CropWatch Cloud （http://Cloud.cropwatch.com.cn）

—Ownership and transparency

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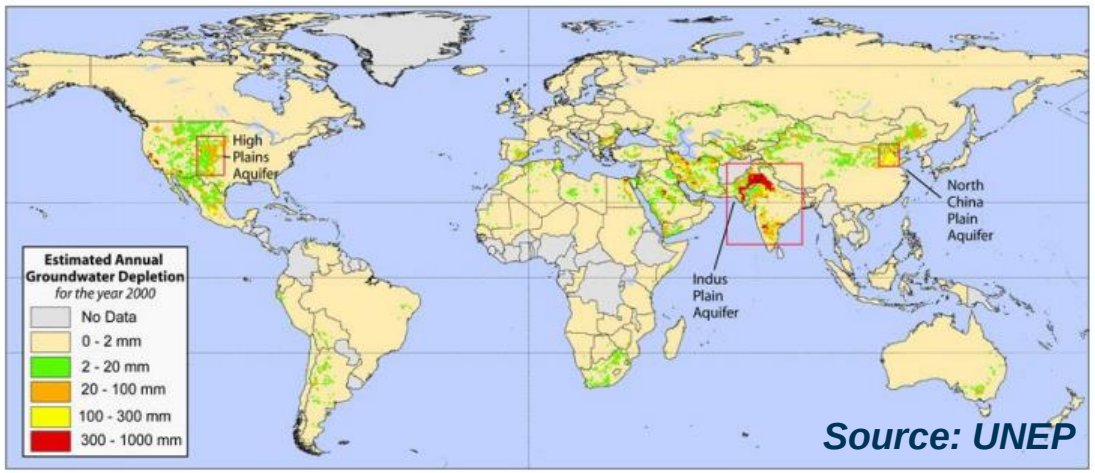
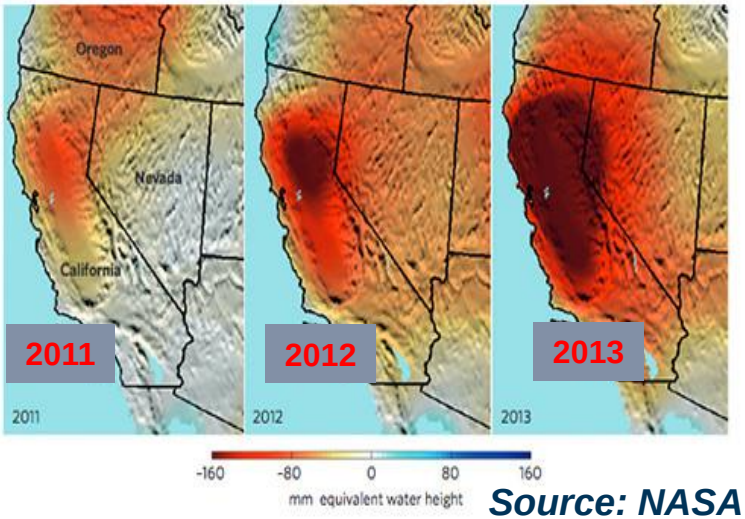
Outline

- Introduction
- CropWatch Cloud
- Implementation at countries

Stress to food production

- Climate variability, especially extreme heat and frost events are inducing yield depressions by more than 10%
- To mitigate the impacts, irrigation is commonly applied causing serious groundwater depletion/transboundary issue
- Pest and diseases overall impact to 10-20% of global crop harvest





Crop Monitoring is essential

- Early production forecasts help policy makers to make evidence-based trade decisions
- In season warning (stress due to drought, pest & diseases) for better farm management
- Early warning information helps early response and actions on providing food aid to food shortage regions

- Many countries want use satellite data to improve food information availability and transparency

Gaps and challenges

- **Owners**
  - Only big countries or int'l organizations have their own systems
- **Information**
  - Crop condition is main output, lack of accurate production
  - Lack of forecasting at early stage or even pre-sowing
- **Technical issues**
  - No automatic processing, manual works mainly
  - System are physical or technically difficult to access openly
  - Unable to customize the system for local
  - Rely on single or a few satellite data
  - Methodology is not well documented and
  - Difficult to participate in agriculture monitoring

Issues for developing countries

- The paucity of adequate capacity in obtain and accessing up-to-date staple crop production information, which is essential for a country economic governance and securing food supply.
- Over-dependence on information provided by third parties and often poses the danger of taking decisions based on delayed and on not easily verifiable information.
- Constraining developing countries to set-up, operate, and maintain crop monitoring facilities.
  - Big financial input and operational cost
  - Adequate technical skills

Outline

- Introduction
- CropWatch Cloud
- Implementation at countries

CropWatch Programme

- **Release first bulletin in August, 1998;**
- **Release first English bulletin in November, 2013**
- **CropWatch aims at improving food information availability, quality and transparency**
  - To provide additional, reliable information for developing countries to fight against hunger,
  - To provide cloud facility to enhance the capacity of developing countries on crop monitoring

CropWatch at Alibaba Cloud

cloud.cropwatch.com.cn

Cropwatch **Pro**

Enter

CropWatch-Pro

- An online tool for people to produce crop monitoring products at any time and anywhere.

CropWatch **Explorer**

Enter

CropWatch-Explore

- An online interface for people to explore and analysis all the crop information data easily.

Cropwatch **Project**

Enter

CropWatch-Project

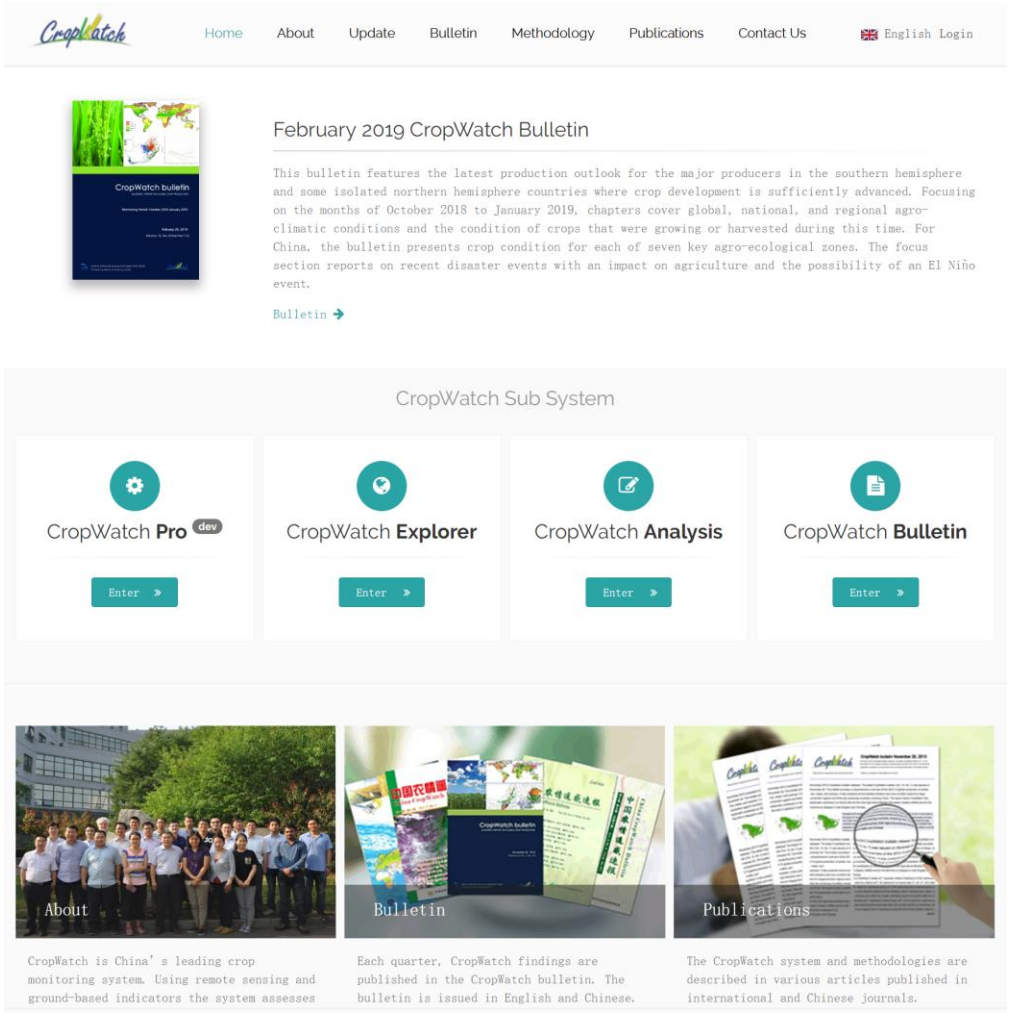
- An online platform for people to create and write the crop bulletin.

Cropwatch **Bulletin**

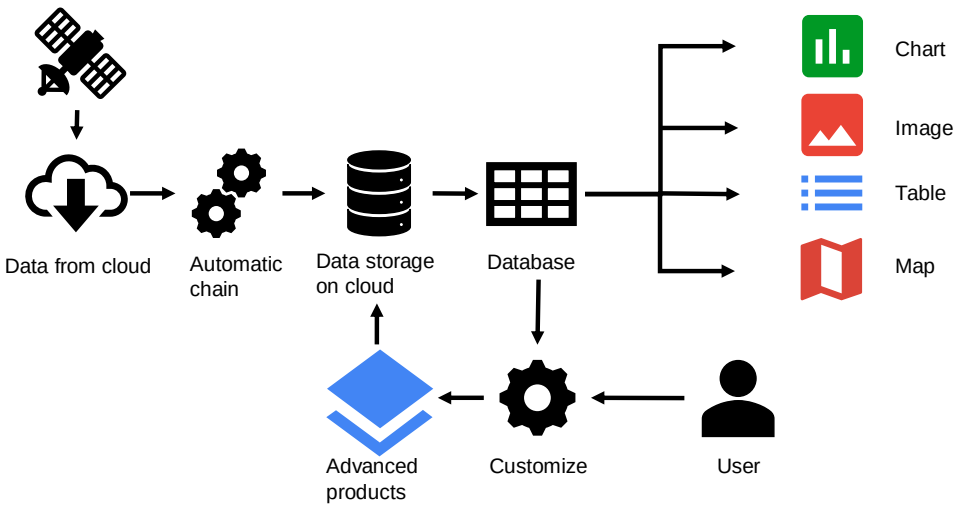
Enter

CropWatch-Bulletin

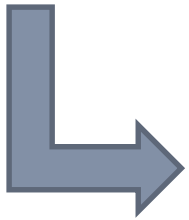
- An webpage for people to read CropWatch bulletin.

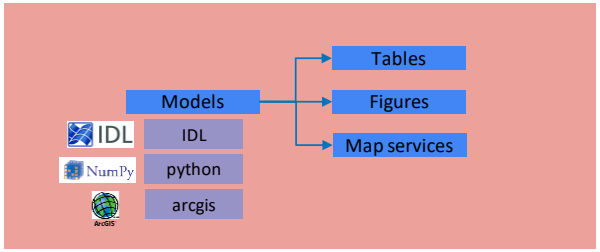


Data converging and preprocessing

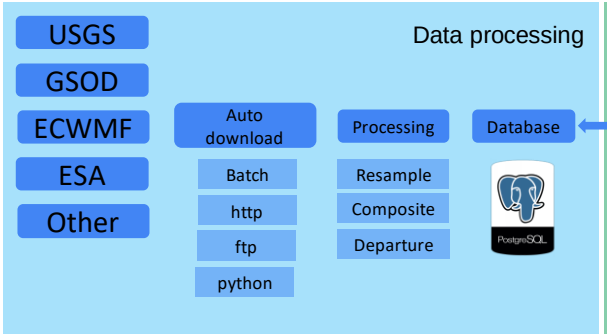


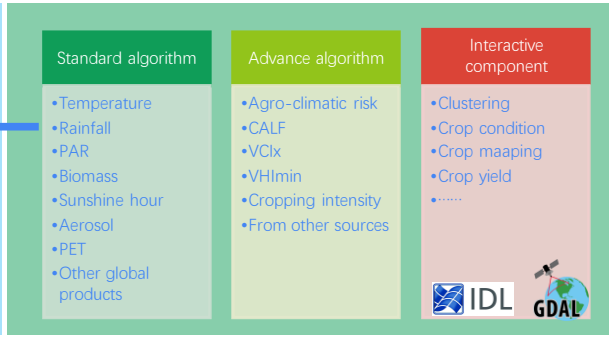
Auto converging





Auto preprocessing





Component 1: CropWatch Processing

CropWatch Processing offers an auto-processing chain from pre-processing of raw data to production outlook

Pre-processing	Agro-meteorology	Agronomic indicator	Crop condition	Production Forecast
• Data conversion • Projection and transformation • Vector to Raster • Merge • Clip • Resample • Band-combination • Spectral-merge • Temporal and spatial merge	• PAR • Temperature • Rainfall • Biomass	• CALF • CI • VCIx • VHI	• NDVI development • Real Time development • Cluster	• Yield • Area • Production

32 Indicators

CropWatch generates 32 agro-climatic, agronomic, early warning indicators, and crop production (area, yield)

1. Agro-climatic

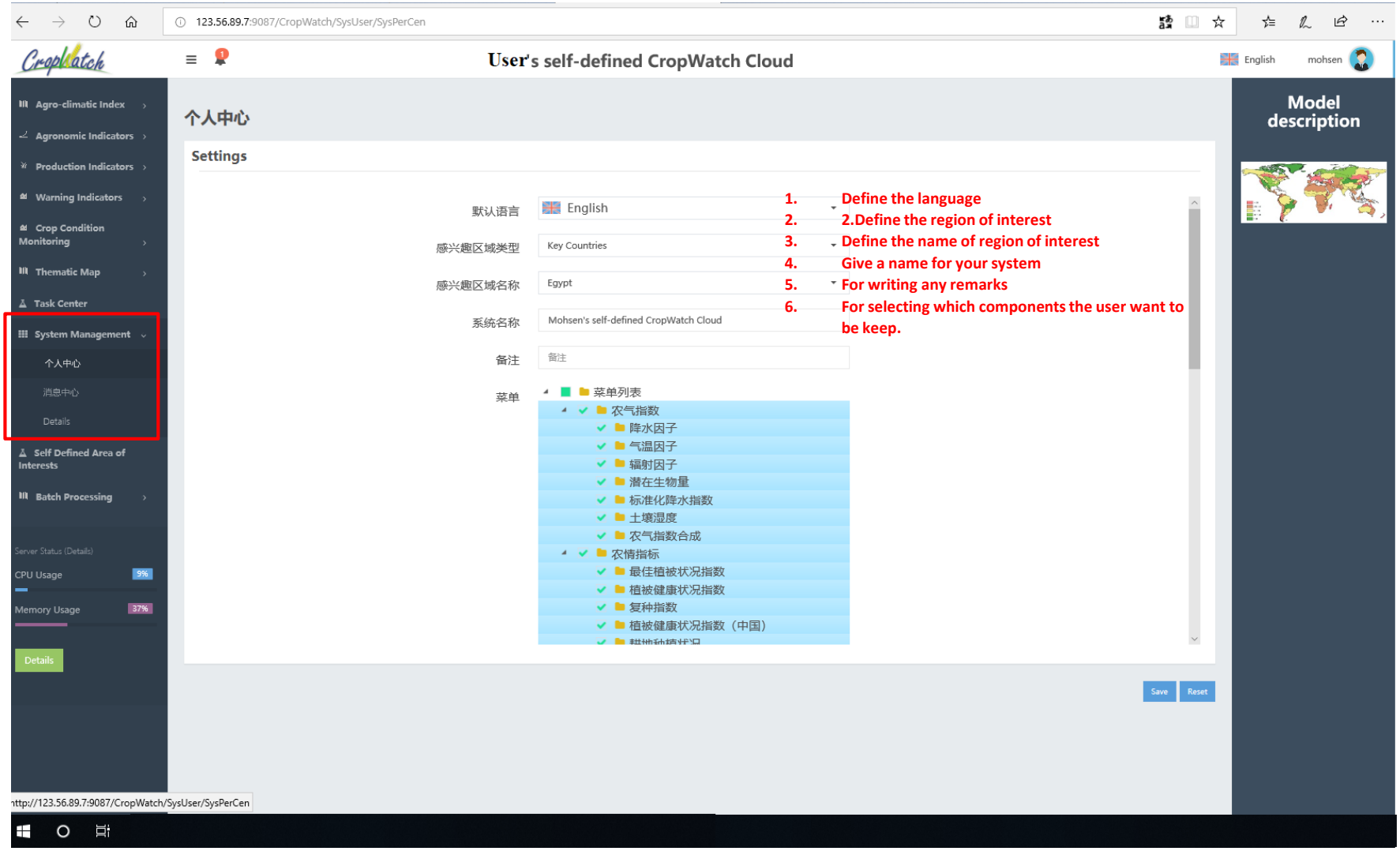
农情遥感监测系统	Temp			Rain					Agro-suitablity	Wind	Wind direction	Humidity	Radiation	Sun hours	Cold spell	Potential NPP	ET		Surface temperature	Water balanc	Soil Moisture	Snow cover	Sea surface temperature	Fire	Flood
	最高	最低	平均	日	周	旬	月	SPI									潜在	实际							
India					×			×													×				
Pakistan	×	×	×				×					×	×												
Pakistan (Provincial)	×	×	×				×																		
South Africa							×	×	可以开发一个平台，可以往里填写指标，河北、河南不一样，指标放开				×				×				×				
Australia							×														×				
Argentina															×			×	×					×	×
Brazil																									
Canada																									
USA	×	×	×			×												×			×	×			
Caribbean	×	×		×				×		×	×												×		
JRC MARS	×	×	×				×					×	×							×	×				
FAO GIEWS							×		大数据																
CropWatch			×				×						×			×									
	适用	适用	适用				适用	适用					适用					可以暂时用MODIS数据	可以考虑LST数据		适用				
	不足每个地方都一样极端温阅值不一样																								

2.Agronomic

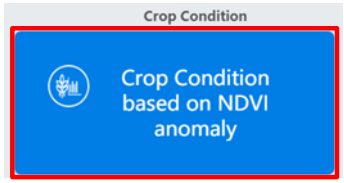
农情遥感监测系统	NDVI	PASG	SDVI	NDWI	FAPAR	VCI	SASI	phenology	Sowing date	ASI	VIII	Fire Watch
India	×			×		×	×					
Pakistan	×											
Pakistan	×											
South Africa	×	×	×			×						×
Australia												
Argentina	×											
Brazil	×											
Canada												
USA	×											
Caribbean												
JRC MARS					×			×	×			
FAO GIEWS						×				×	×	
CropWatch	×					×					×	
	适用				有特色	适用	有特色	有特色			适用	

SPI	Standardized Precipitation Index (SPI) expresses the actual rainfall as a standardized departure with respect to rainfall probability distribution function and hence the index has gained importance in recent years as a potential drought indicator permitting comparisons across space and time.
NDVI	NDVI= (NIR – Red) / (NIR + Red)
NDWI	NDVI=(NIR-SWIR)/(NIR+SWIR)
PASG	Percentage of Average Seasonal Greennes
FAPAR	Fraction of absorbed photosynthetically active radiation
SDVI	SDVI is the standardized anomaly of the NDIV-表示受旱程度
VCI	VCI=100*(NDVI-NDVImin)/(NDVImax-NDVImin) , VCI = 100*(NDWI-NDWImin)/(NDWImax-NDWImin)
SASI	Shortwave Angle Slope Index (SASI).SASI sensitive to surface wetness, has been found to be strongly correlated with
物候期	物候期预测：heading, flowering, grain filling, ripering, maturity
VHI	VHI: 植被健康度指数（VHI）是一项综合指数，是用于计算ASI的基础指标。它结合了VCI指数和温度状况指数（TCI）。TCI是采用与VCI类似的方程计算得出的，但反映的是当前温度与长期最高值之间的关系，它假定温度较高倾向于造成植被状况的恶化。例如当VCI值下降（绿色植被状况相对较差）和TCI值提高（温度提高）时出现VHI值下降的情况，则可能意味着植被状况受到应力影响，而且从较长期来看可能是旱灾的指征。在计算该指数时VHI成分（VCI和TCI）被给予同样权重，VHI图谱按两个季节和三种模式（旬、月、年）计算得出。

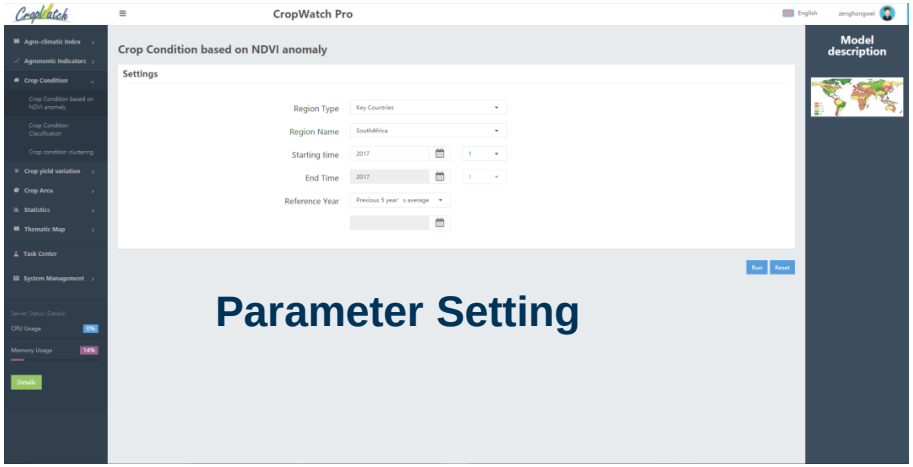
CropWatch-Pro

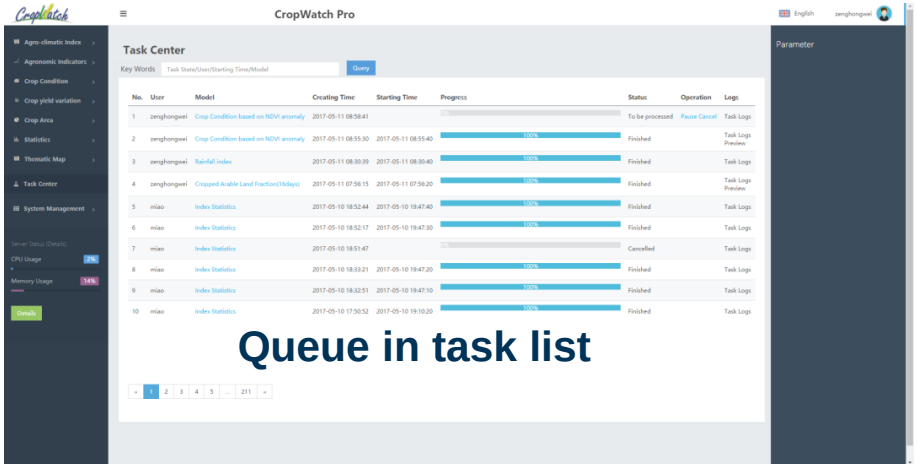


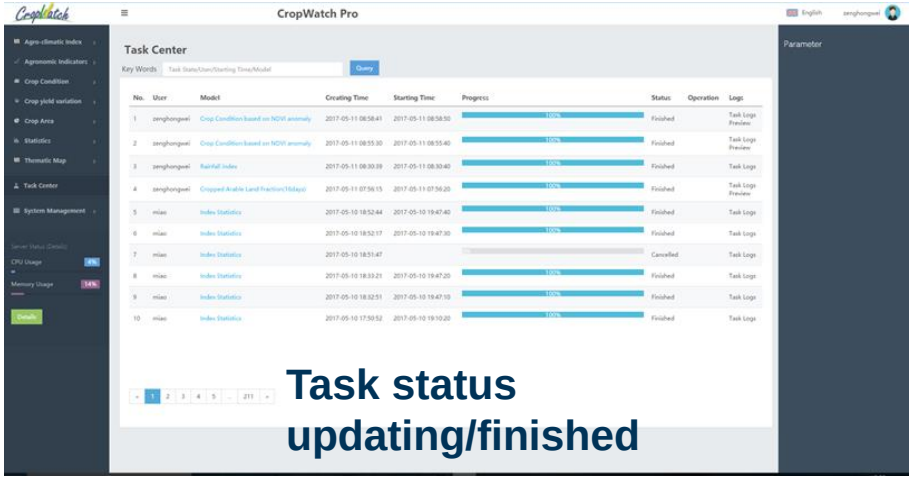
NDVI Anomaly

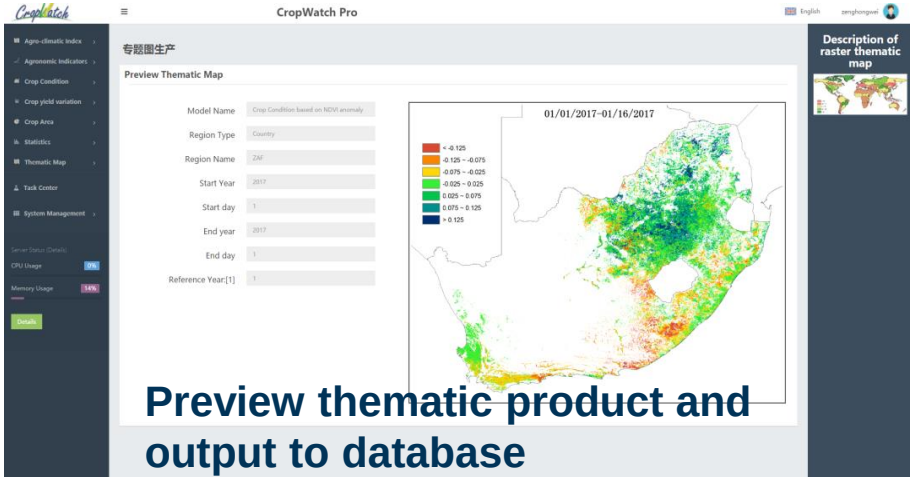


Model selection → **Parameter Setting** → **Submit task** → **Task finished** → **Thematic Product**



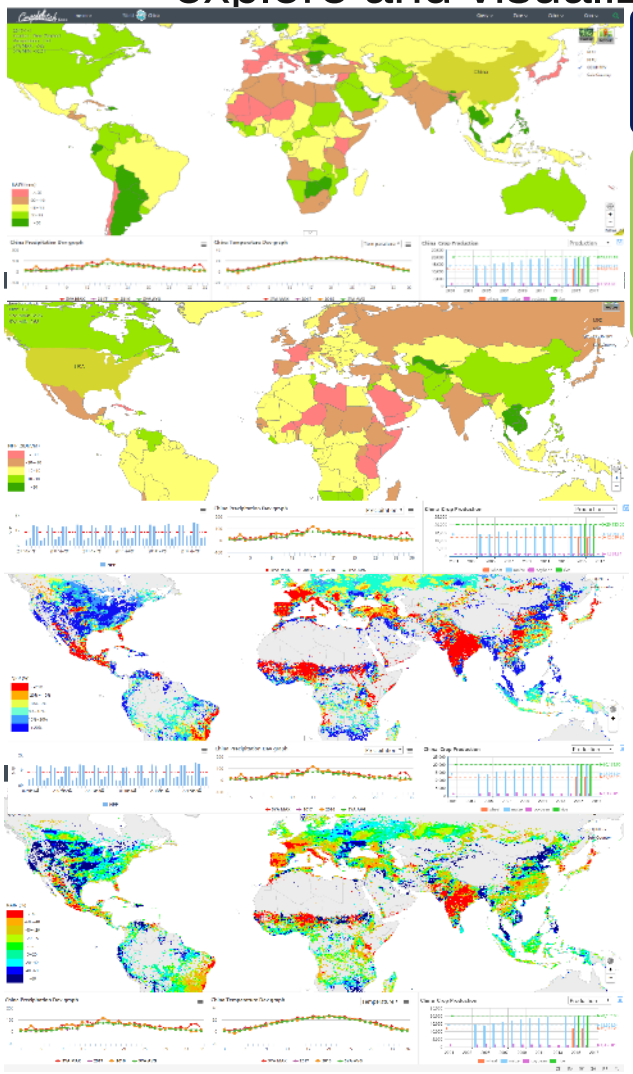






Component 2: CropWatch Explore

CropWatch-Explore provide a web service for users to conveniently explore and visualize our data.



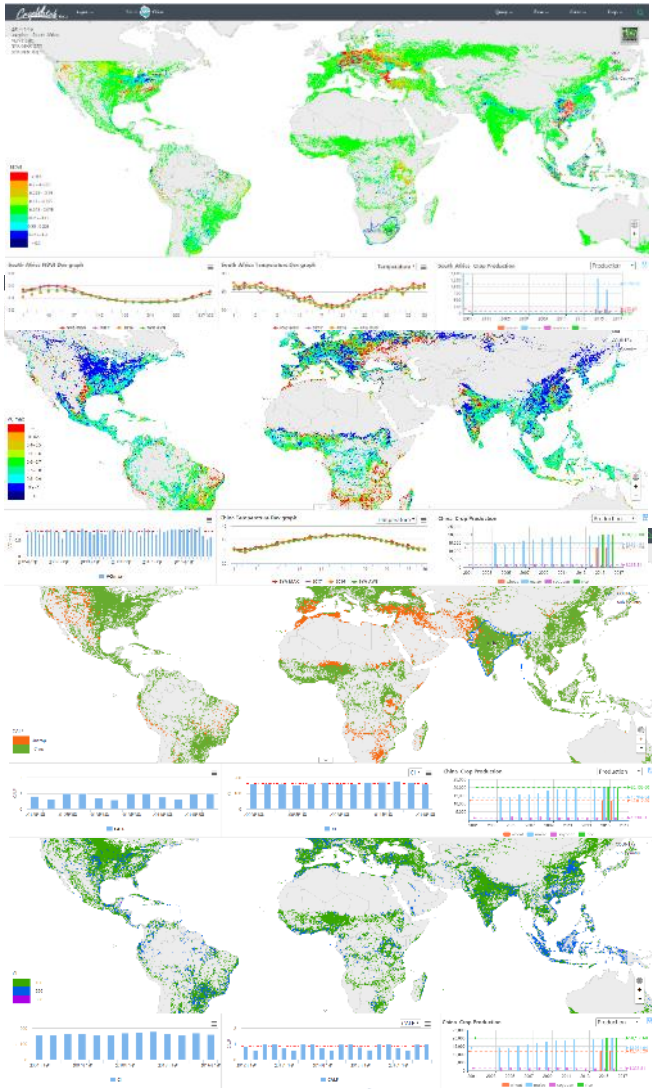
CropWatch-Explore

- Visual Type
  - Vector
  - Raster
  - Cluster
- Scale Type
  - MPZ
  - MRU
  - Country
  - Sub-Country
- Crop Type
  - Wheat
  - Maize
  - Rice
  - Soybean

- RAIN
- TEMP
- PAR
- BIOMASS

- NDVI
- VCIx
- VHI
- CALF
- CI

- Area
- Yield
- Production
- Early warning
- Price



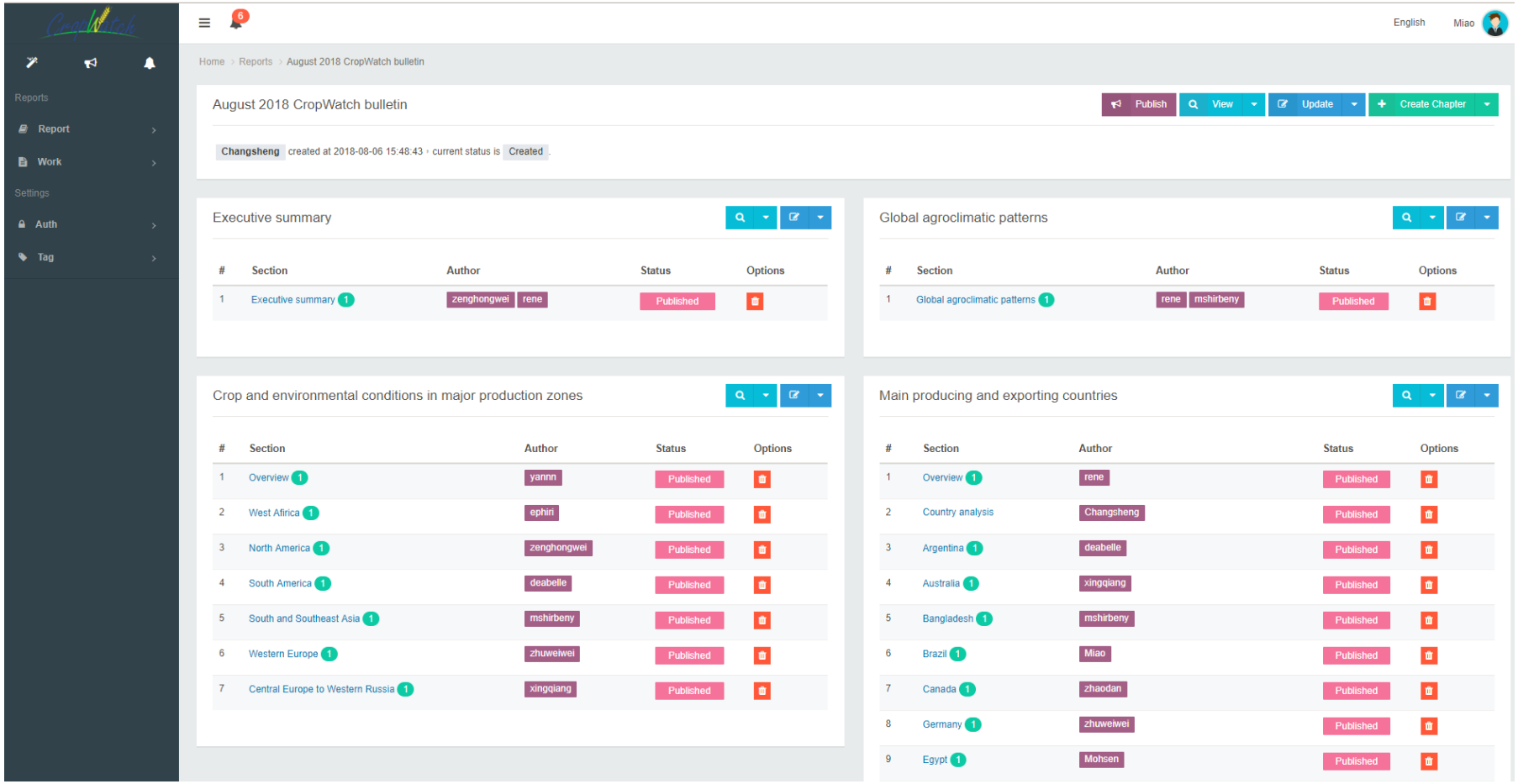
Component 3: CropWatch Analysis

CropWatch Analysis is **cloud based participatory tool** for the CropWatch teams or invited people from over the world analyzing their CropWatch indicators anywhere. It provides create document, allocate and manage tasks, monitor schedule and publish the document online functions which let people over the world finish their documents together on the cloud platform.

CropWatch Team

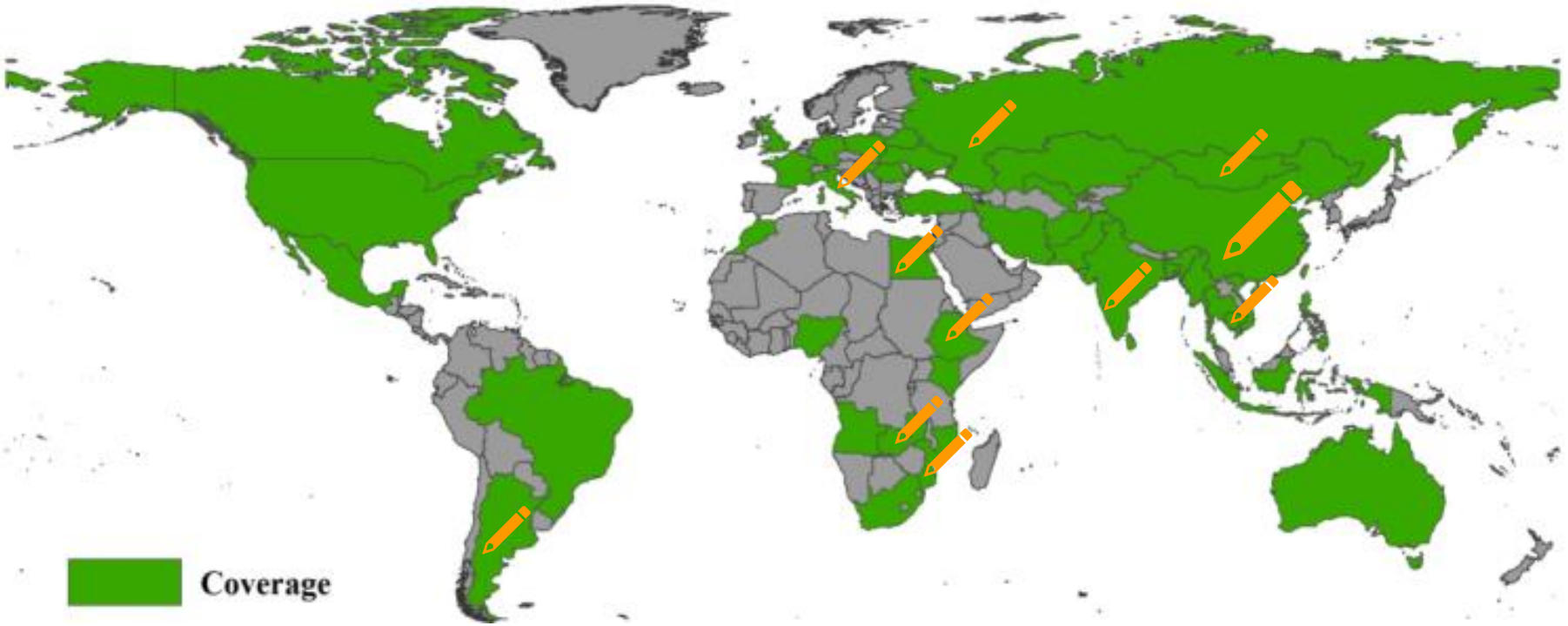
Experts across the world

Author assignment

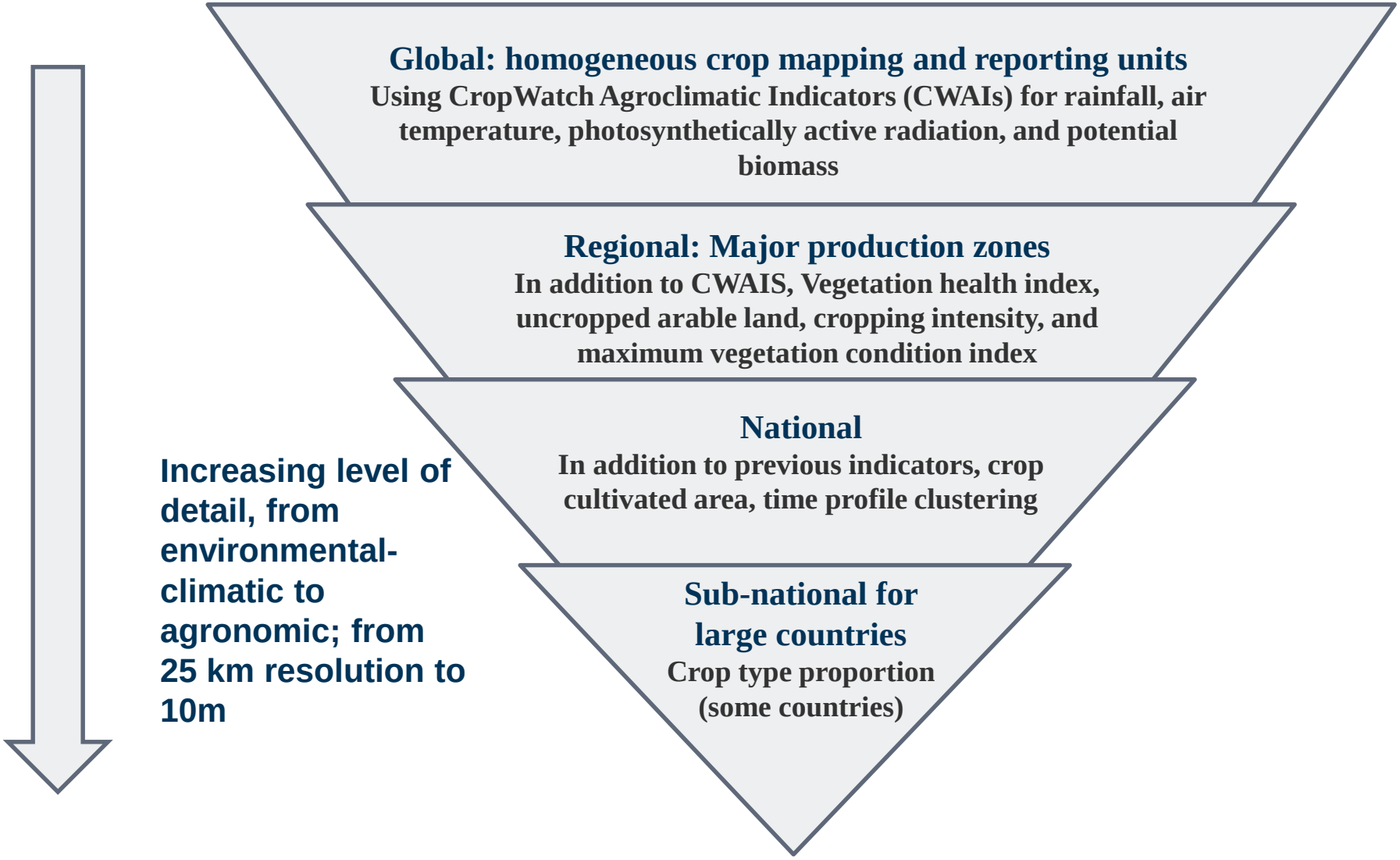


Joint Analysis from over the world

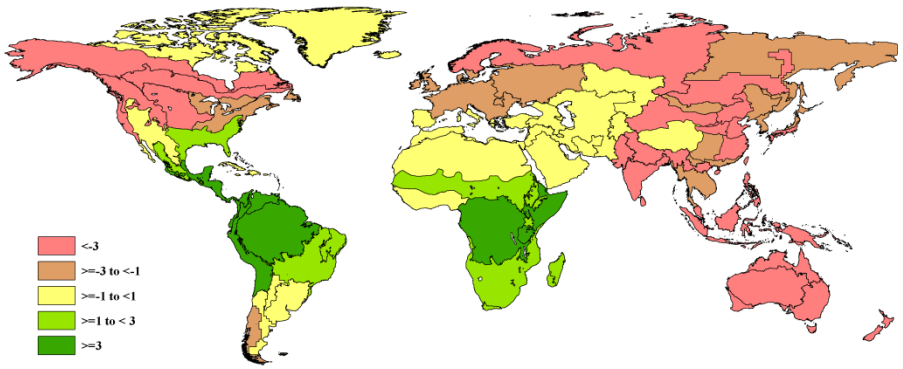
Joint analysis by 37 experts from 11 countries



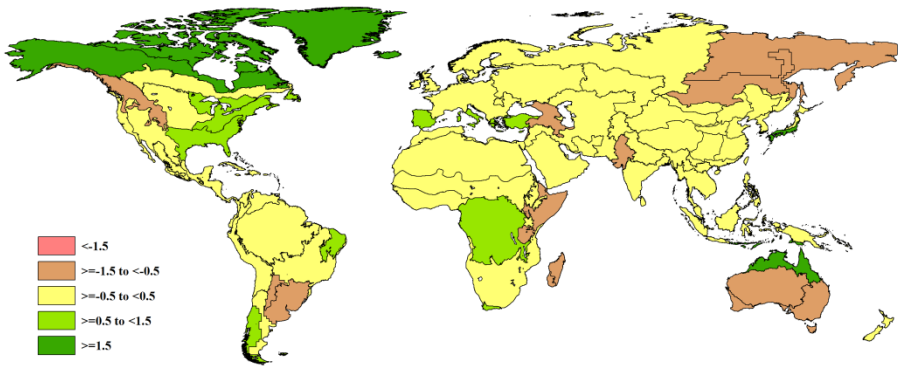
CropWatch Hierarchical approach



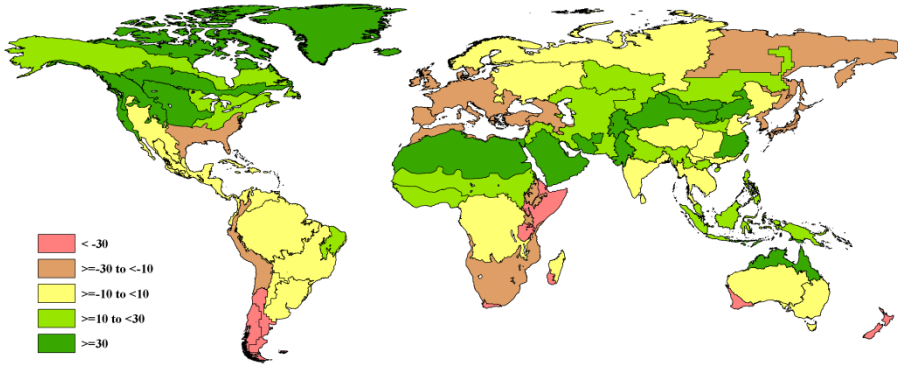
Global: 65 MRUs



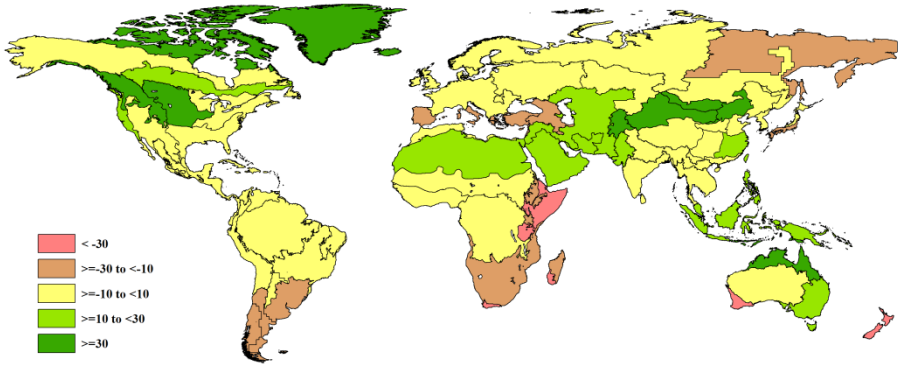
PAR departure



Temperature departure



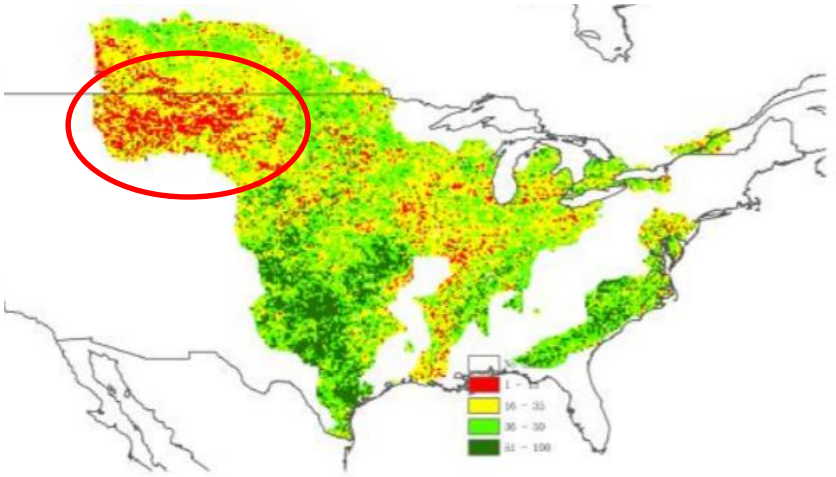
Precipitation departure



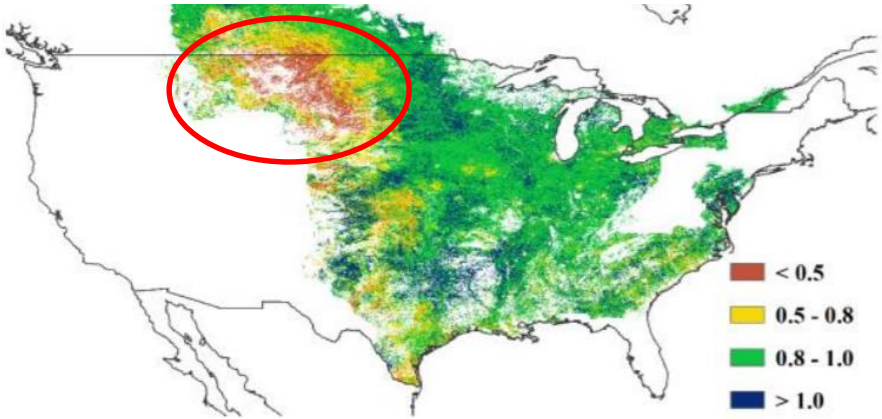
Biomass departure

Hotspots for MPZs

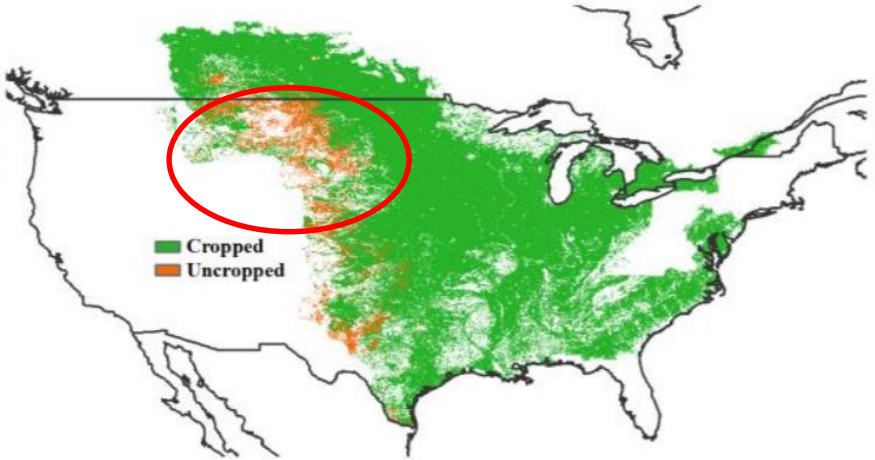
- North America: shortage of rainfall and above average temperature resulted in drought.
- Drought was confined to Manitoba (RAIN, -20%) and Saskatchewan (RAIN, -23%). The temperature was 2 to 3˚above average July to late August



h. VHI minimum

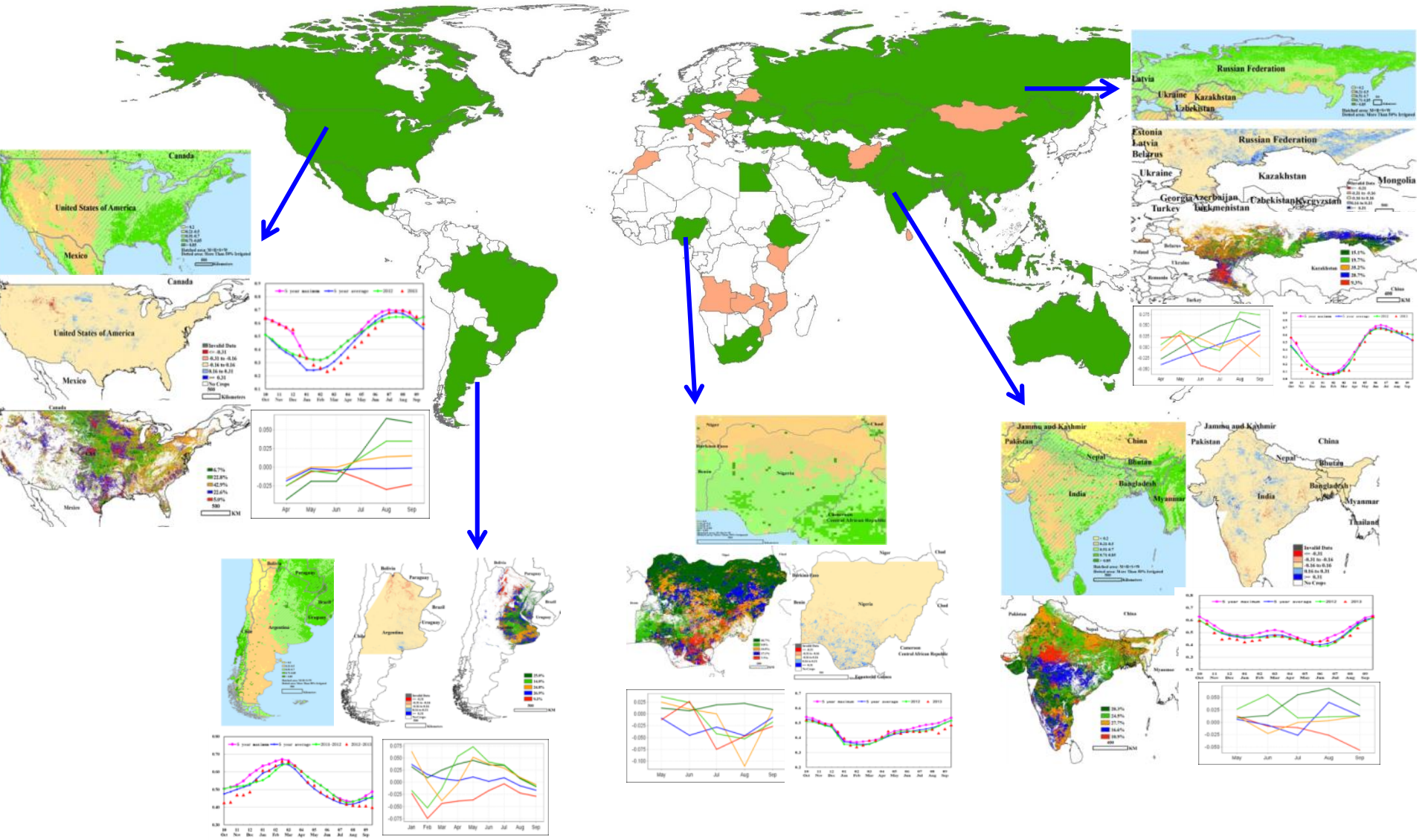


e. Maximum VCI



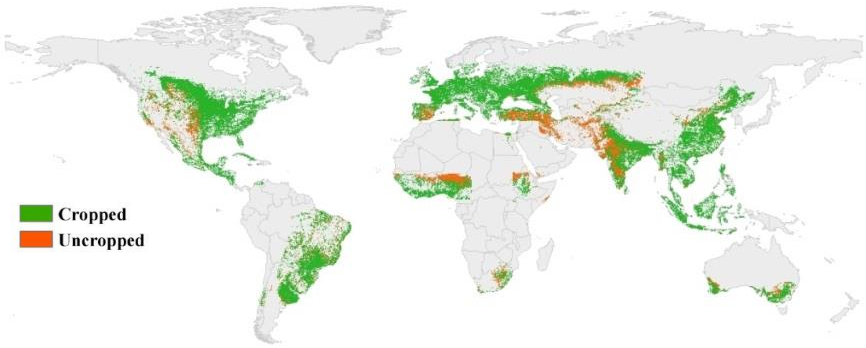
f. Cropped arable land

Countries: 42

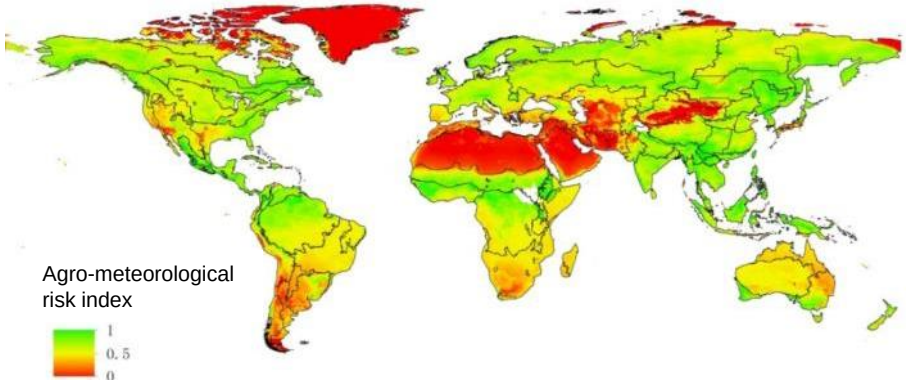


Food security early warning

- **Cropped arable land fraction (CALF) represents the total cropping proportion at early growing stage**
- **Agro-meteorological risk index (AMRI) considering meteorological suitability for crops at different growing stage is used for yield alarming**



July to October 2015

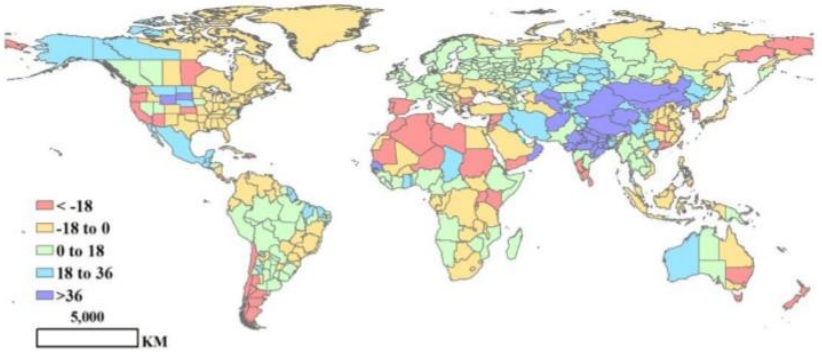


August 2013

Early outlook

	Environmental indices departure from 12YA (2001-2013)				Crop indicators departure from 5YA (2008-2013)	
	Rainfall total (%)	Temperature average (°C)	PAR accumulation (%)	Biomass accumulation (%)	Uncropped arable land in % of pixels (Absolute difference in % points)	Maximum VCI (absolute difference)
Argentina	5	1.0	0.1	-1	0.7	-0.05
Australia	-27	0.3	3	3	9.2	0.01
Bangladesh	11	-0.5	-0.5	33	-0.2	0.06
Brazil	-1	0.2	-0.4	2	-0.4	0.01
Cambodia	5	-0.8	5	8	0.5	-0.01
Canada	8	-1.3	6	-2	10.7	0.01
China	19	0.5	8	21	-3.3	0.03
Egypt	-24	0.2	3	26	-1.0	0.05
Ethiopia	28	0.3	0.2	16	-4.3	0.01
France	-3	0.8	0.1	4	-2.0	0.07
Germany	5	1.2	-0.4	8	-10.7	0.11
India	52	-0.3	1	33	-3.0	0.11
Indonesia	-2	-0.2	-2	-2	0.4	-0.01

Figure 3.1. Global map of biomass accumulation by country and sub-national areas, departure from twelve-year average (2001-13) average (percentage)



Overall, CropWatch tentatively summarizes the ongoing season as follows:

Mostly unfavorable: Armenia, Azerbaijan, Canada, Georgia, Philippines, Poland, Spain, Turkey, Ukraine, Moldova, Morocco, United States, and Vietnam.

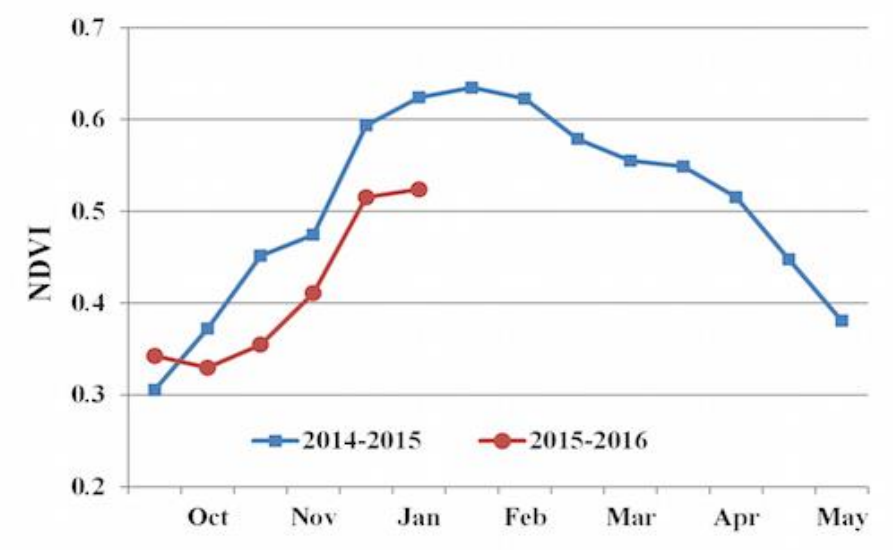
Mixed: Argentina, Brazil, China, Denmark, Egypt, France, Hungary, Indonesia, Iran, Italy, Nigeria, Romania, Russia, South Africa, United Kingdom, and Uzbekistan.

Mostly favorable: Bangladesh, Czechia, Germany, India, Kazakhstan, Mexico, Myanmar, Pakistan, and Thailand.

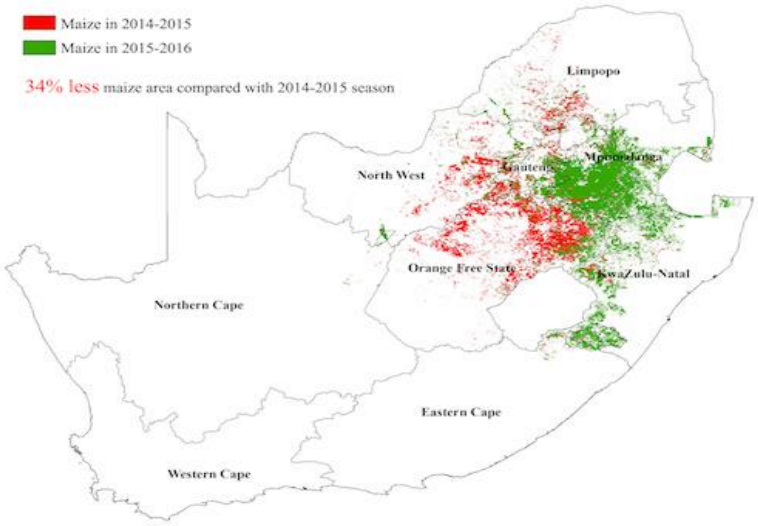
Server drought in South Africa

- **Large production drop alert** given in November 2015 Bulletin
- **January 2016** Bulletin: Maize production was **projected at 44.6% drop**: Server drought prevented farms sowing maize, with a reduction of 34% of maize area; yield was 16% lower than 2015
- **April 2016** Bulletin: Maize production is **revised to 32% drop**, since Feb 2016, rainfall benefited the maize in fields.

Development of NDVI profiles over maize growing areas in 2014-15 and 2015-16

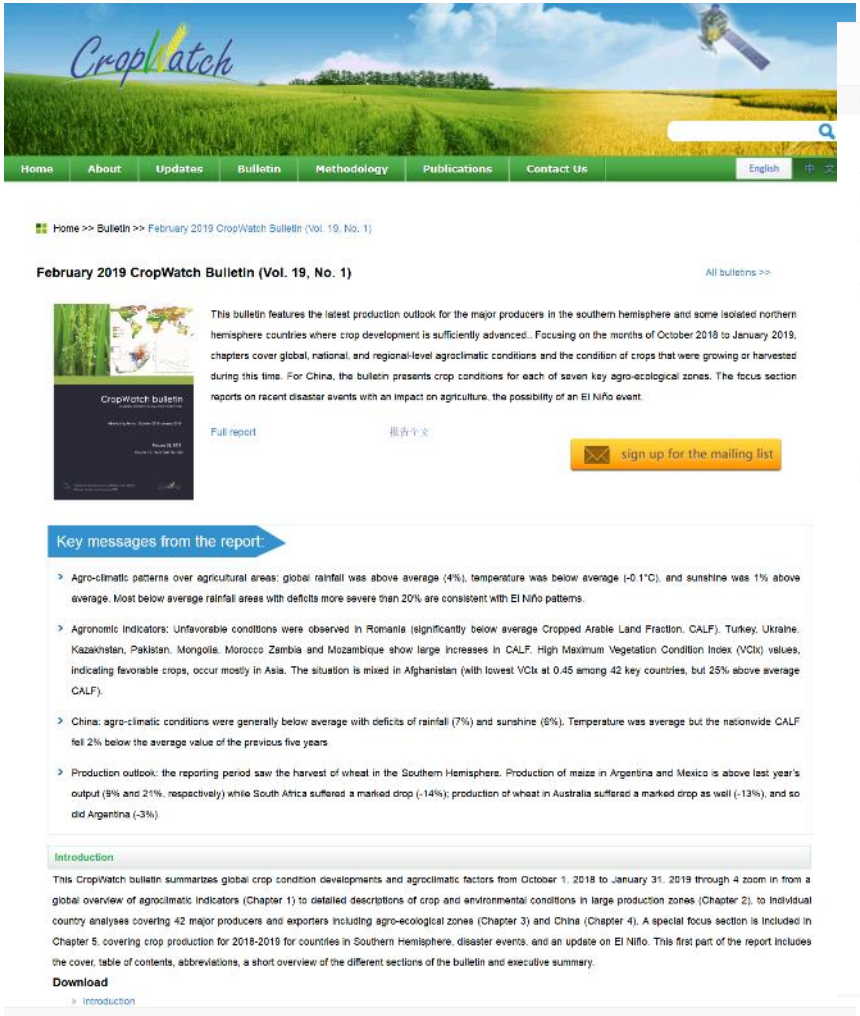


Relative distribution of maize in 2014-15 and 2015-16



Component 4: CropWatch Bulletin

Provide global crop report as pdf or html format

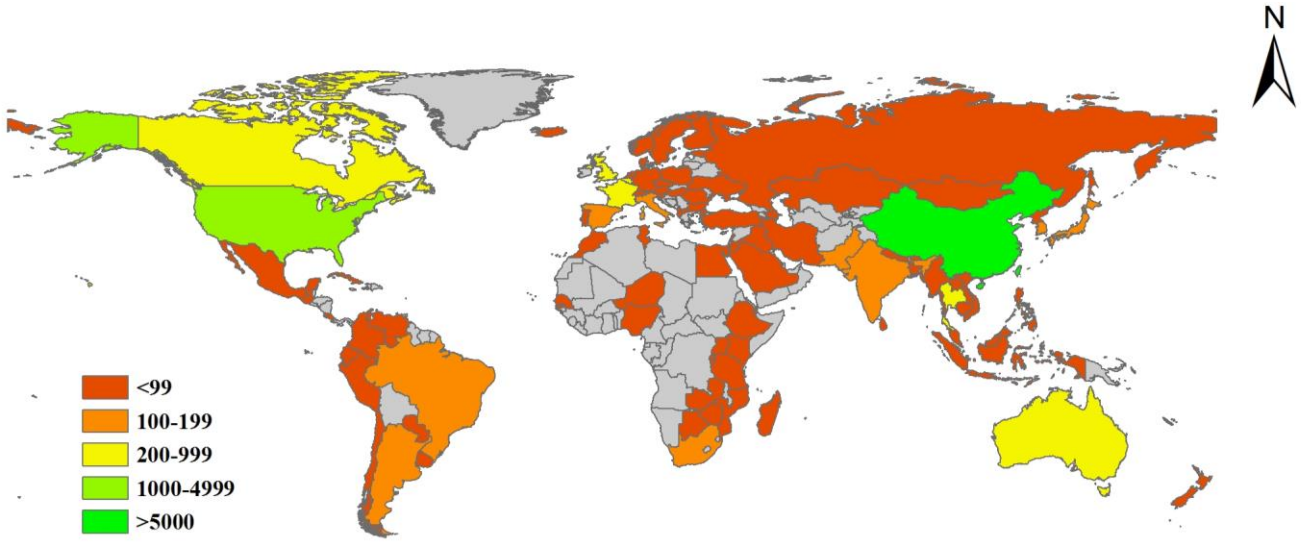


Component 4: CropWatch Bulletin

- Four Quarterly CropWatch Bulletins
- One annual report

Component 4: CropWatch Bulletin

- already provided information services for 149 countries, and obvious enhance the transparence of global agricultural monitoring.



Features

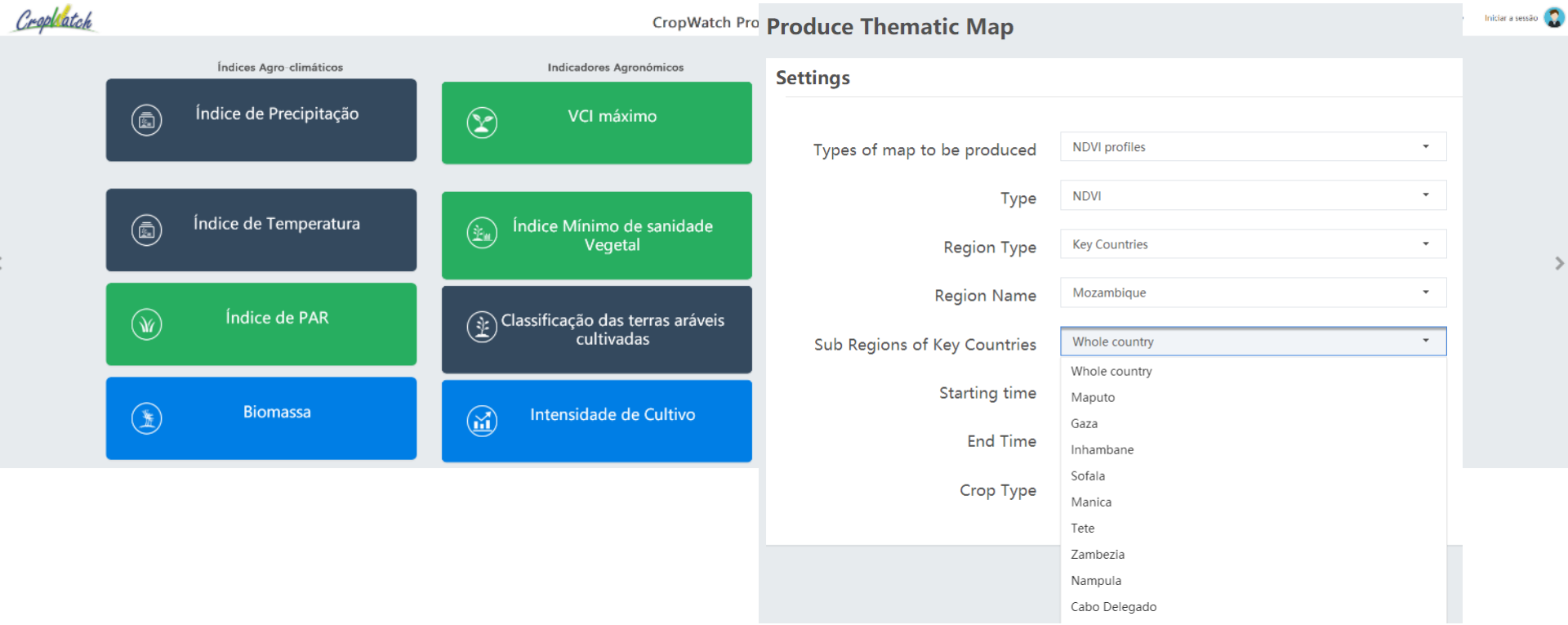
- **Analysis-ready products**
  - 32 Indicators ready in CropWatch Cloud considering most indicators used in existing system
  - Indicators customizable, easy to include new national or regional specific indicators
- **Cloud computing improves efficiency of data processing**
- **Customized for local condition**
- **Joint work promotes confident and transparency**

Outline

- Introduction
- CropWatch Cloud
- Implementation at countries
  - Monitoring on Cloud
  - Cloud services
  - Handover

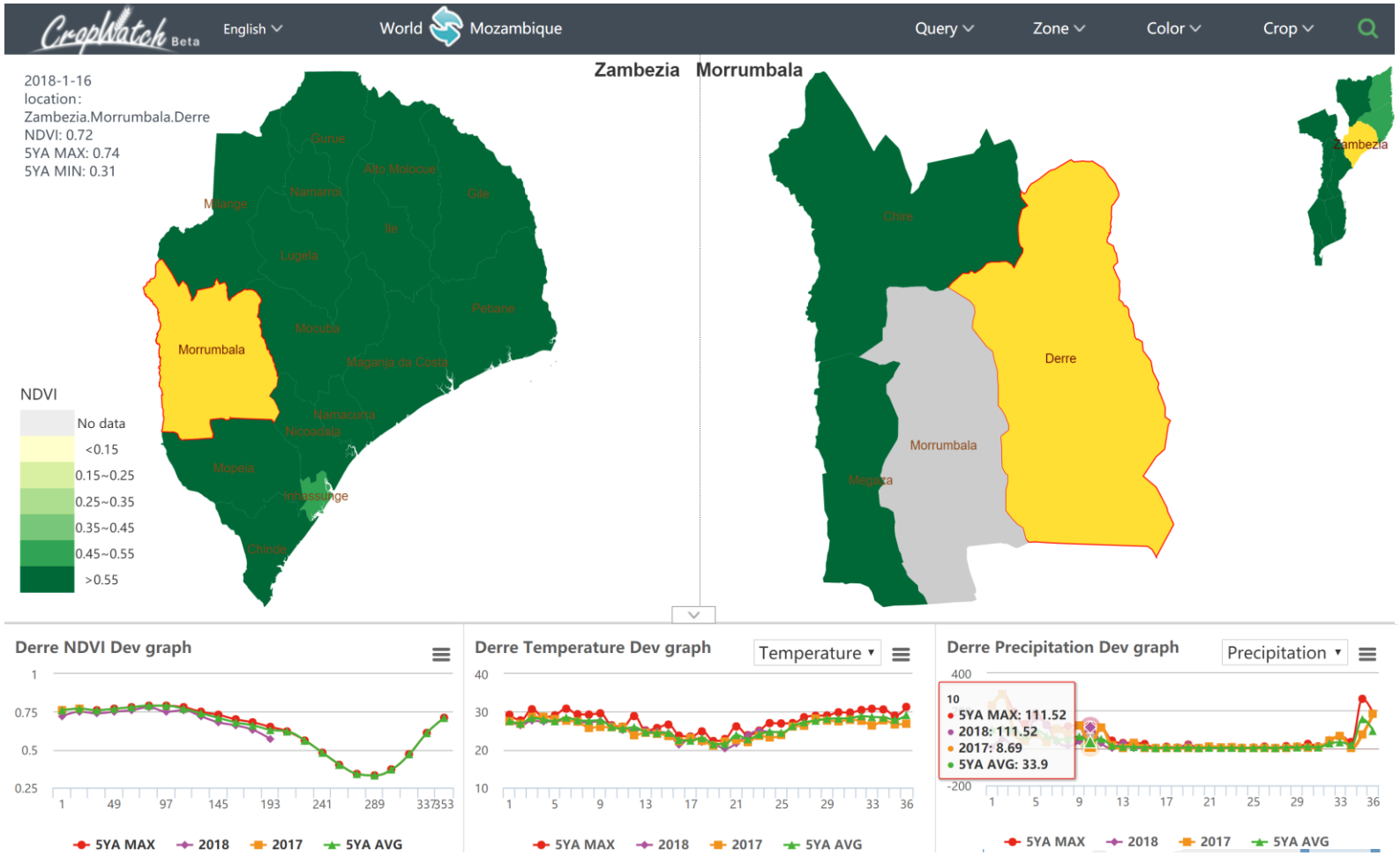
CropWatch for Mozambique

- **Customize CropWatch for Mozambique**
  - **Portuguese Interface**
  - **Including all provinces and districts**
  - **Crop phenology**
  - **Portuguese version of GVG tools**



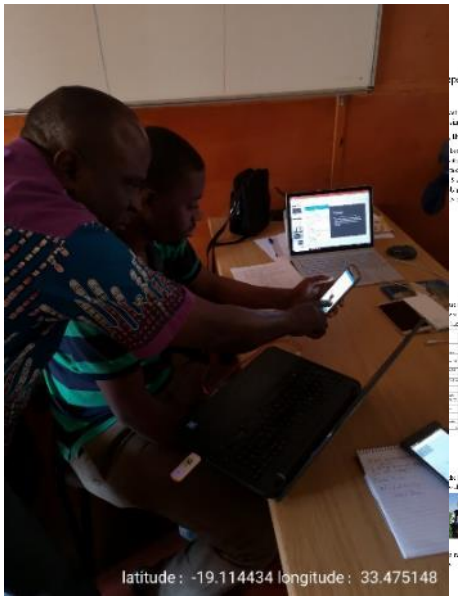
CropWatch for Mozambique

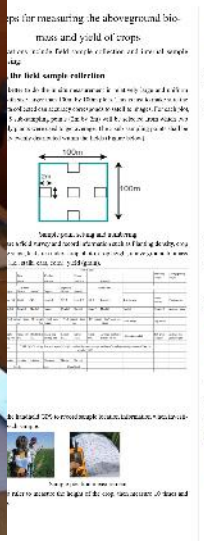
Monitoring units: every districts and provinces

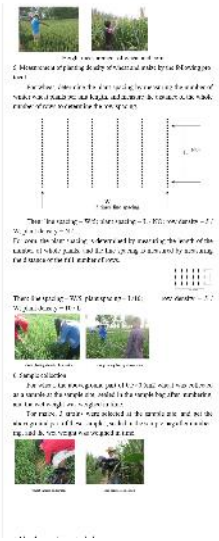


Technical training

- First round training for selected experts from national and provincial offices (3 colleagues)
- Extended training for 29 participants including local experts from 8 provincial offices attend the training
- In-situ data collection training at different major agricultural provinces







Mozambique National Meteorological Bulletin

- **National Meteorological Bulletin powered by CropWatch**

DIRECÇÃO NACIONAL DE AGRICULTURA E SILVICULTURA–MASA

DEPARTAMENTO DE CULTURAS E AVISO PRÉVIO

Edição Nº 08
Campanha Agrícola 2017/18
Publicado em: 15/06/2018

BOLETIM AGROMETEOROLÓGICO

Em Foco

- *Registo de precipitação muito abaixo do normal, na região Sul do país e* ***acima do normal*** *nas regiões Centro e Norte, no período de Outubro de 2017 à Março de 2018;*
- *Registo de perda de cerca de* ***275 mil hectares*** *de culturas diversas devido aos efeitos combinados de inundações, estiagem e lagarta do funil ao nível do país;*
- *Boas Perspectivas de Produção das principais culturas alimentares na Campanha Agrícola 2017/18;*
- *Preços de principais produtos agrícolas, com tendências de redução ao nível dos principais mercados do país;*

PRECIPITAÇÃO REGISTADAS E ACUMULADA DE OUTUBRO DE 2017 Á MARÇO DE 2018

O período entre Outubro e Dezembro de 2017 foi caracterizado por precipitação irregular e escassa nas regiões Sul e partes do Centro do País. Na região Norte, incluindo as províncias de Sofala e Zambézia (região Centro), a precipitação registada no mês de Dezembro, mostrou-se regular, com valores entre 300 e 500 mm, tendo atingido valores superiores a 500 mm em alguns distritos isolados, no mês de Dezembro.

De Janeiro a Março de 2018, houve queda regular e excessiva de precipitação em quase todo o país, sobretudo no mês de Janeiro. Na região Sul, a precipitação registada não foi suficiente para as culturas, o que causou stress hídrico e falhas no desenvolvimento das culturas.

Na região Centro, as chuvas foram intensas sobretudo nas províncias de Sofala, Manica e Zambézia, com registo acumulado entre 500 e 1000 mm, causando igualmente inundações. Na província de Tete a precipitação foi inferior a 500 mm, excepto nos distritos situados no planalto, onde tiveram registo entre 500 e 1000 mm.

Na região Norte do País, as chuvas foram intensas com valores superiores a 500 mm verificado níveis aceitáveis para um bom desenvolvimento das culturas nesta região, não obstante o registo de inundações ocorridas no mês de Janeiro. (Fig. 1).

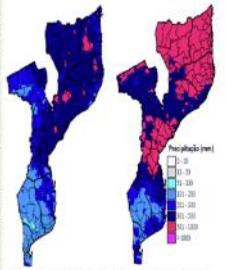


Fig.1: Precipitação registada durante a Época Chuvosa 2017/18

DESVIO DE PRECIPITAÇÃO REGISTADO DE OUTUBRO DE 2017 Á MARÇO DE 2018

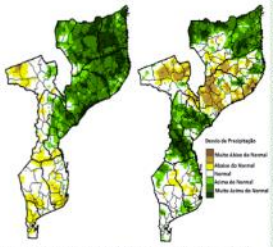


Fig.2: Desvio padrão da precipitação durante a Época Chuvosa 2017/18

Em geral, a precipitação registada entre os meses de **Outubro e Dezembro de 2017** no país, foi irregular e esteve **abaixo do normal**, nas regiões Sul (Maputo, Gaza e Inhambane) e partes da região Centro (Manica, Tete e distritos a Sul de Sofala). Nas restantes províncias de Centro e Norte, a precipitação foi regular e **acima do normal.** (Fig.2)

Entre os meses de **Janeiro e Março de 2018**, a precipitação esteve **muito acima do normal** nas províncias de Manica, Sofala (região Centro), Cabo Delgado e Niassa (região Norte) e **abaixo do normal** nas regiões Centro (Tete e Zambézia) e Norte (Nampula e Sul de Niassa).

Na região Sul, em geral, registou-se precipitação **normal e abaixo do normal** em alguns distritos do interior de Gaza e Inhambane.

1

ÍNDICE DE SATISFAÇÃO HÍDRICA DAS CULTURAS

O **Índice de Satisfação Hídrica (WRSI)** das cultura da 1ª época em geral **foi considerado bom** para região Norte, médio à mediocre para a região Centro e pobre para a região Sul do país.(fig. 3)

Na **Regiões Sul**, as culturas da 1ª época foram colhidas até o mês de Março. O índice de satisfação hídrica (WRSI) foi pobre, o que pressupõe produtividade das culturas baixa e consequentemente produção não satisfatória.

Na **Região Centro**, as culturas da 1ª época foram colhidas até o mês de Abril. Em geral, o WRSI nesta região é considerado de médio, pese embora em alguns distritos da província de Tete, Manica, Sofala e Zambézia, o índice ter sido afectado pela irregularidade da precipitação.

Na **Região Norte**, as culturas foram colhidas até finais do mês de Maio. O WRSI foi considerado bom a muito bom, o que pressupõe boa produtividade e produção nas principais culturas da 1ª época.

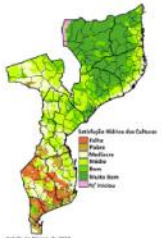


Fig.3: WRSI até finais de Março de 2018

ANÁLISE DE NDVI

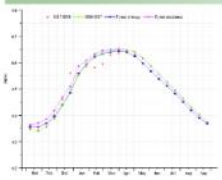
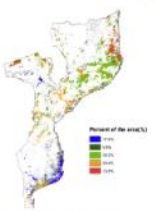


Fig.4: NDVI Profile ao nível do País

A análise de desenvolvimento das culturas baseado no NDVI a nível nacional (fig 4), demonstram que as condições para desenvolvimento das culturas foram desfavoráveis desde o início do mês de Março, estas condições foram recuperando, chegando a situar-se próximo da média dos últimos 5 anos.

O gráfico abaixo (fig 5), mostra que os padrões de partida de NDVI epacial associados aos perfis de NDVi, indicam diversidade de comportamento antes do mês de Fevereiro, com partes das provincias de Cabo Delgado, Nampula, Tete e Gaza acima da media e outras abaixo (5.6%). A partir de Fevereiro, os padrões de NDVI estiveram situados notavelmente perto da media. Em resum, entre os meses de Janeiro a Abril de 2018, a maior parte das áreas cultivadas (43%), estavam em condições abaixo da média dos últimos cinco anos.



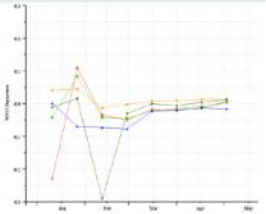


Fig.5: Padroes deportida do NDVI espacial

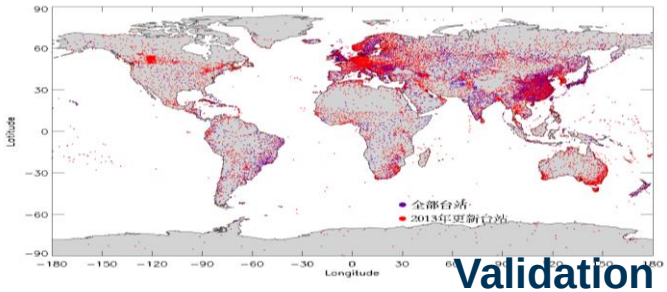
3

Independent evaluation

- CropWatch's yield estimation result is quite accurate when compared to real ground data collected from their district and provincial level staff.
- It is also relatively more accurate and has higher resolution than other similar technologies they used before
- CropWatch is easy to learn and operate after several trainings.
- able to get in-time response from CropWatch teamwhenever he needs any troubleshooting.
- applying the tool to generate monthly agriculture bulletin during the rainy season, which informs policy making at national and provincial-level agriculture departments.
- Stressed the importance of building long-term internal capacity to understand the algorithm and the technology deeper so that maybe they can also build similar technology by themselves one day.

CropWatch for Thailand

- **Using CropWatch to process the data for required indicators**
- **CropWatch provides API for Thailand to feed ago-climate and agronomic information to Agri-Map, which provides services to local with own data**



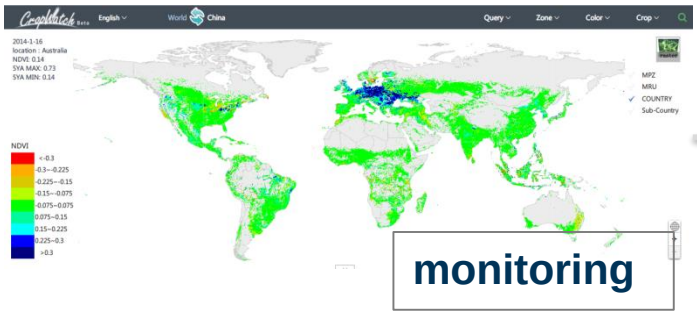
Validation

Agronomic

Agrometeorological

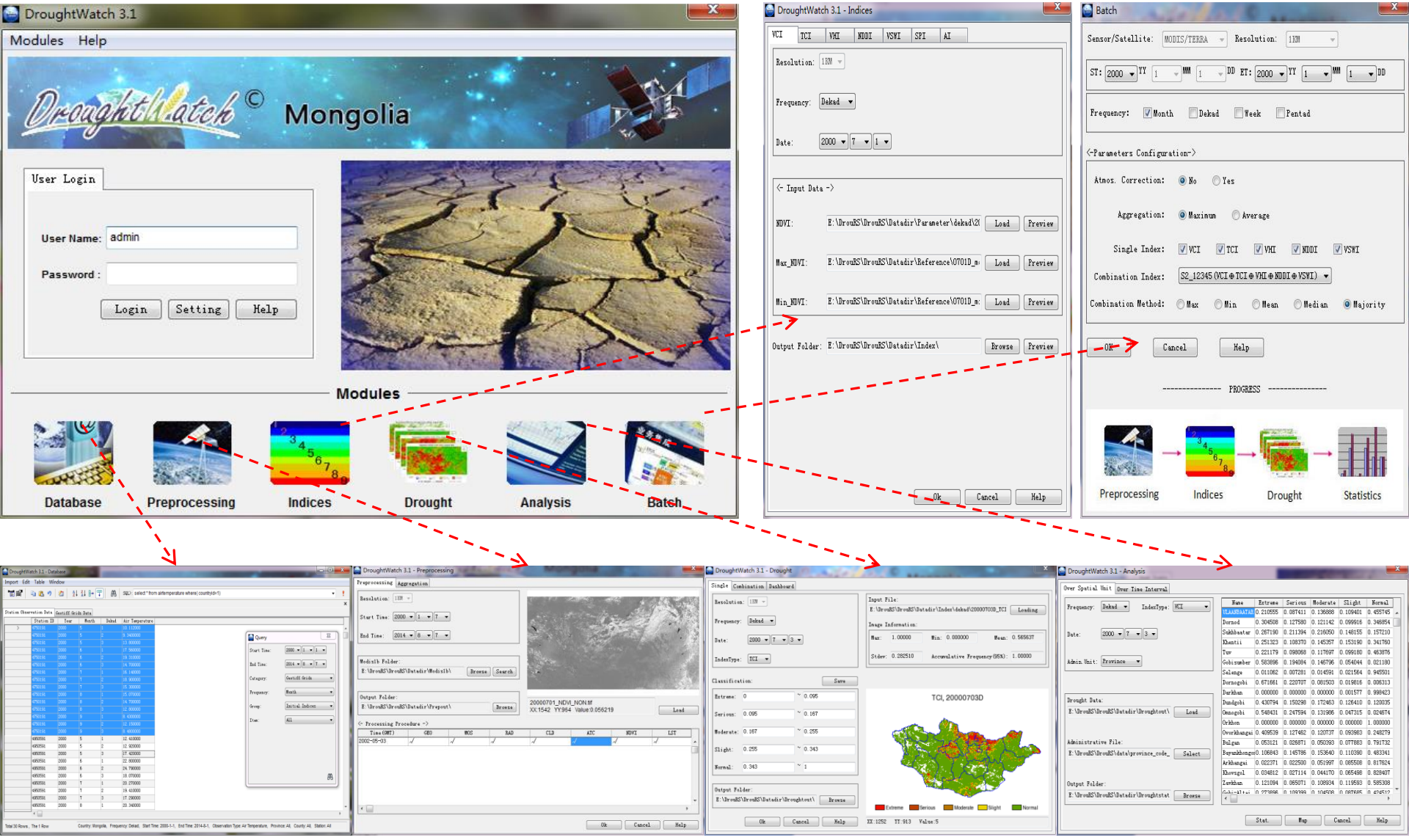
Agri-Map

ยินดีต้อนรับเข้าสู่ระบบ Agri-Map Online



monitoring

DroughtWatch for Mongolia



DroughtWatch Handover to Mongolia

On September 17, 2018, the DroughtWatch-Mongolia was officially handed over to the Mongolian National Remote Sensing Center (NRSC)

Potential

- **Promote ownership for developing countries**
  - Customized according to the specific demand for each country and work as a national/regional system
  - After customization and training, countries will strengthen the agricultural monitoring capacity on your own
  - Promote developing countries leap-frag development
- **Cloud services for crop monitoring**
  - Cloud based system assessible from internet everywhere without investment on computing infrastructure, storage, etc

Thank you for your attention!