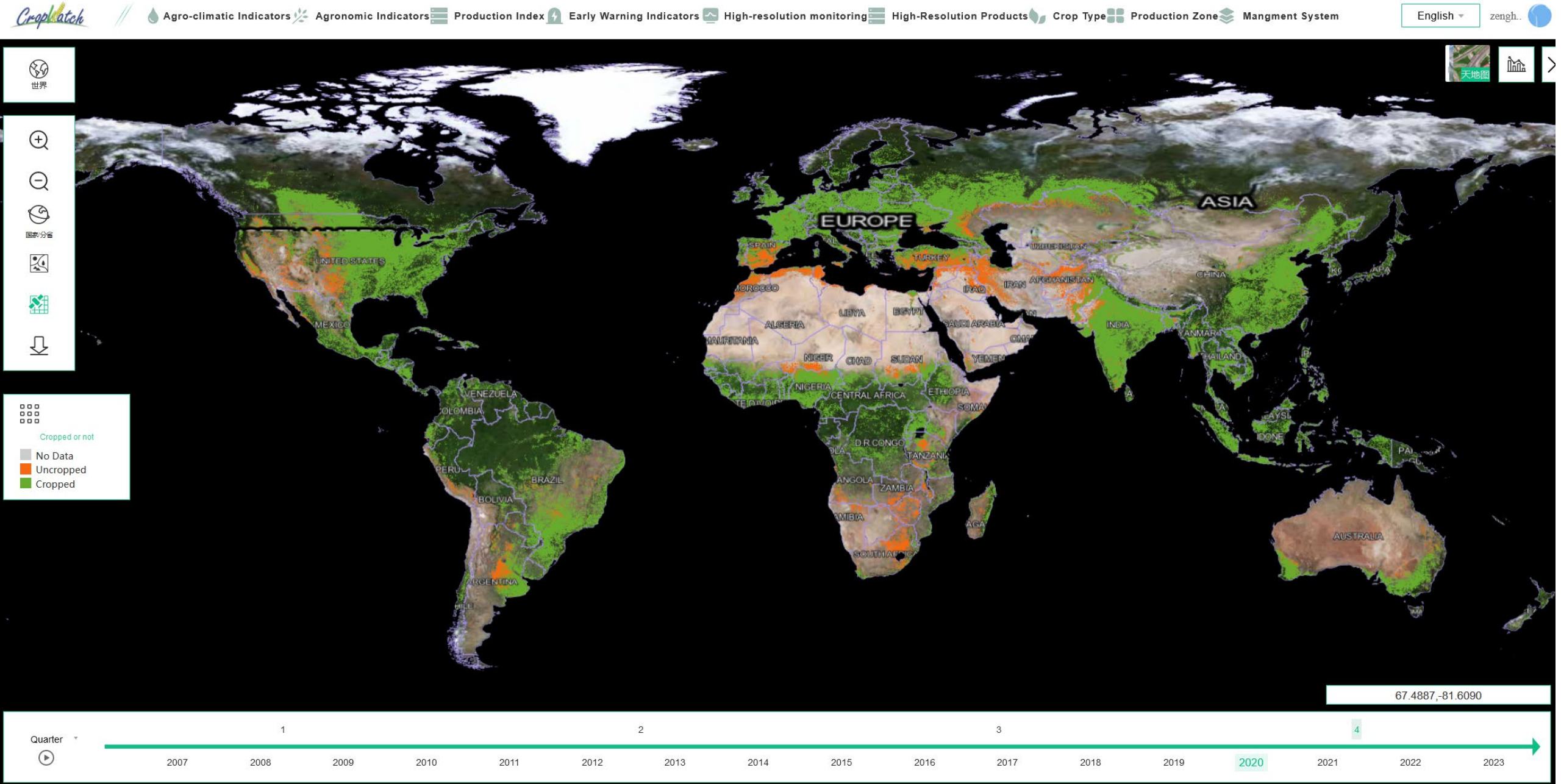
Products-NDVI



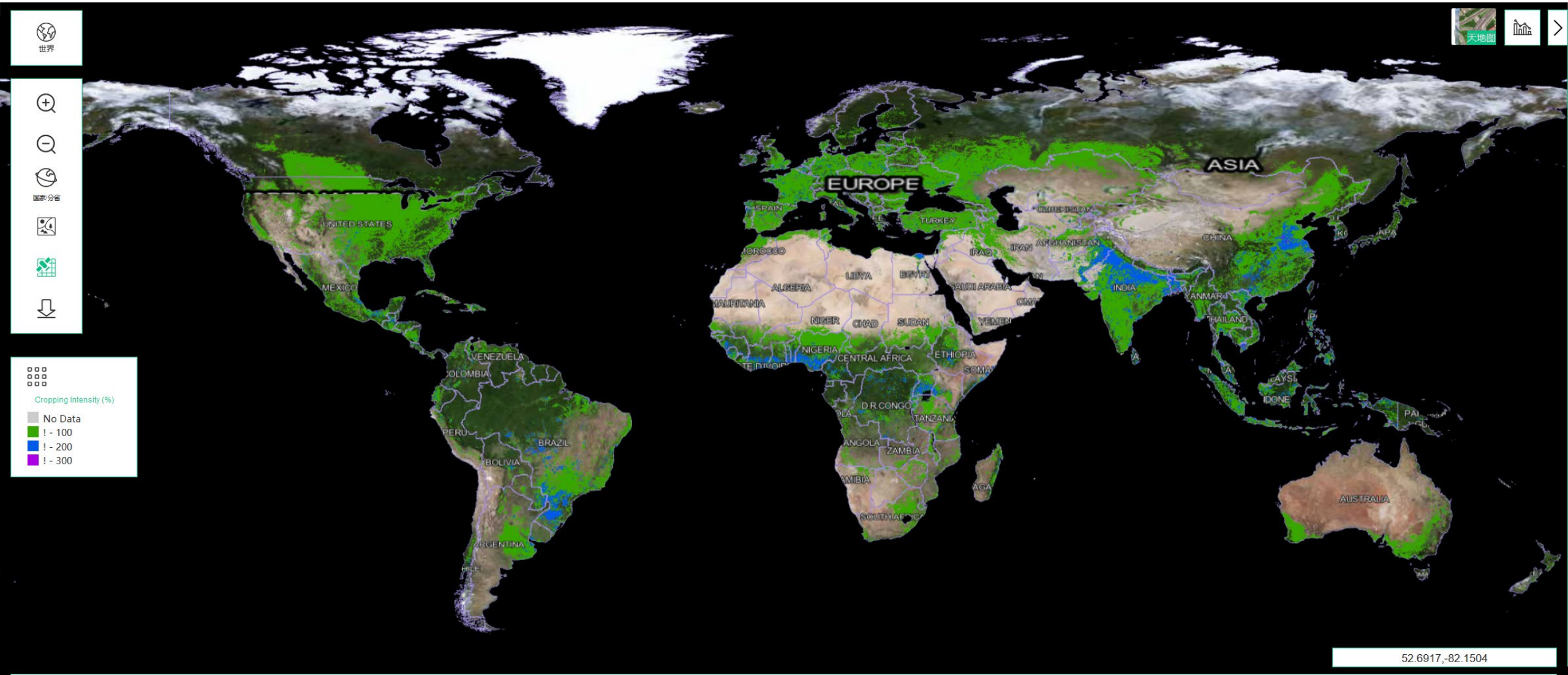
Products-VCIx



Products-Cropped Arable Land Fraction(CALF)



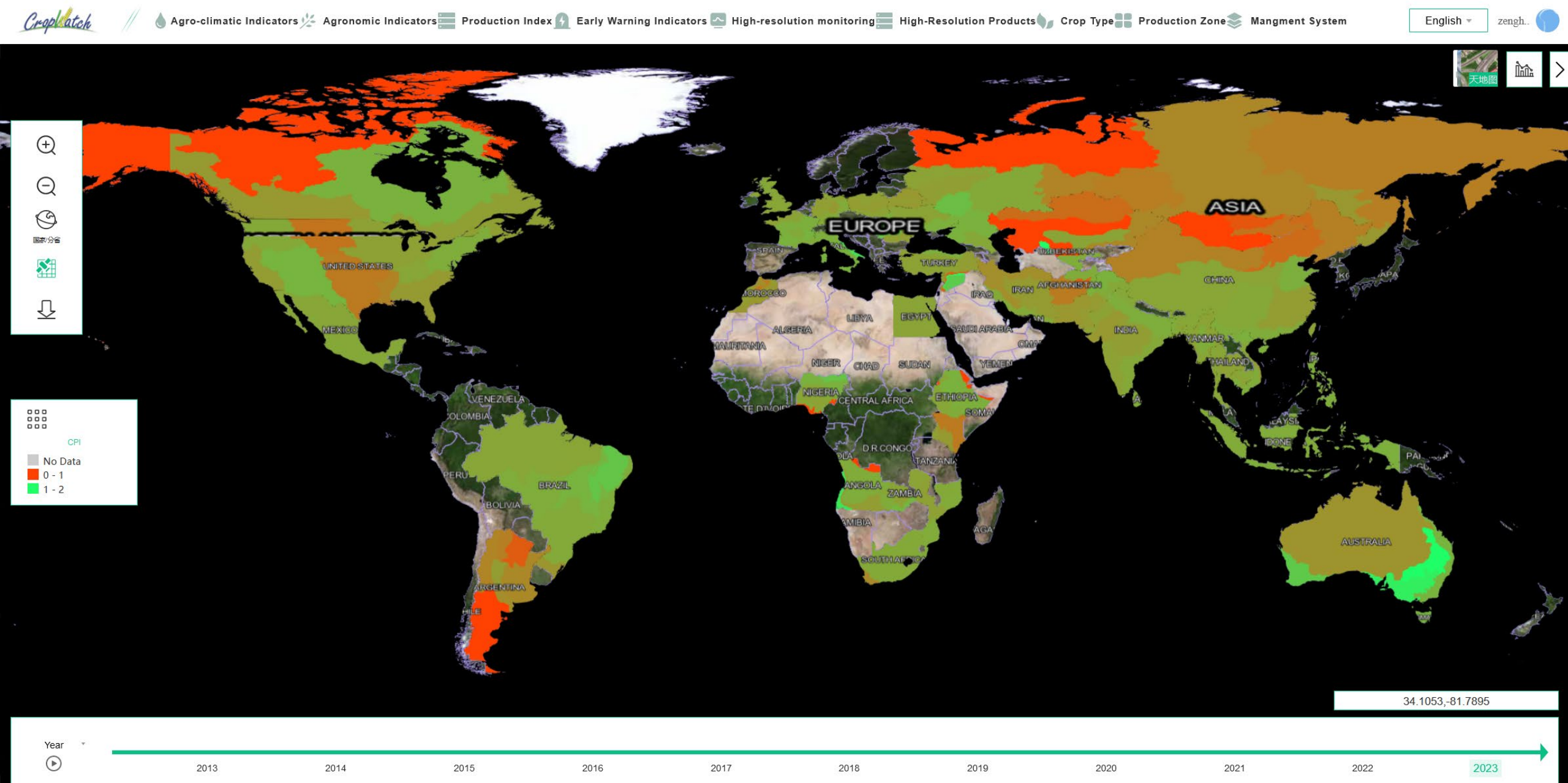
Products-Cropping Intensity



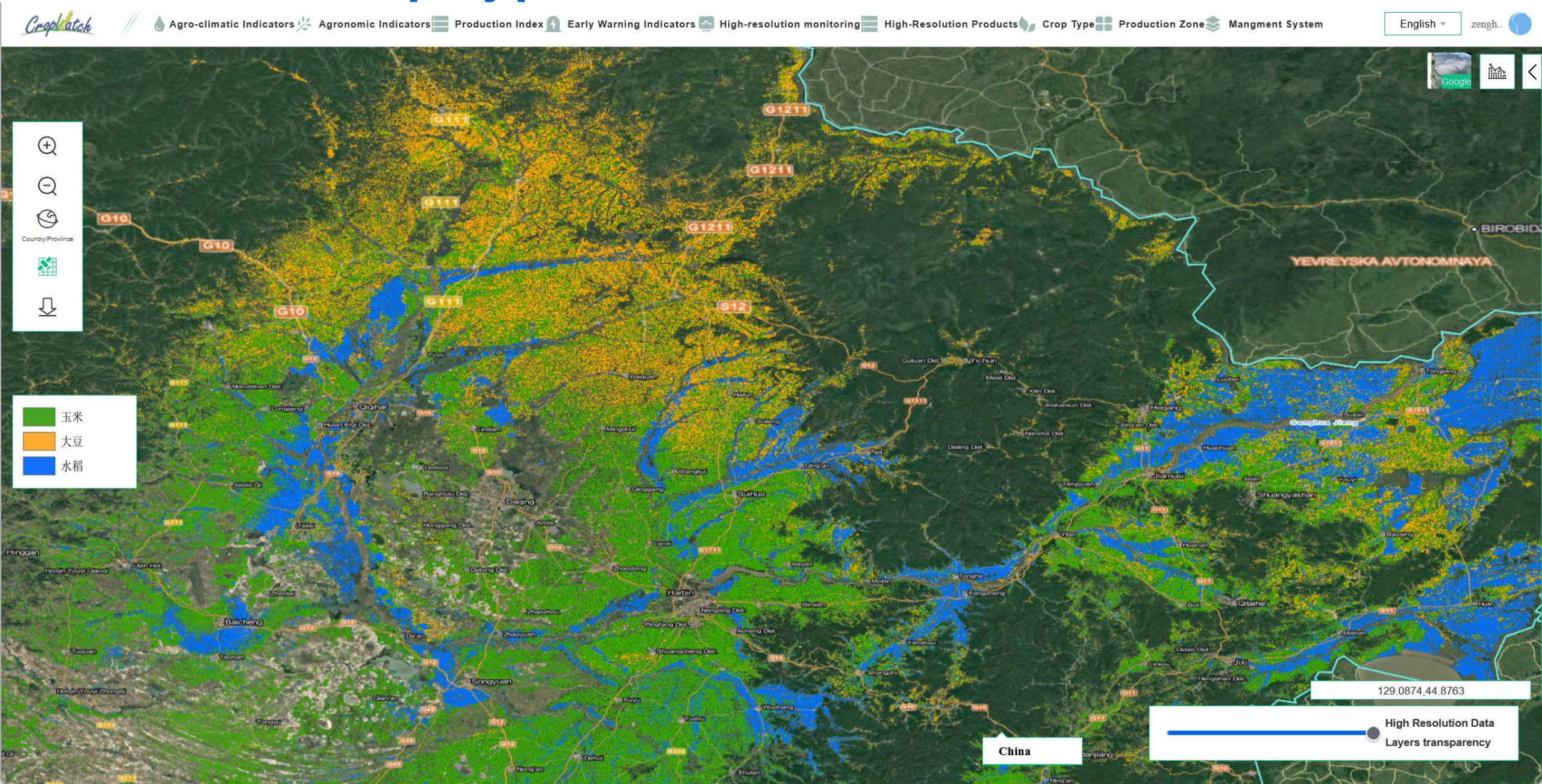
Year

2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023

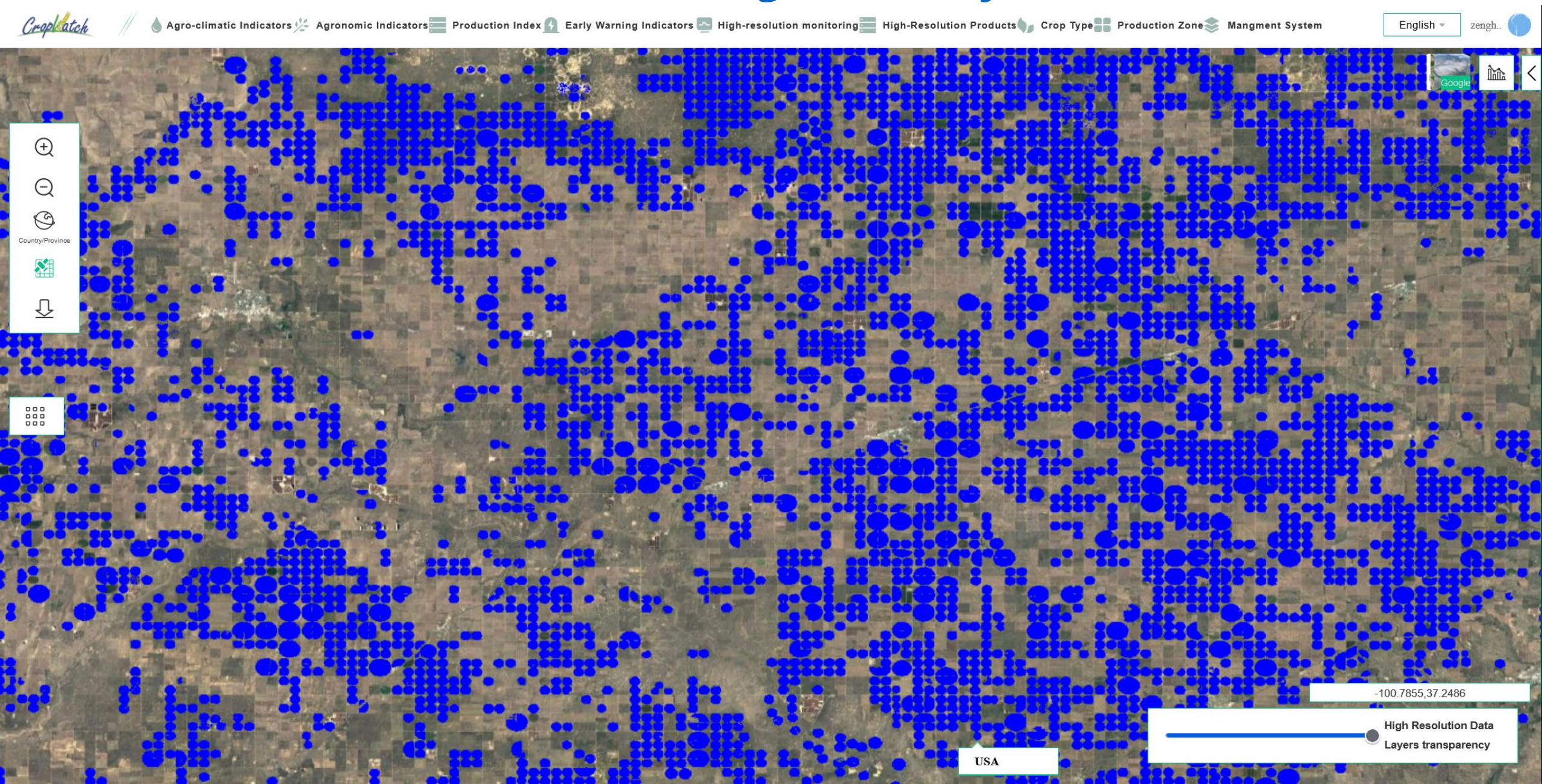
Products-CPI



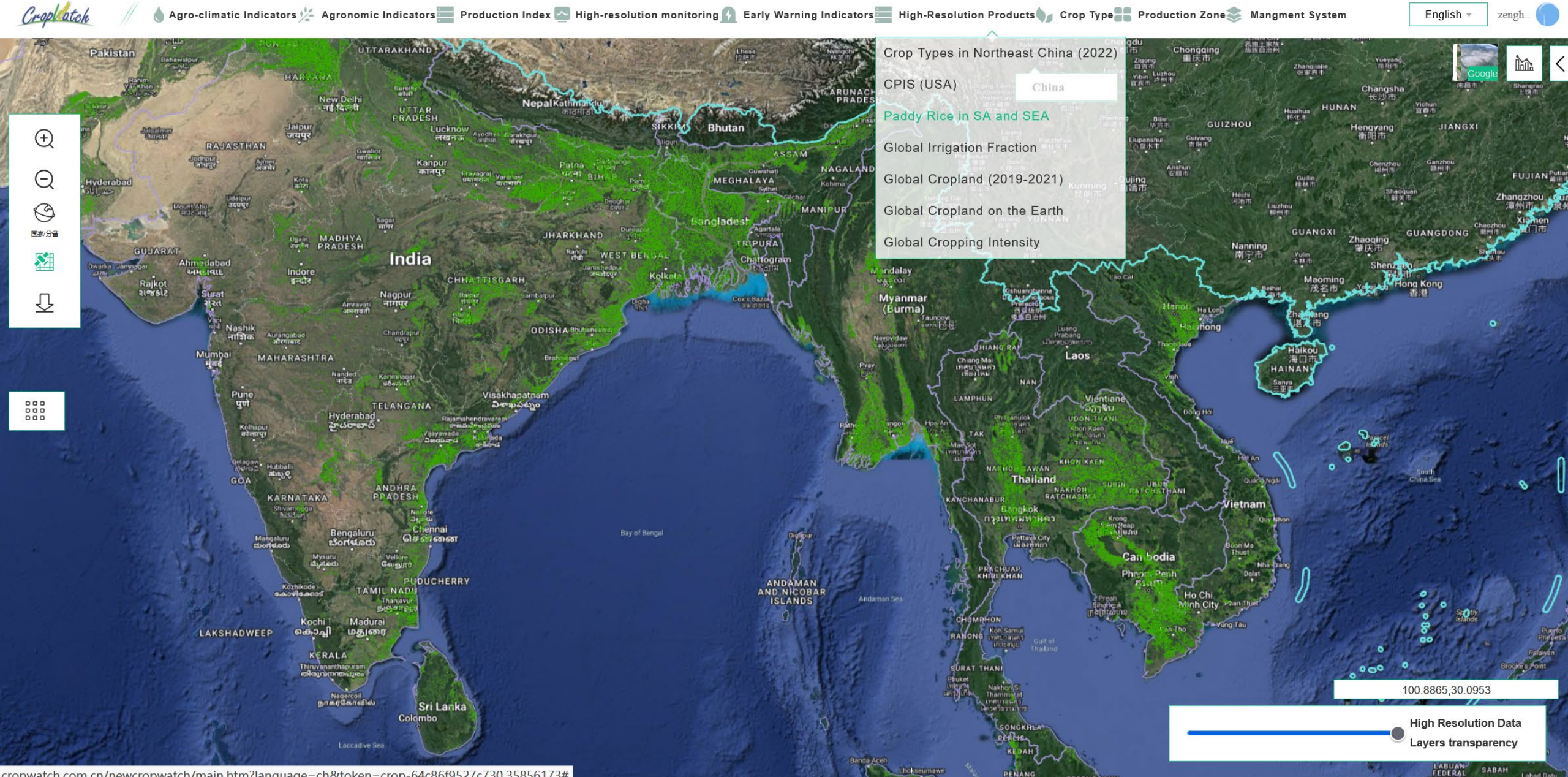
Products-Crop types in the Northeast China(2022)



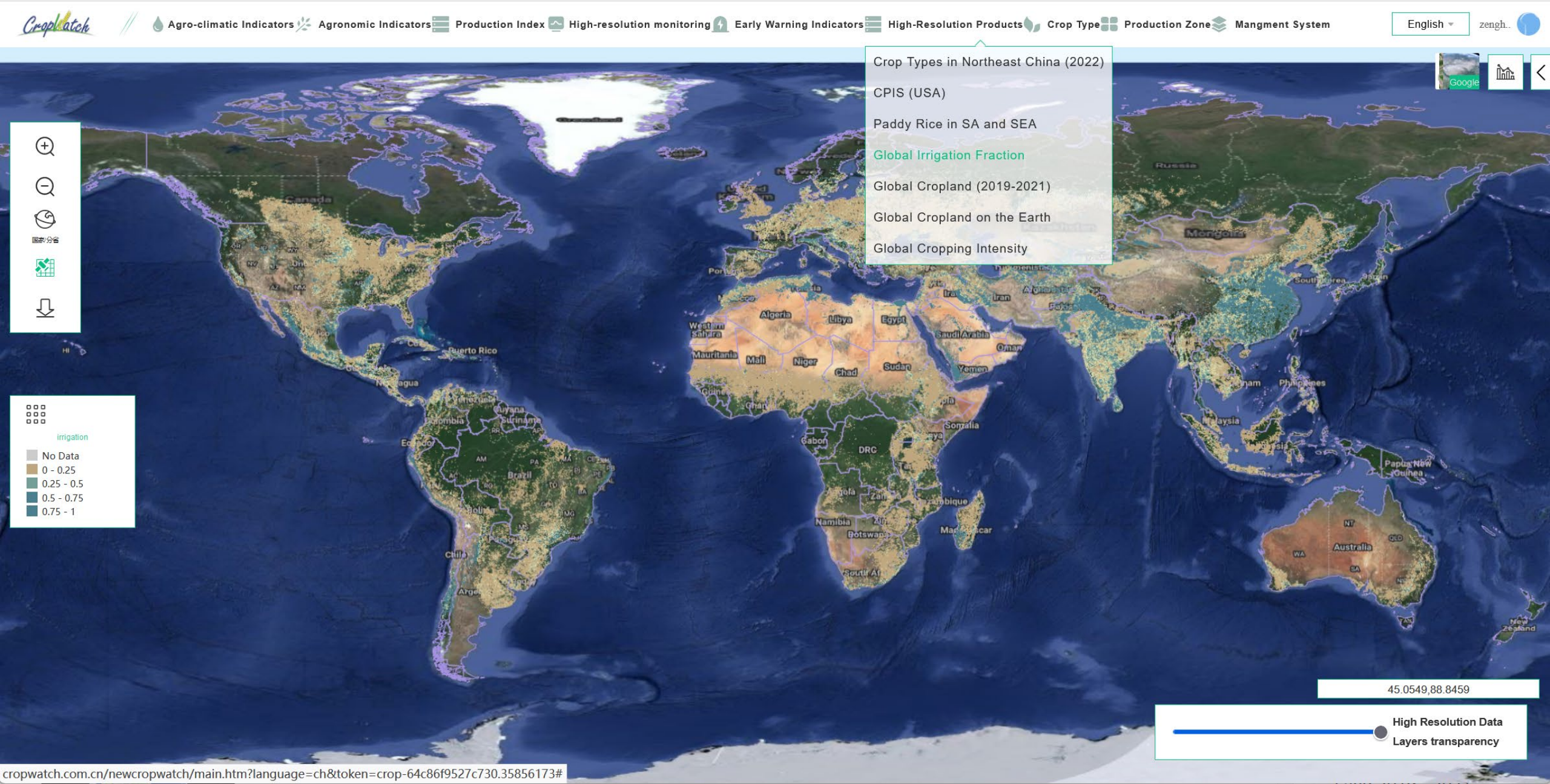
Products-Center Pivot Irrigation System(CPIS)



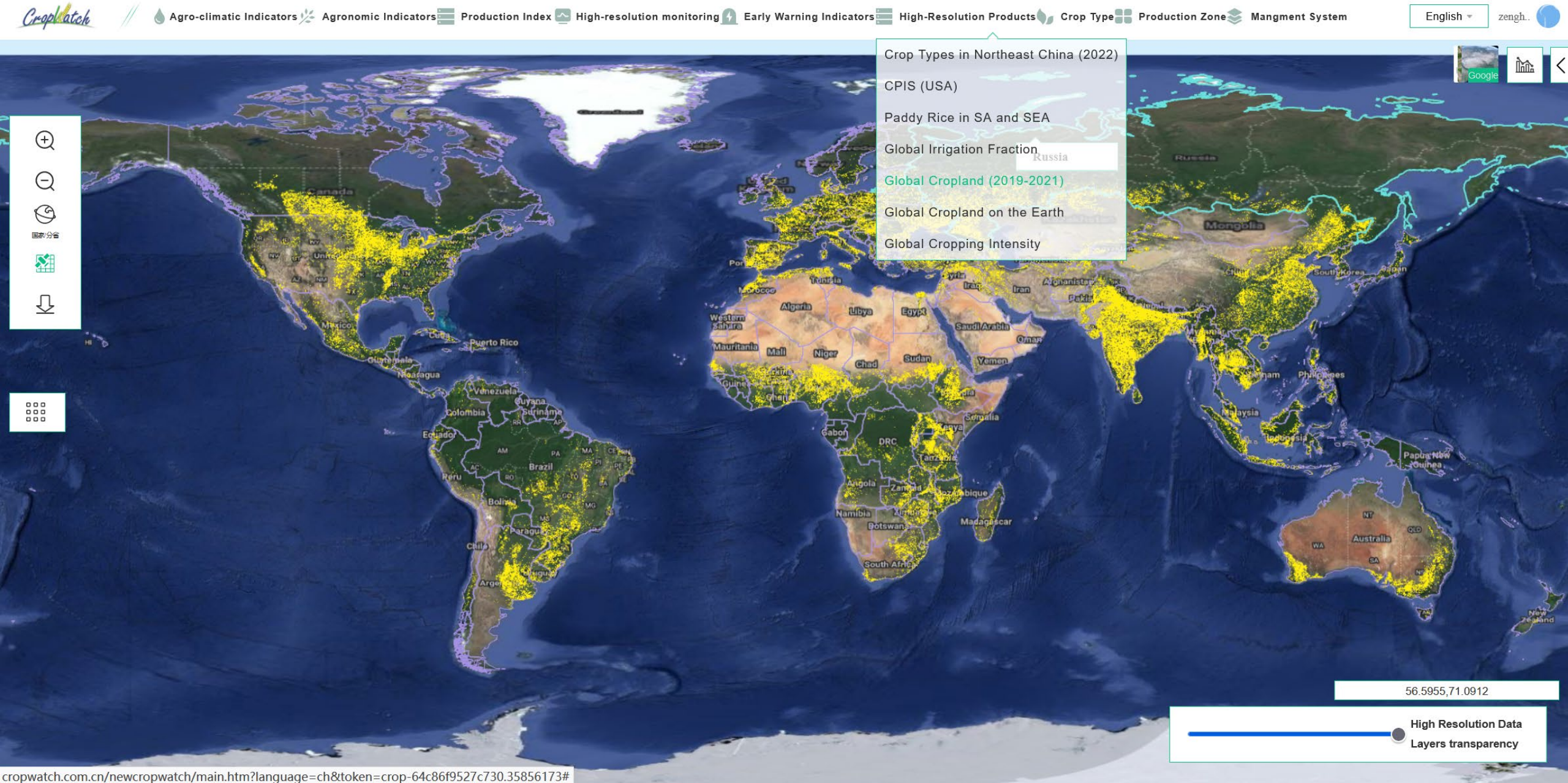
Products-Southeast Asian Paddy Fields



Products-Global Irrigation Fraction



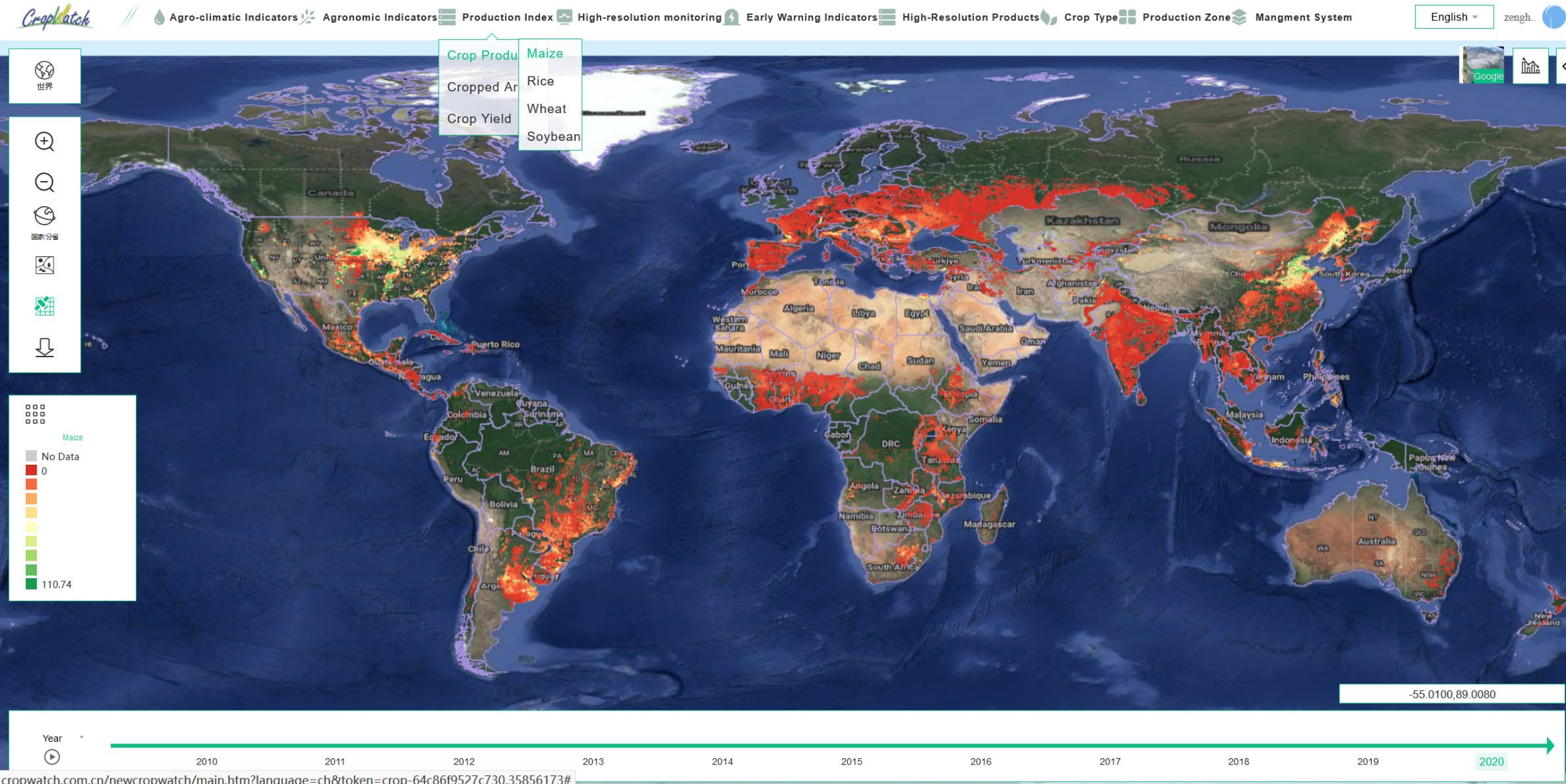
Products-Global Cropland (2019-2021)



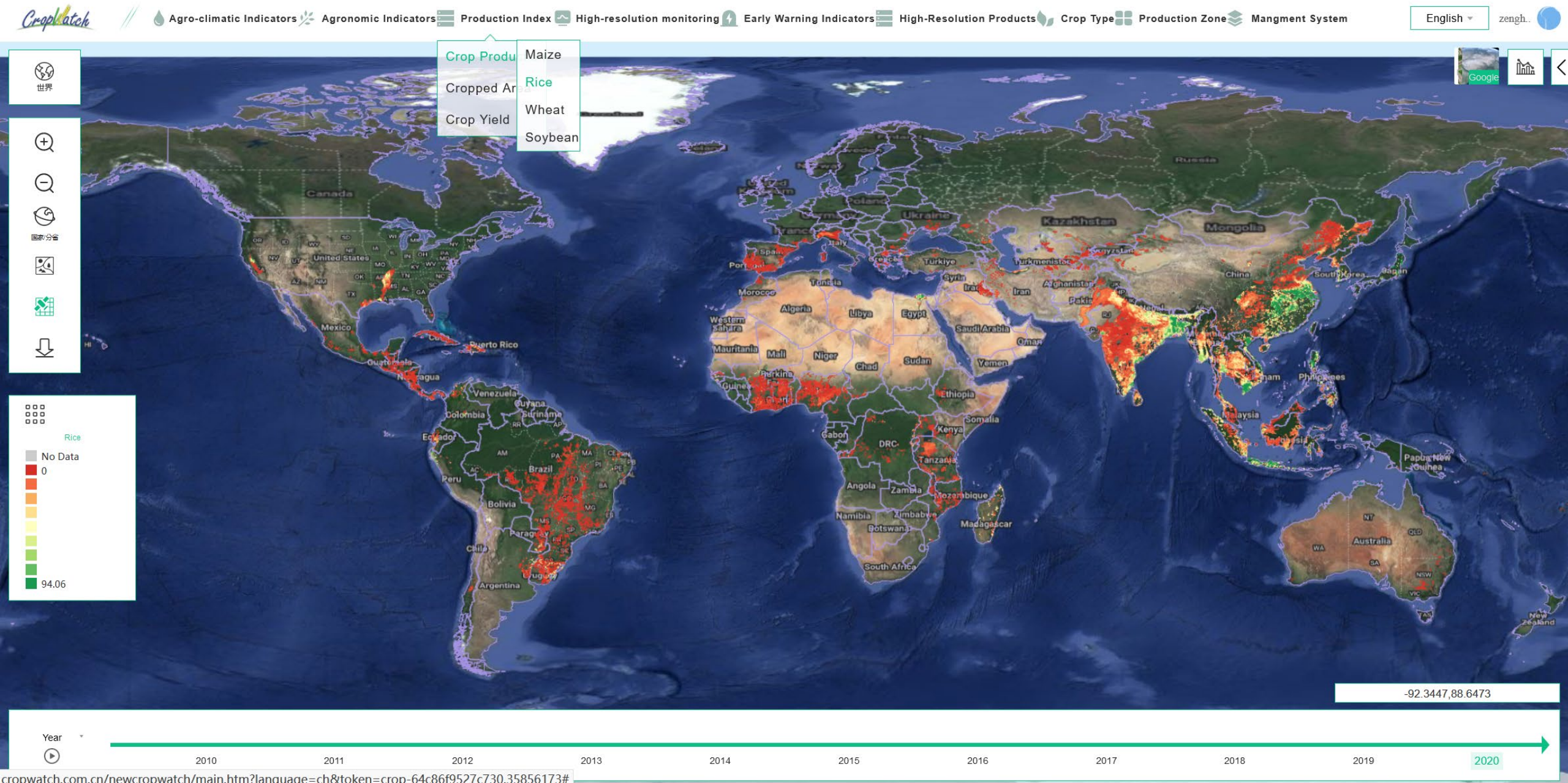
CropWatch-Cropland on the Earth

CropWatch-Cropping Intensity on the Earth

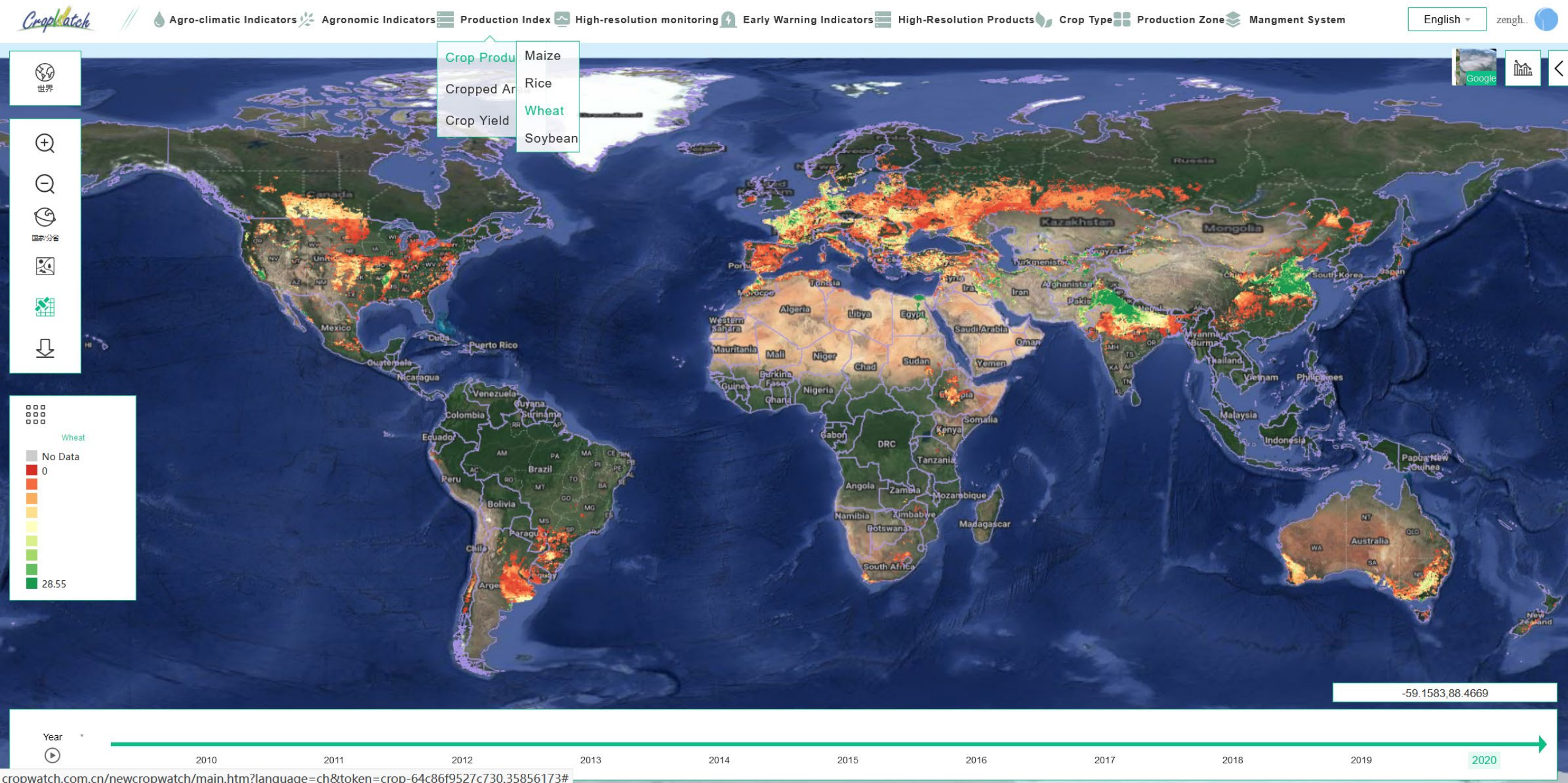
Grid Products-Production of Maize



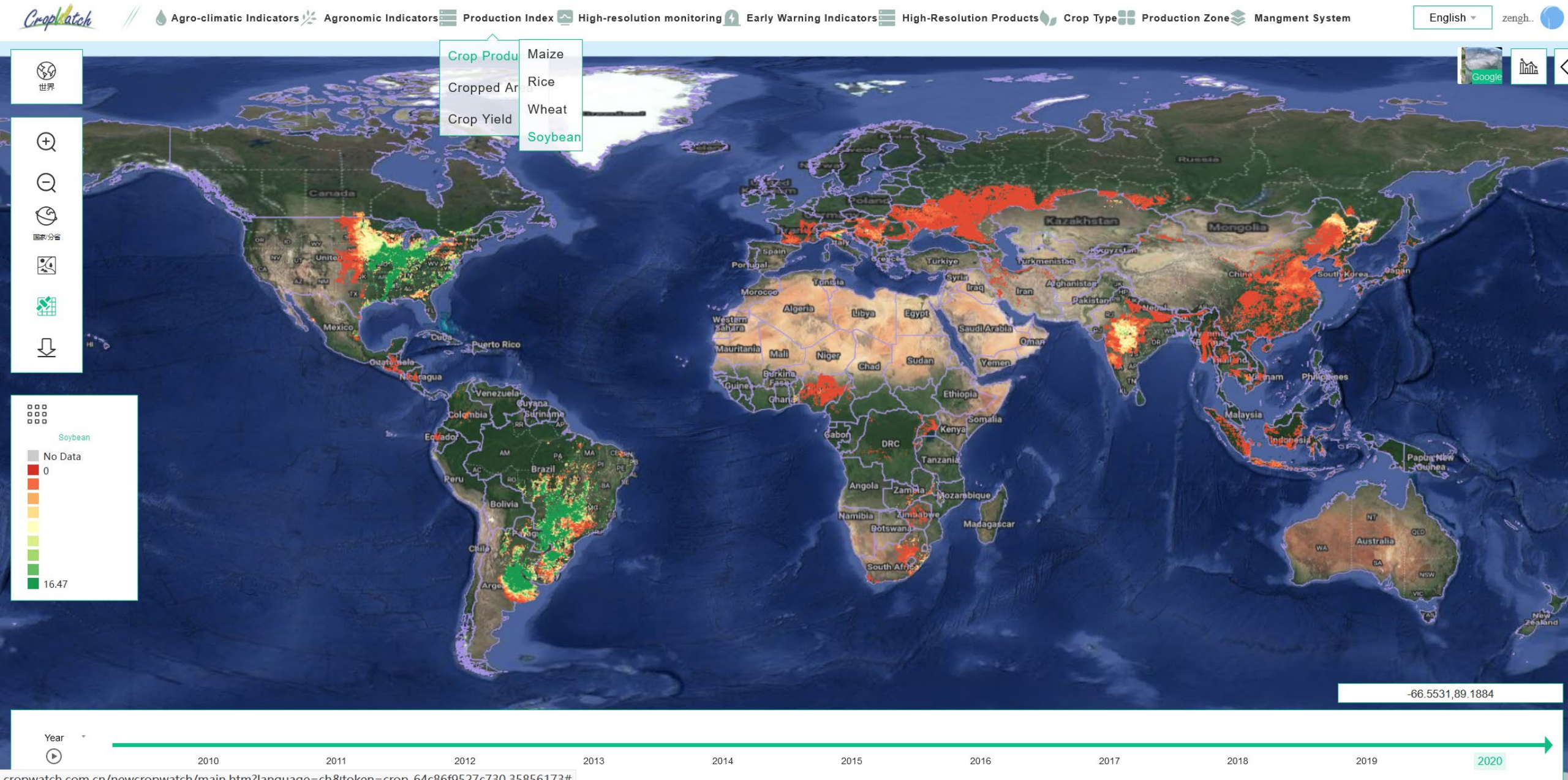
Grid Products-Production of Rice



Grid Products-Production of Wheat

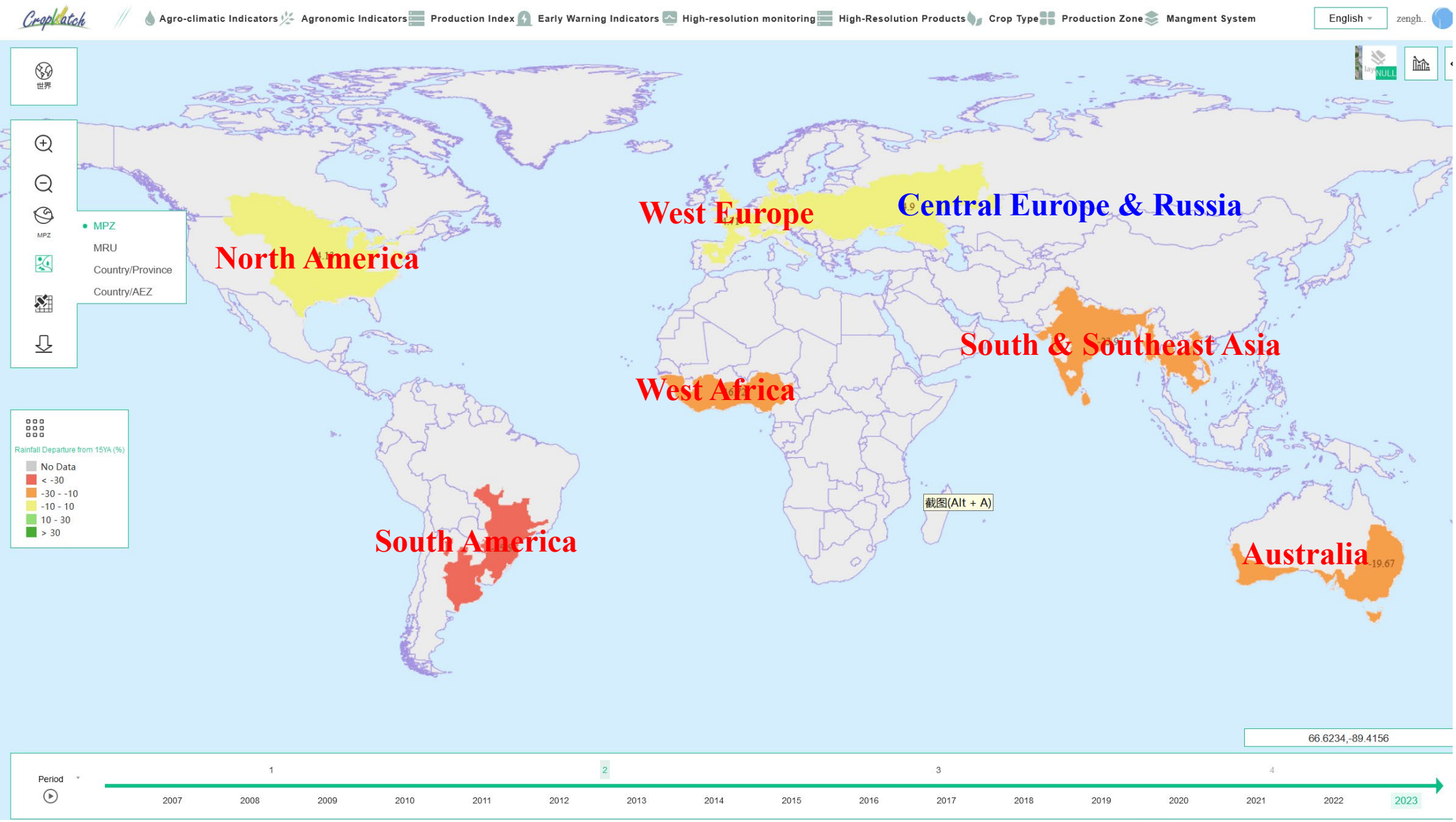


Grid Products-Production of Soybean



Information at MPZ level

7 MPZ: Agro-climatic information



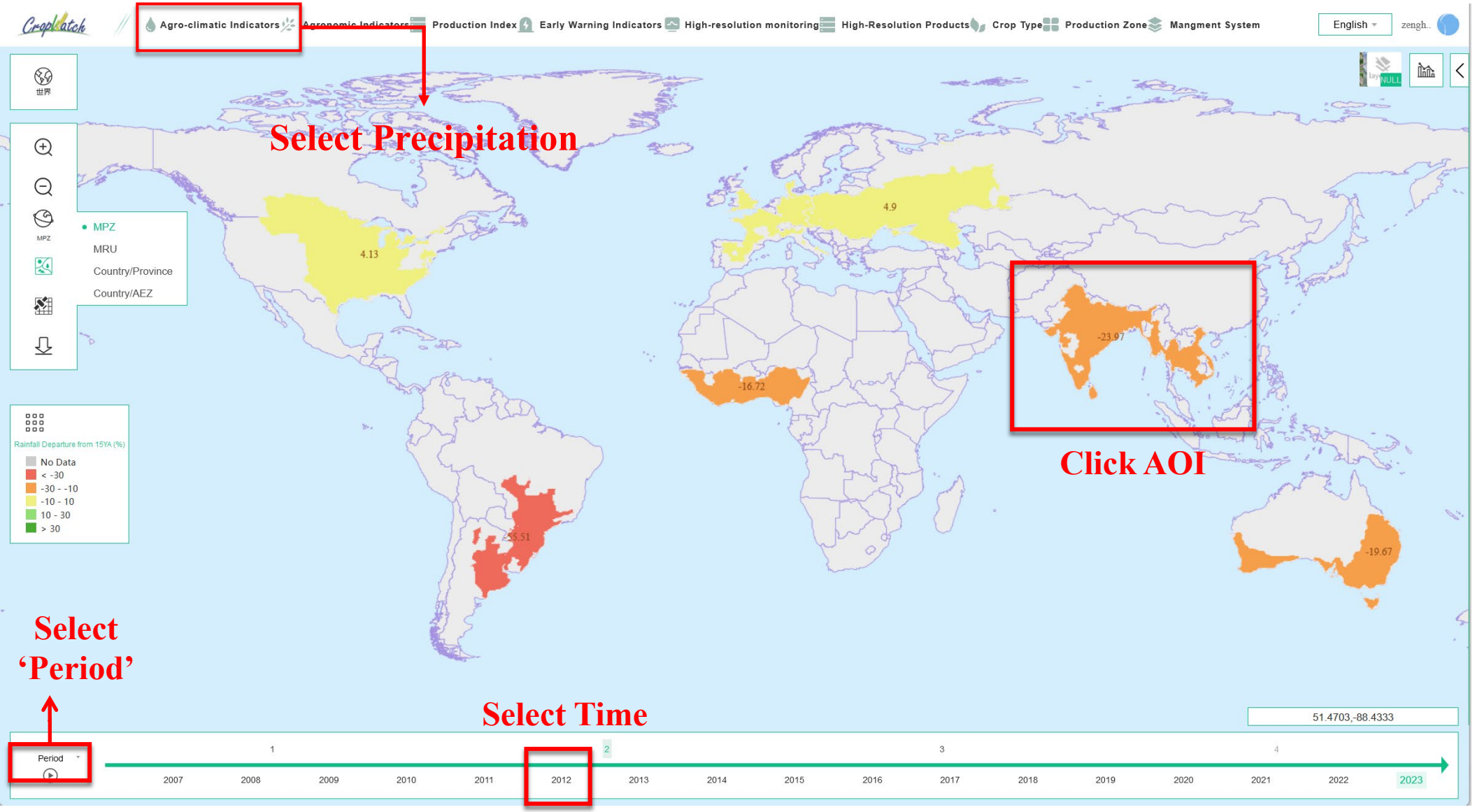
Agro-climatic

- Rainfall
- Avg. Temp
- PAR
- Potential Biomass

Agronomic

- NDVI
- VCIx
- CALF
- CI
- LAI
- FPAR

Rainfall-period



CropWatch divides each year into 4 periods, including 1st , 2nd , 3rd, and 4th period.

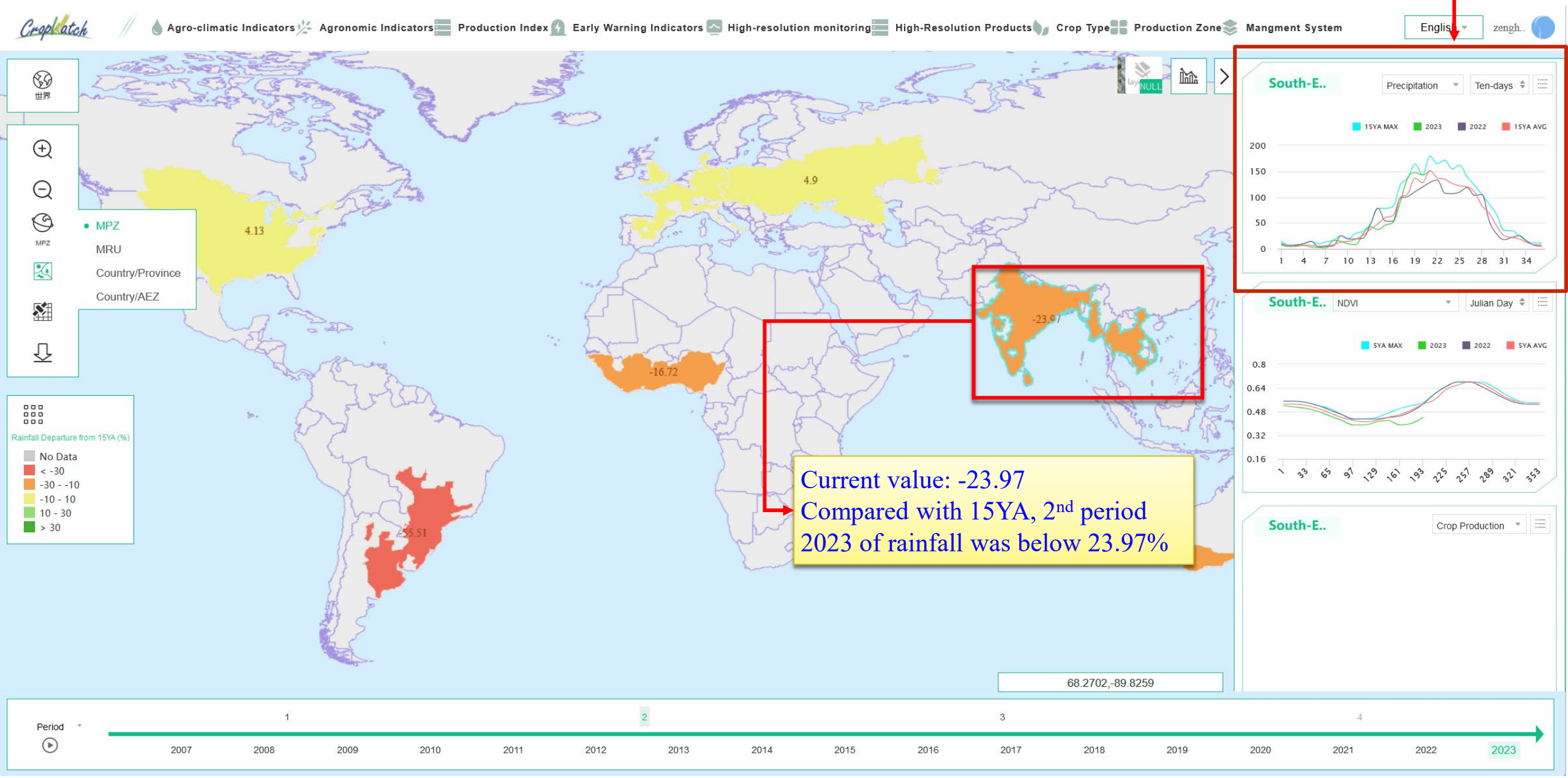
1st : Oct. – Jan.
2nd: Jan. – April
3rd: April – Jul.
4th: Jul. – Oct.

Meaning of result: rainfall departure from 15 YA(%)

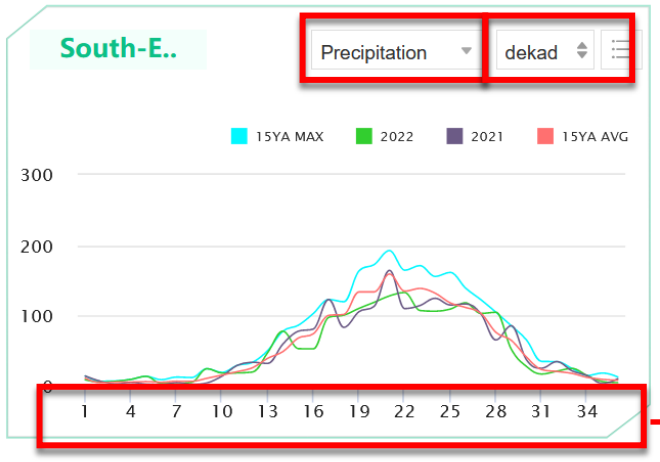
Departure: Current Value/Ave. Value of last 15 years×100%

Rainfall-period

click



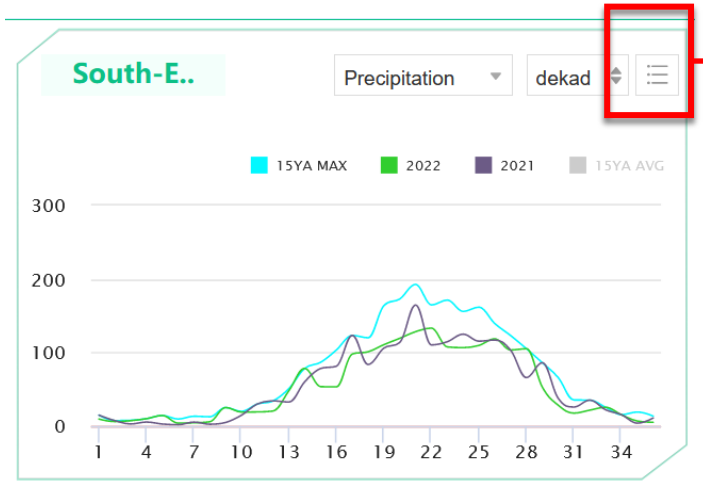
Rainfall-period



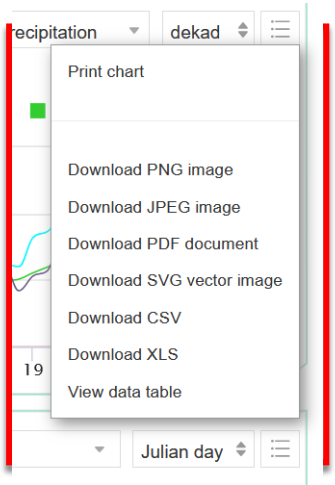
This box shows precipitation information in current year, last year, maximum and average value of last 5 years

Users can close or open the value series of special group through clicking any icon

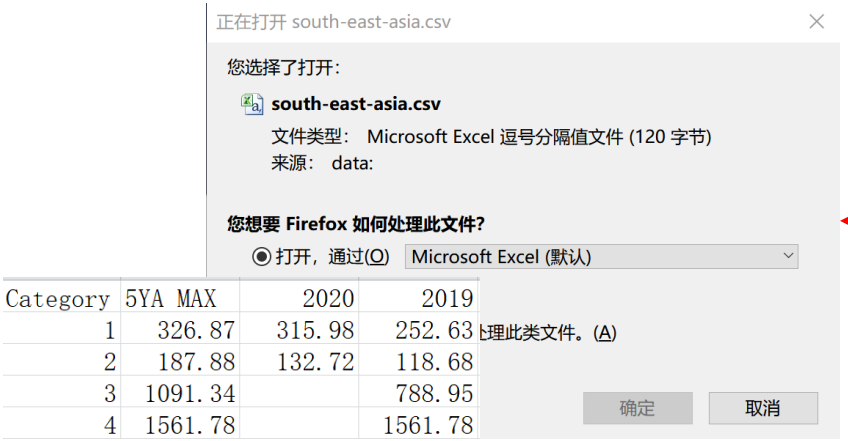
Click



Close 5 YA average

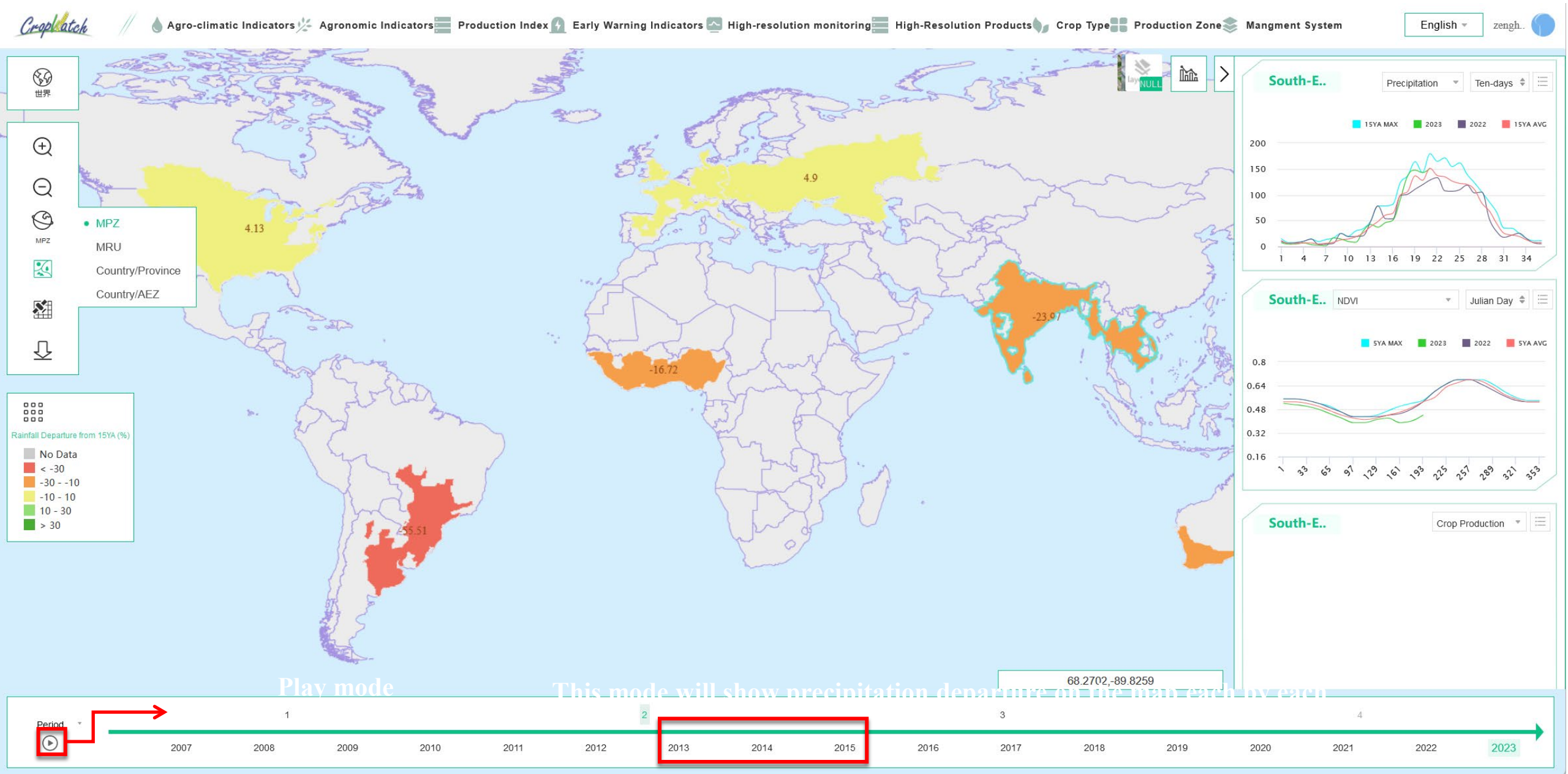


User can print the chart or download and save the time series to your computer as pictures(PNG, JPEG, PDF, SVG) or table(XLS, CSV) format

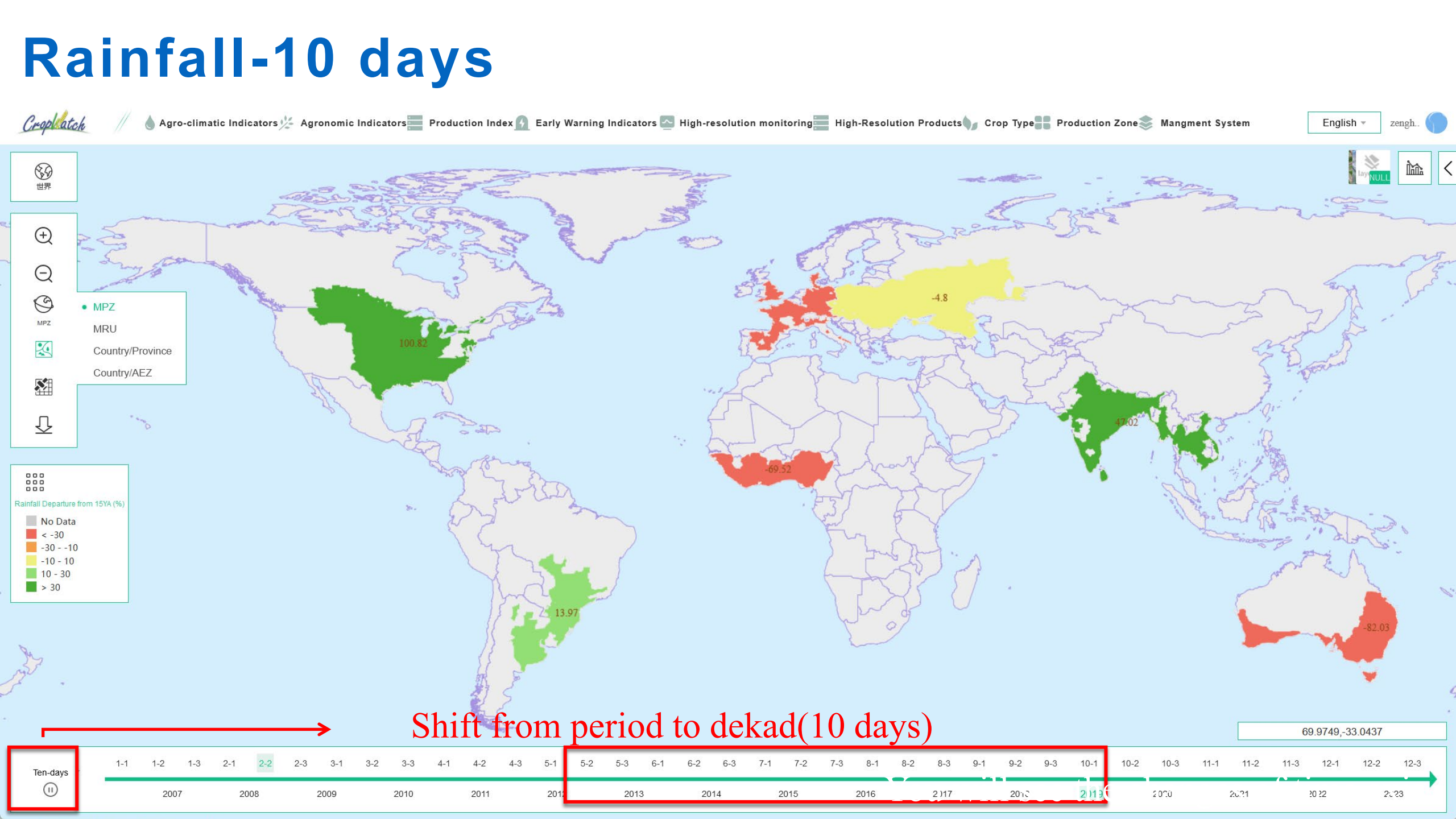


Category	5YA MAX	2020	2019
1	326.87	315.98	252.63
2	187.88	132.72	118.68
3	1091.34		788.95
4	1561.78		1561.78

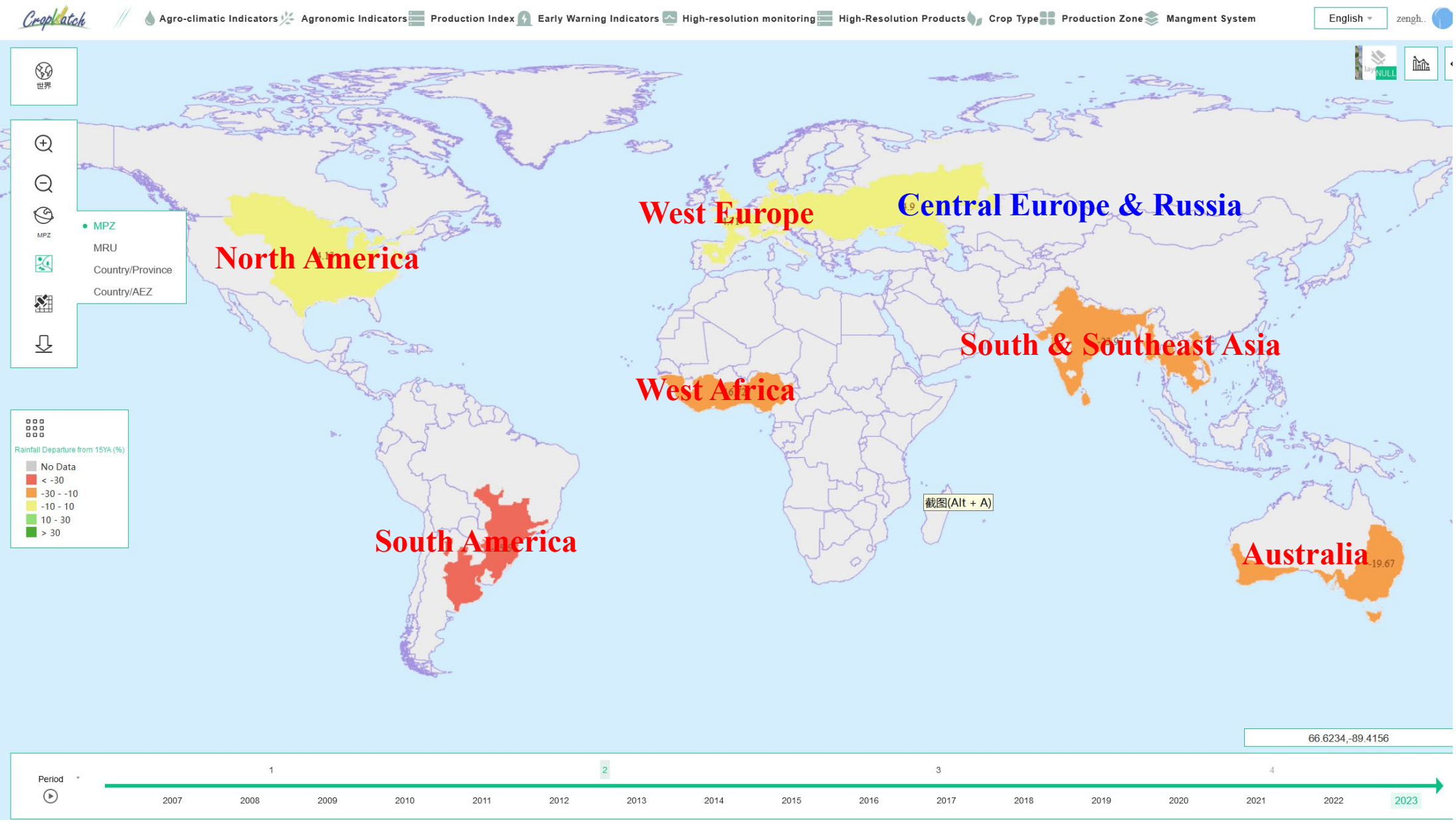
Rainfall-period



Rainfall-10 days



7 MPZ: Agronomic information



Agro-climatic

- Rainfall
- Avg. Temp
- PAR
- Potential Biomass

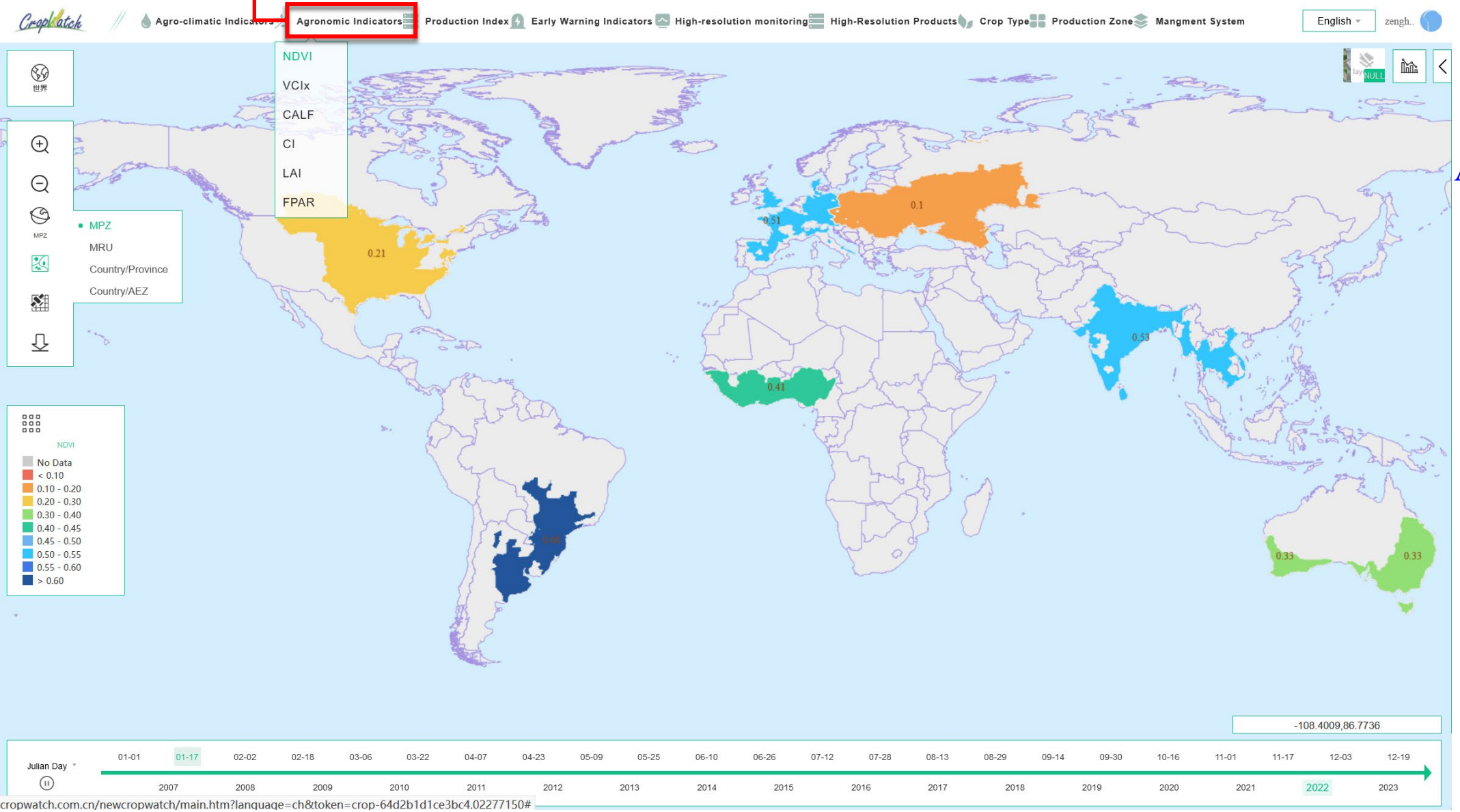
Agronomic

- NDVI
- VCIx
- CALF
- CI
- LAI
- FPAR

Agronomic-NDVI

Select NDVI

The crop condition can be described by NDVI



Agro-climatic

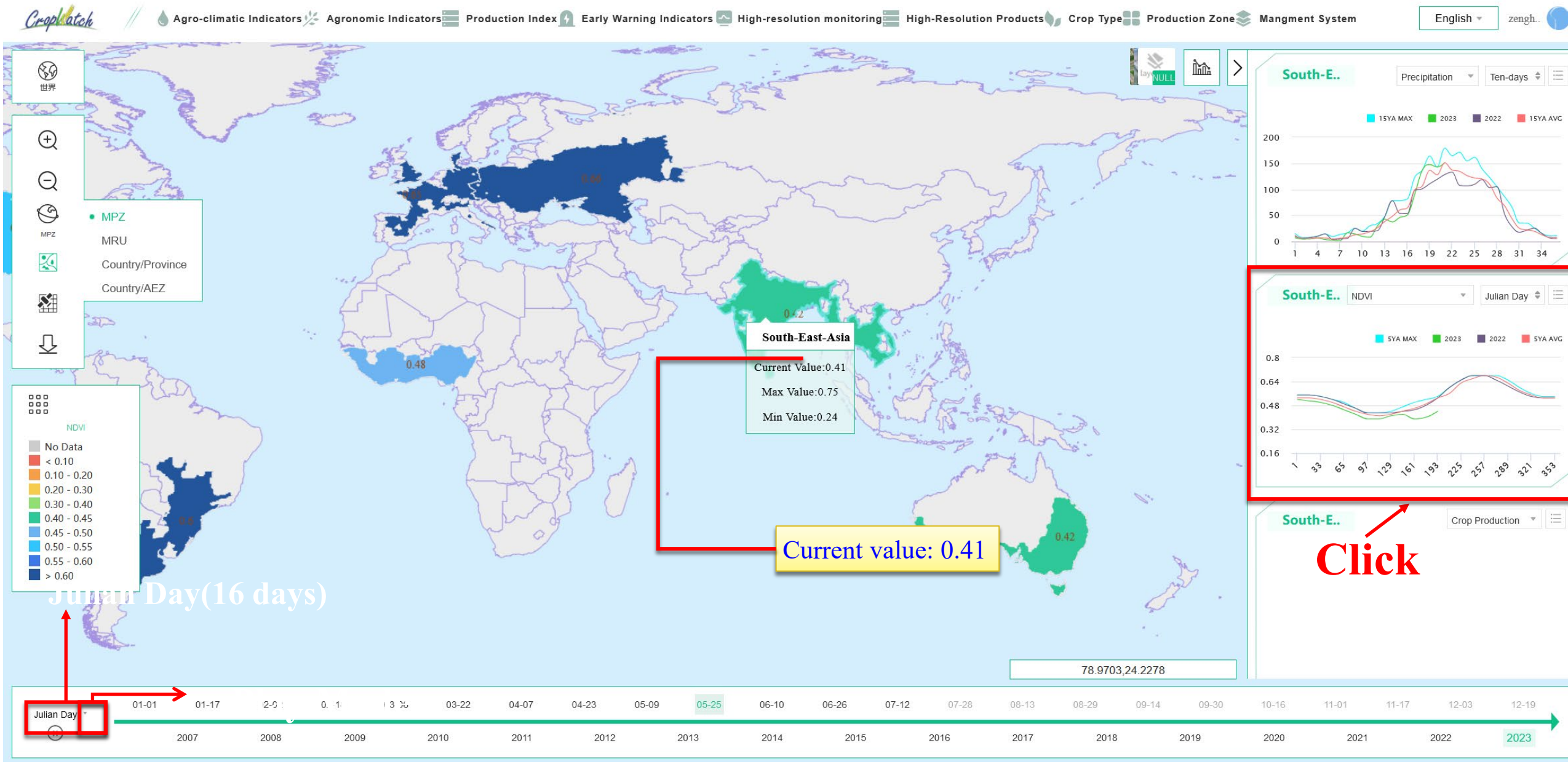
- Rainfall
- Avg. Temp
- PAR
- Potential Biomass

Agronomic

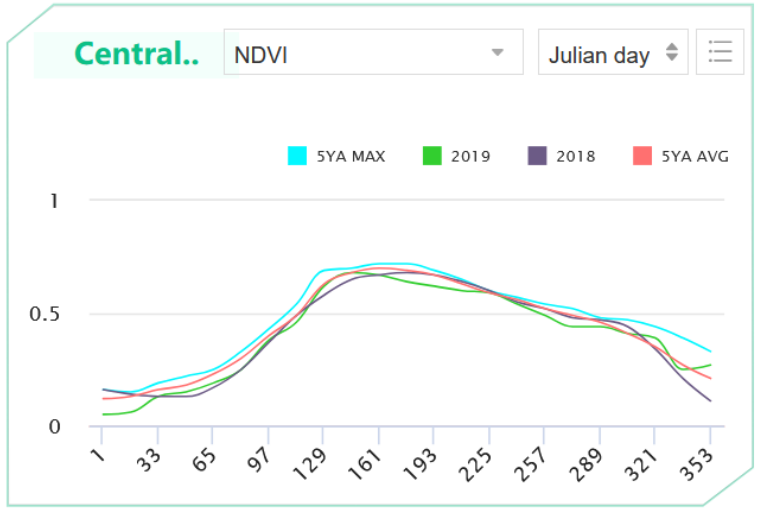
- NDVI
- VCIx
- CALF
- CI
- LAI
- FPAR

cropwatch.com.cn/newcropwatch/main.htm?language=ch&token=crop-64d2b1d1ce3bc4.02277150#

Agronomic-NDVI

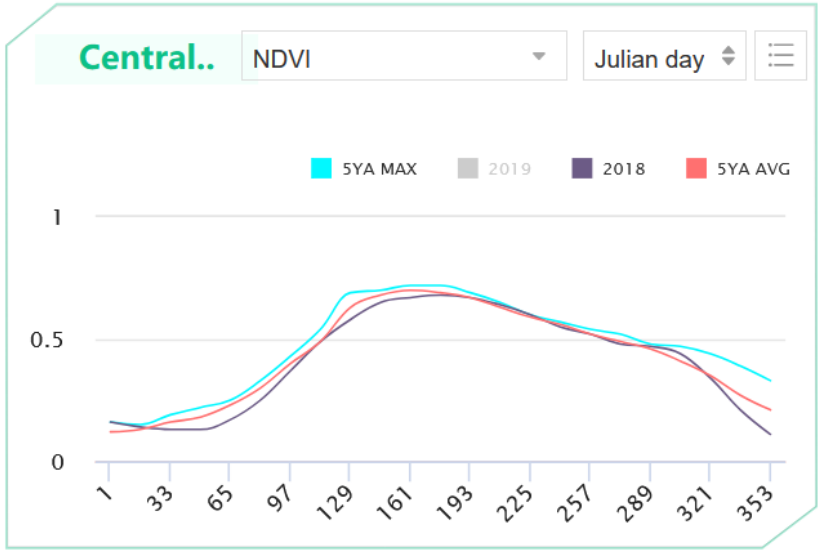


Agronomic-NDVI

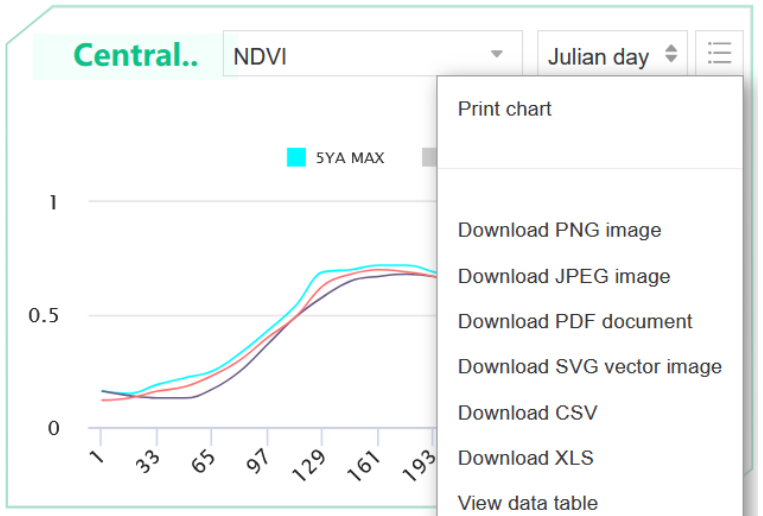


In general, compared the current NDVI value with the same time of last year, last 5 year's average, and last 5 year's maximum value, the users can assess crop condition easily

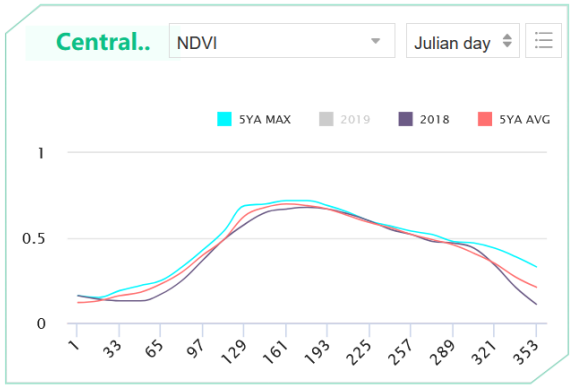
Users can close or open the value series of special group through clicking any icon



Result after closing 2019



User can print the chart or download and save the time series to your computer as pictures(PNG, JPEG, PDF, SVG) or table(XLS, CSV) format

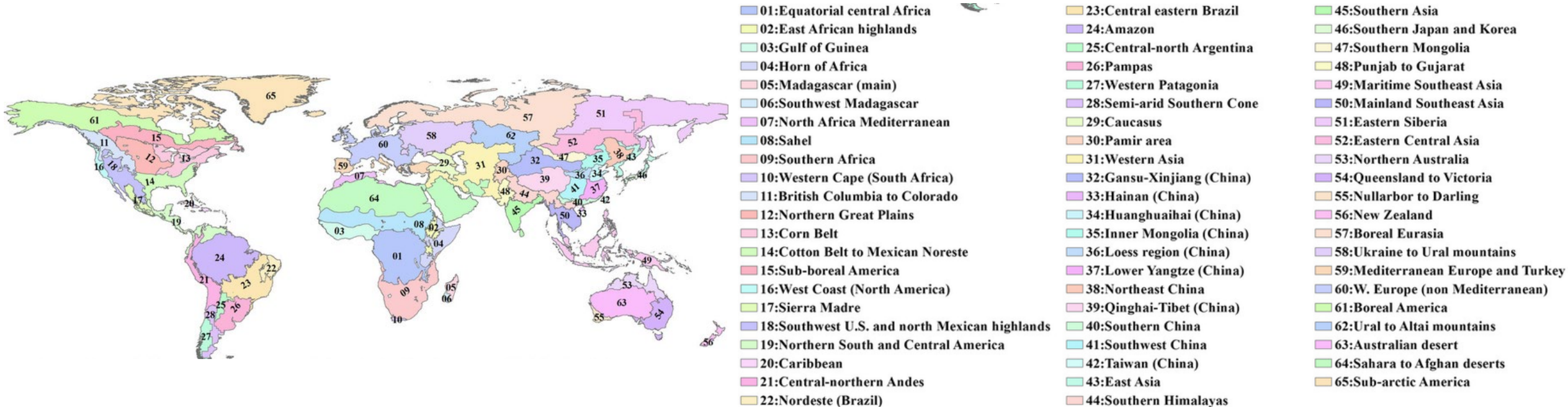


Category	5YA MAX	2020	5YA AVG
1.00	0.54	0.52	0.51
17.00	0.55	0.53	0.51
33.00	0.49	0.51	0.48
49.00	0.48	0.50	0.47
65.00	0.45	0.48	0.44
81.00	0.42	0.43	0.41
97.00	0.40	0.40	0.38
113.00	0.39	0.40	0.37
129.00	0.40	0.40	0.38
145.00	0.41	0.39	0.40
161.00	0.43	0.42	0.42
177.00	0.45	0.44	0.44
193.00	0.50	0.49	0.47
209.00	0.55		0.52
225.00	0.60		0.58
241.00	0.66		0.64
257.00	0.67		0.66
273.00	0.68		0.65
289.00	0.65		0.61
305.00	0.60		0.56
321.00	0.56		0.53
337.00	0.54		0.51
353.00	0.54		0.51

Information at MRU Level

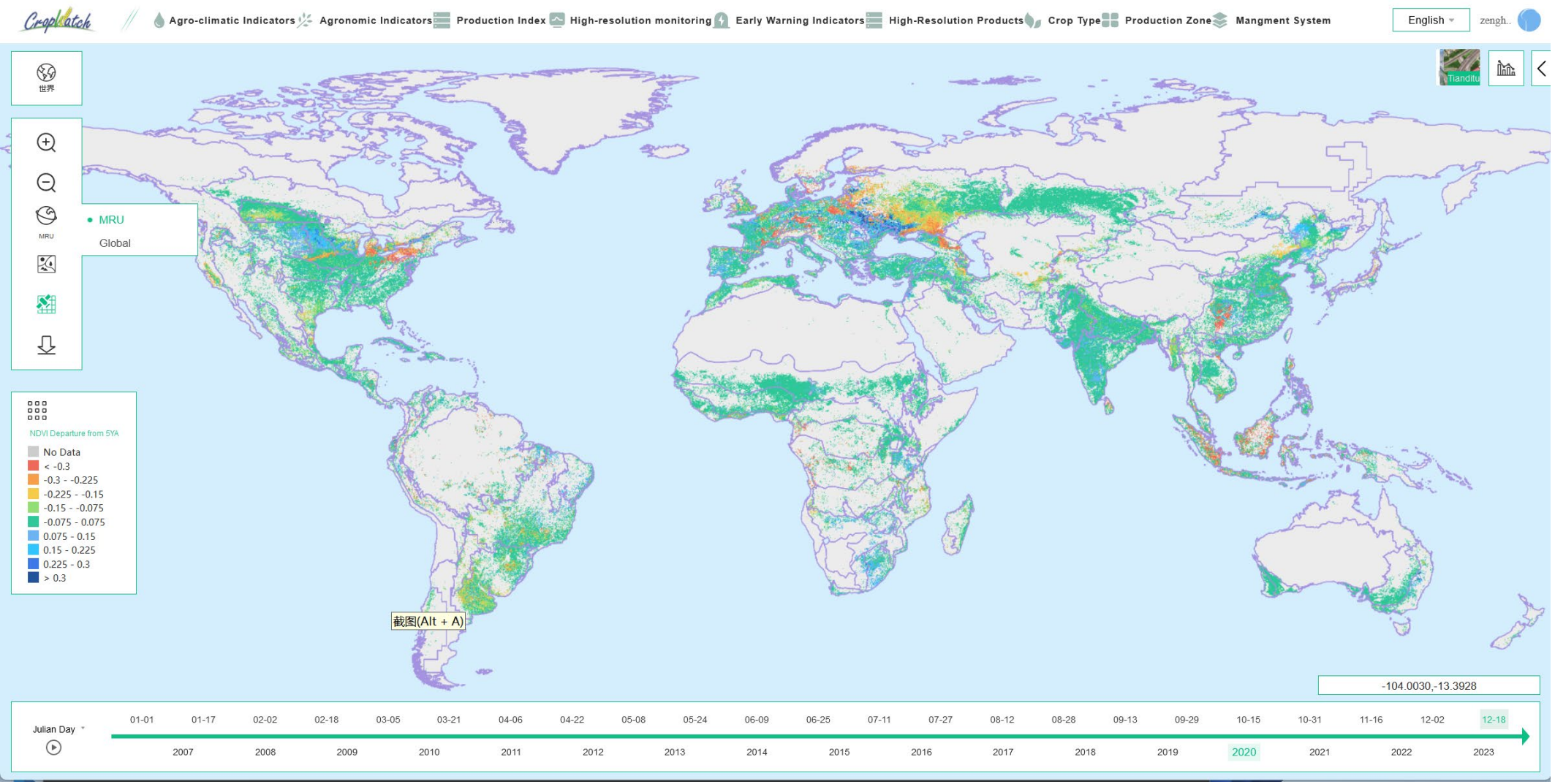
What's meaning of MRU

- CropWatch divided the global into 65 agri-climatic zones based on climate, terrain, agricultural activities, etc.
- The purpose of designing MRUs is to provide more detail agricultural information to users and help them understanding agricultural information patterns change.



Gommes Rene, Wu Bingfang, Li Zhongyuan, Zeng Hongwei. Design and characterization of spatial units for monitoring global impacts of environmental factors on major crops and food security. Food and Energy Security, 2016, 5(1): 40-55.

Information can be showed at MRU level



Agro-climatic

- Rainfall
- Avg. Temp
- PAR
- Potential Biomass

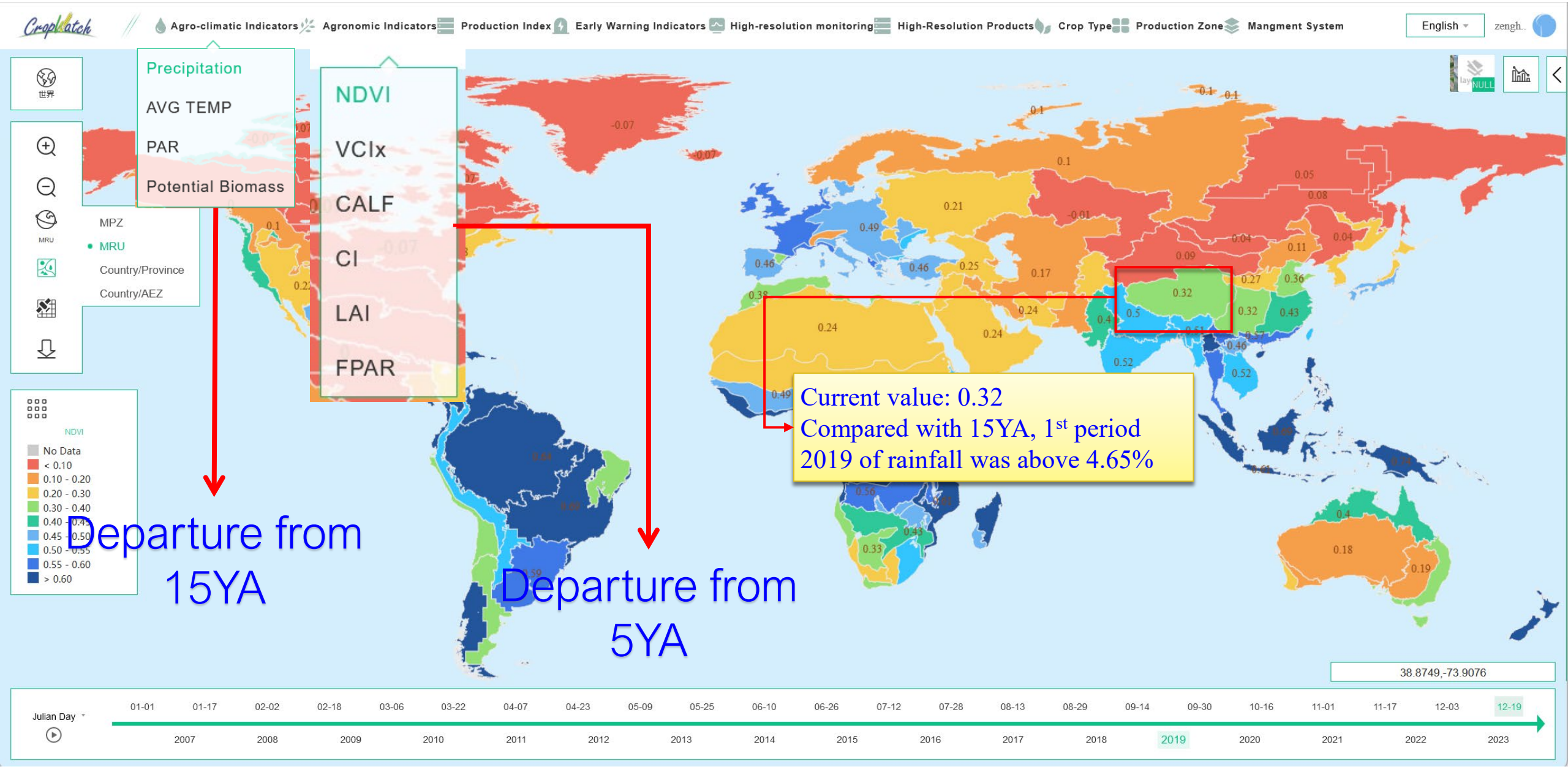
Agronomic

- NDVI
- VCIx
- CALF
- CI
- LAI
- FPAR

Information Search at MRUs

Users can select different indices

User can export time series of different indices

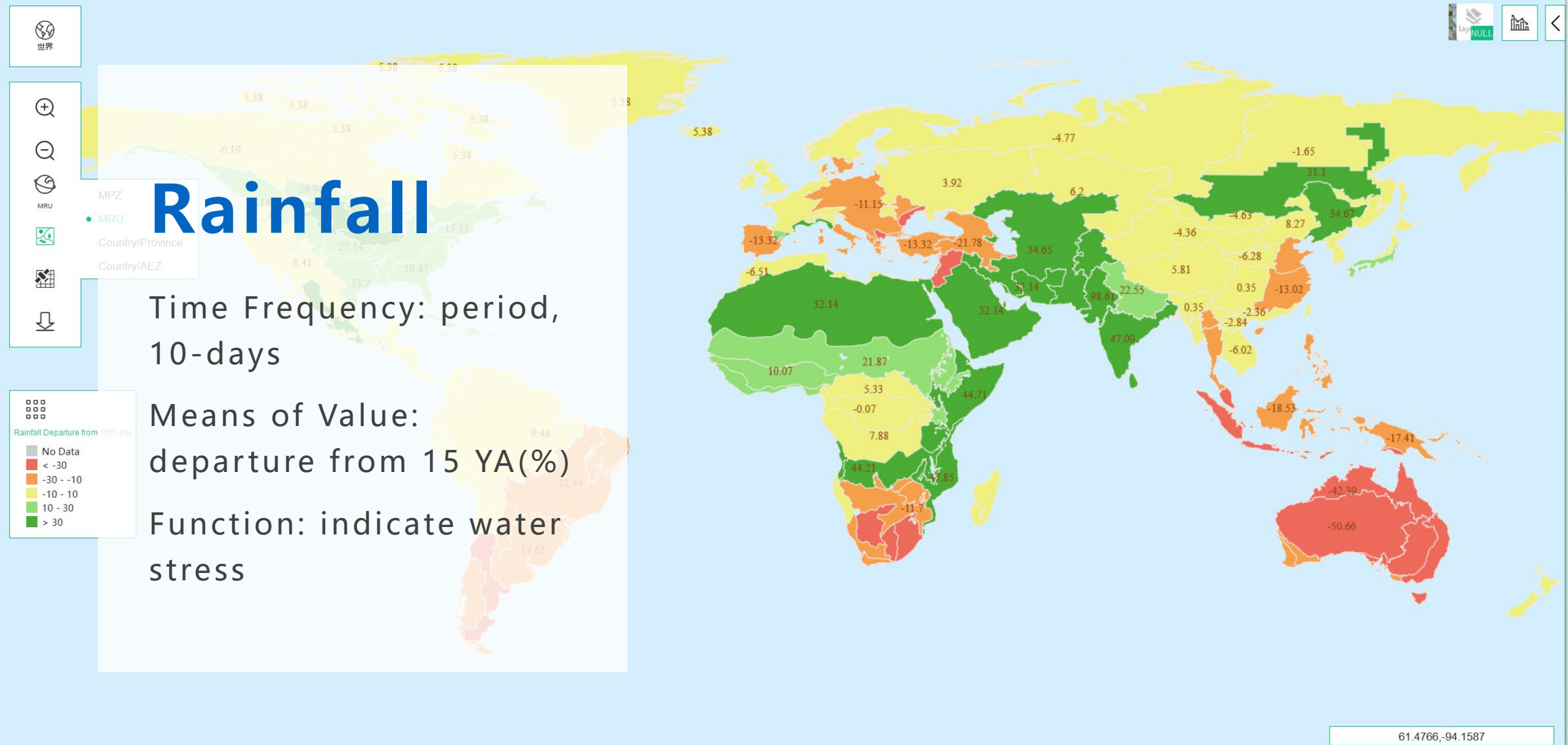


Rainfall

Time Frequency: period, 10-days

Means of Value: departure from 15 YA(%)

Function: indicate water stress

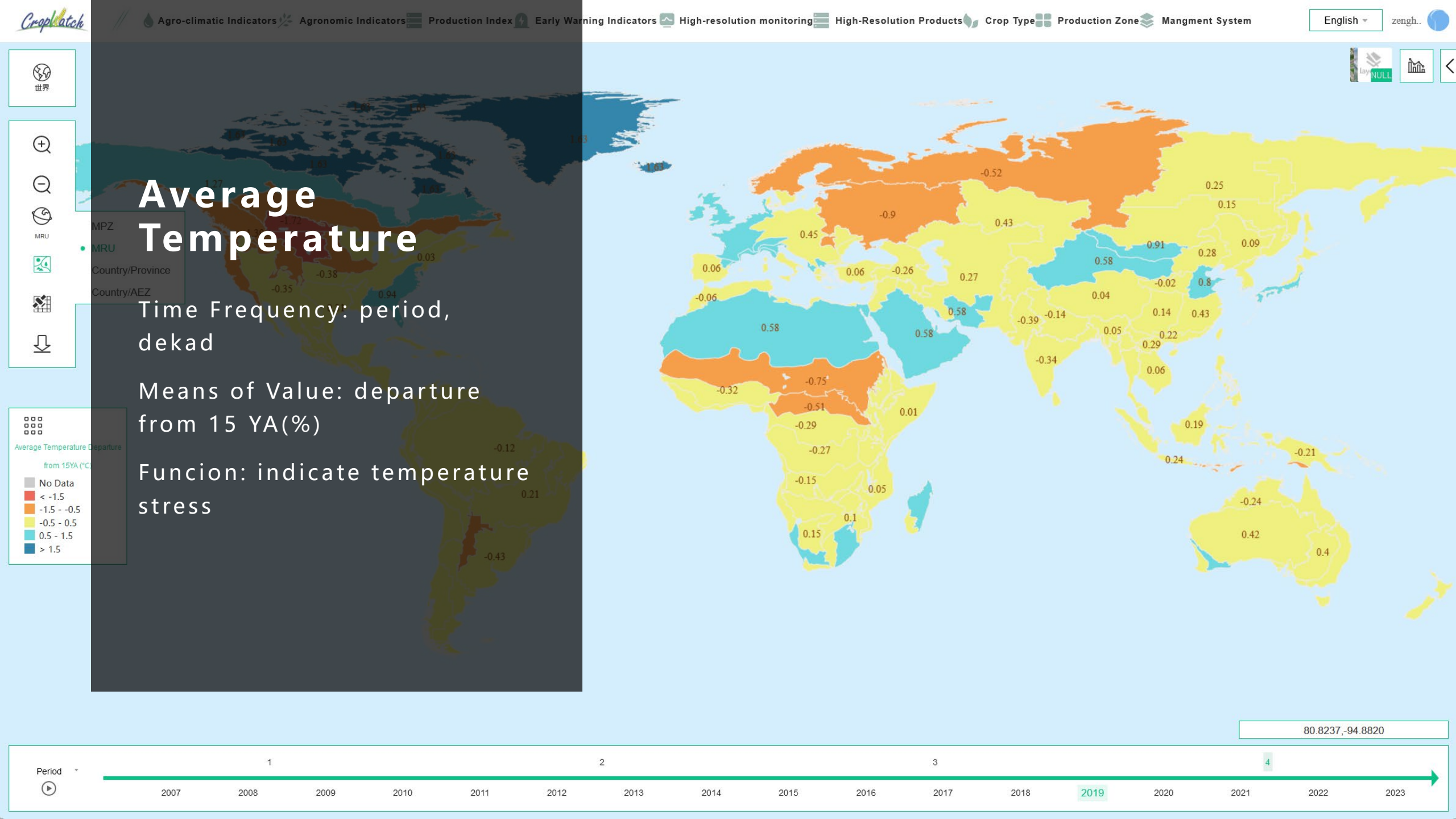


Average Temperature

Time Frequency: period, dekad

Means of Value: departure from 15 YA(%)

Funcion: indicate temperature stress

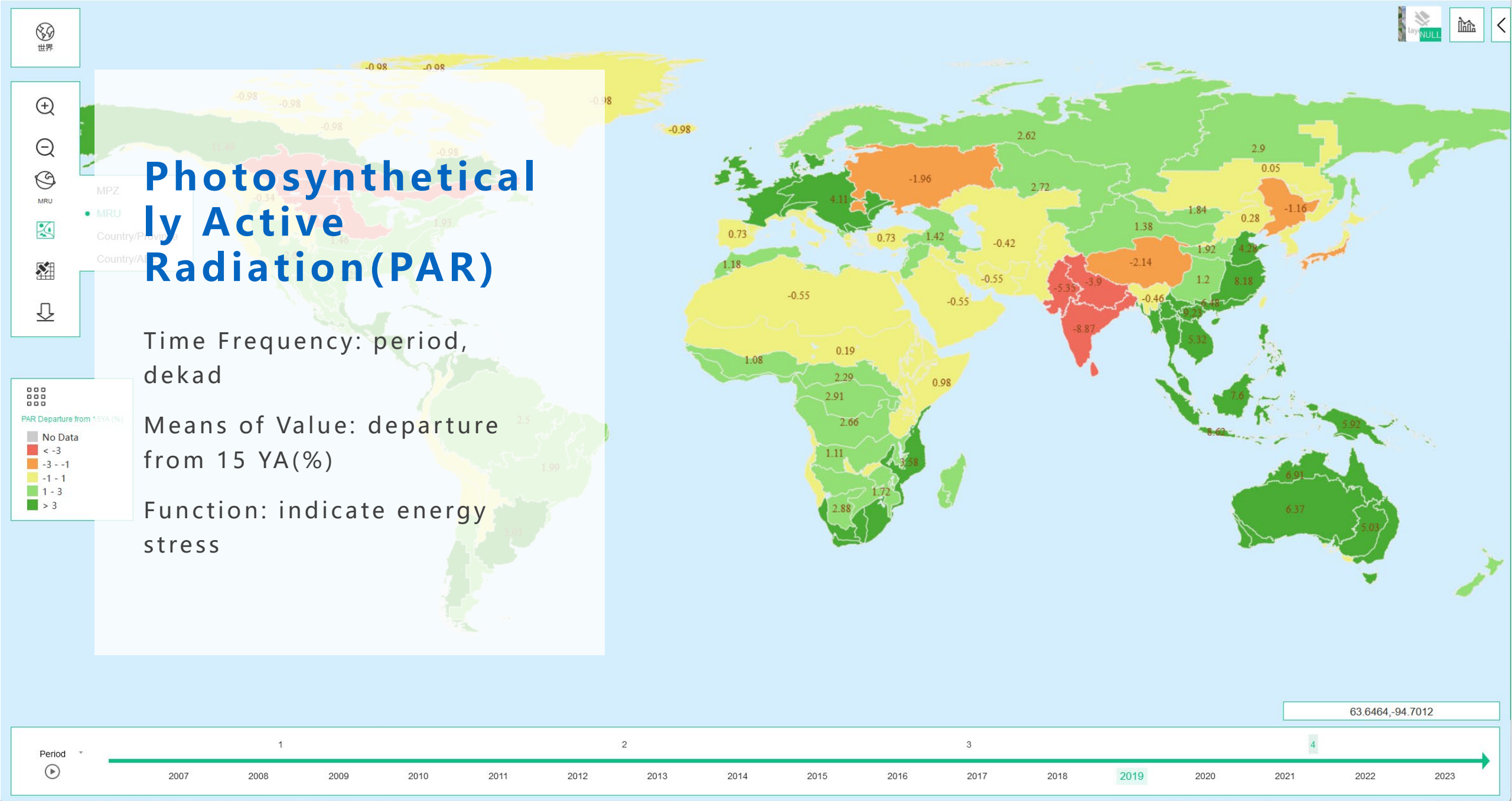


Photosynthetically Active Radiation(PAR)

Time Frequency: period, dekad

Means of Value: departure from 15 YA(%)

Function: indicate energy stress

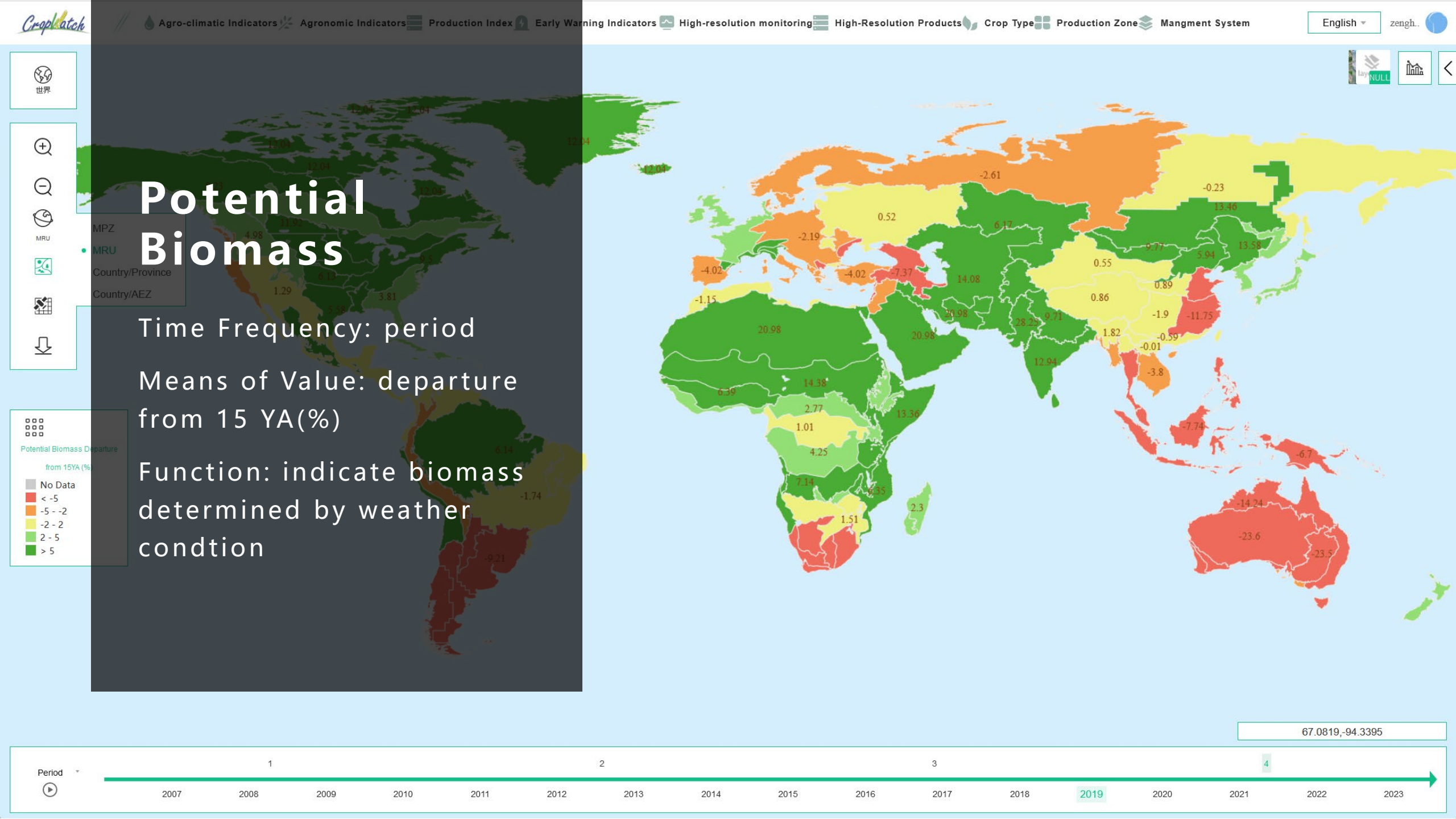


Potential Biomass

Time Frequency: period

Means of Value: departure from 15 YA(%)

Function: indicate biomass determined by weather condtion



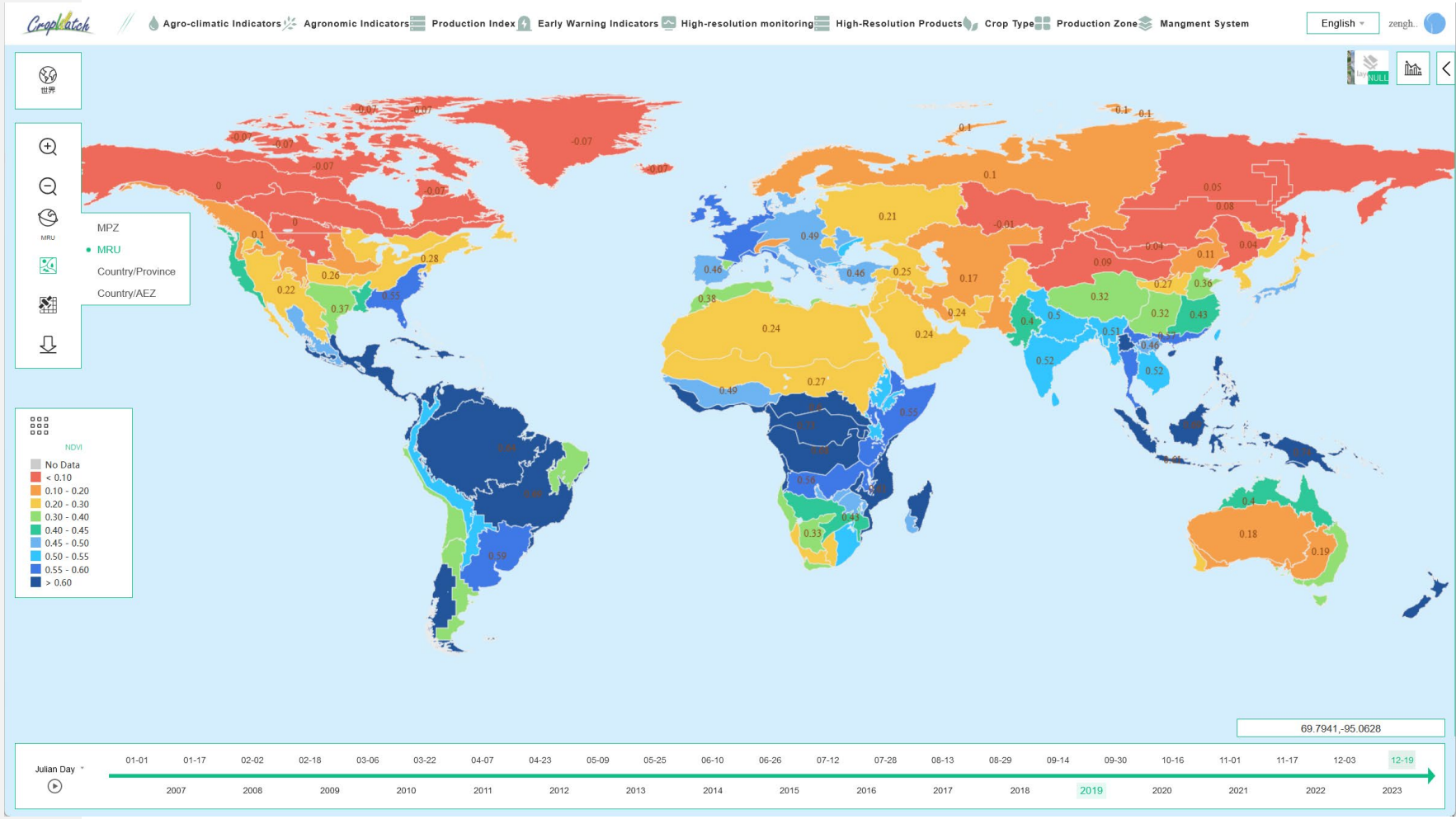
Normalized Difference Vegetation Index(NDVI)

Time Frequency: Julian day(16)

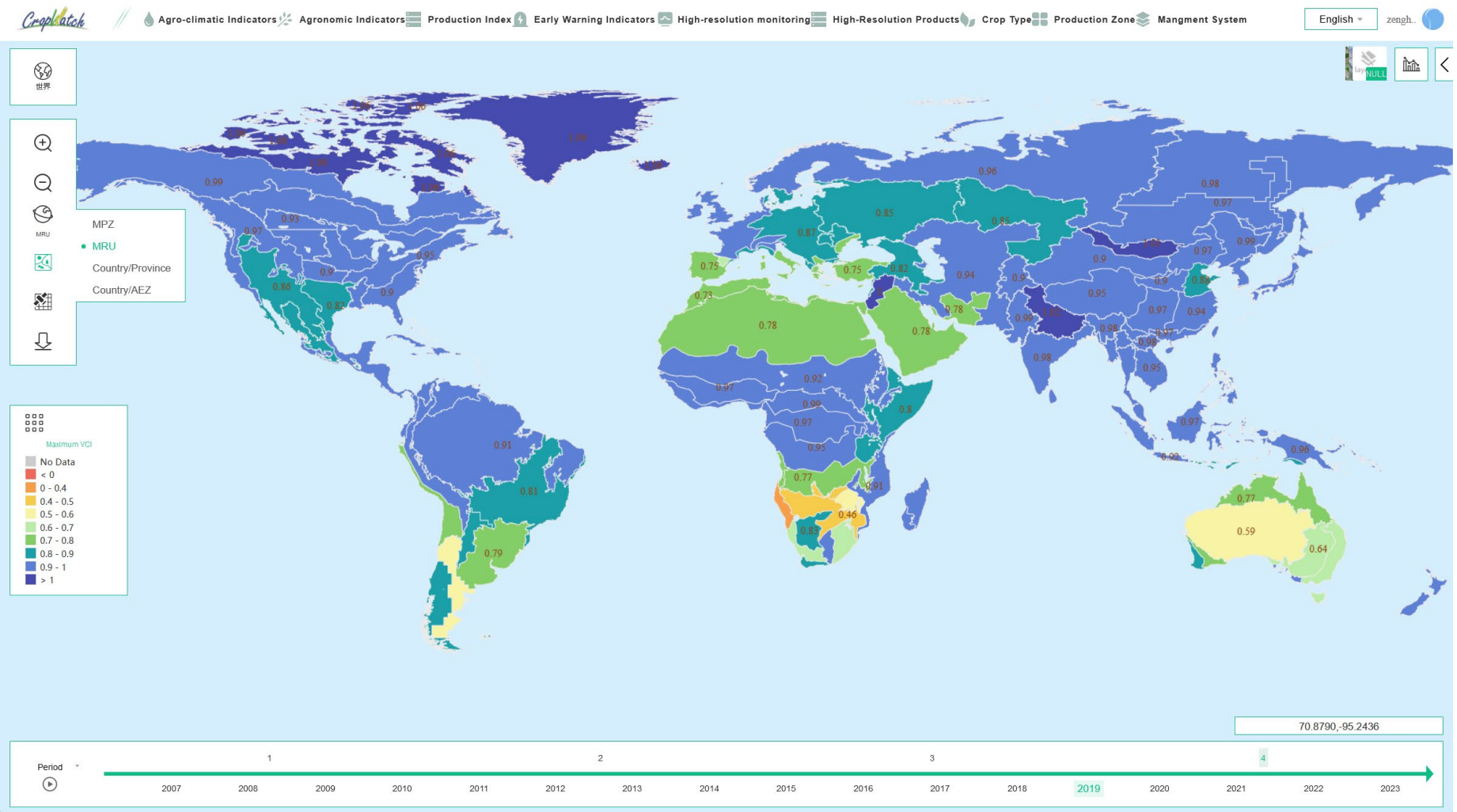
Means of Value: absolute value of NDVI

Function: indicate crop condition at different crop growing stage.

- Same crop in the field, more higher NDVI, means better condition, otherwise, worse condition

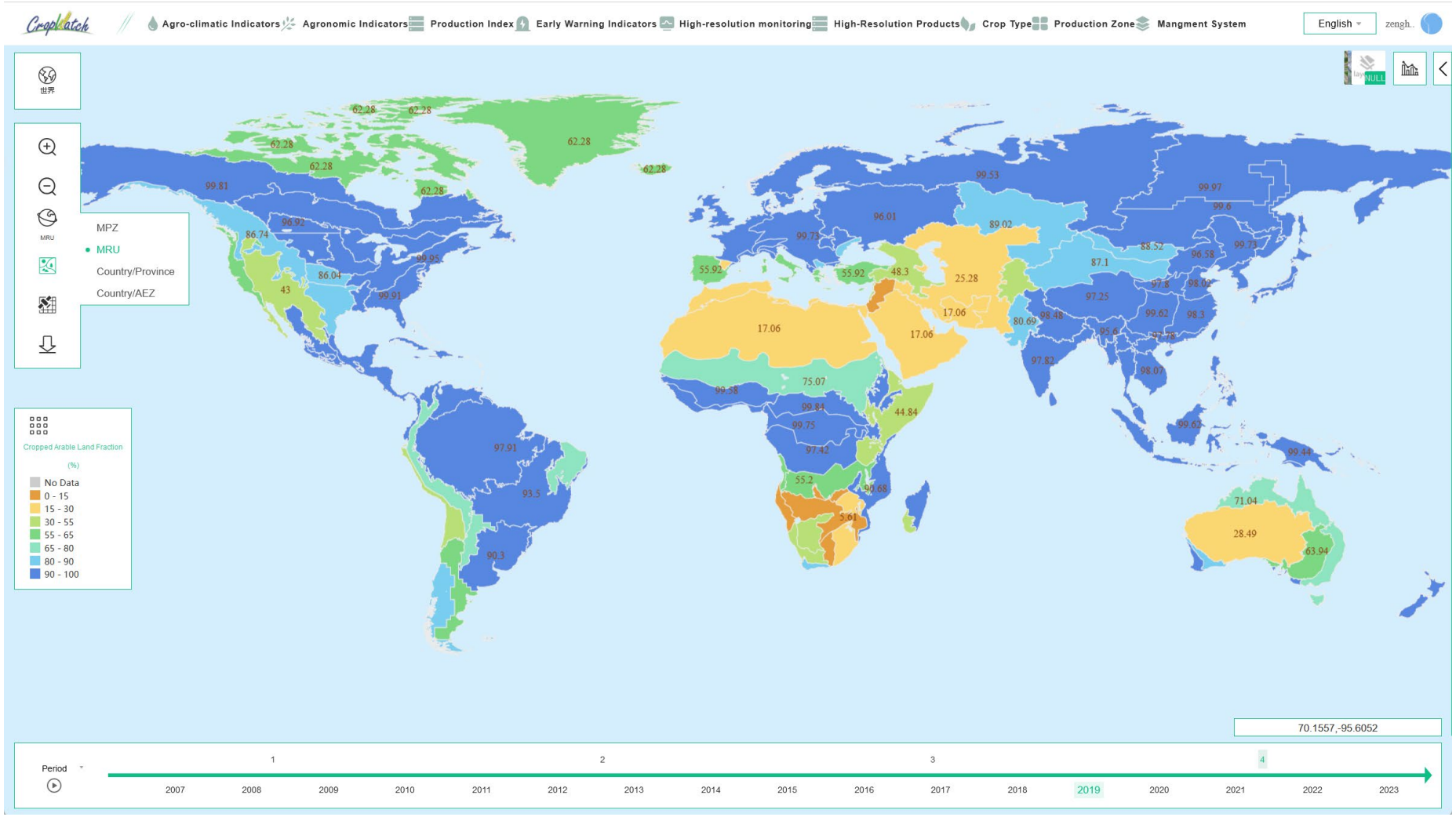


Maximum Vegetation Index(VCIx)



- Time Frequency: period, dekad
- Means of Value: compare with last 5YA, what's is the NDVI level
- Function: indicating the crop condition at different crop growing stage compared to last 5 year’s average
  - Worse crop condition: < 0.5
  - Favorable crop condition: > 1

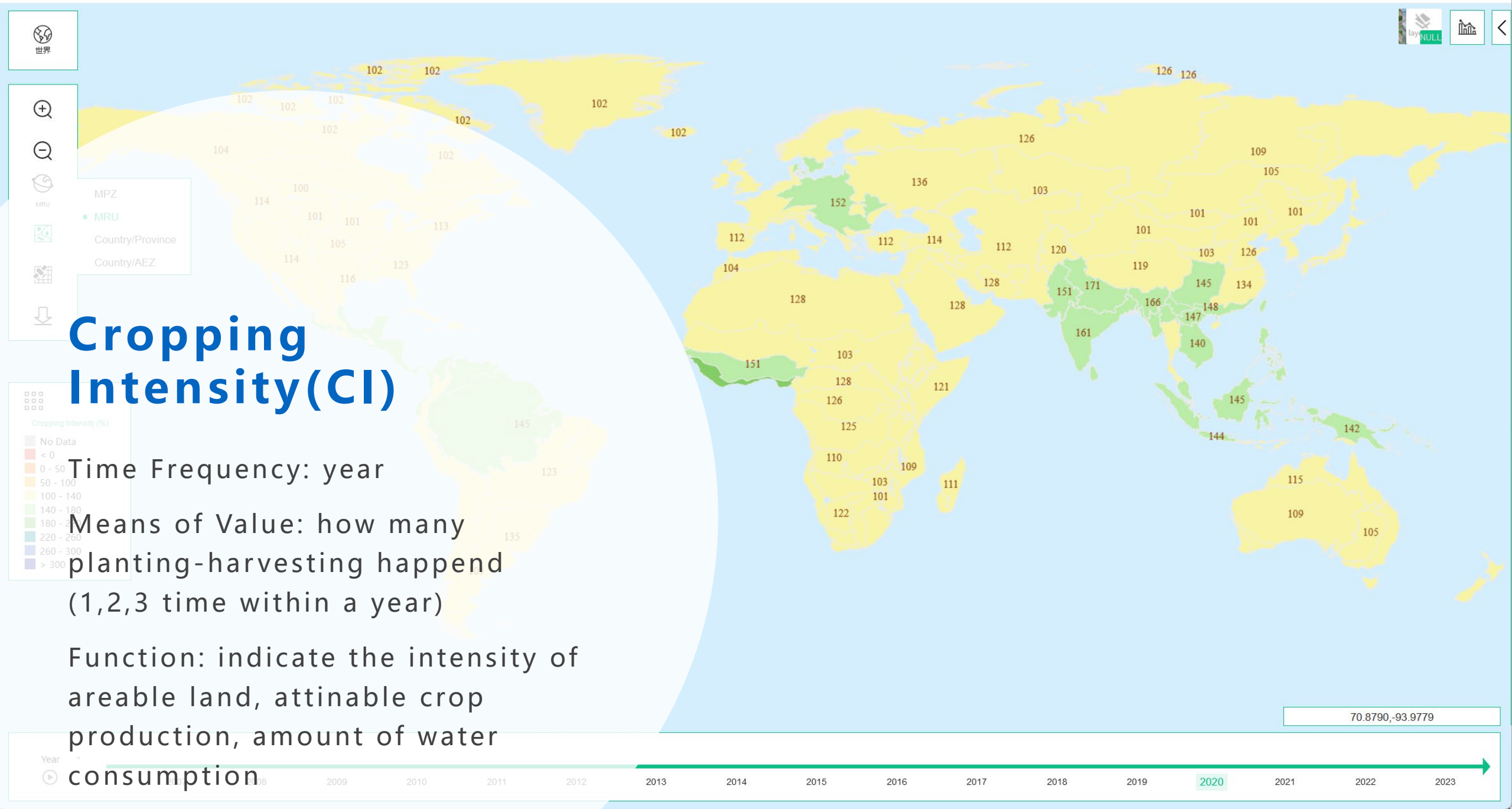
CALF(Cropped Arable Land Fraction)



Time Frequency: period

Means of Value: fraction of cropped land account for area of interest

Function: indicate the progress of sowing, harvesting,or early warning of crop production

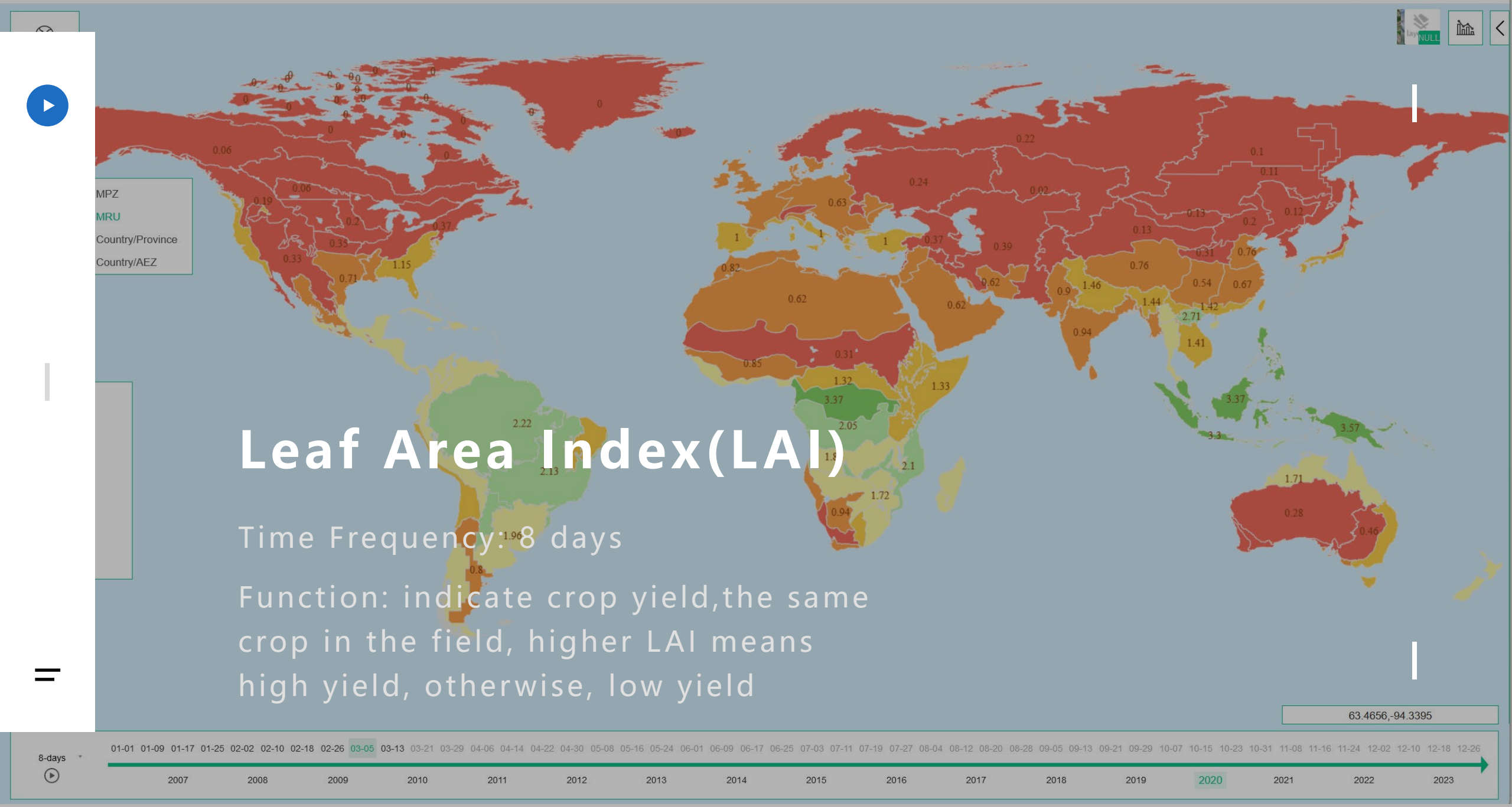


Cropping Intensity(CI)

Time Frequency: year

Means of Value: how many planting-harvesting happend (1,2,3 time within a year)

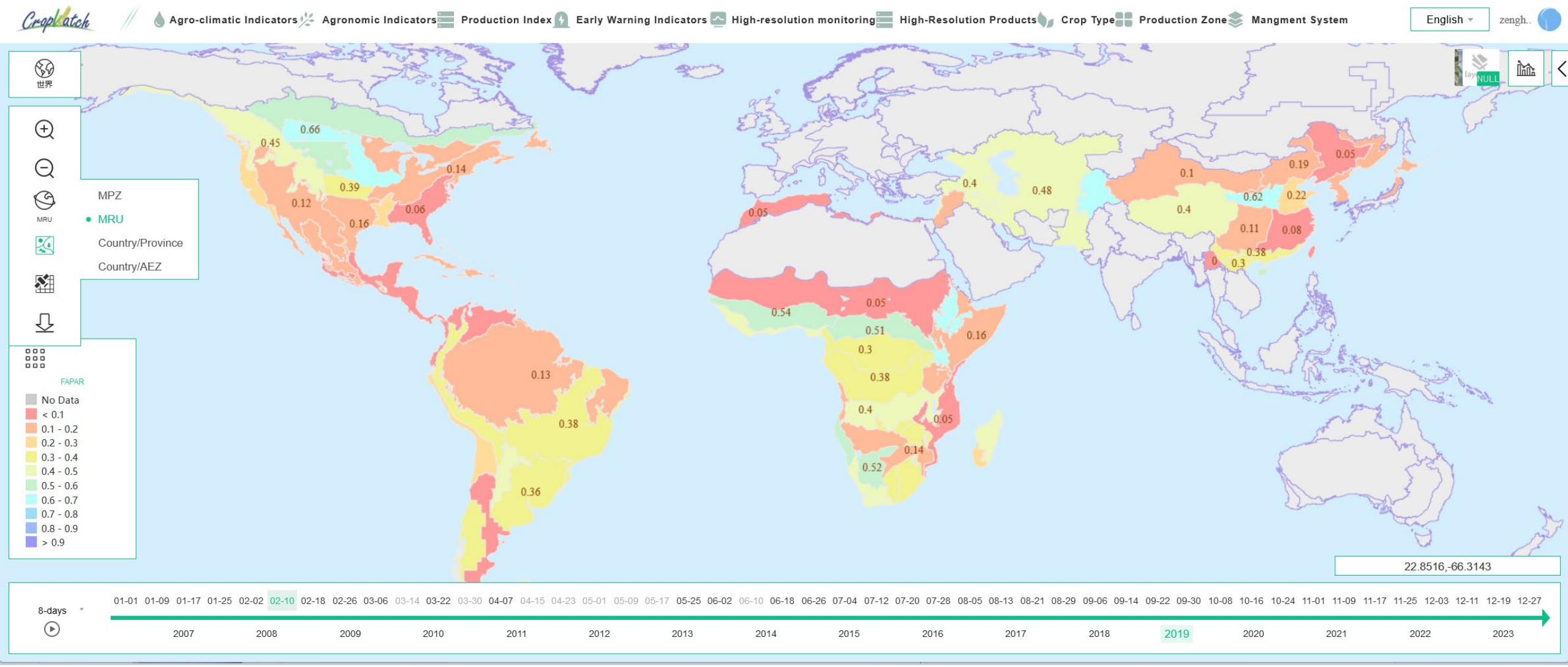
Function: indicate the intensity of areable land, attinable crop production, amount of water consumption



Leaf Area Index(LAI)

Time Frequency: 8 days

Function: indicate crop yield,the same crop in the field, higher LAI means high yield, otherwise, low yield



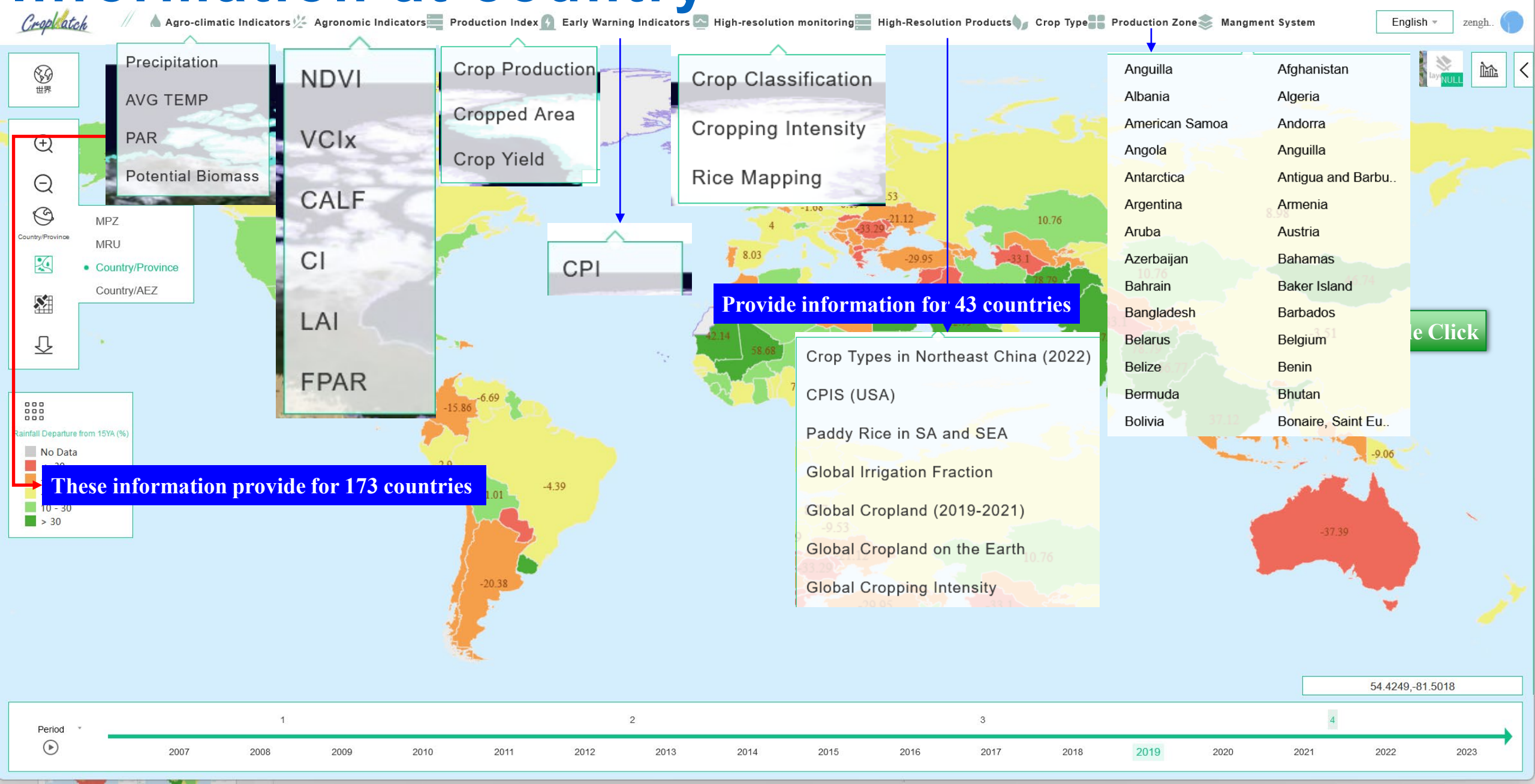
Time Frequency: 8 days

Function: indicates capacity of energy absorbtion by crop

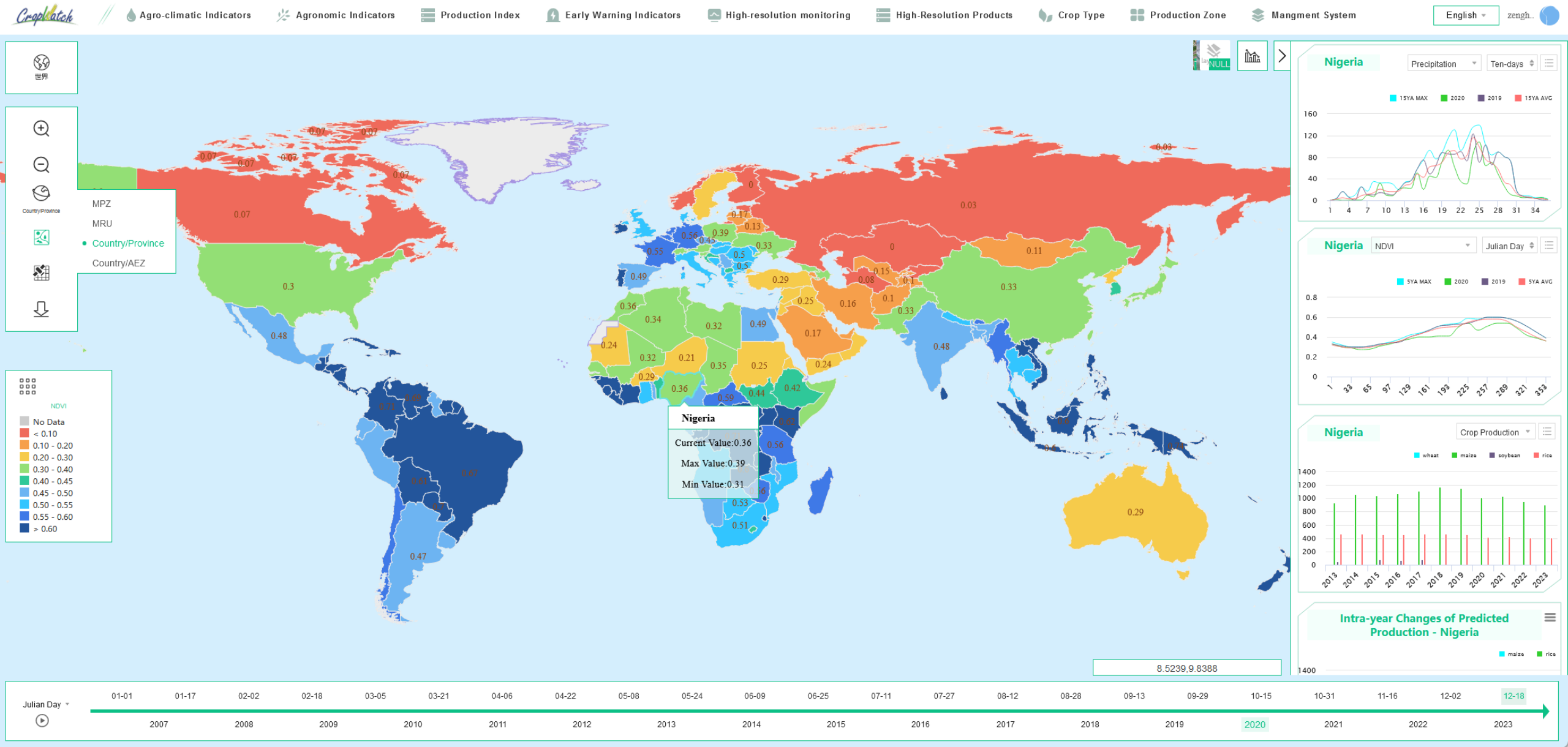
Fraction of Absorbed Photosynthetically Active Radiation(FPAR)

Information at Country Level(Province)

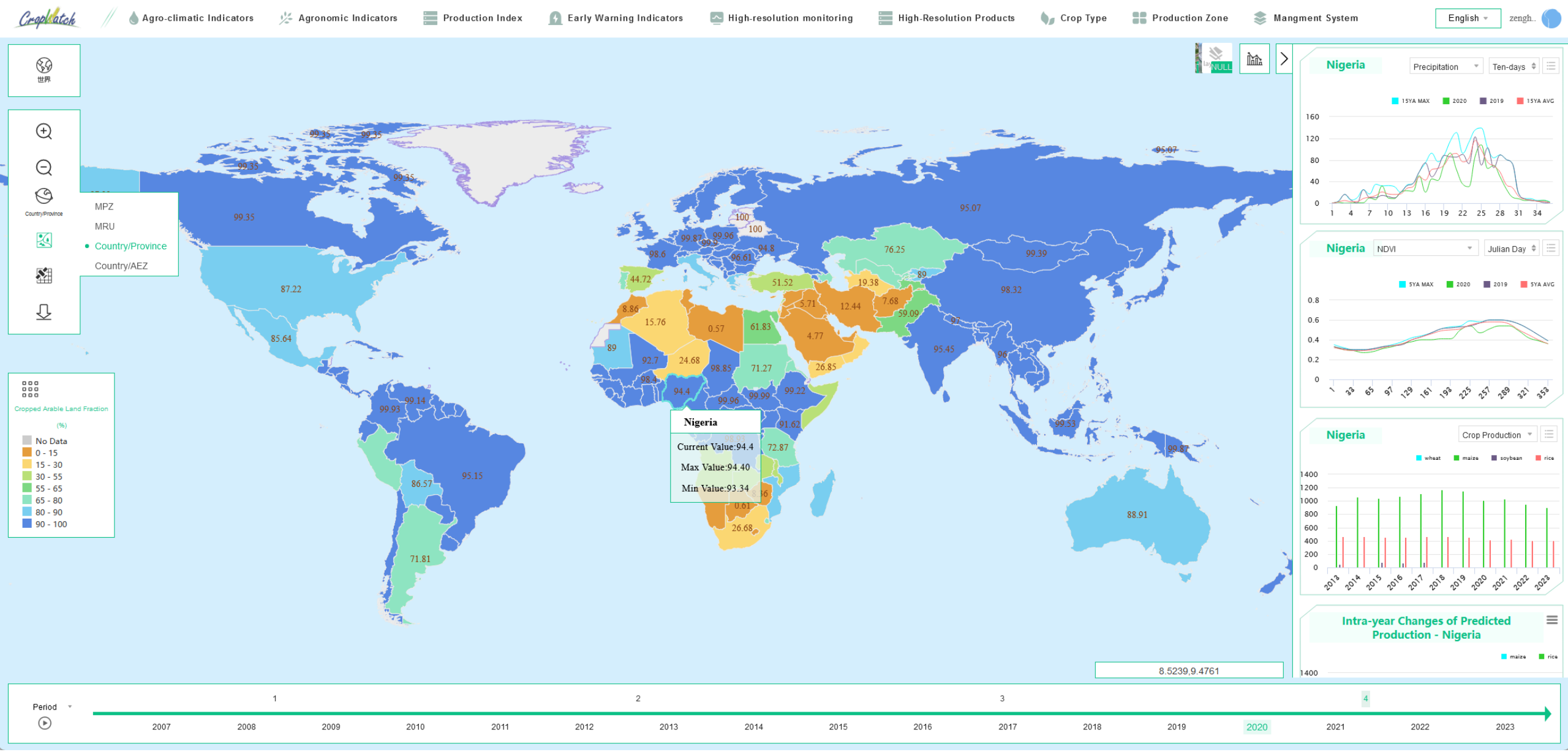
Information at country



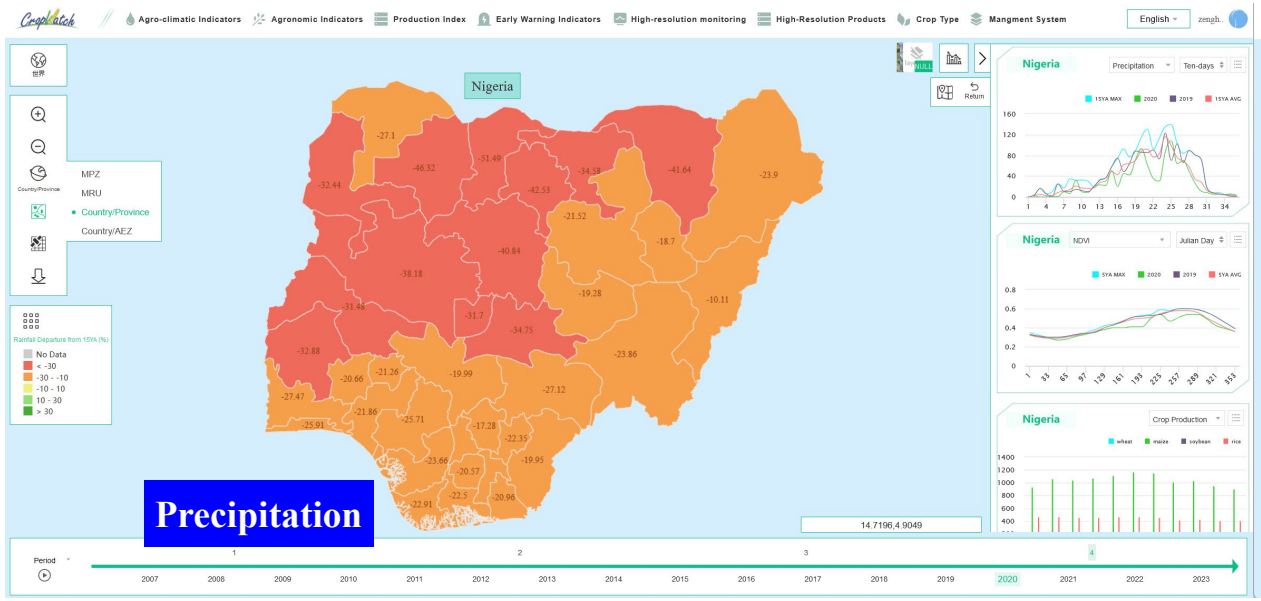
Information at country- Nigeria



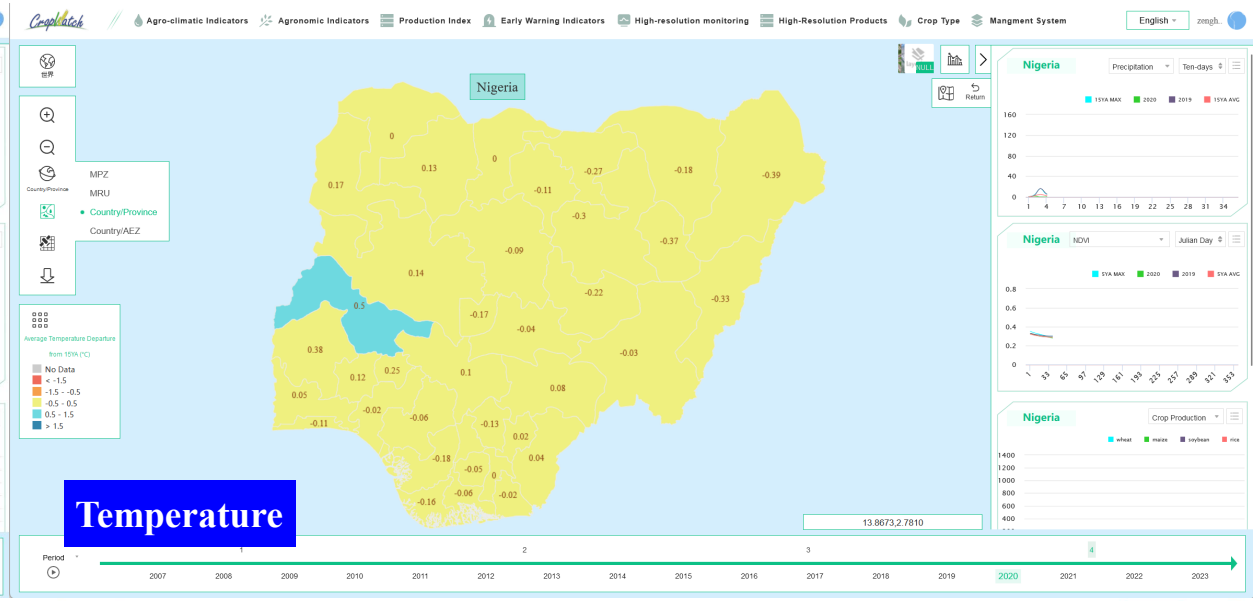
Provide province's information for 173 countries



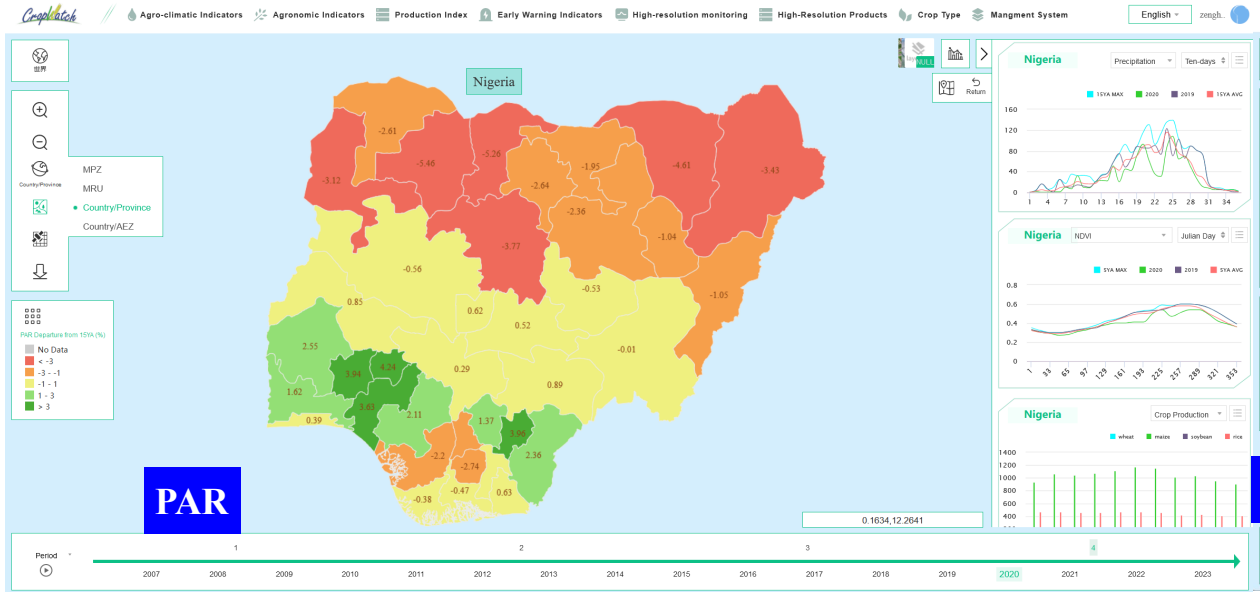
Agro-climatic information at province level of Nigeria



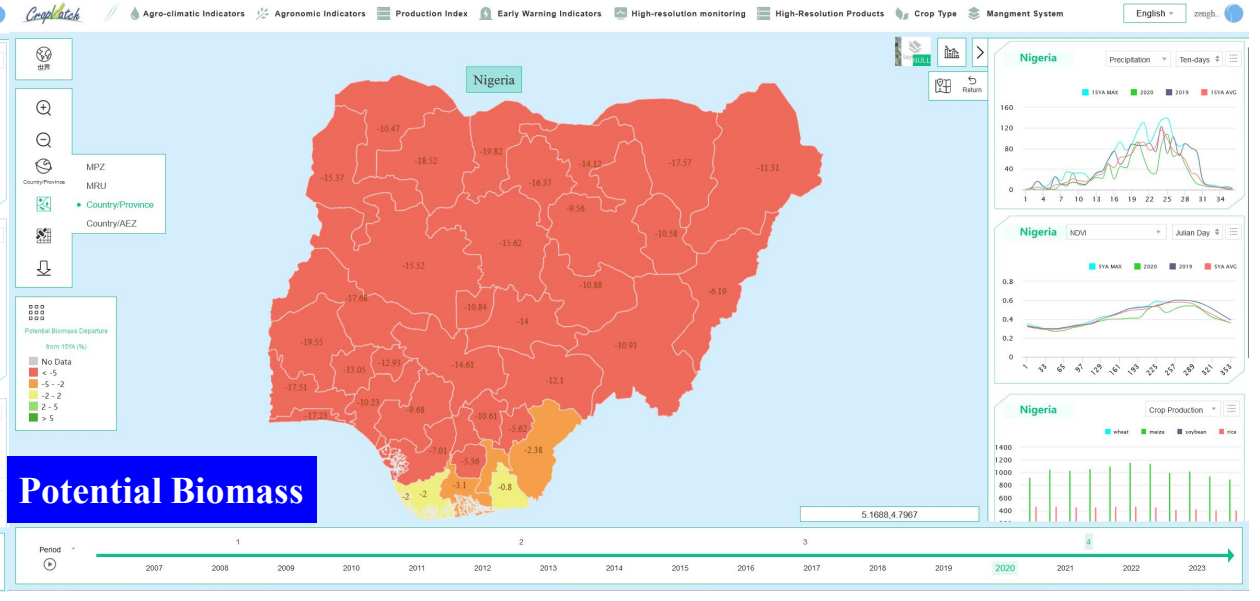
Precipitation



Temperature

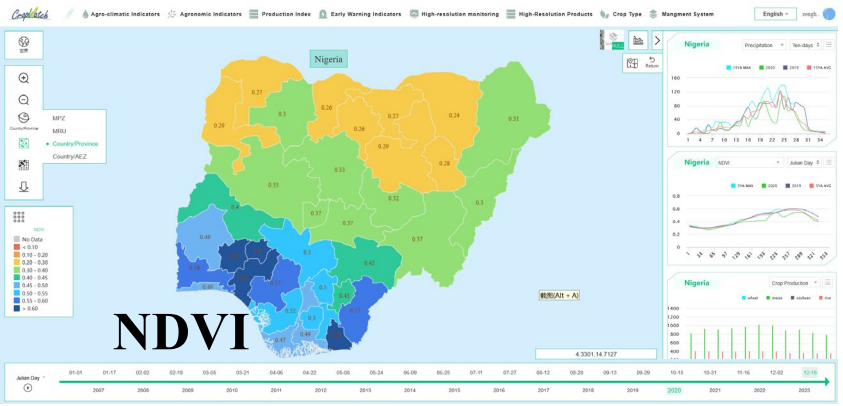


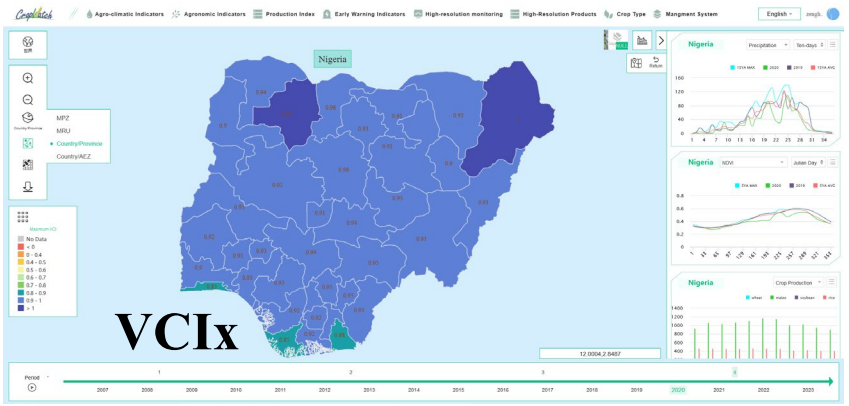
PAR

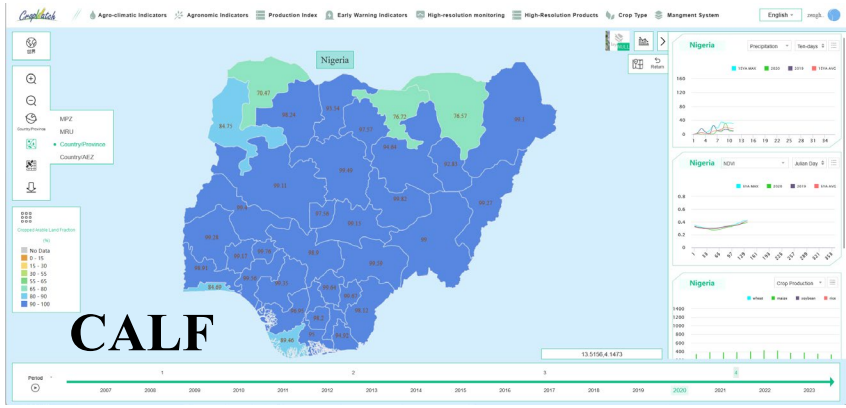


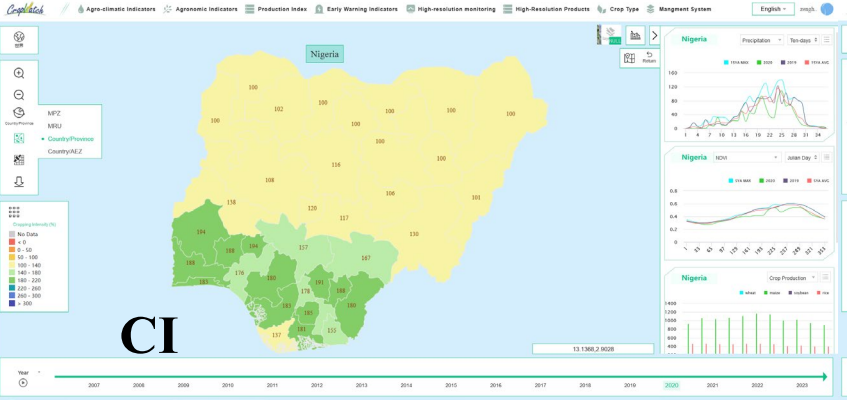
Potential Biomass

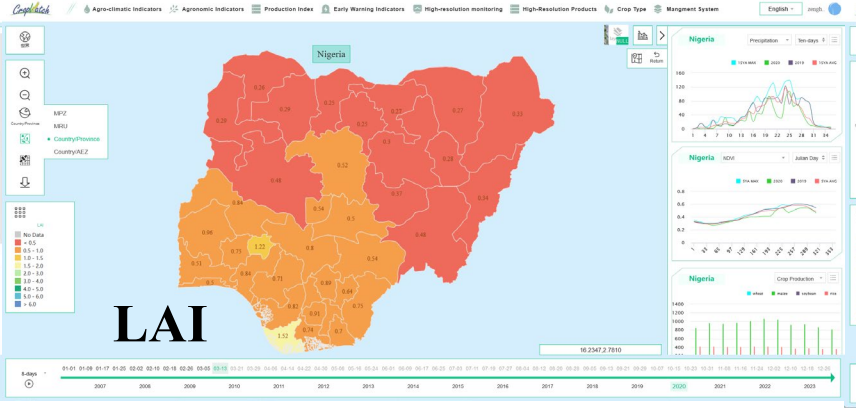
Agronomic information at province

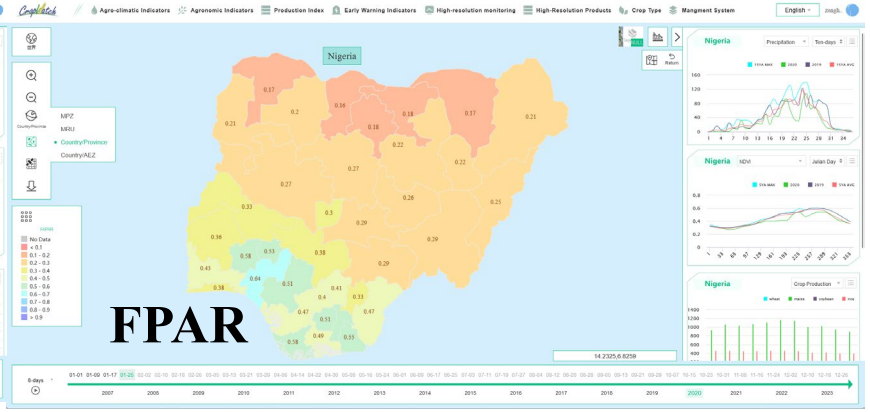






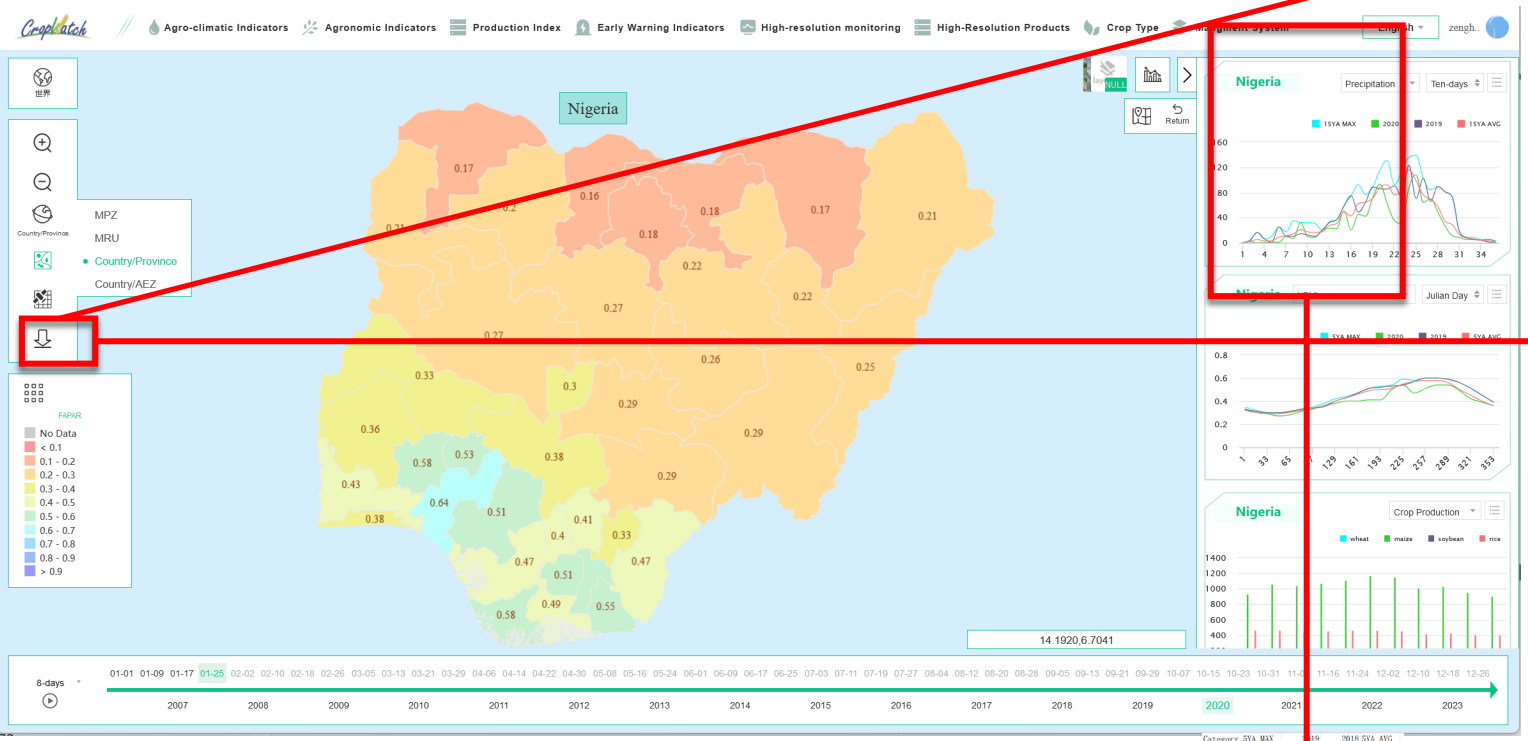


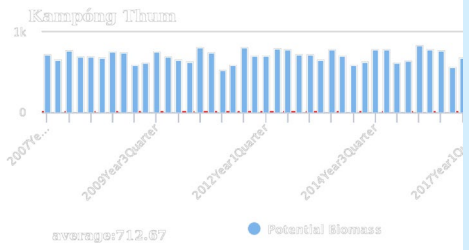


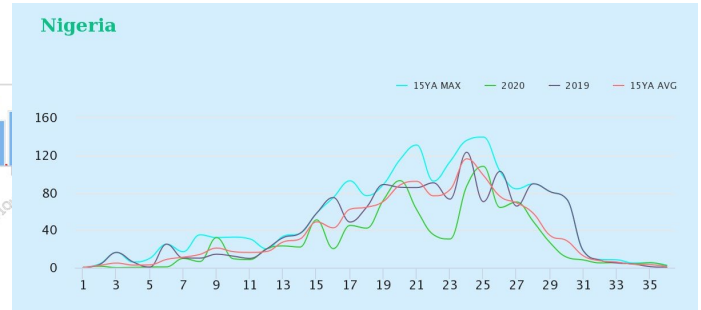


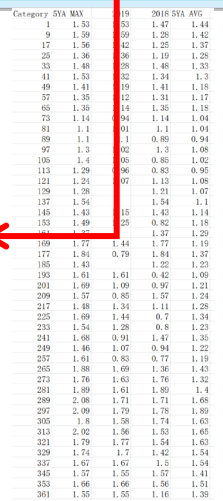
Information exports

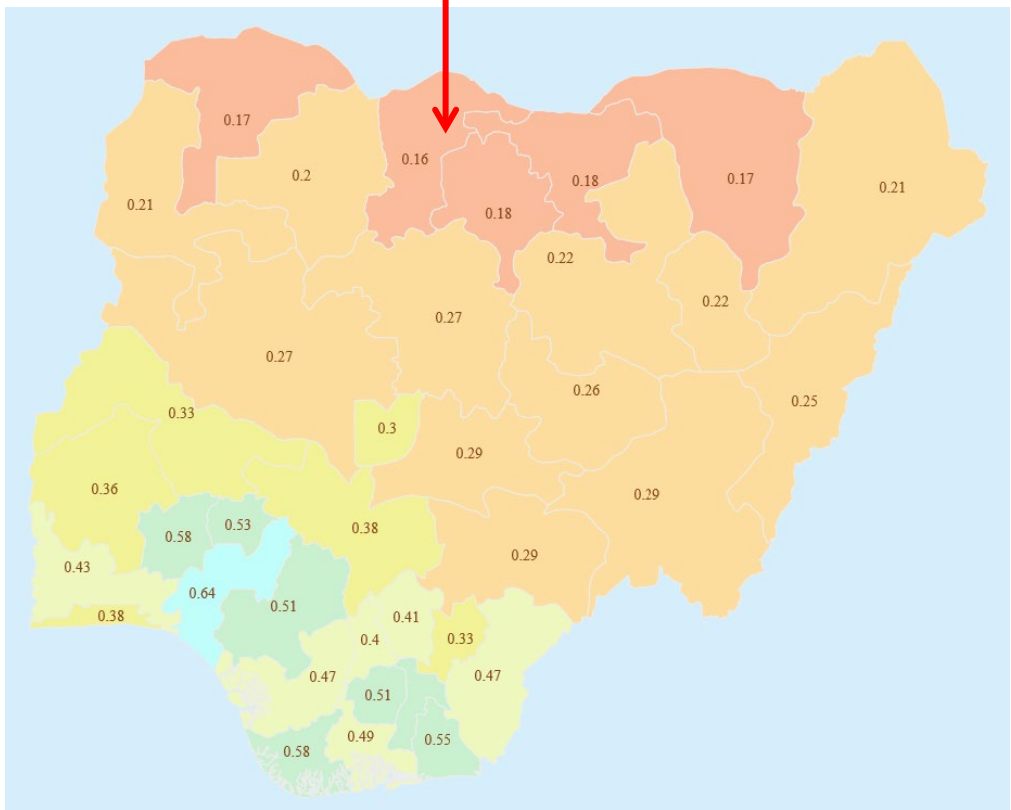
Export Image





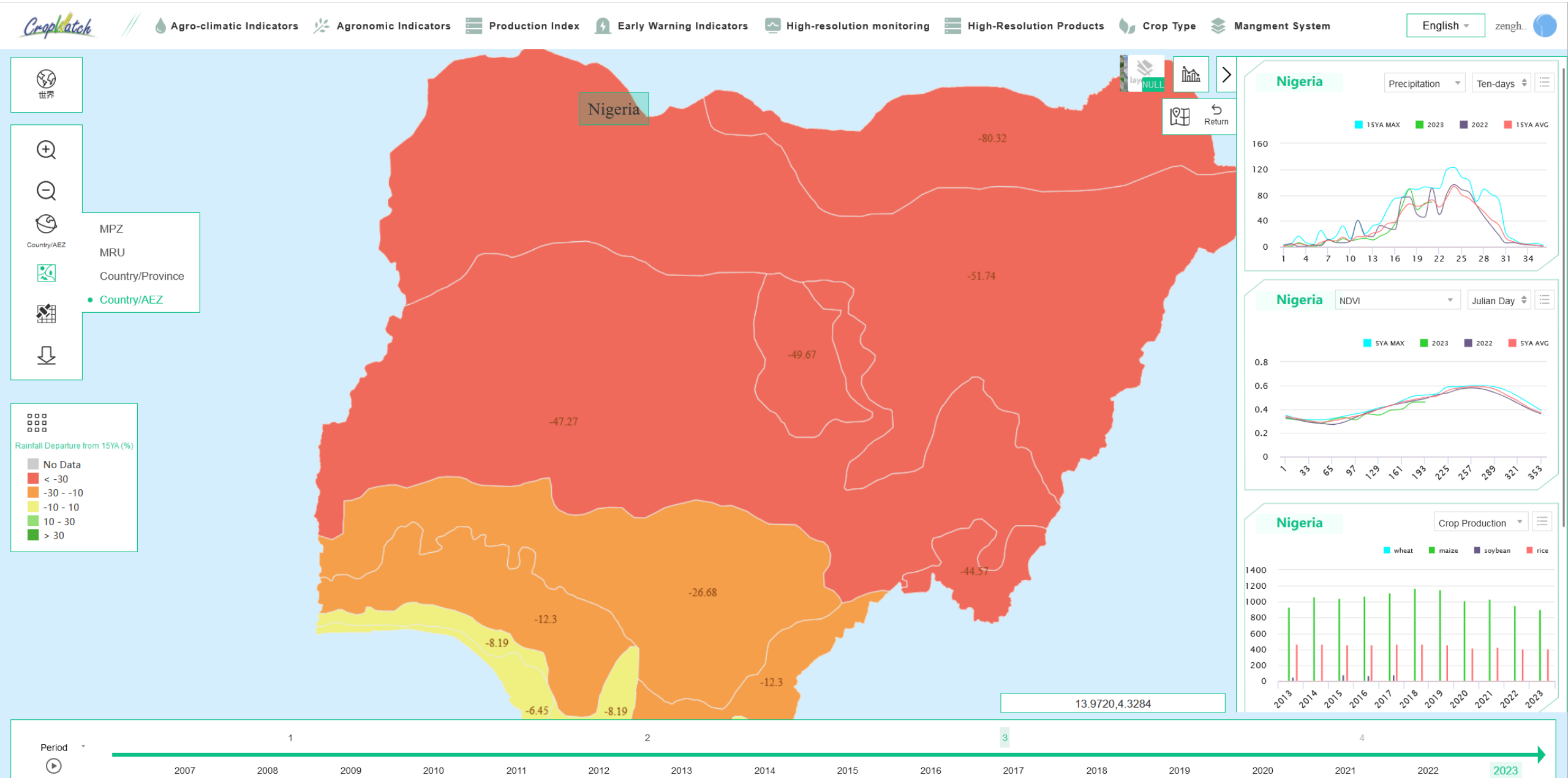




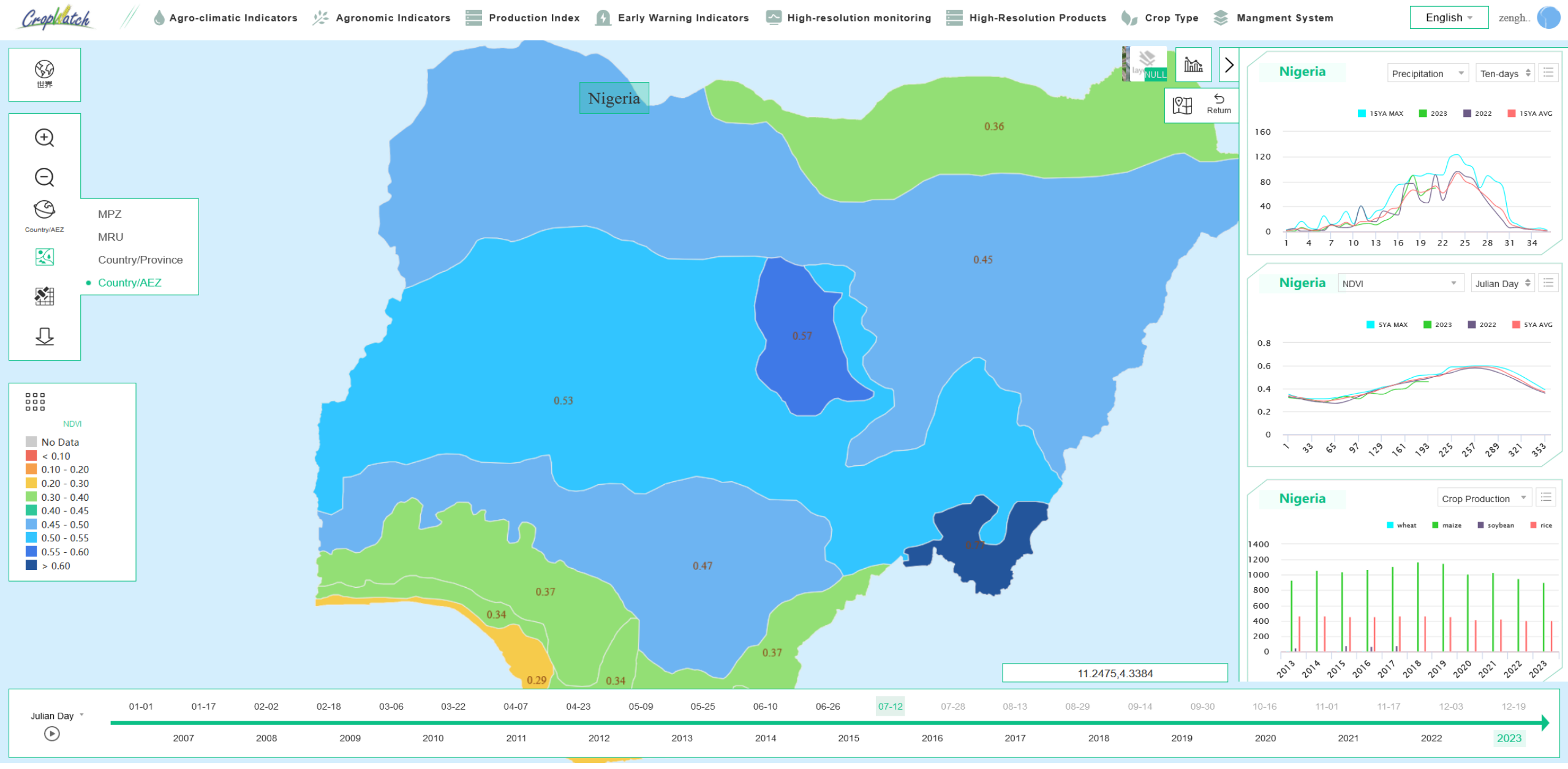


Information at country Level(AEZ)

Information at the country Level(AEZ)-Agroclimatic Info.

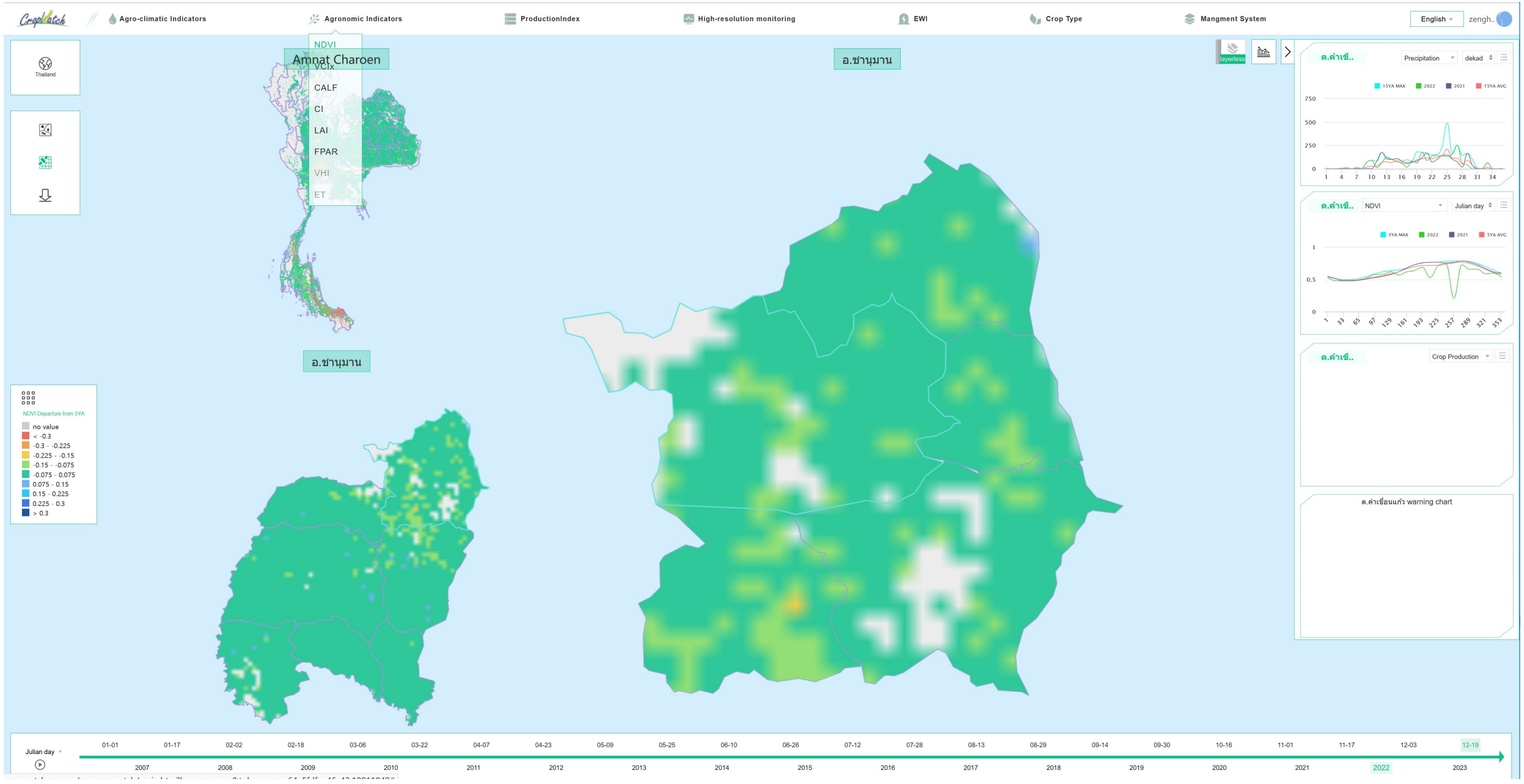


Information at the country Level(AEZ)- Agronomic Info

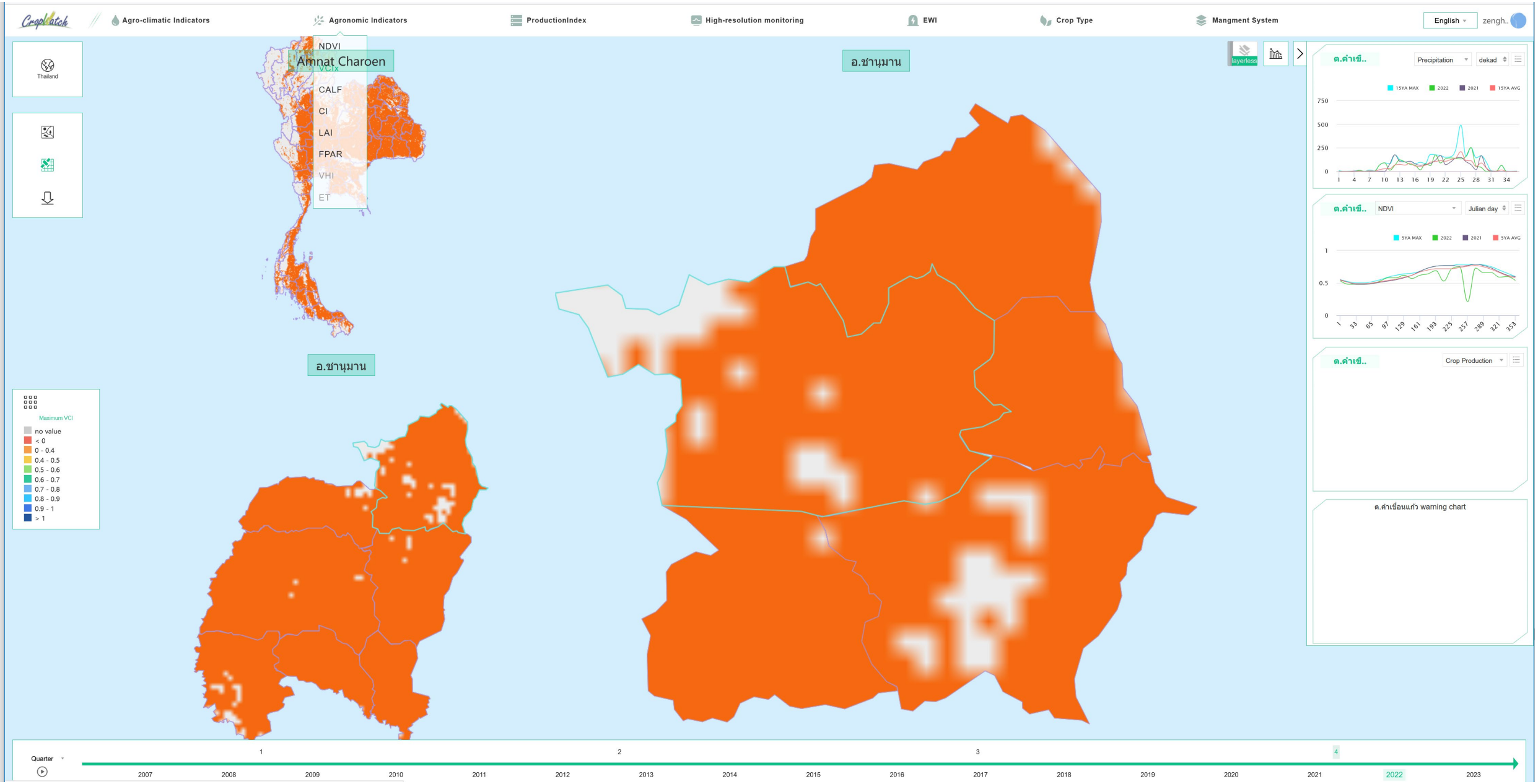


Information for special country

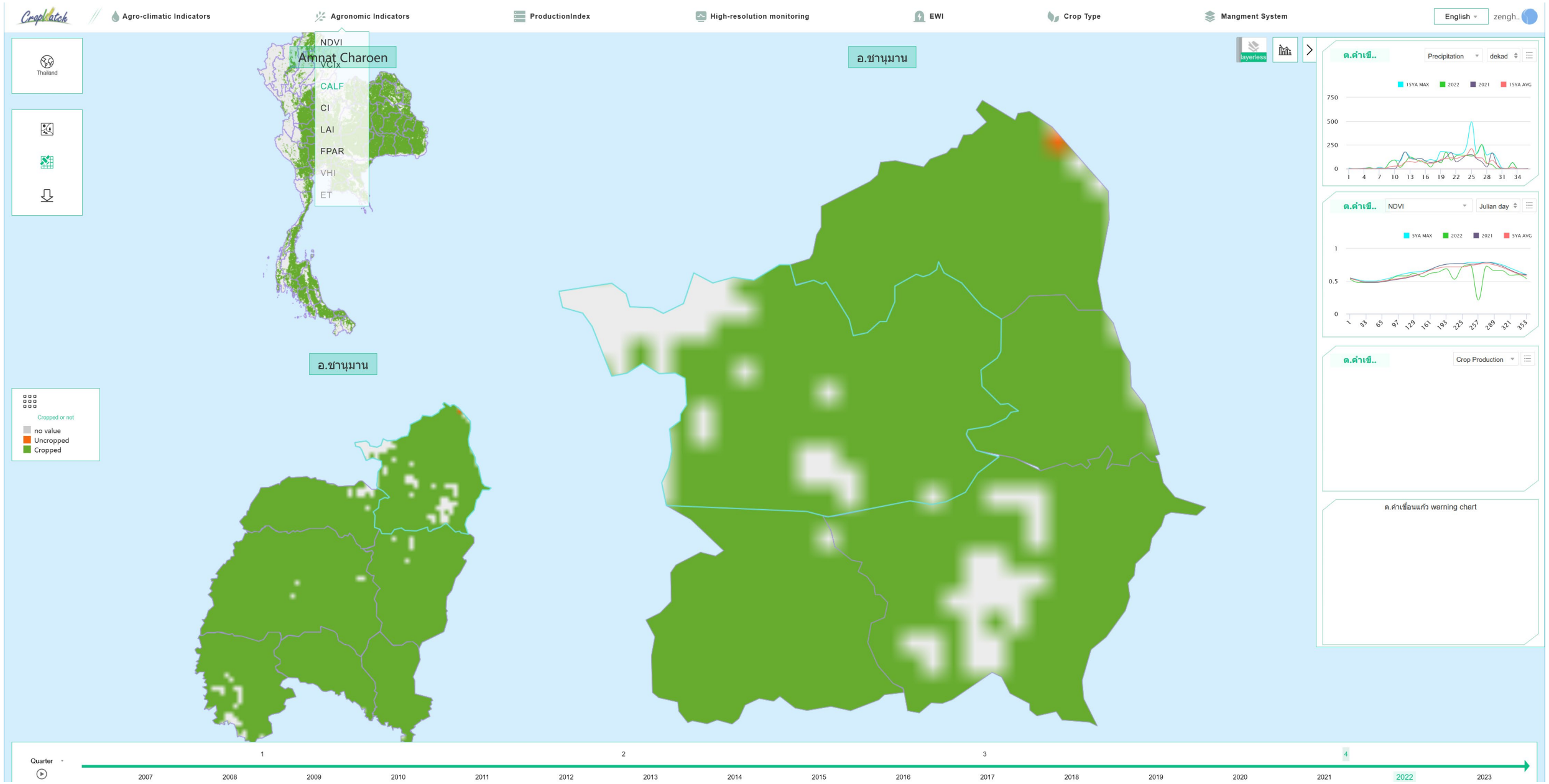
Interface of CropWatch for Thailand-NDVI



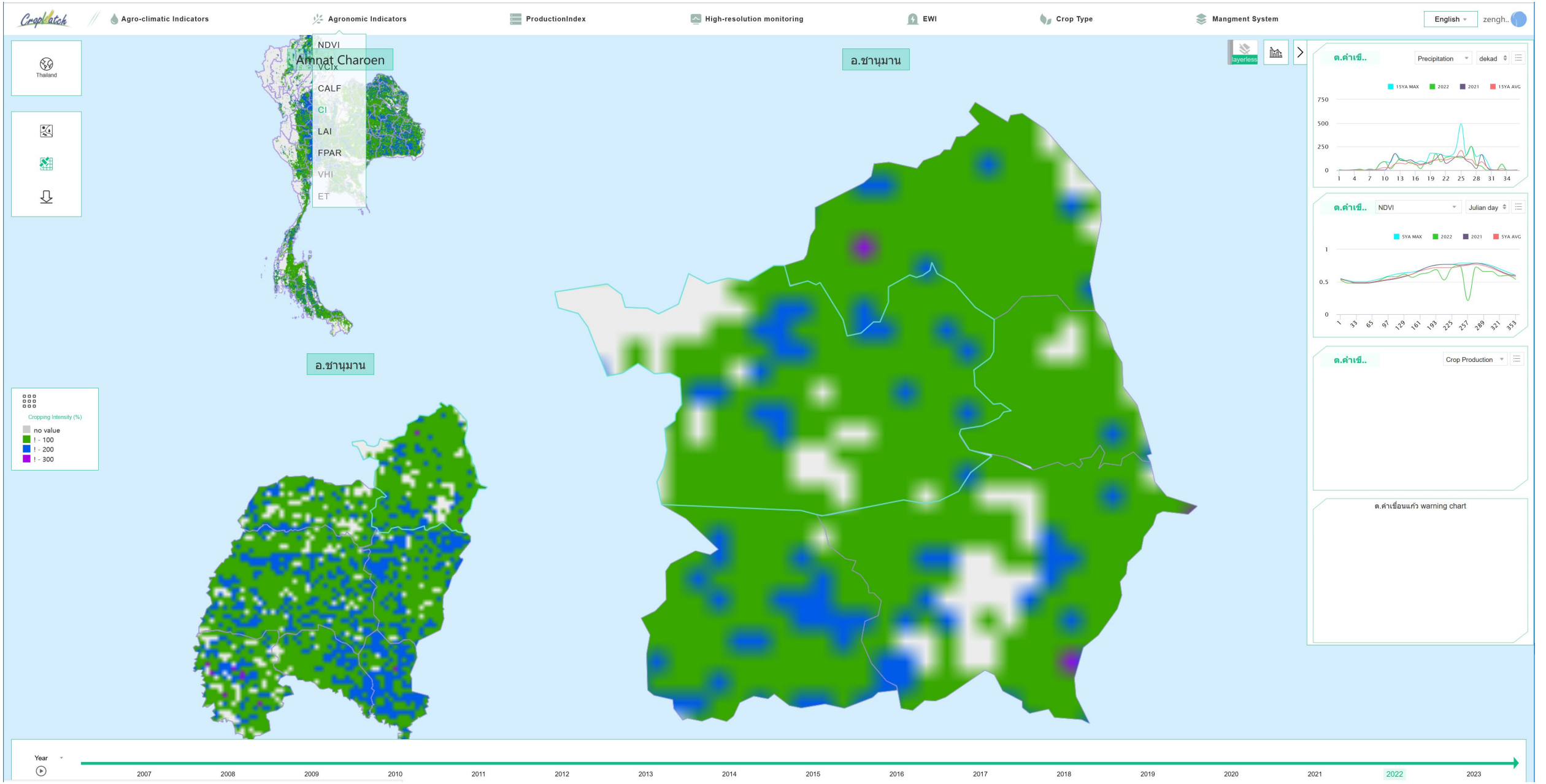
Interface of CropWatch for Thailand-VCIx



Interface of CropWatch for Thailand-CALF



Interface of CropWatch for Thailand-Cropping Intensity



How to provide information for specific countries

Identify information needs

Provide basic data: borders, crop masks, etc.

Training courses: basic skills

Conclusion and Outlook

Conclusion

This presentation introduces the functions of CropWatch Explorer and how to use it to search and download information (images and tables) at MPZ, MRU, national and provincial (AEZ) level, and details of special countries.

We hope that every colleague will understand and master this function.

Outlook

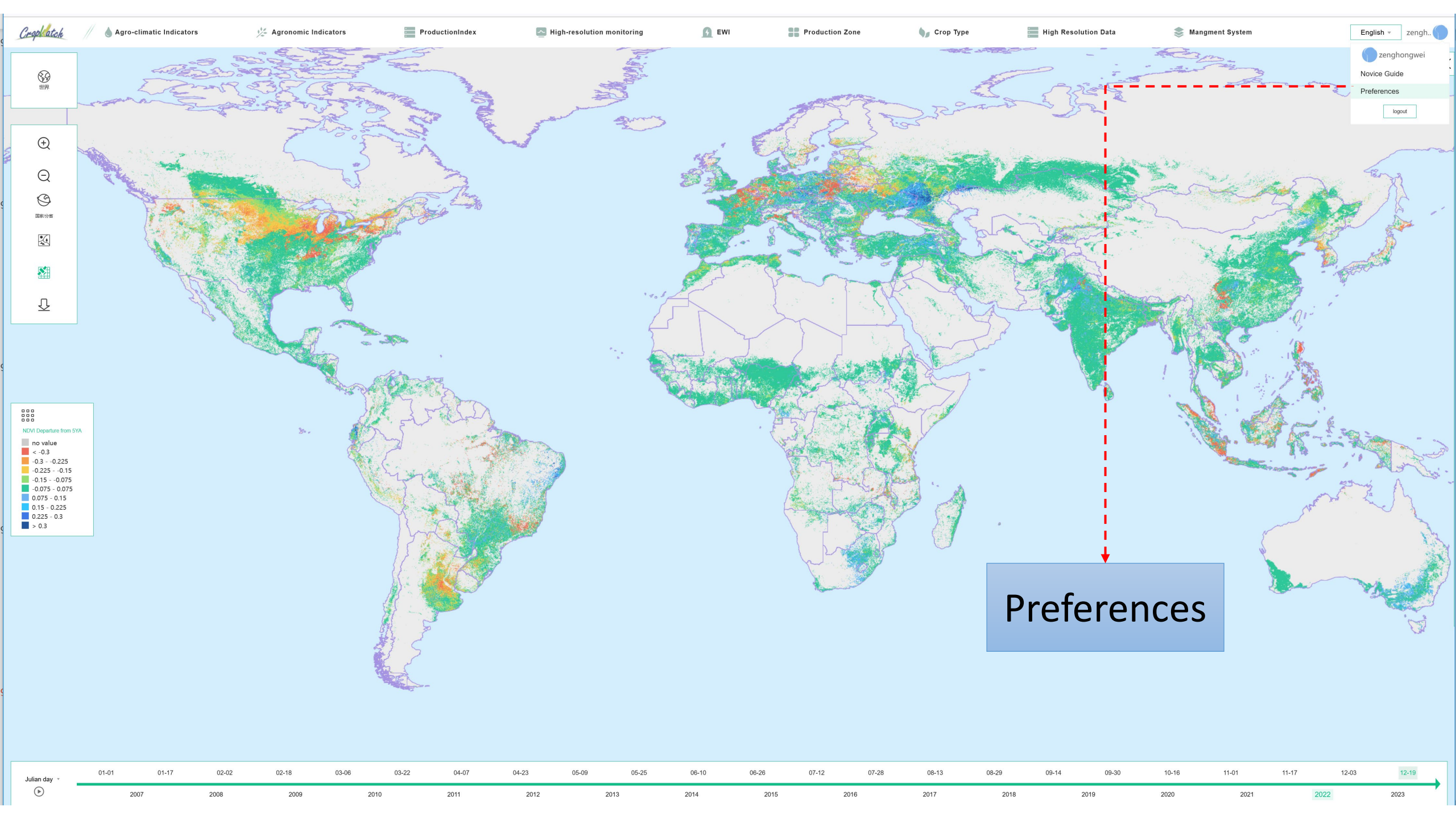
01. All information generated by CropWatch Pro will be displayed in CropWatch Explorer, including raster information.

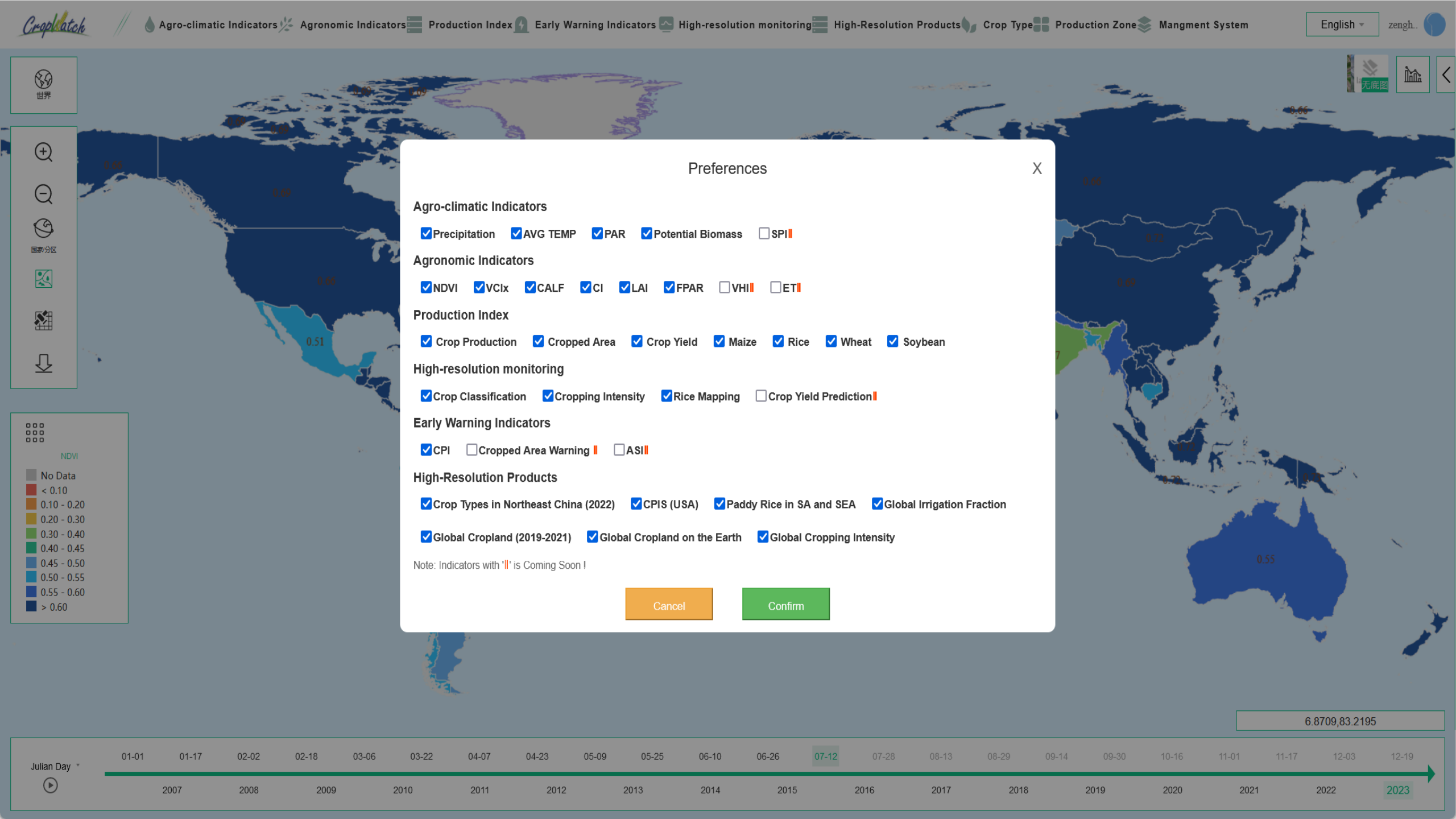
02. CropWatch Explorer will provide information personalised to the specific needs of the user (any region, any time, anyone).

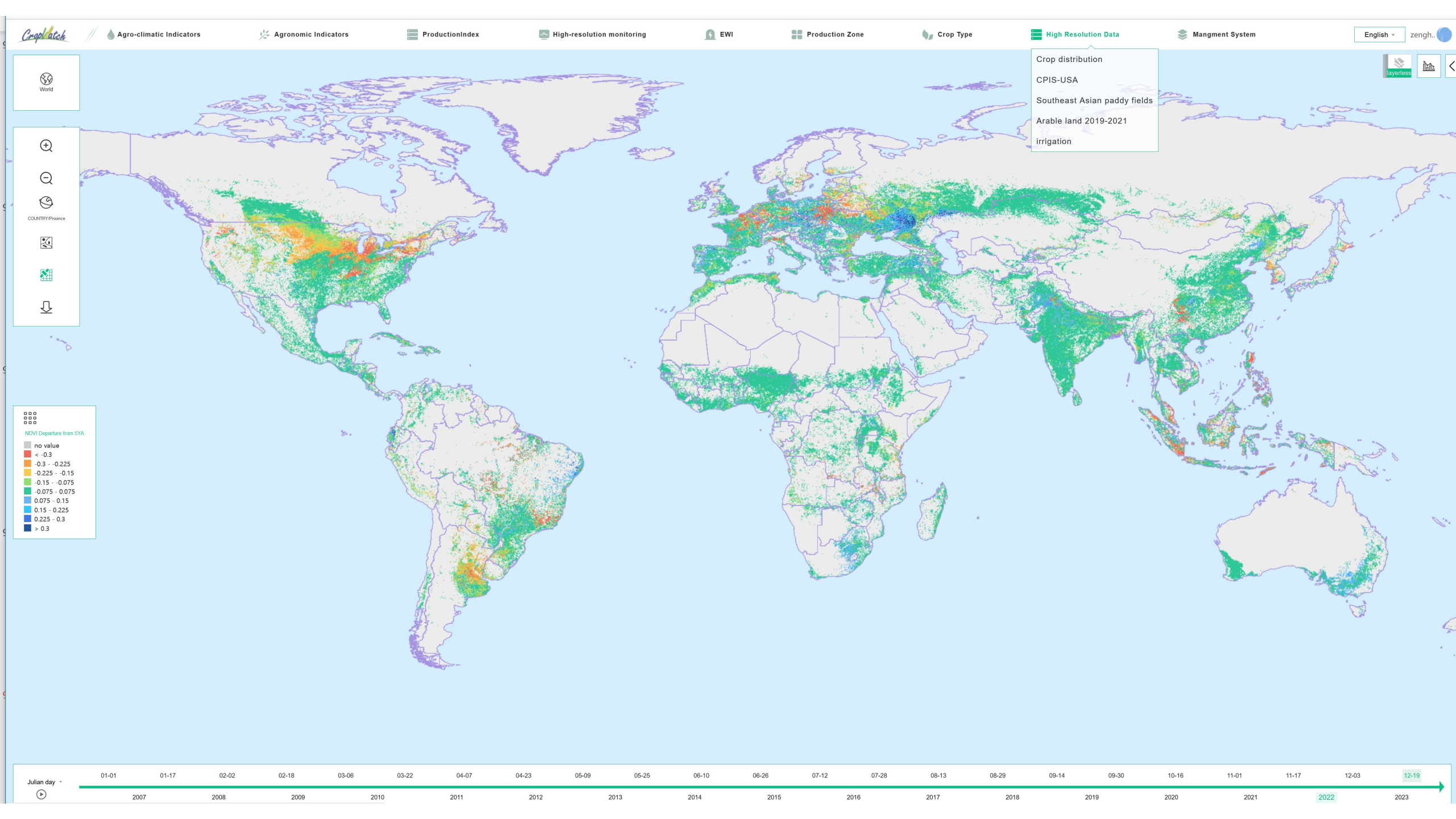
Practices

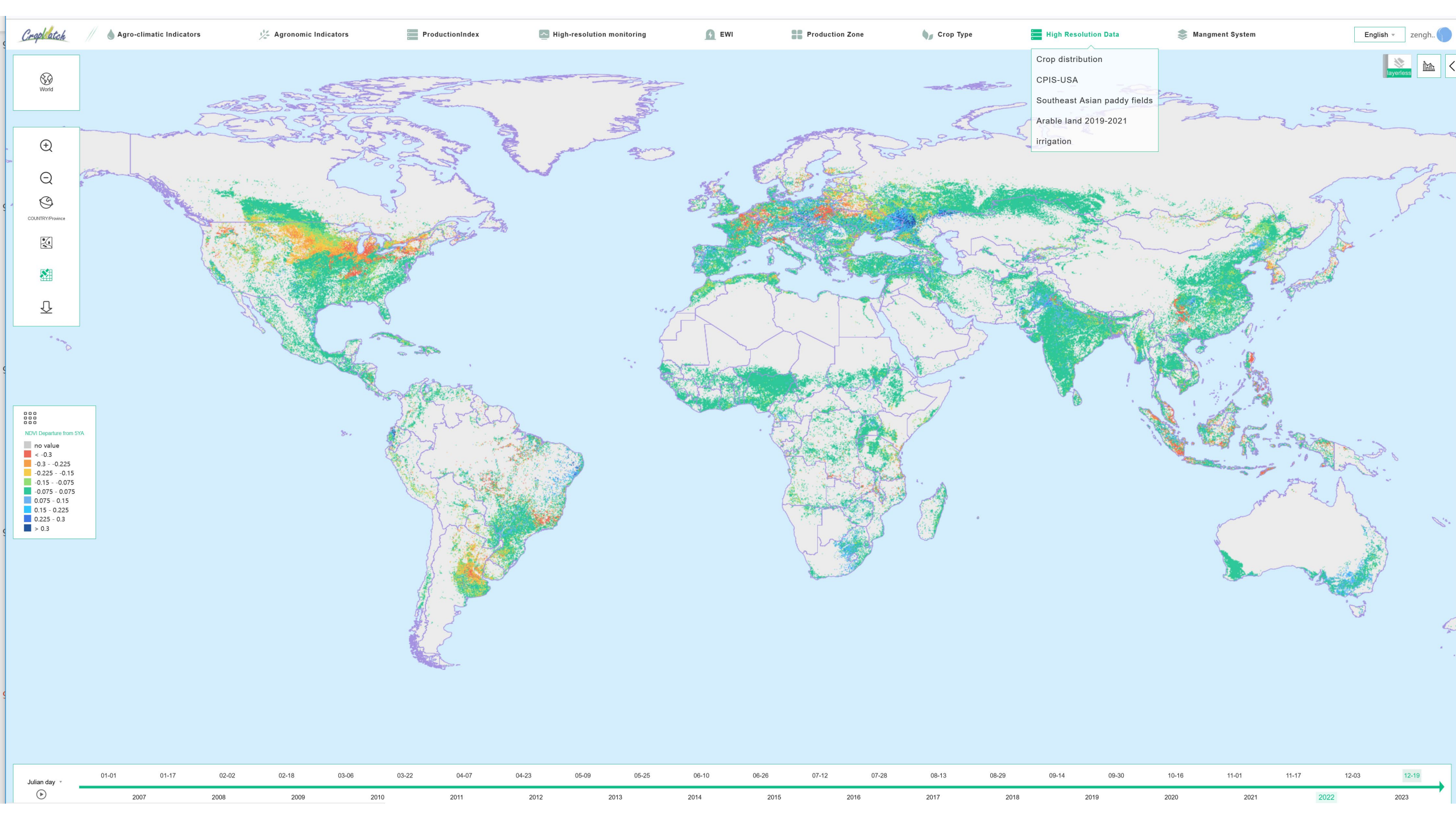
More&Practise

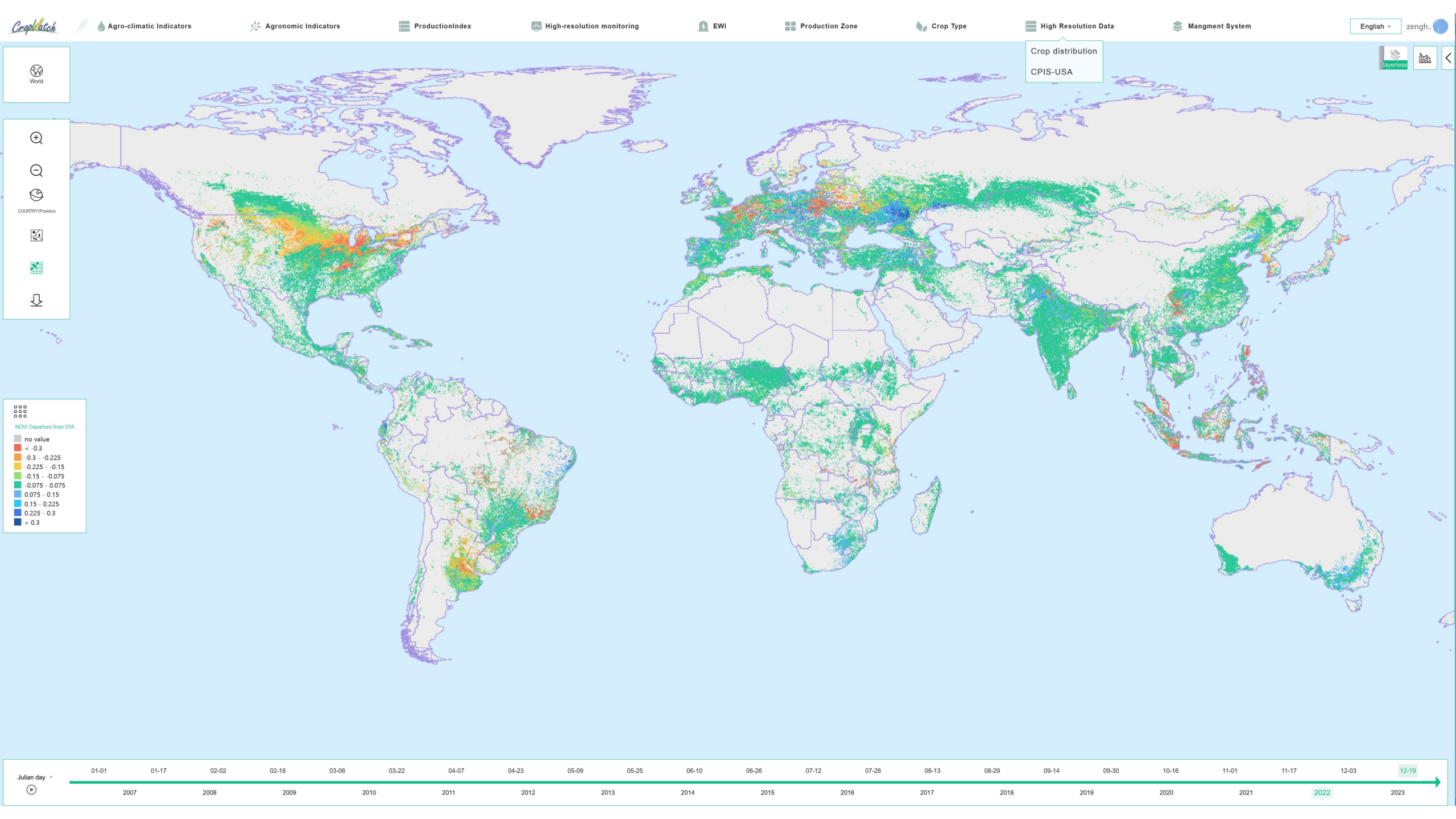
Interface configuration


Agro-climatic Indicators
Agronomic Indicators
ProductionIndex
High-resolution monitoring
EWI
Production Zone
Crop Type
High Resolution Data
Mangment System
English
zenghongwei
Novice Guide
Preferences
logout
世界
国家分省
NDVI Departure from 5YA
no value
< -0.3
-0.3 - -0.225
-0.225 - -0.15
-0.15 - -0.075
-0.075 - 0.075
0.075 - 0.15
0.15 - 0.225
0.225 - 0.3
> 0.3
Preferences
Julian day
01-01
01-17
02-02
02-18
03-06
03-22
04-07
04-23
05-09
05-25
06-10
06-26
07-12
07-28
08-13
08-29
09-14
09-30
10-16
11-01
11-17
12-03
12-19
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

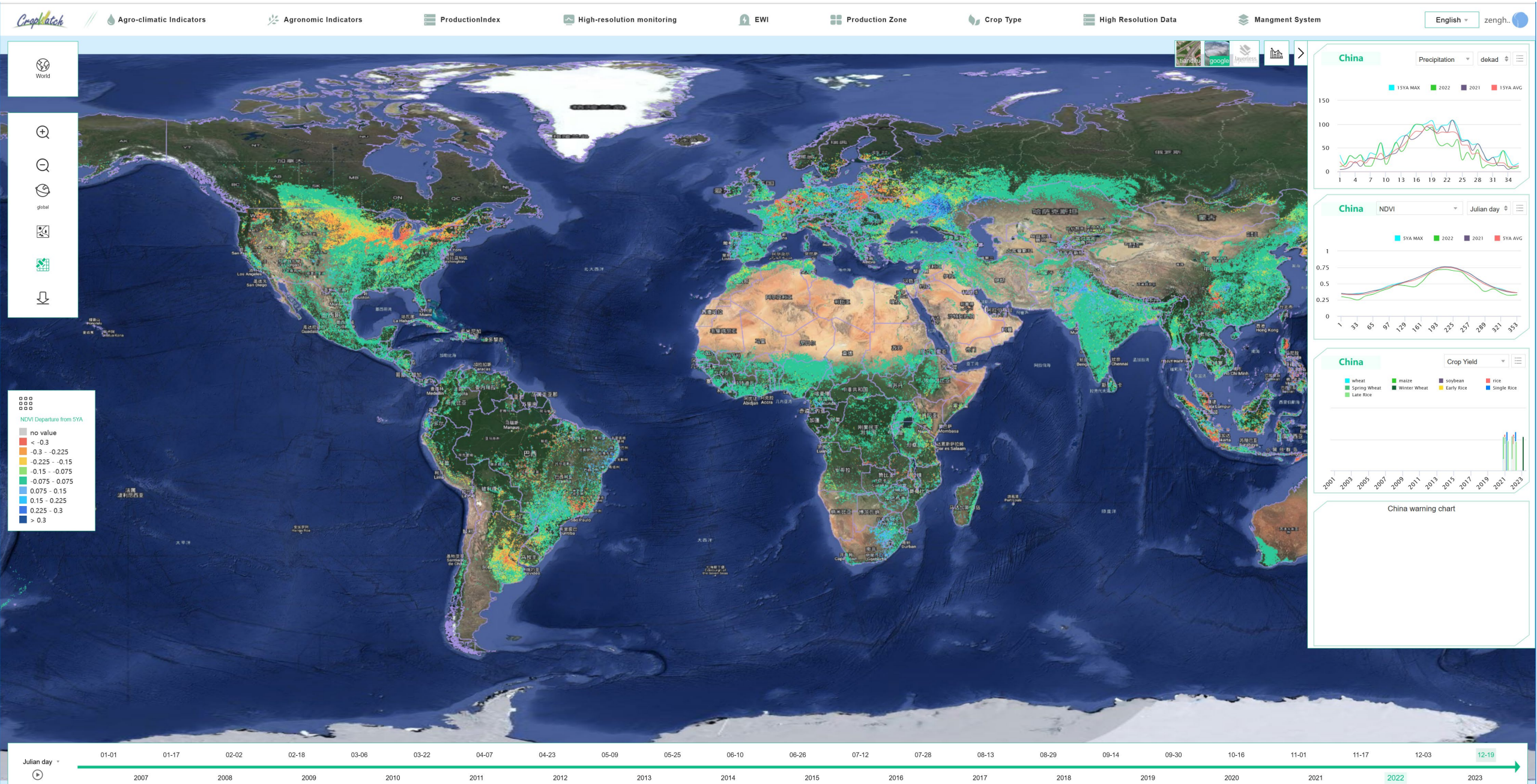

Cropwatch
Agro-climatic Indicators
Agronomic Indicators
Production Index
Early Warning Indicators
High-resolution monitoring
High-Resolution Products
Crop Type
Production Zone
Mangment System
English
zengh..
世界
国家/分区
无底图
NDVI
No Data
< 0.10
0.10 - 0.20
0.20 - 0.30
0.30 - 0.40
0.40 - 0.45
0.45 - 0.50
0.50 - 0.55
0.55 - 0.60
> 0.60
Preferences
X
Agro-climatic Indicators
Precipitation
AVG TEMP
PAR
Potential Biomass
SPI
Agronomic Indicators
NDVI
VCIx
CALF
CI
LAI
FPAR
VHI
ET
Production Index
Crop Production
Cropped Area
Crop Yield
Maize
Rice
Wheat
Soybean
High-resolution monitoring
Crop Classification
Cropping Intensity
Rice Mapping
Crop Yield Prediction
Early Warning Indicators
CPI
Cropped Area Warning
ASI
High-Resolution Products
Crop Types in Northeast China (2022)
CPIS (USA)
Paddy Rice in SA and SEA
Global Irrigation Fraction
Global Cropland (2019-2021)
Global Cropland on the Earth
Global Cropping Intensity
Note: Indicators with 'II' is Coming Soon !
Cancel
Confirm
6.8709,83.2195
Julian Day
01-01
01-17
02-02
02-18
03-06
03-22
04-07
04-23
05-09
05-25
06-10
06-26
07-12
07-28
08-13
08-29
09-14
09-30
10-16
11-01
11-17
12-03
12-19
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023


Cropwatch
Agro-climatic Indicators
Agronomic Indicators
ProductionIndex
High-resolution monitoring
EWI
Production Zone
Crop Type
High Resolution Data
Mangment System
English
zengh..
Crop distribution
CPIS-USA
Southeast Asian paddy fields
Arable land 2019-2021
irrigation
layerless
World
COUNTRY/Province
NDVI Departure from 5YA
no value
< -0.3
-0.3 - -0.225
-0.225 - -0.15
-0.15 - -0.075
-0.075 - 0.075
0.075 - 0.15
0.15 - 0.225
0.225 - 0.3
> 0.3
Julian day
01-01
01-17
02-02
02-18
03-06
03-22
04-07
04-23
05-09
05-25
06-10
06-26
07-12
07-28
08-13
08-29
09-14
09-30
10-16
11-01
11-17
12-03
12-19
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023


Cropwatch
Agro-climatic Indicators
Agronomic Indicators
ProductionIndex
High-resolution monitoring
EWI
Production Zone
Crop Type
High Resolution Data
Mangment System
English
zengh..
Crop distribution
CPIS-USA
Southeast Asian paddy fields
Arable land 2019-2021
irrigation
layerless
World
COUNTRY/Province
NDVI Departure from 5YA
no value
< -0.3
-0.3 - -0.225
-0.225 - -0.15
-0.15 - -0.075
-0.075 - 0.075
0.075 - 0.15
0.15 - 0.225
0.225 - 0.3
> 0.3
Julian day
01-01
01-17
02-02
02-18
03-06
03-22
04-07
04-23
05-09
05-25
06-10
06-26
07-12
07-28
08-13
08-29
09-14
09-30
10-16
11-01
11-17
12-03
12-19
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

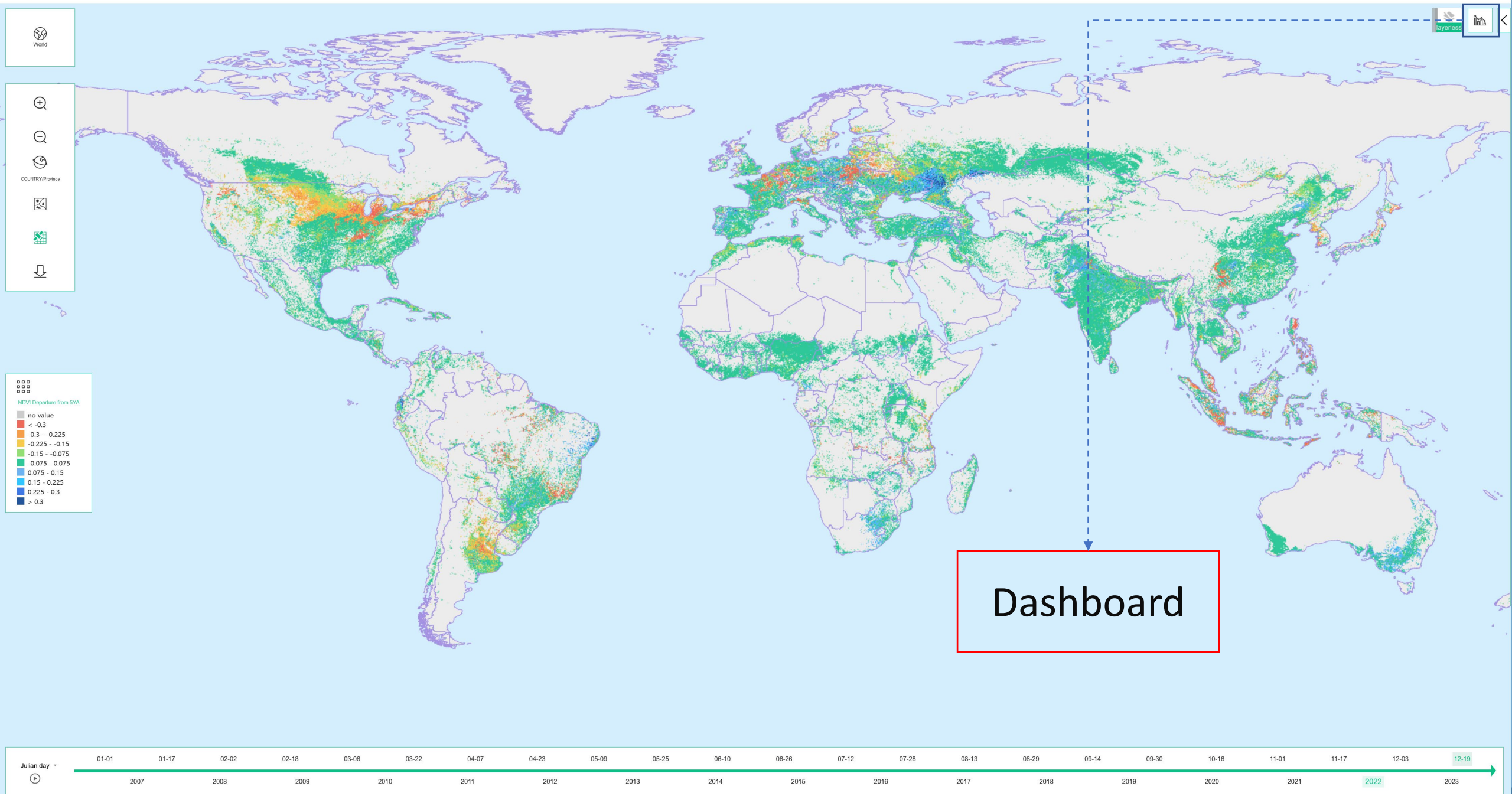

Cropklatch
Agro-climatic Indicators
Agronomic Indicators
ProductionIndex
High-resolution monitoring
EWI
Production Zone
Crop Type
High Resolution Data
Mangment System
English
zengh..
Crop distribution
CPIS-USA
layerless
World
COUNTRY/Province
NDVI Departure from 5YA
no value
< -0.3
-0.3 - -0.225
-0.225 - -0.15
-0.15 - -0.075
-0.075 - 0.075
0.075 - 0.15
0.15 - 0.225
0.225 - 0.3
> 0.3
Julian day
01-01
01-17
02-02
02-18
03-06
03-22
04-07
04-23
05-09
05-25
06-10
06-26
07-12
07-28
08-13
08-29
09-14
09-30
10-16
11-01
11-17
12-03
12-19
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

Change the background map

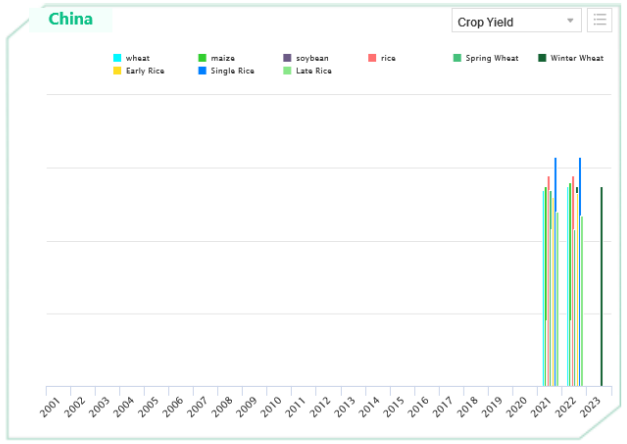


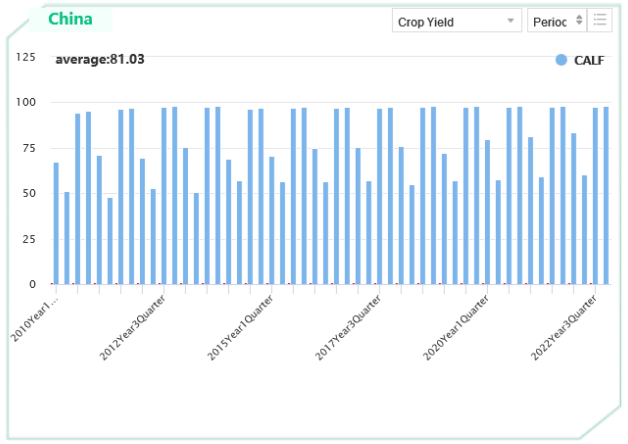
More&Practise

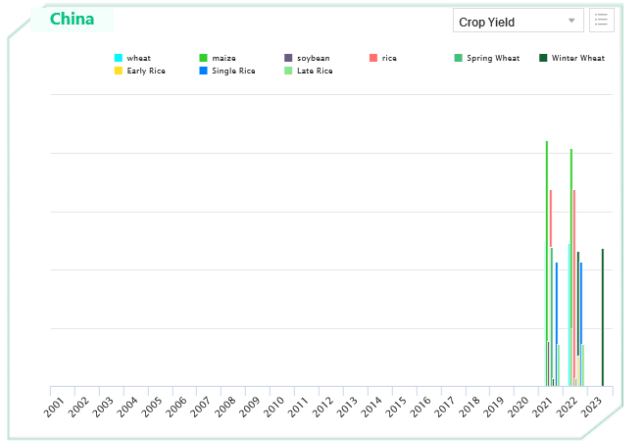
Training on Dashboard

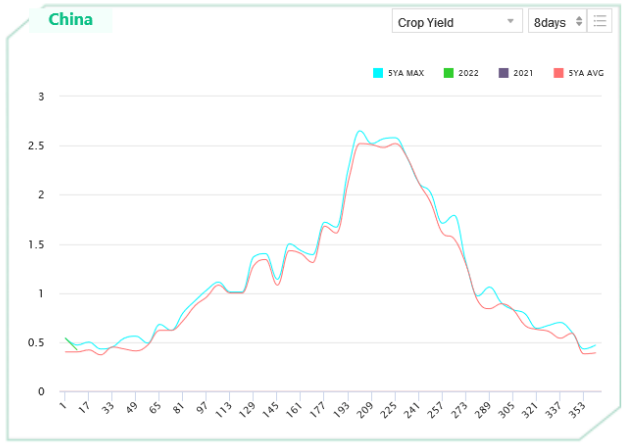

World
COUNTRY/Province
layerless
NDVI Departure from 5YA
no value
< -0.3
-0.3 - -0.225
-0.225 - -0.15
-0.15 - -0.075
-0.075 - 0.075
0.075 - 0.15
0.15 - 0.225
0.225 - 0.3
> 0.3
Dashboard
Julian day
01-01 01-17 02-02 02-18 03-06 03-22 04-07 04-23 05-09 05-25 06-10 06-26 07-12 07-28 08-13 08-29 09-14 09-30 10-16 11-01 11-17 12-03 12-19
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023

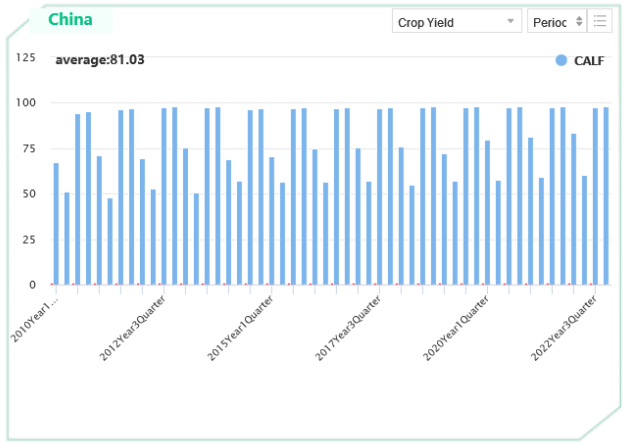

Agro-climatic Indicators
English
China
Crop Yield
Export Image
Export Image
CALF
Period
Cropped Area
LAI
8days
NDVI
Julian day
Potential Biomass
Avg. Temp
dekad
FPAR
average:81.03
average:693.75
Crop Yield
VHI
Cropped Area
LAI
CALF
NDVI
ET
Avg. Temp
FPAR
PAR
Potential Biomass
SPI
Crop Production
VCIx
CI
Precipitation
Print chart
Download PNG image
Download JPEG image
Download PDF document
Download SVG vector image
Download CSV
Download XLS
View data table

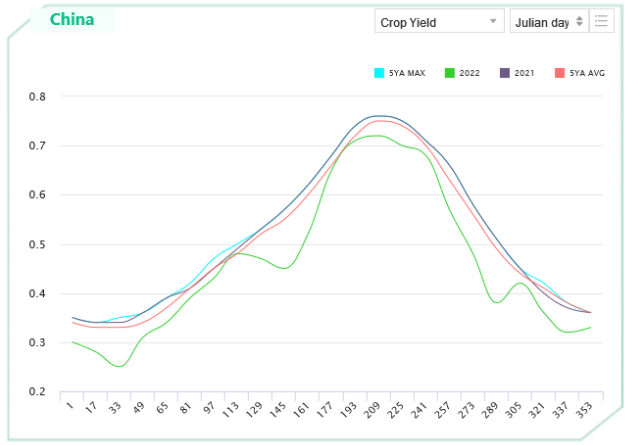

China
Crop Yield
wheat
Early Rice
maize
Single Rice
soybean
Late Rice
rice
Spring Wheat
Winter Wheat

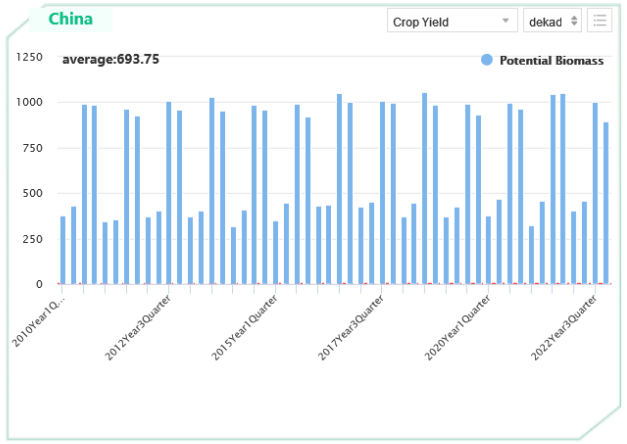

China
Crop Yield
Perioc
average:81.03
CALF

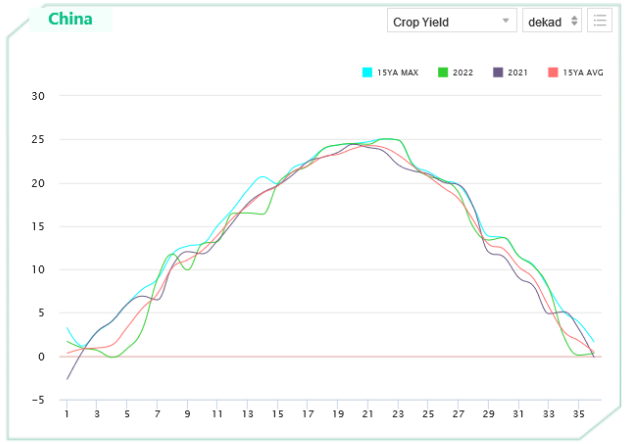

China
Crop Yield
wheat
Early Rice
maize
Single Rice
soybean
Late Rice
rice
Spring Wheat
Winter Wheat

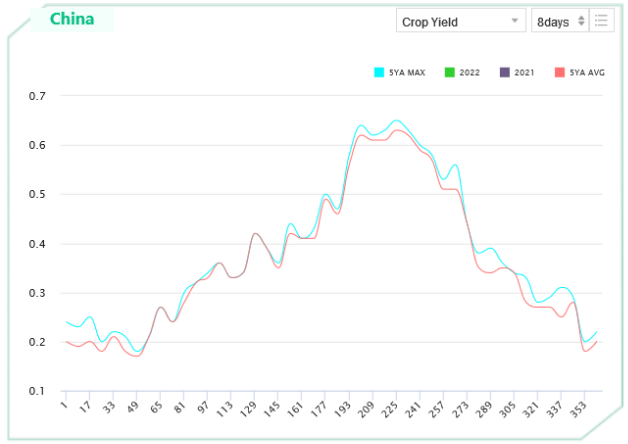

China
Crop Yield
8days
5YA MAX
2022
2021
5YA AVG


China
Crop Yield
Perioc
average:81.03
CALF


China
Crop Yield
Julian day
5YA MAX
2022
2021
5YA AVG


China
Crop Yield
dekad
average:693.75
Potential Biomass

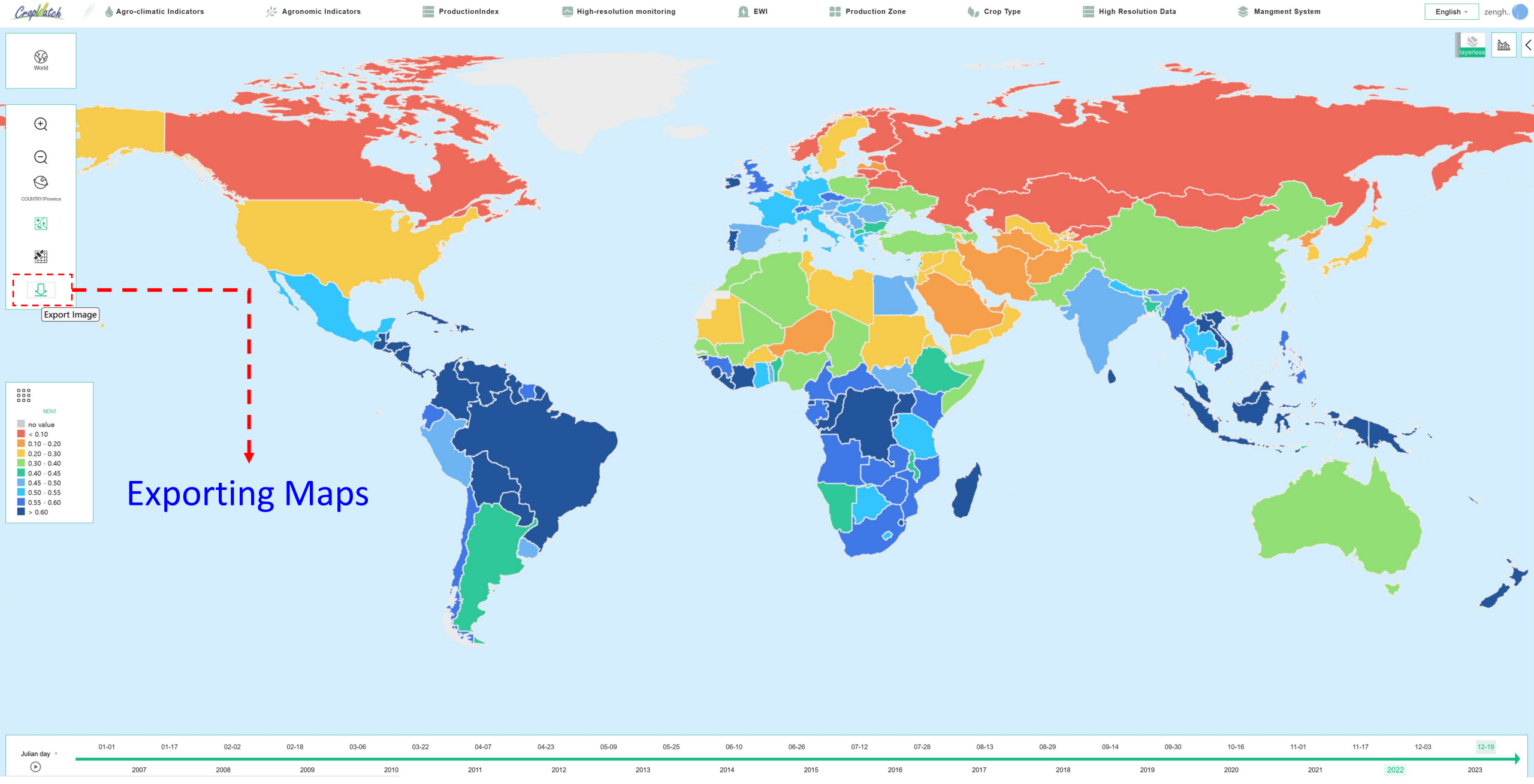

China
Crop Yield
dekad
15YA MAX
2022
2021
15YA AVG


China
Crop Yield
8days
5YA MAX
2022
2021
5YA AVG

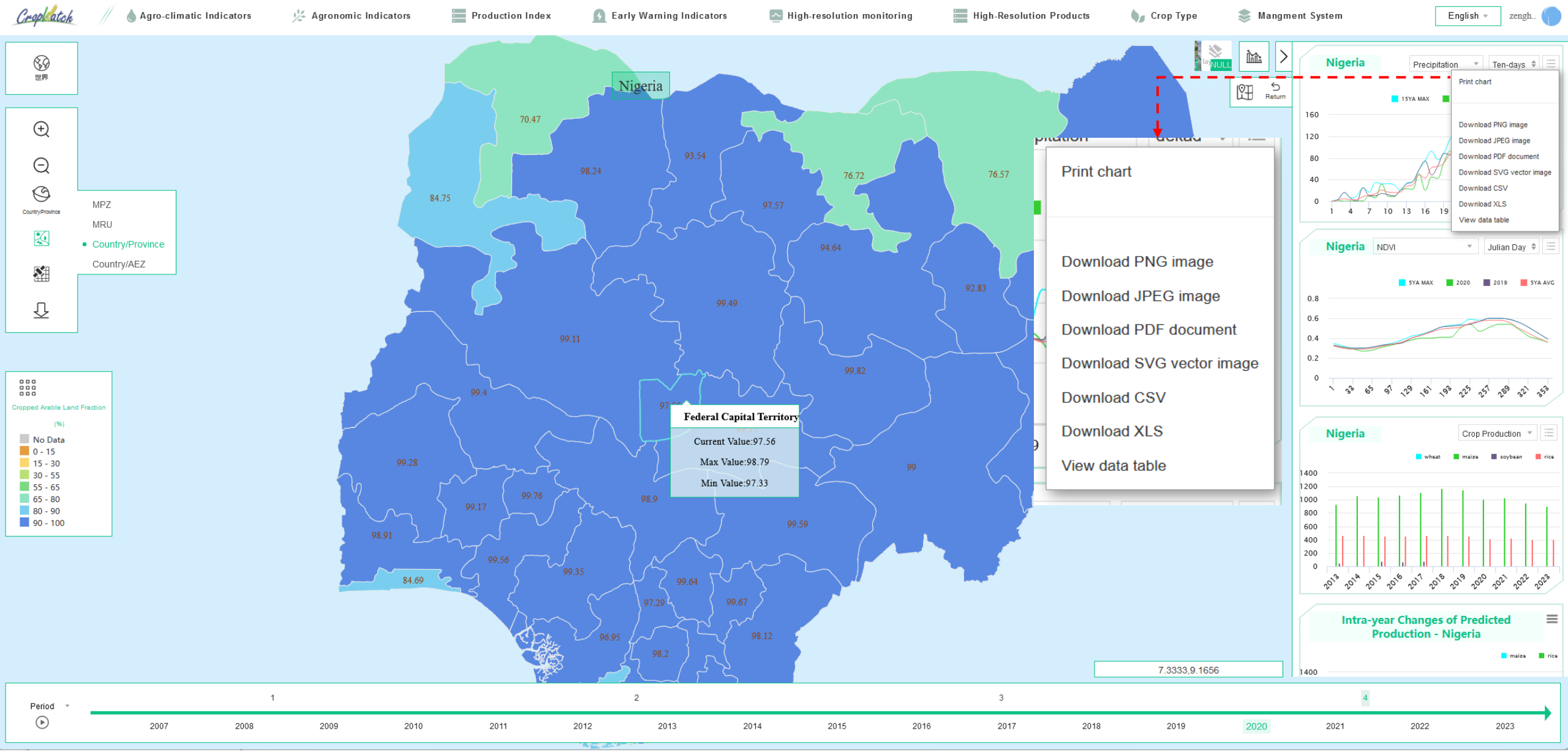
More&Practise

Exporting tables, maps, and data

Exporting Maps



Exporting Tables



Welcome to join us!!!

Contact us:

Dr. Zeng Hongwei

Email: zenghw@aircas.ac.cn

THANKS!

ANSO project(No. ANSO-SBA-2022-02)
NSFC-UNEP Project(No. 41861144019)
CropWatch4GEOGLAM(No.2019YFE0126900)