GROUP ON EARTH OBSERVATIONS

GEOGLAM
Global Agricultural Monitoring

GEOGLAM
Global Agricultural Monitoring

Chris Justice
on behalf of the GEOGLAM CoP

GEOGLAM RAPP Workshop, July 23rd 2014, INRA

G-20 GEOGLAM: A GEO Initiative on Global Agricultural Monitoring through the use of earth observations

- Aim: Strengthen the international community's capacity to produce and disseminate relevant information on agricultural production at national, regional and global scales, through earth observations
- Building on existing monitoring systems
- Focus on producer countries and countries-at-risk

GEO the Group on Earth Observations

an Intergovernmental Organization with 90 Members and 77 Participating Organizations

U.S. Department of State, Washington DC. July 31, 2003

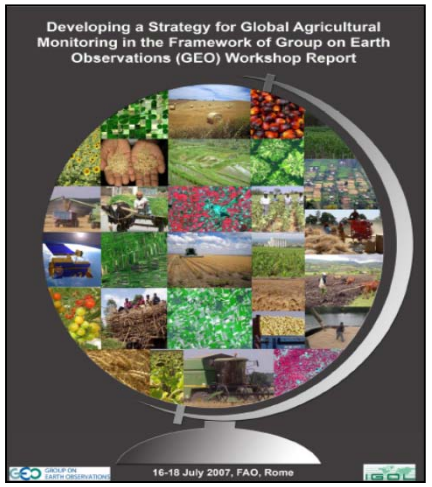
Led to the Establishment of a

Global Earth Observing System of Systems (GEOSS)

Initial GEO Agricultural Monitoring Workshop

July 2007, UN-FAO

- IGOL*/GEO AgMon Workshop to develop a strategy for global agricultural monitoring in the framework of GEO
  - Attendance: 25 national and international organizations
  - Establishment of the *'GEO/IGOL Agricultural Monitoring Community of Practice'*

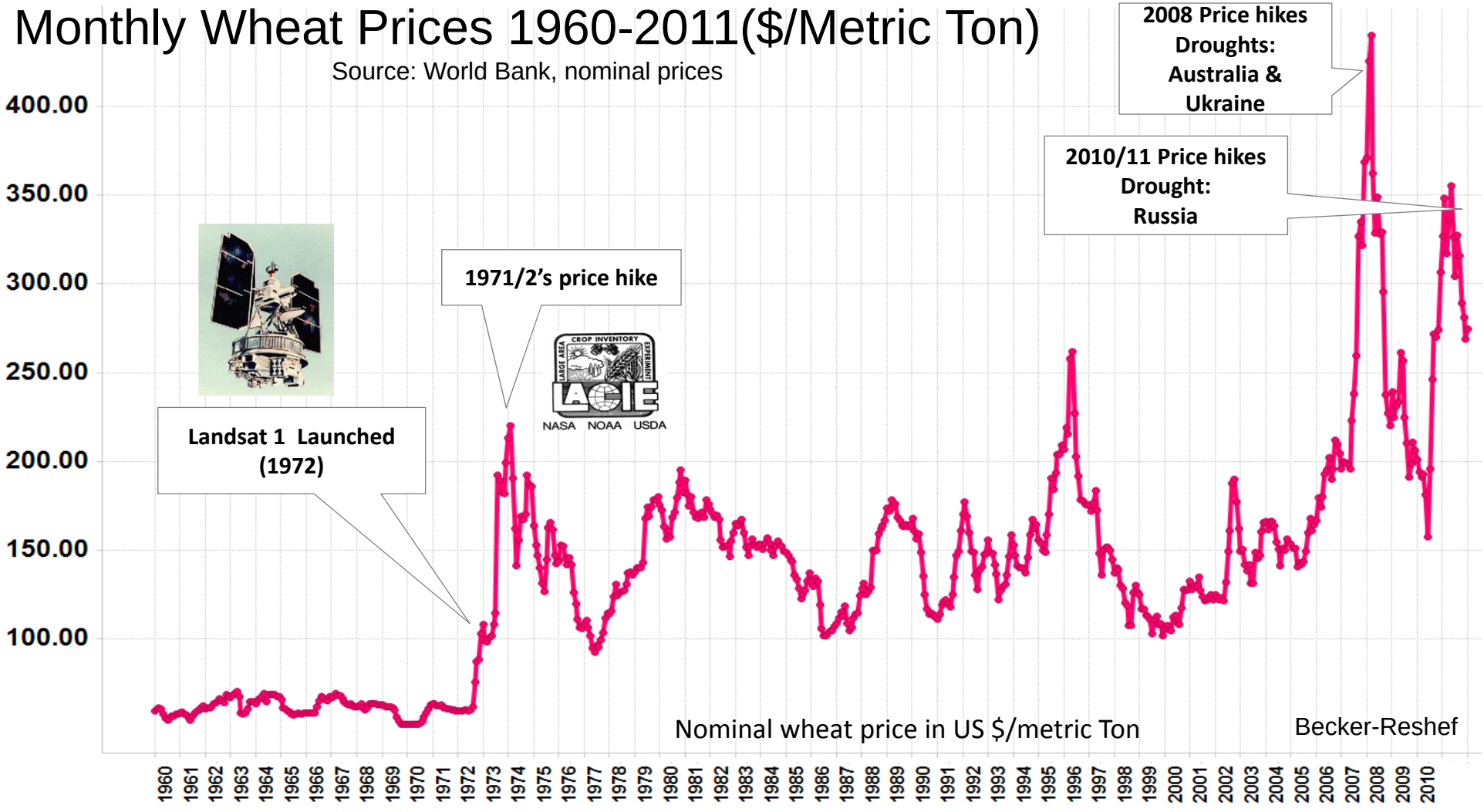


- Agricultural Monitoring Community: many common issues of data frequency, timeliness, policy, availability and continuity
- Agricultural Monitoring Research Community: little that could be adopted as 'operational'
  - Reviewed the current state of agricultural monitoring, identified gaps and developed a set of priorities and recommendations

IGOL : Integrated Global Observation of Land, a GEO programme*

Volatility of Agricultural Prices *(1/2)*

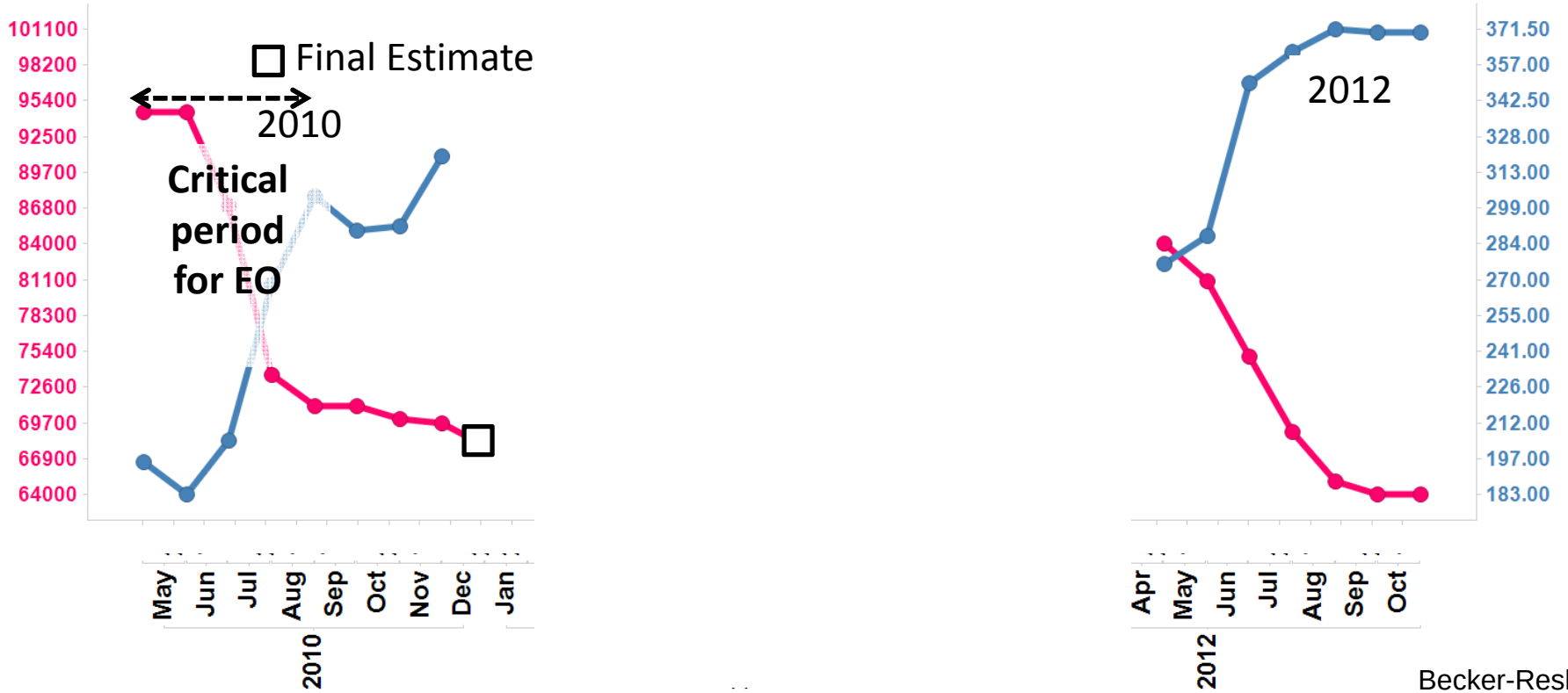
- International recognition of critical need for improved real time, reliable, open information on global agricultural production prospects



Volatility of Agricultural Prices *(2/2)*
Link with Production Forecasts

Aggregation of Wheat Production Forecasts from Main Wheat Export Countries vs. International Market Price: 2010, 2012

Price ($/Ton) Production Forecasts 1,000 MT



Becker-Reshef

The G20 Agriculture Mandate (2011)
G20 Final Declaration – Cannes, November 2011

- *44. We commit to improve market information and transparency in order to make international markets for agricultural commodities more effective. To that end, we launched:*
  - *The "Agricultural Market Information System" (AMIS) in Rome on September 15, 2011, to improve information on markets ...;*
  - *The "Global Agricultural Geo-monitoring Initiative" (GEOGLAM) in Geneva on September 22-23, 2011. This initiative will coordinate satellite monitoring observation systems in different regions of the world in order to enhance crop production projections…*
    - *Two initiatives to increase information availability, quality and transparency :*

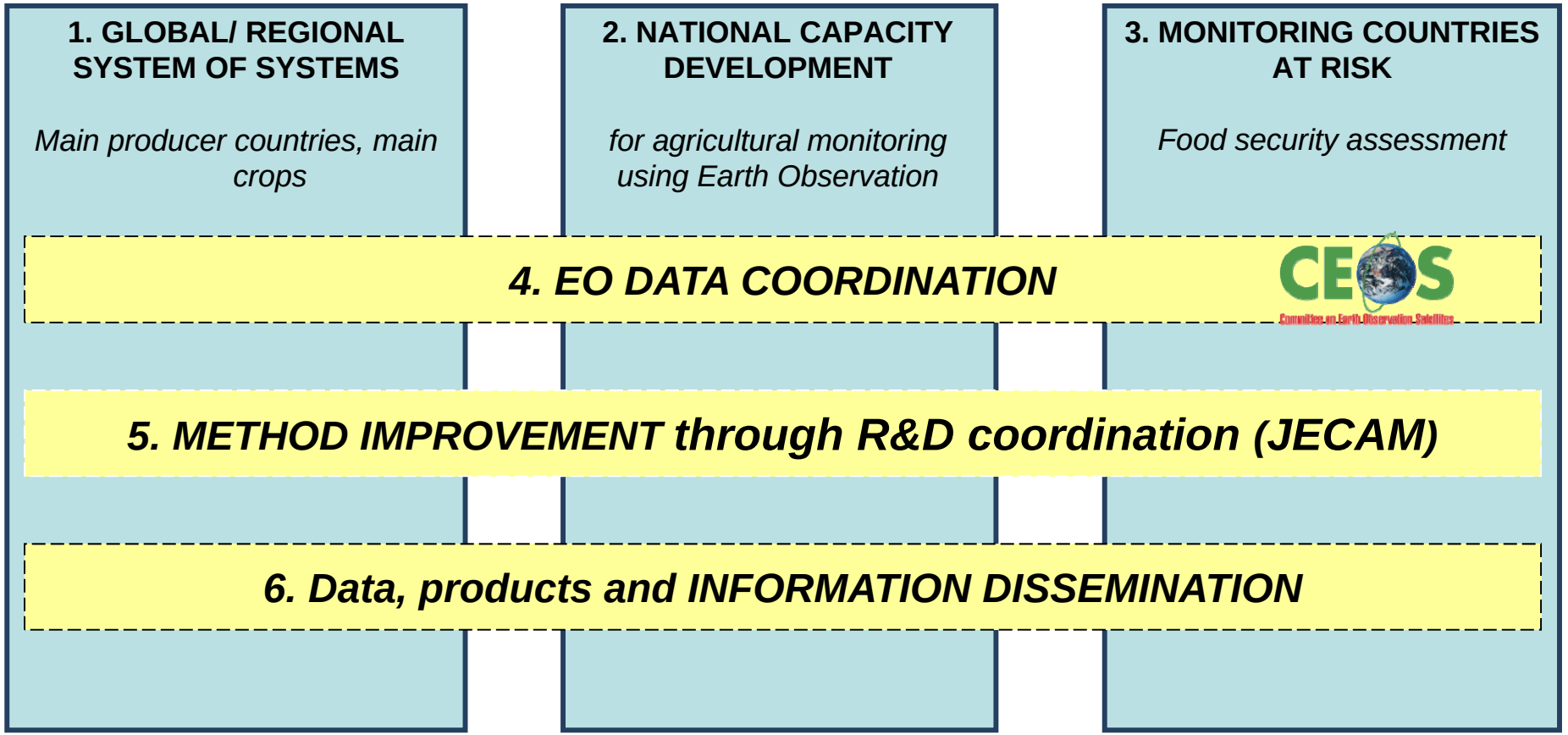
GEOGLAM : improve information on supply

AMIS : improve information on markets

GEOGLAM Actors
GEOGLAM Community of Practice

Open Community made up of international and national agencies concerned with agricultural monitoring including Ministries of Ag, space agencies, universities, & industry

The GEOGLAM Components



GEOGLAM - Phase 1 Support

- EU FP 7
  - SIGMA project
- EU-ESA
  - Sentinel-2 for Agriculture project
- US-NASA
  - Land Cover/Use Change
  - Crop Monitor
  - Global Soy Area Estimation
  - Wheat Yield Forecasting prototype
  - GEOGLAM operations
- US-USDA
  - Pakistan Capacity Building
  - GEOGLAM Operation w. NASA
- Canada-Belgium (UCL)
  - JECAM office
- China
  - CropWatch project
- CEOS
  - CEOS = Committee on Earth Observation Satellites
  - Provision of satellite imagery to GEOGLAM
- CSIRO
  - RAPP Office
- Japan
  - Asia-RICE Project (JAXA + ADB)
- France
  - Secondment of GEOGLAM project coordinator
- Gates Foundation
  - STARS Project (Africa & Asia)
- Germany
  - Indicated interest to support GEOGLAM
- Argentina (Ministry of Ag)
  - National capacity building initiative
- Mexico (SIAP)
  - National capacity building initiative

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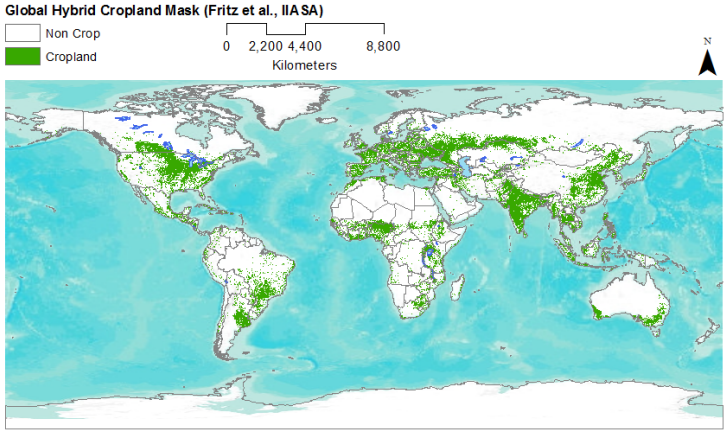
GEOGLAM Global Agricultural Monitoring

GEOGLAM Component #1
Global Agricultural Monitoring

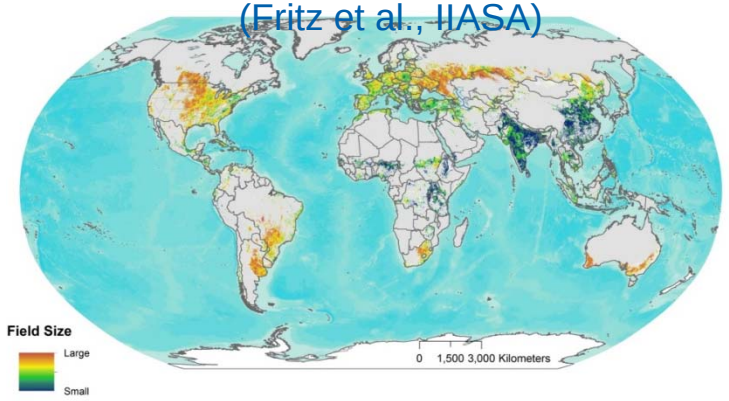
Focus on major export and producer countries

Development of Baseline Datasets as inputs to Agricultural Monitoring Strategy

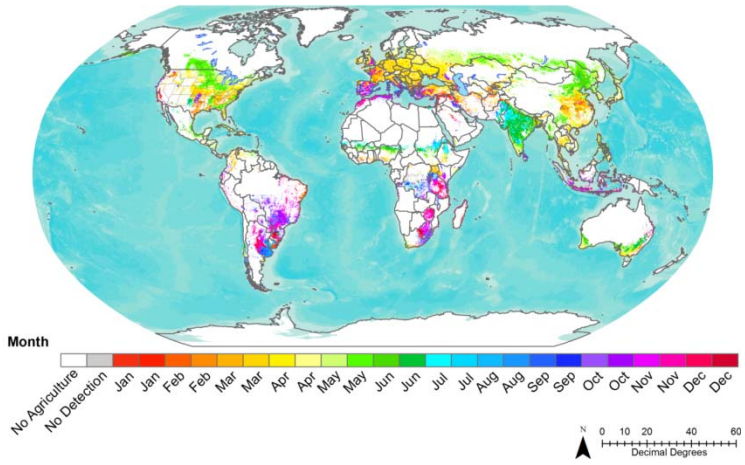
Where? Cropland Distribution
(Fritz et al., IIASA)



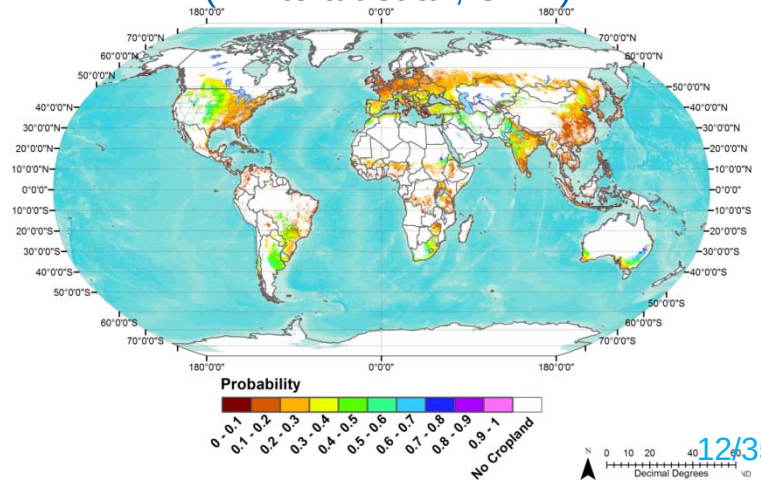
At what scale? Field Size Distribution
(Fritz et al., IIASA)



When are the crops growing?
(Whitcraft et al., UMD)



How do clouds impact clear views?
(Whitcraft et al., UMD)



GROUP ON EARTH OBSERVATIONS

GEOGLAM Global Agricultural Monitoring

GEOGLAM Crop Monitor

- **Objective: develop transparent, timely, crop condition assessments in primary agricultural production areas highlighting potential hotspots of stress/bumper crop**
- **Reflect international consensus of crop conditions**
- **Assessments published monthly in the AMIS Market Monitor**
- **http://www.geoglam-crop-monitor.org**

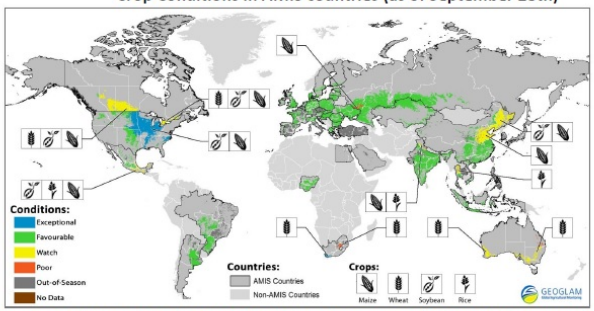
Coordinated by Center for Global Agricultural Monitoring Research, UMD

AMIS Agricultural Market Information System

October 2014 Crop Monitor issue

Crop Monitor*

Crop Conditions in AMIS countries (as of September 28th)



Crop condition map synthesizing information for all four AMIS crops as of September 28th. Crop conditions over the main growing areas for wheat, maize, rice, and soybean are based on a combination of national and regional crop analyst inputs along with earth observation data. ***Crops that are in other than favourable conditions are displayed on the map with their crop symbol.***

Highlights

Wheat conditions remain mostly favourable. In the northern hemisphere, the spring wheat season is coming to a close and winter wheat planting has begun. In Kazakhstan, Russia, US and China spring wheat conditions remain generally favourable. In Canada, spring wheat conditions have deteriorated due to ongoing excess of moisture, cool conditions and frost damage. In the southern hemisphere, wheat is mostly in vegetative to reproductive stages. In Australia, conditions remain mixed and overall yield prospects are reduced. Slightly warmer temperatures and below normal precipitation exacerbated crop deterioration in southern growing regions. In contrast, recent rainfall across Western Australia and central Queensland benefited late planted crops. Timely rainfall will be critical for sustaining crops through to harvest. In South Africa, Brazil, and Argentina conditions remain favourable though there is still some concern due to excess rainfall in parts of Argentina.

Maize overall conditions remain favourable. In the northern hemisphere, conditions remain very good in the US and good in the EU owing to favourable weather. In China, concern remains due to earlier dry and hot weather. In Russia concern remains over the central region and in Ukraine conditions have improved. In Mexico conditions remain generally favourable. In the southern hemisphere, planting has begun and conditions are favourable in Brazil and Argentina.

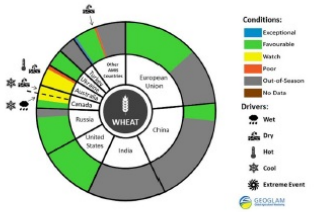
Rice conditions remain favourable. In India, conditions are mostly favourable and the crop is in vegetative to reproductive stages. In Indonesia and Thailand conditions are favourable, however, some concern remains over excess moisture in Thailand. In China, conditions are favourable. However, there is some concern over excess moisture due to Typhoon Kalmaegi. In Viet Nam, conditions are good however total planted area is down relative to last year.

Soybeans overall conditions are very good primarily owing to the US crop. In the northern hemisphere a record crop is expected in the US owing to good weather and increased area. In China, conditions are generally favourable though concern remains due to earlier dry conditions in parts of the northeaster growing region. In Canada, conditions remain mixed due to the ongoing cool and wet weather and recent frost events. In the southern hemisphere the planting season has begun in Brazil under favourable conditions.

El Niño situation update

Outlooks released in mid and late September by the Australian Bureau of Meteorology, the International Research Institute for Climate and Society, and the U.S. National Oceanic and Atmospheric Administration put the probability of an El Niño event during the 2014-2015 southern hemisphere growing season above 50%. Model projections suggest the event will not be a strong one. Potential impacts of El Niño should be considered nonetheless. These include below-normal rainfall in parts of Asia, Southern Africa, and Australia, potentially affecting rice, maize, and wheat. In major regions of South America, El Niño is often associated with above-average rainfall potentially benefiting maize, soy and wheat.

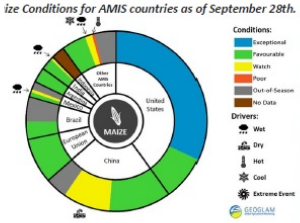
Wheat Conditions for AMIS countries as of September 28th.



For detailed description of the pie chart please see box on page 4.

Wheat conditions in the northern hemisphere remain ...ourable. The spring wheat season is drawing to a close ...d winter wheat planting is in progress. In **Russia**, spring ...eat prospects remain favourable as harvest is close to ...mpletion. Winter wheat planting is progressing well ...ing to favourable weather that boosted moisture ...nditions. In **Ukraine**, winter wheat planting has ...tiated under mostly favourable conditions. Recent ...ecipitation helped to alleviate dry conditions, however ...yness continued in southern regions. In **Kazakhstan**, ...ring wheat conditions remain overall favourable and ...rvest in the main wheat zone is in progress with ...ported yield slightly below average. In the **EU**, harvest complete and overall yields remain favourable, slightly ...ove the 5-year average. Winter wheat planting has ...rted as normal. In the **US**, spring wheat conditions are ...erall favourable. Harvest is nearly complete after some delays in northern areas due to wet conditions. Planting of ...nter wheat is underway. In **Canada,** conditions have deteriorated. In the Prairies, dry conditions and frost in early ...ptember caused crop damage, though the full impact will not be known until harvest is complete. In addition the ...going excess moisture and cool conditions continue to delay harvest by a couple of weeks. In eastern regions ...nditions were good and harvest was progressing normally until a mid September frost event. Impacts are still to be ...termined. In **Argentina**, conditions remain generally good, and the crop is in vegetative to reproductive stages. ...ncern remains due to excess moisture in south-western Buenos Aires region. In **Brazil**, weather conditions are ...ourable. Planted area increased relative to last year and an increase in production is likely. Sowing is concluded and ...e crop is mostly in reproductive to harvest stages. In **Australia**, conditions remain mixed and overall yield prospects ...e reduced. Slightly warmer temperatures and below normal precipitation exacerbated crop deterioration in ...uthern growing regions where soil moisture deficits persisted since August. In contrast, recent rainfall across ...estern Australia and central Queensland benefited late planted crops. Timely rainfall will be critical for sustaining ...ops through to harvest. In **South Africa** conditions remain favourable over the winter rainfall region (main area) ...ing to normal to above-normal rainfall in winter, and yields are expected to be similar to last year. Over the ...mmer rainfall region, below-normal rain since April resulted in reduced planted area.

...ize Conditions for AMIS countries as of September 28th.

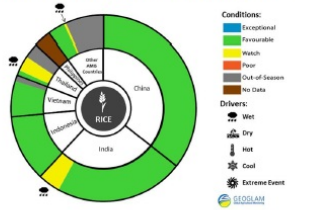


For detailed description of the pie chart please see box on page 4.

Maize conditions in the northern hemisphere remain overall favourable. In the **US**, the crop will likely surpass both yield and production records in large part due to excellent and consistent summer conditions, particularly in the dominant Corn Belt region. In the **EU**, yield prospects of grain maize remain good despite limited local concerns due to excessive rainfall. In **Russia,** harvest is underway. Concern remains in the central region where yields are expected to be down relative to last year. In **Ukraine**, prospects improved for maize. Quality is expected to be average and harvest is progressing. In **China**, conditions remain mixed with concern across much of the North China Plain and Northeast growing regions due to earlier dry conditions. In south-western regions, maize harvest is mostly complete. In **Mexico** conditions remain generally favourable with sufficient ...isture for crop development. Sowing of the spring-planted crop is complete. There is some concern over excess ...isture in a few production areas in southern growing regions, but without considerable damage to production. In ...nada, conditions remain mixed and harvest is underway. Wet weather remains a concern and is delaying harvest. In ...dition, there is some concern over the September frost events. In **Nigeria,** conditions improved and are favourable. ...the southern hemisphere conditions are favourable. In **Brazil** weather conditions are favourable for sowing of the ...st crop. In **Argentina**, planting is progressing in Buenos Aires, Cordoba and Santa Fe and conditions are overall ...ourable for the emerging crops.

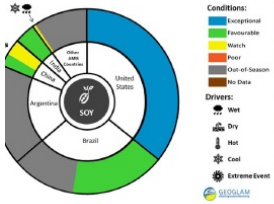
...conditions are generally favourable. In **India,** ...ions are mostly favourable and the crop is in ...tive to reproductive stages. In **Indonesia,** the dry ...crop conditions remain favourable. Rice growth ...range between vegetative to maturity stages ...ding on planting date. In **Viet Nam,** overall ...ions of the summer, the summer-autumn, and ...n-winter crops are good. However, total planted ...lower relative to last year. Growth stages range ...transplanting to harvest. In **Thailand,** overall ...ions are favourable. Some concern remains over ...ason rice in some provinces in the north and ...ast due to heavy rainfall and some flooding. ...l planted area of wet season rice has decreased ...e to last year in favour of other crops. In **China,** ...ions remain generally favourable. However, ...s some concern due to typhoon Kalmaegi, which brought heavy rainstorms to southern growing regions. Single ...d rice is mostly in heading to harvest stages, while late season rice is in booting to flowering stages. In the **EU**, ...e crop is still progressing as normal. In the **US**, conditions are favourable and much of the crop has been ...ted. In **Nigeria**, conditions are favourable. In **Brazil**, the main producer state started the soil tillage in ...ation for the next crop.

Rice Conditions for AMIS countries as of September 28th.



For detailed description of the pie chart please see box below.

...nditions for AMIS countries as of September 28th



...iled description of the pie chart please see box below.

Soybeans prospects in the northern hemisphere are overall very good primarily owing to the US crop. In the **US**, there will be an exceptionally large soybean crop, well surpassing past production records. This is due to both very good growing conditions, which have occurred throughout the summer, and a big increase in planted area from previous years. In **Canada,** conditions remain mixed due to excess moisture and a cooler than normal summer and recent frost events. Development is generally a week behind normal, with frost becoming an increasing risk. In **China,** conditions remain generally favourable except in the western and southern parts of the northeast soybean producing area where persistent drought occurred earlier in the season. The crop is mainly in maturity stages. In **Nigeria,** conditions are favourable owing to good moisture conditions. In addition planted ...as been on the rise. In **Brazil**, the planting season began in main producer states under mostly favourable ...ions.

...art description: Each slice represents a country's share of total AMIS production (5-year average). Main producing ...ries (representing 90 percent of production) are shown individually, with the remaining 10 percent grouped into the ...r AMIS Countries" category. The area within each slice is divided between crops in-season (colour) and out-of-season ... The in-season portion is coloured according to the various crop conditions within that country. When conditions are ...ed as 'poor' or 'watch', icons are added that provide information on the key climatic drivers affecting conditions. The ...red areas reflect conditions by area rather than overall national production.

...nd Disclaimers: The Crop Monitor assessment is conducted by GEOGLAM with inputs from the following partners (in alphabetical order): Argentina ...sia Rice Countries (AFSIS, ASEAN+3 & Asia RICE), Australia (ABARES & CSIRO), Brazil (CONAB & INPE), Canada (AAFC), China (CAS), EU (EC JRC MARS), ... (LAPAN & MOA), International (CIMMYT, FAO, IFPRI & IRRI), Japan (JAXA), Mexico (SIAP), Russia (IKI), South Africa (ARC & GeoTerraImage & SANSA), (GISTDA & OAE), Ukraine (NASU-NSAU & UHMC), USA (NASA, UMD, USGS – FEWS NET, USDA (FAS, NASS)), Viet nam (VAST & VIMHE-MARD). The findings ...lusions in this joint multi-agency report are consensual statements from the GEOGLAM experts, and do not necessarily reflect those of the individual ...represented by these experts. Map data sources: Major crop type areas based on the IFPRI/IIASA SPAM 2005 beta release (2013), USDA/NASS 2013 CDL, ...FC Annual Crop Inventory Map, GLAM/UMD, GLAD/UMD, Australian Land Use and Management Classification (Version 7), SIAP, ARC, and JRC. Crop ... based on GEOGLAM partner crop calendars and USDA crop calendars.

...tailed information on the GEOGLAM crop assessments is available www.geoglam-crop-monitor.org.

... information regarding on the new crop monitor and pie charts: http://www.geoglam-crop-monitor.org/content/about-geoglam-crop-monitor.

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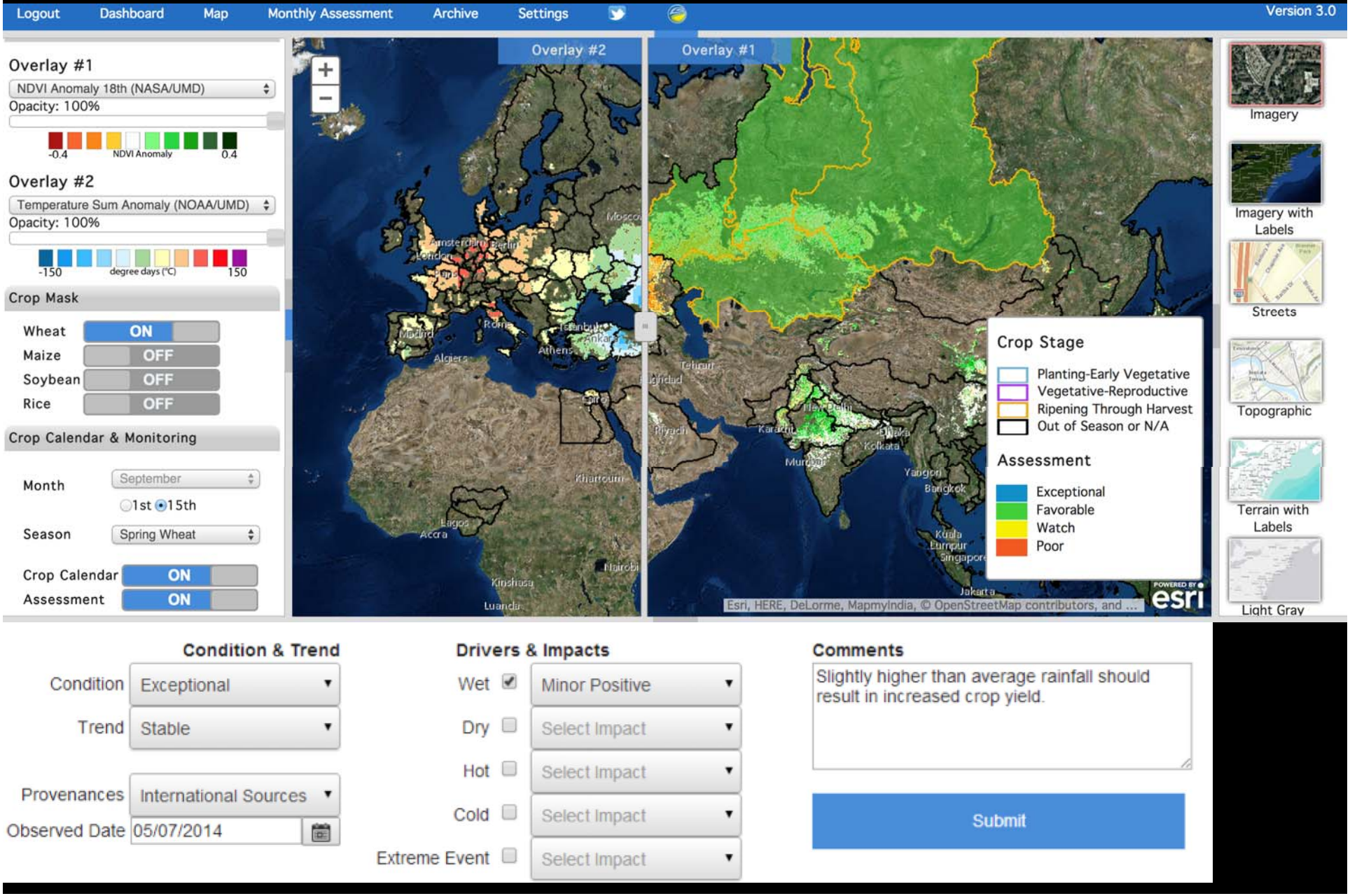
GEOGLAM Global Agricultural Monitoring

GEOGLAM Crop Monitor Partners
>30 partners & growing

Country	Organization/Agency	Country	Organization/Agency
Argentina	INTA	Japan	JAXA
Asian Rice Countries	AFSIS ASEAN +3	Mexico	SIAP
Asian Rice Countries	Asia RiCE	Russia	IKI
Australia	ABARES	South Africa	ARC
Australia	CSIRO	South Africa	GeoTerraImage
Brazil	CONAB	South Africa	SANSA
Brazil	INPE	Thailand	GISTDA
Canada	AAFC	Thailand	OAE
China	CAS	Ukraine	NASU-NSAU
EU	EC JRC MARS	Ukraine	UHMC
India	ISRO	Uruguay	MGAP
Indonesia	LAPAN	USA	NASA
Indonesia	MOA	USA	UMD
International	CIMMYT	USA	USDA (FAS, NASS)
International	FAO	USA	USGS - FEWS NET
International	IRRI	Vietnam	VAST
International	IFPRI	Vietnam	VIMHE-MARD

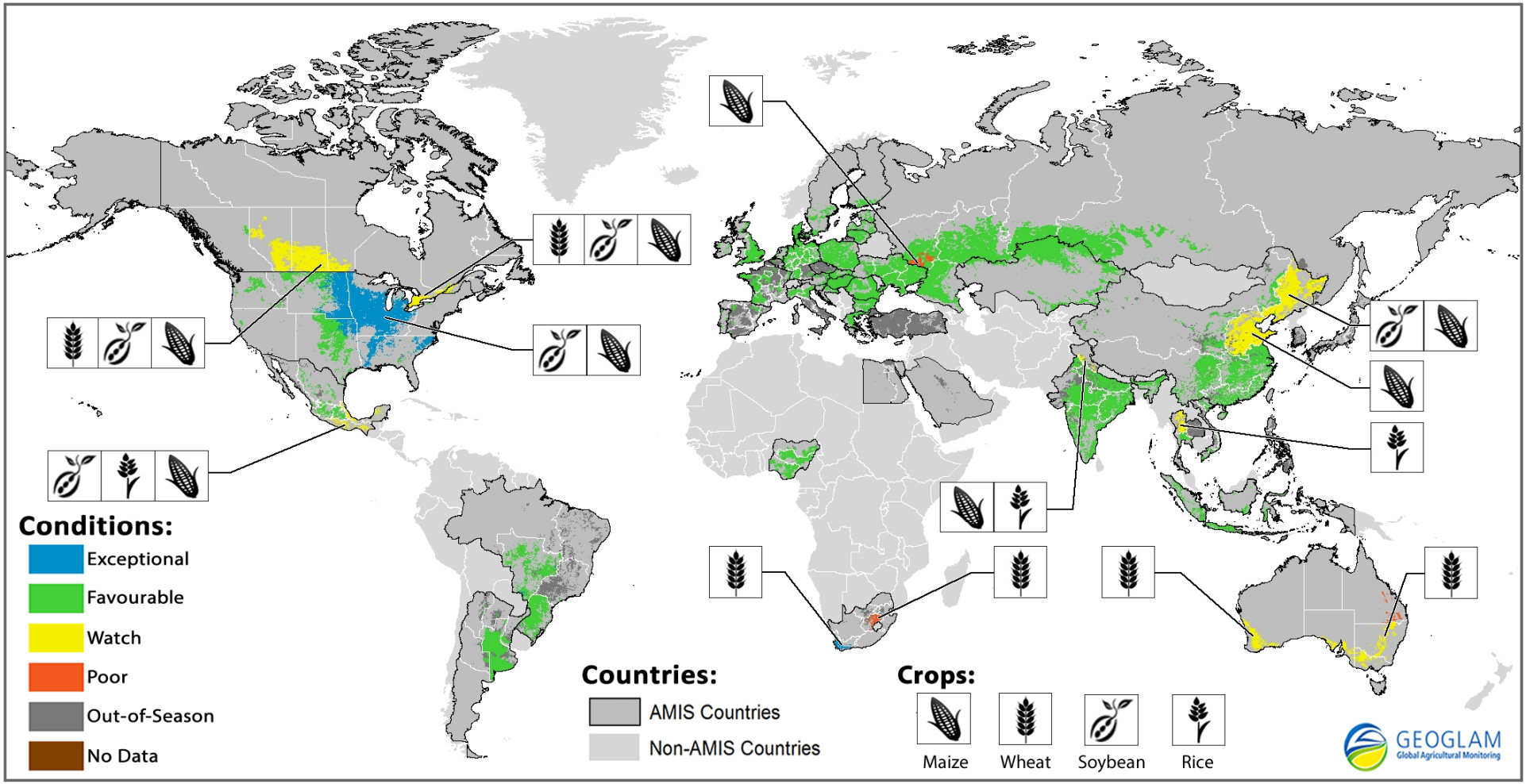
Refining the Communication Interface for Crop Condition Assessments



Current Crop Monitor Products for AMIS:

Synthesis Condition Maps (other versions available online)

Crop Conditions as of September 28th, 2014



Crop condition map synthesizing information for all four AMIS crops

Crops that are in other than favorable conditions are displayed on the map with their crop symbol.

(Cropland area shown is an aggregation of all cropland areas)

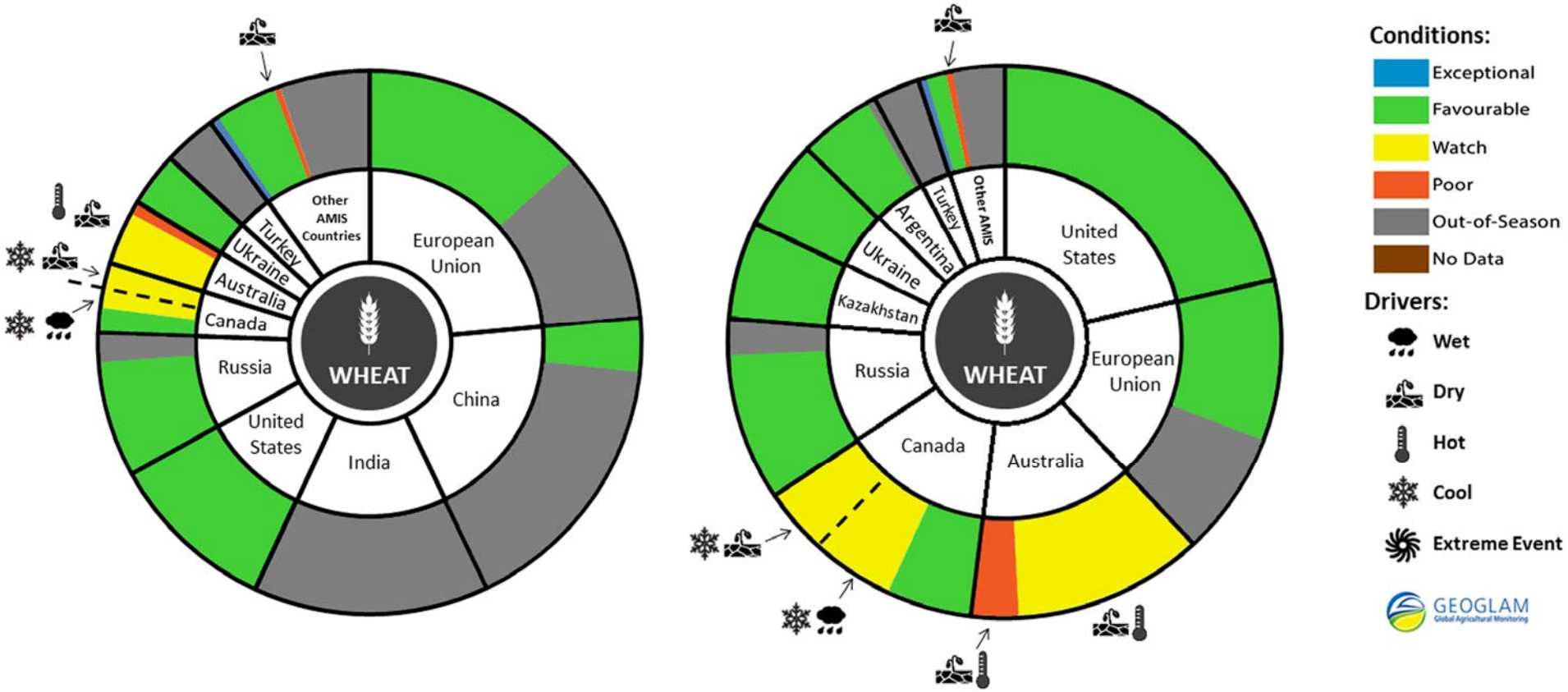
Pie Charts, with crop condition drivers

Crop Conditions as of September 28th, 2014

As share of:

Wheat Production

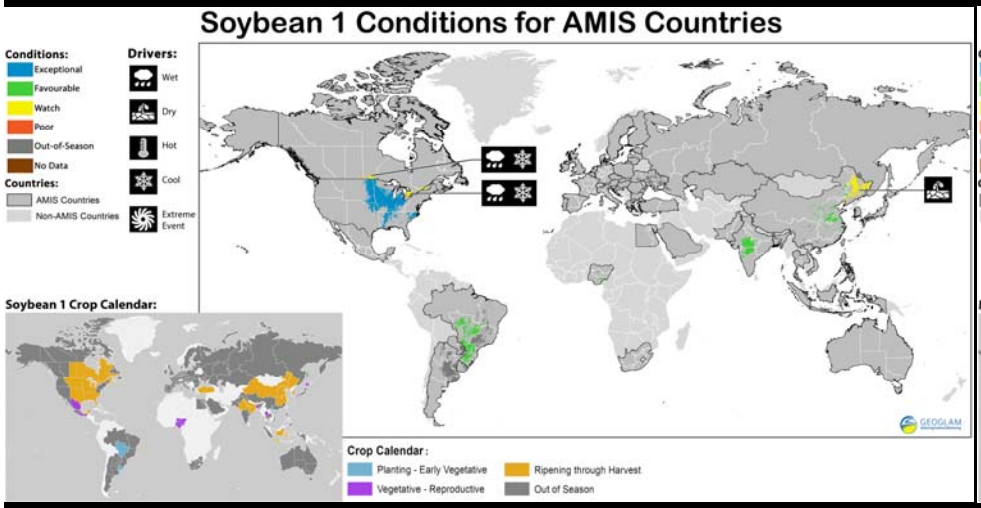
Wheat Exports (available online)

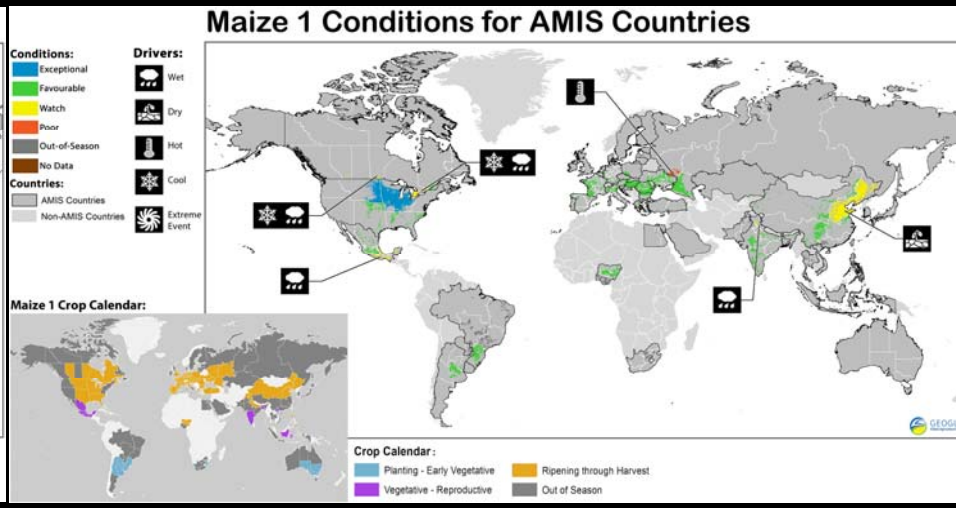


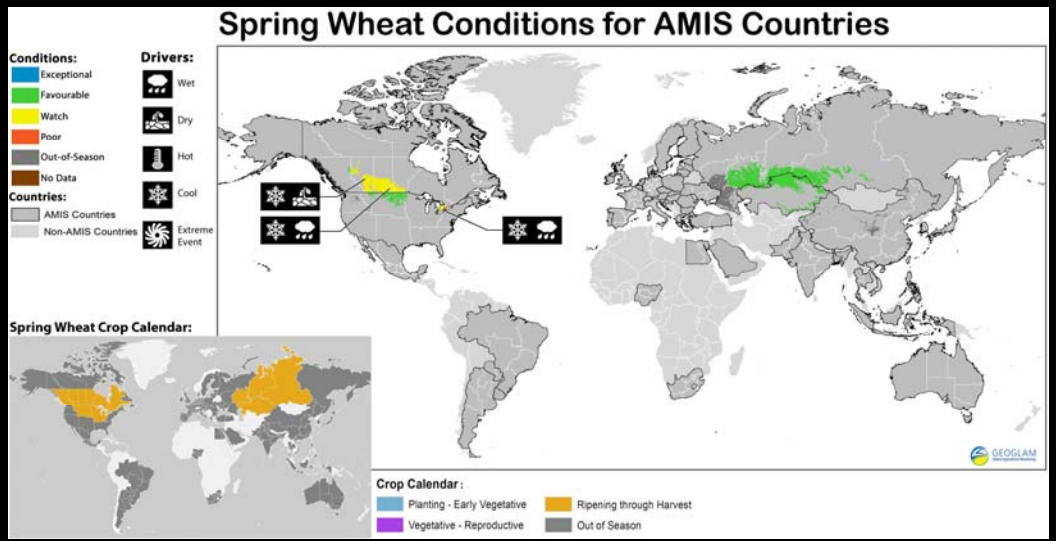
A country's slice represents its portion of the 5 year average of the total AMIS countries production

Crop Specific Crop Condition Maps with Crop Calendar inserts (available online)

Crop Conditions as of September 28th, 2014







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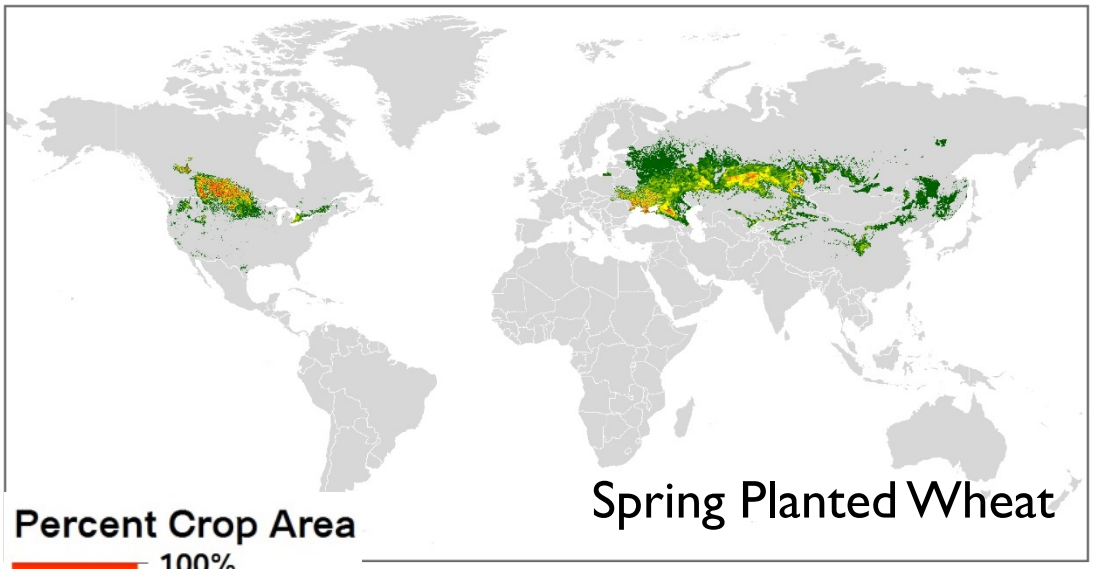
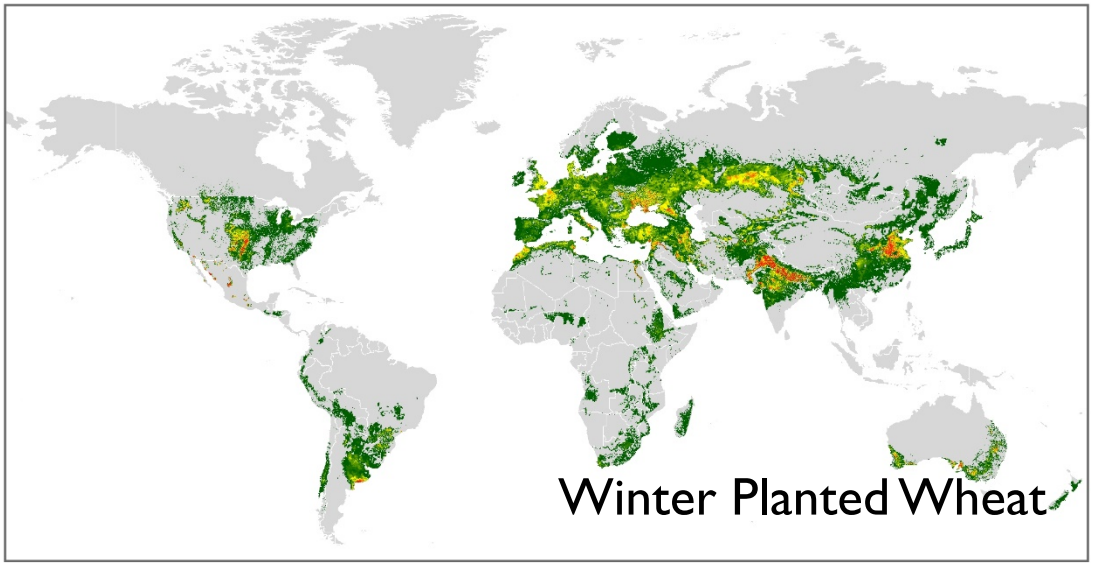
Crop Monitor Crop Masks and Calendars



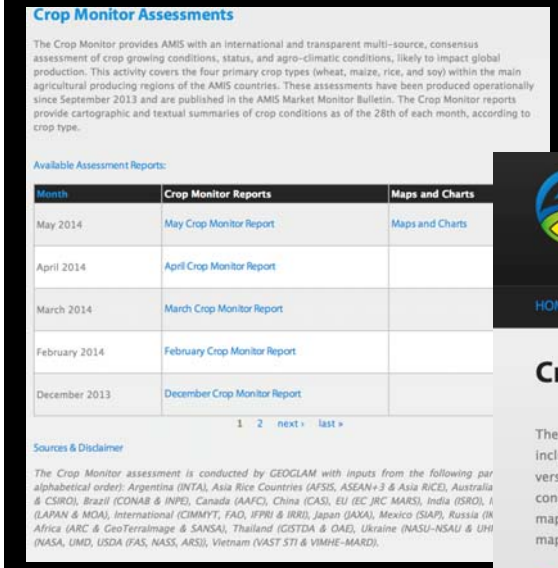
New Crop Monitor products
Reflect best available crop type distribution based on multiple national & global products

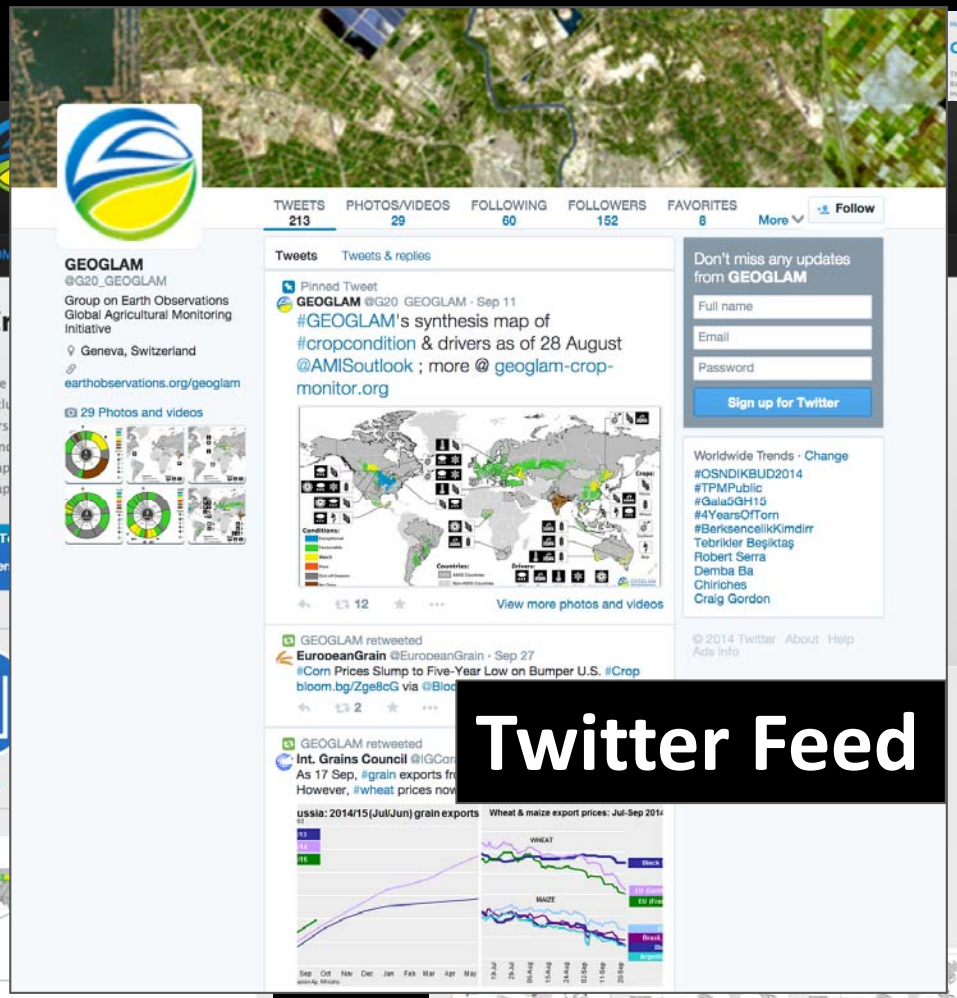
Sources: IFPRI/IIASA SPAM 2005 [beta version; released 2013]), USDA/NASS CDL 2013, AAFC Annual Crop Inventory Map 2013, SIAP (Mexico) Crop Type Maps, GLAM/UMD wheat and soy masks, Australian Land Use and Management Classification (Version 7), ARC South Africa, Nigeria, and EC JRC MARS crop type masks. Asian Rice countries to be- added in August.

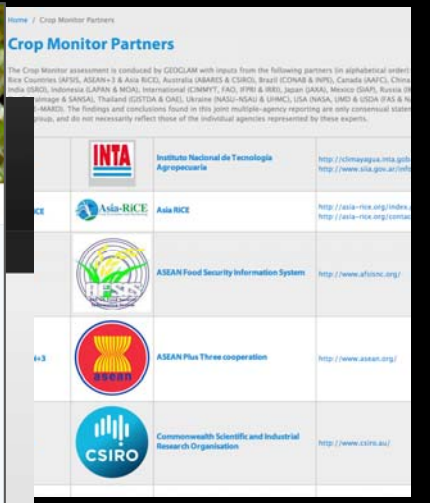


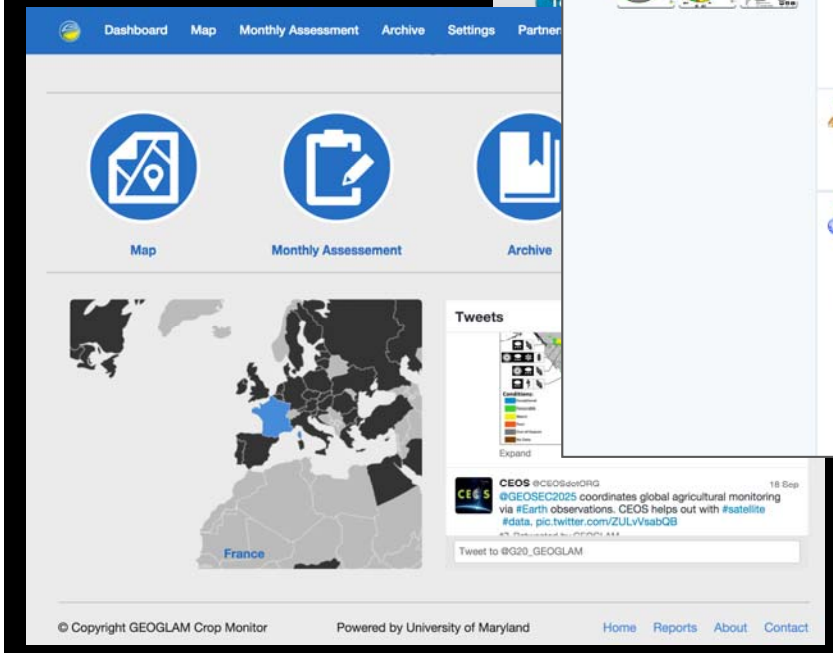
Crop Monitor Website

www.geoglam-crop-monitor.org









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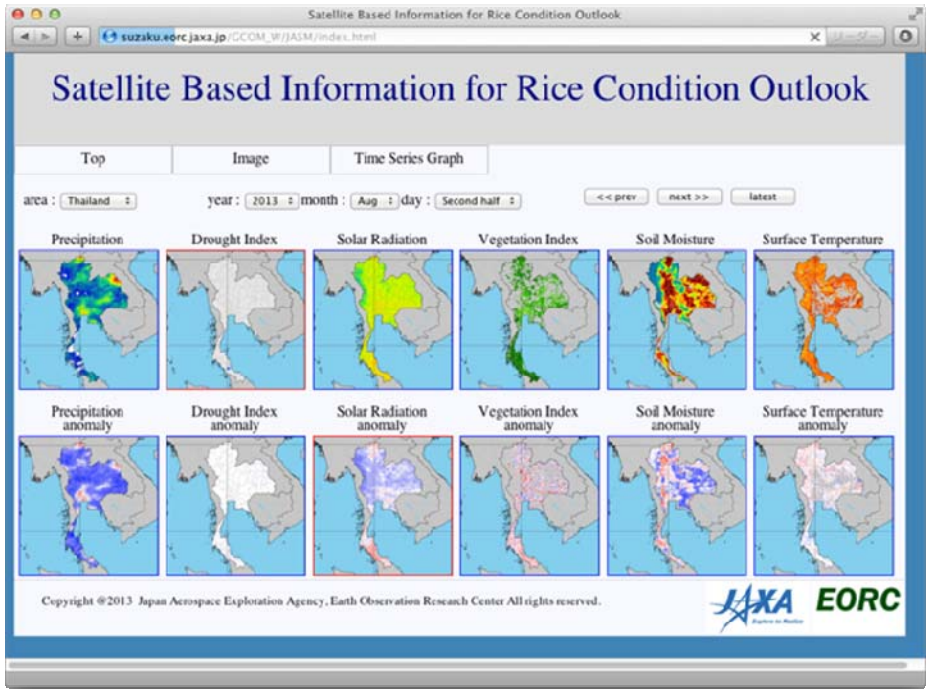
GEOGLAM Global Agricultural Monitoring

Asia-RiCE – Asian Rice Monitoring

- A multi-national project led by Japan (JAXA), with collaborations in ASEAN+3 countries and India
- A regional view using agro-meteorological data derived from low resolution optical satellite imagery (MODIS, GCOM-W, TRMM and others)
- A local view to estimate rice crop area and production using available radar and other satellite data with ground observation data and statistical information (test-sites in Indonesia, Thailand and Vietnam)



http://www.asia-rice.org

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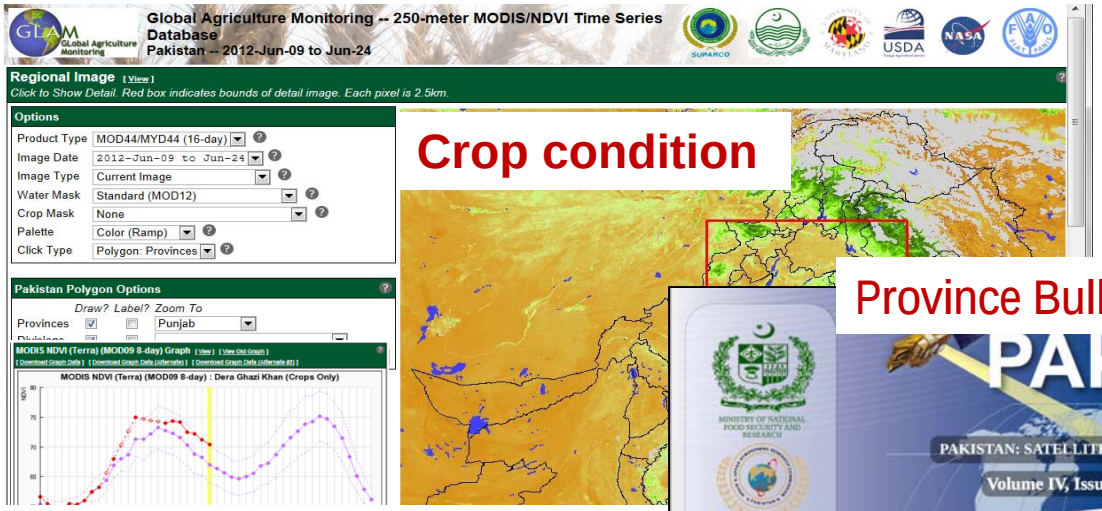
GEOGLAM Global Agricultural Monitoring

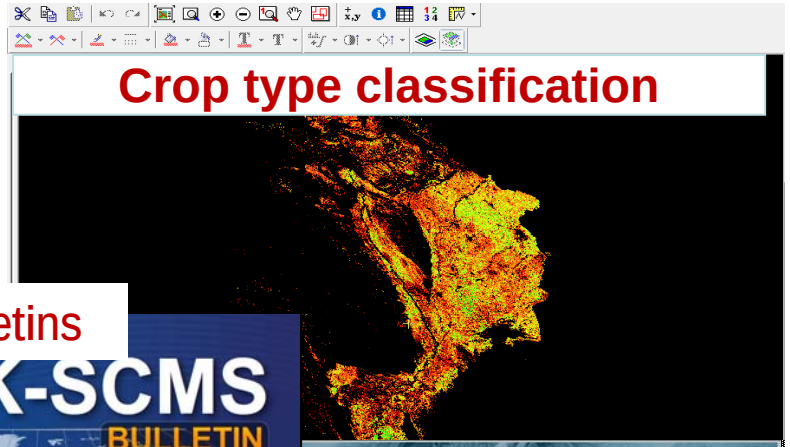
GEOGLAM Component #2
Capacity Building

Example : Pakistan Agricultural Information System

(Collaboration among CRS, FAO, SUPARCO, UMD & USDA)

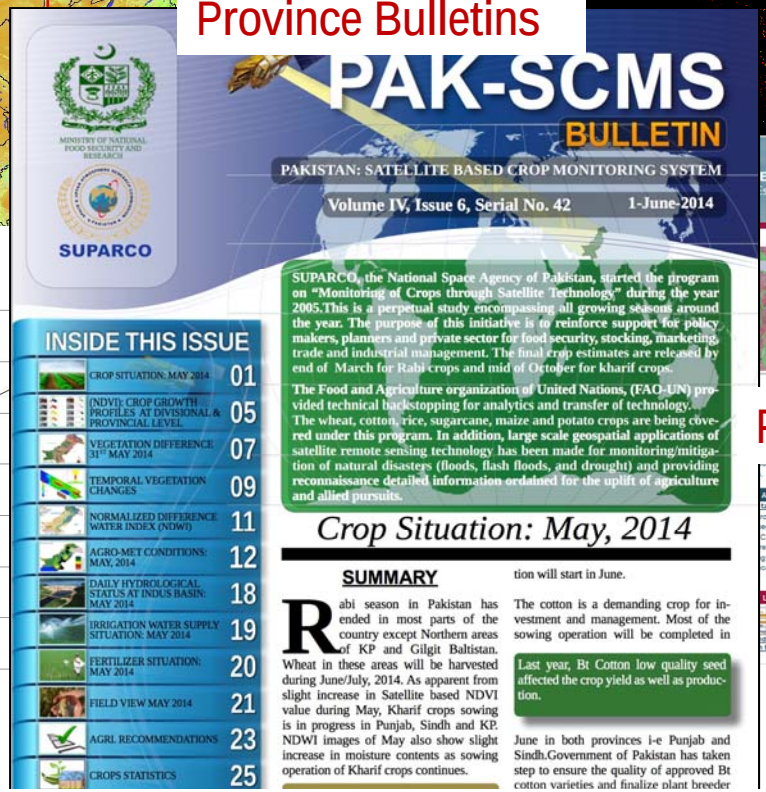


Crop condition

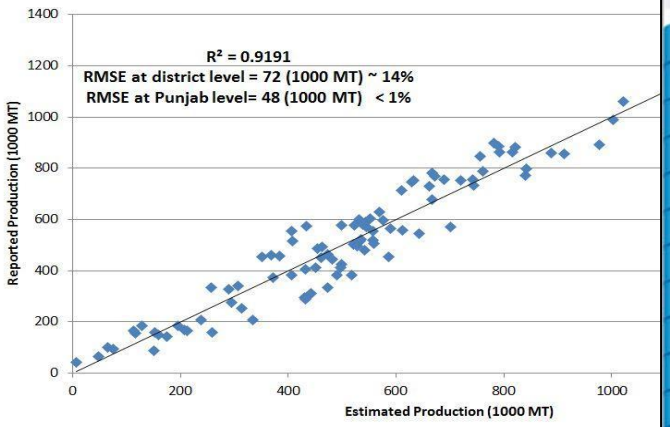


Crop type classification

Province Bulletins



EO Wheat Production Forecasting



Project information

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STARS

SPURRING A TRANSFORMATION FOR AGRICULTURE THROUGH REMOTE SENSING

- BMGF Funded project, launched by University of Twente
- *A project on the application of satellite images in African and Asian agriculture*
- *Partners:*
  - *ITC*
  - *ICRISAT*
  - *CIMMYT*
  - *CSIRO*
  - *UMD*

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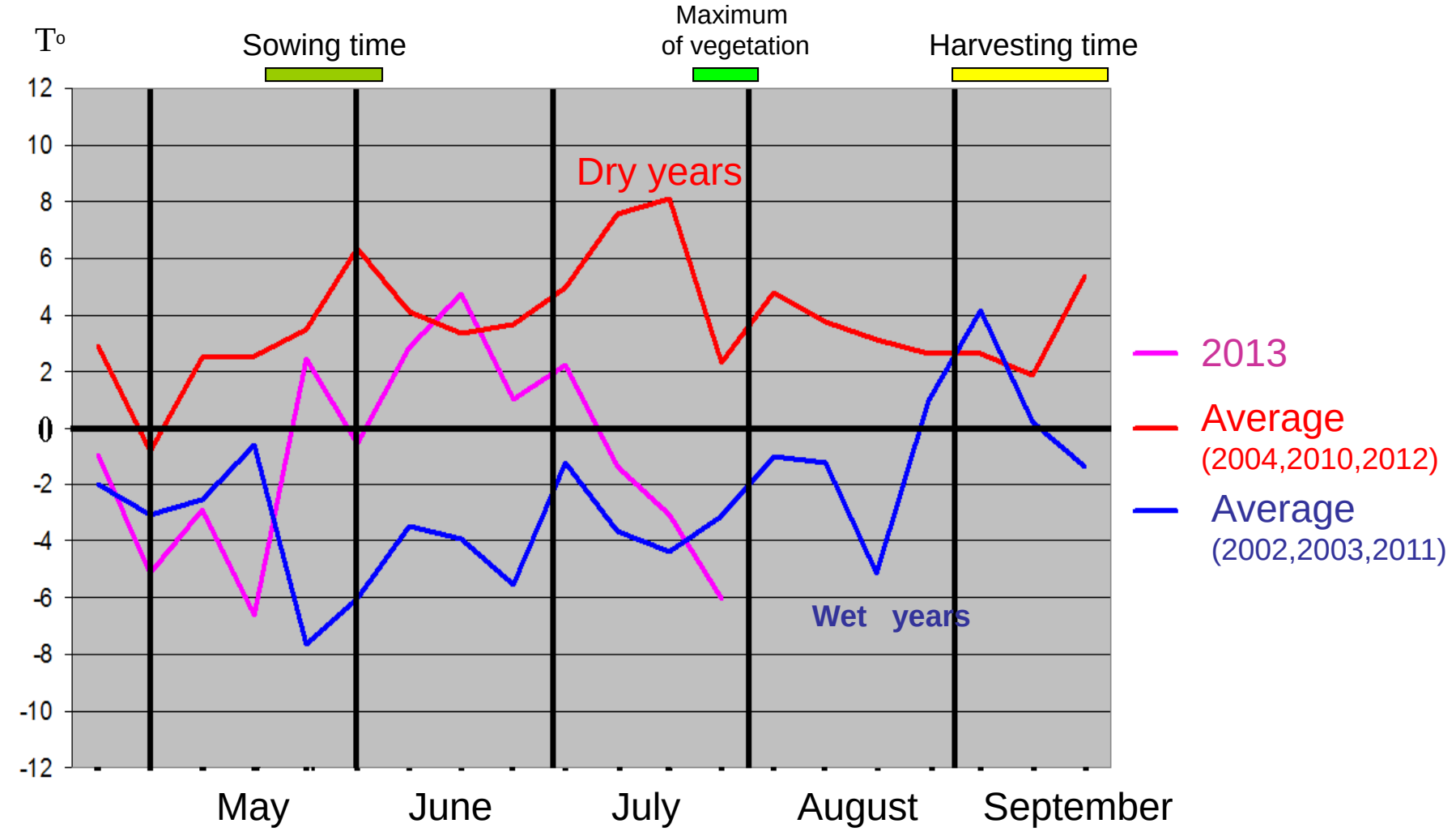
Development of new monitoring products - UKRAINE

- ***Project and initiatives***
  - **JECAM and GEOGLAM**
    - **MDA SOAR-JECAM project**
    - **SIGMA**
  - **ESA Sentinel-2 for Agriculture**
- ***Applications***
  - **Crop mapping**
  - **Biophysical parameters estimation**
- ***Data***
  - **Take5 – SPOT4 + RapidEye (5 days interval)**
  - **SOAR-JECAM – Radarsat-2 (~12 days interval)**
- ***Ground observation campaigns***
  - **2013: 350 fields inspected (crop type), 30 ESU bio. params**
  - **2012: 300 fields inspected**

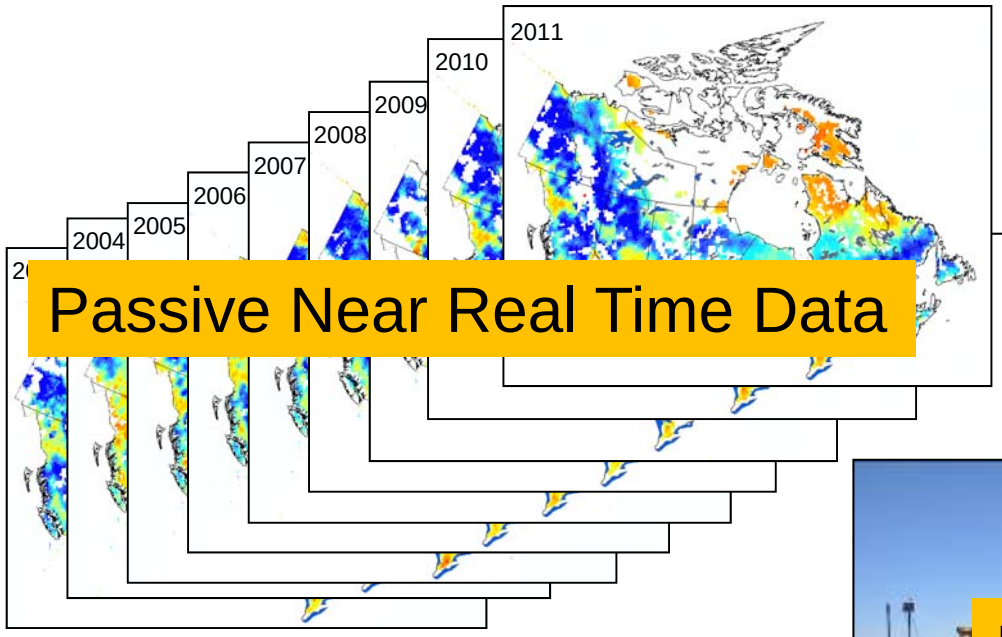
Use of MODIS LST data to monitor growing conditions in Kazakhstan



NEO LST anomaly – regime of Northern Kazakhstan cropland (3 oblasts) during vegetation season of 2013 year

A. Terekhov

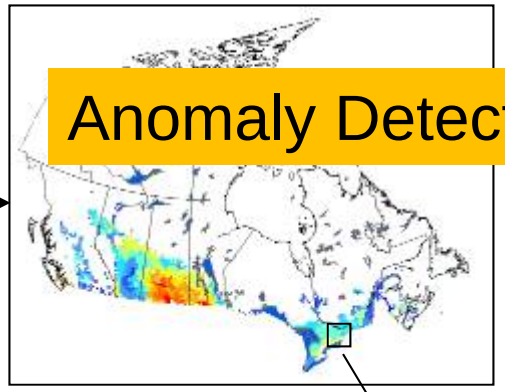
Integrated Soil Moisture Monitoring System using Active and Passive Microwave in Canada



Passive Near Real Time Data

Weekly coarse resolution passive microwave derived soil moisture in near real time

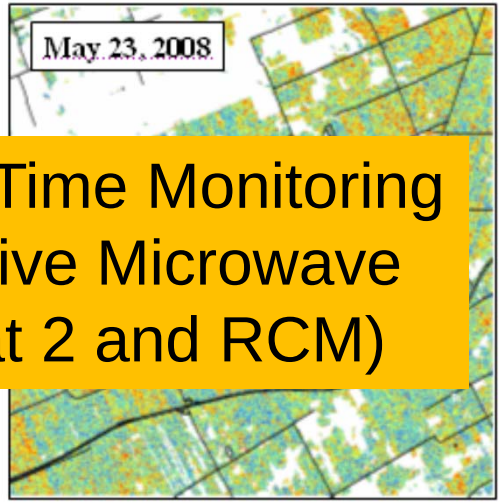
Use historical record of passive microwave soil moisture to derive anomalies



Anomaly Detection

anomalies

Da
assessment through
in situ stations

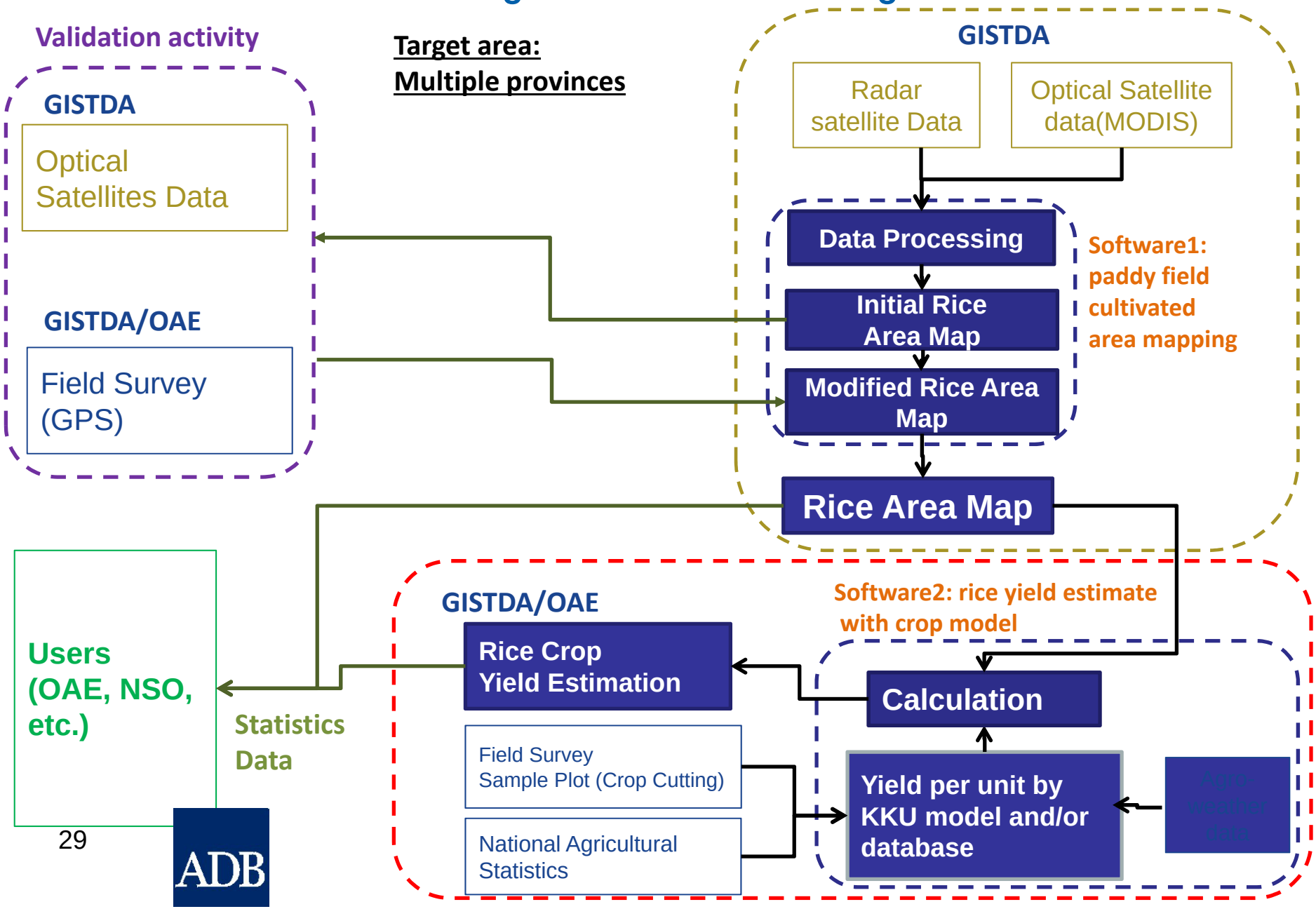


Near Real Time Monitoring Using Active Microwave (Radarsat 2 and RCM)

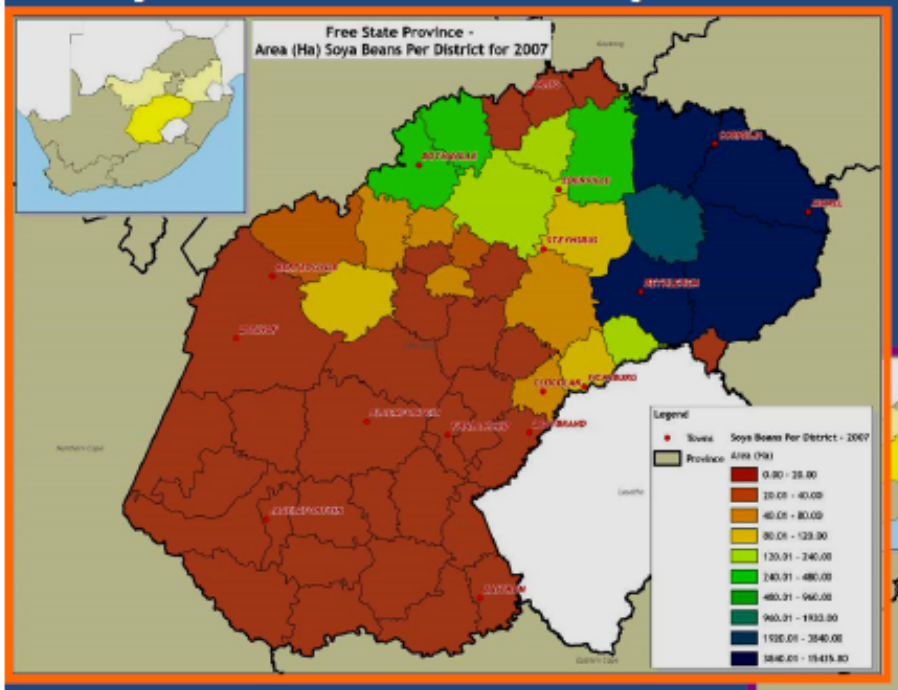
Derive field-scale information on soil moisture from targeted Radarsat acquisitions over areas of interest

Ian Jarvis (Agriculture Canada)

SE Asia Regional Rice Monitoring: Thailand

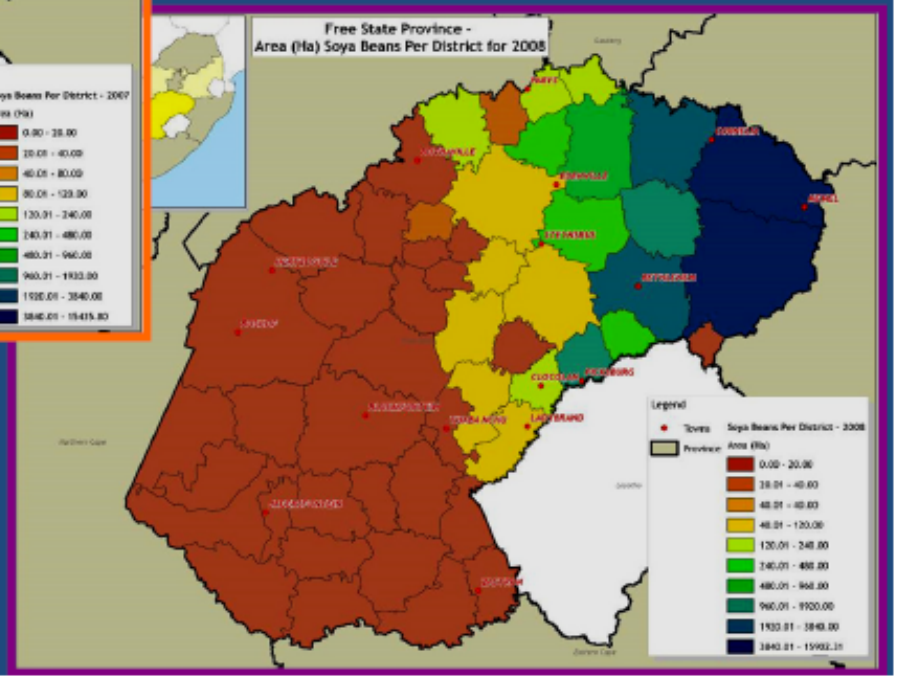


South Africa
SoyaBean Comparison: 2007 vs 2008



Spatial Distribution

- Cultivated area
  - Crop type classification



District level comparison:

- ✓Soya area / district

T. Newby

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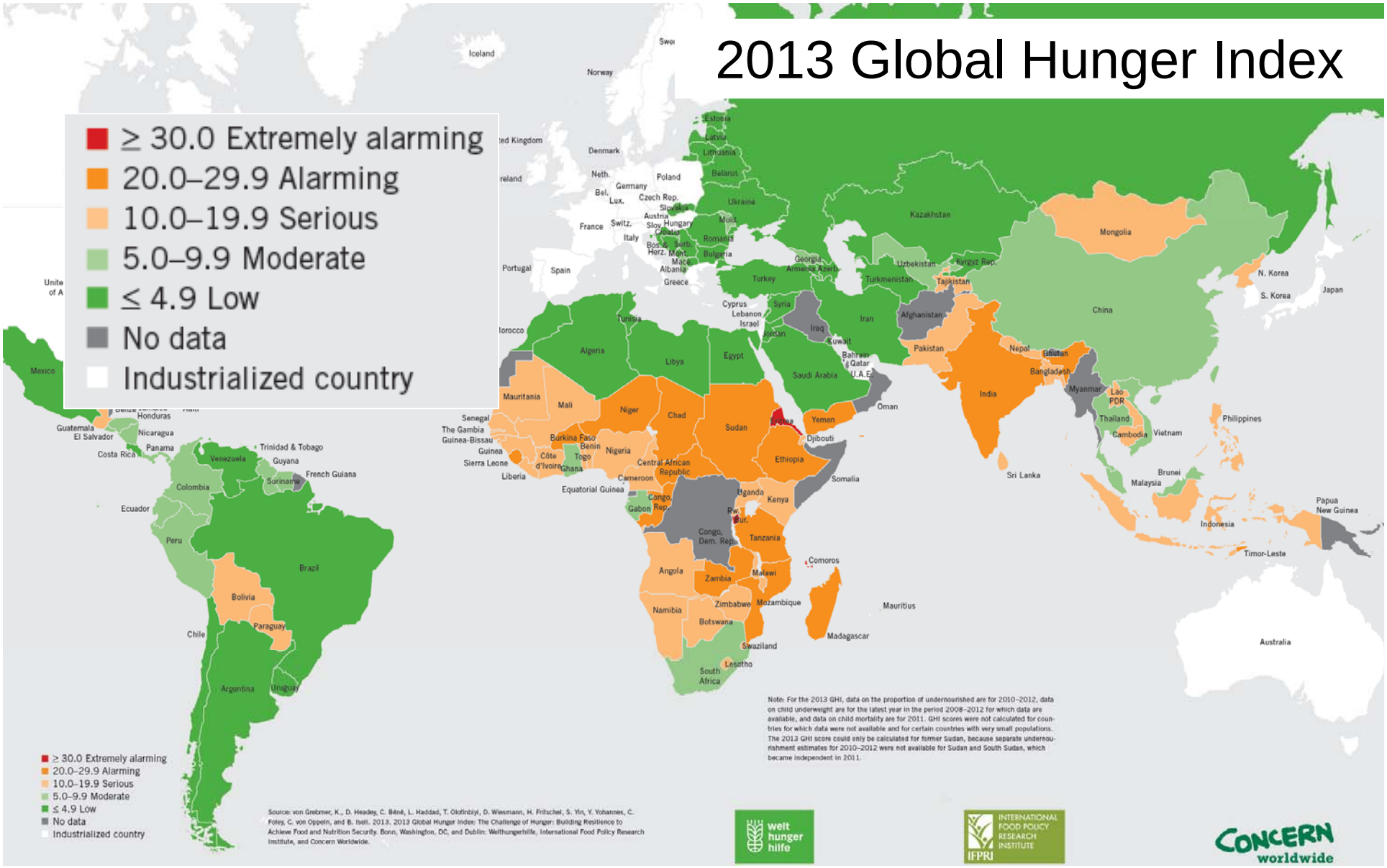
GEOGLAM Global Agricultural Monitoring

GEOGLAM Component #3
Countries at risk

Countries At Risk For Food Insecurity
Primary focus area for GEOGLAM



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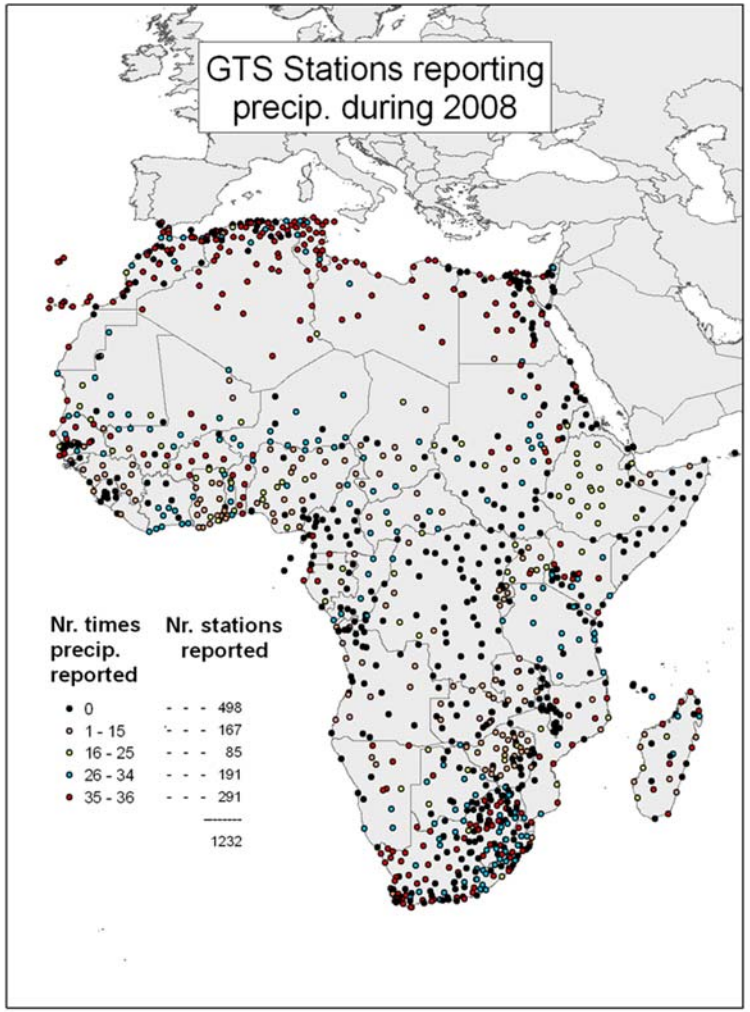
Countries at risk

- Subsistence Agriculture & Pastoralism
  - basis of livelihood systems in many countries
  - highly climate-sensitive
- Climate station networks not well working (sparse, bad or late reporting)
- Satellite remote sensing & models can fill the gap
  - and provide the basis for early detection of agricultural droughts
- *On all continents:*
  - *Africa* : Senegal, Mauritania, Mali, Burkina, Niger, Chad, Somalia, Sudan, Eritrea, Ethiopia, Djibouti, Somalia, Kenya, Uganda, Rwanda, Tanzania, Zambia, Mozambique, Zimbabwe, Botswana, South Africa, Lesotho, Swaziland…
  - *Central America:* Guatemala, Honduras, El Salvador, Nicaragua
  - *Caribbean:* Haiti
  - *Central Asia:* Afghanistan

J. Verdin

Gaps in Rainfall Station Reporting

- For one year, systematic sample on the 1st, 11th & 21st of month (3x12=36 samples)
- 1232 African GTS stations:
  - 40% did not report on any of the 36 days of the sample
  - only 25% sent all reports or missed only one



GTS = Global Telecommunication System

Verdin et al .

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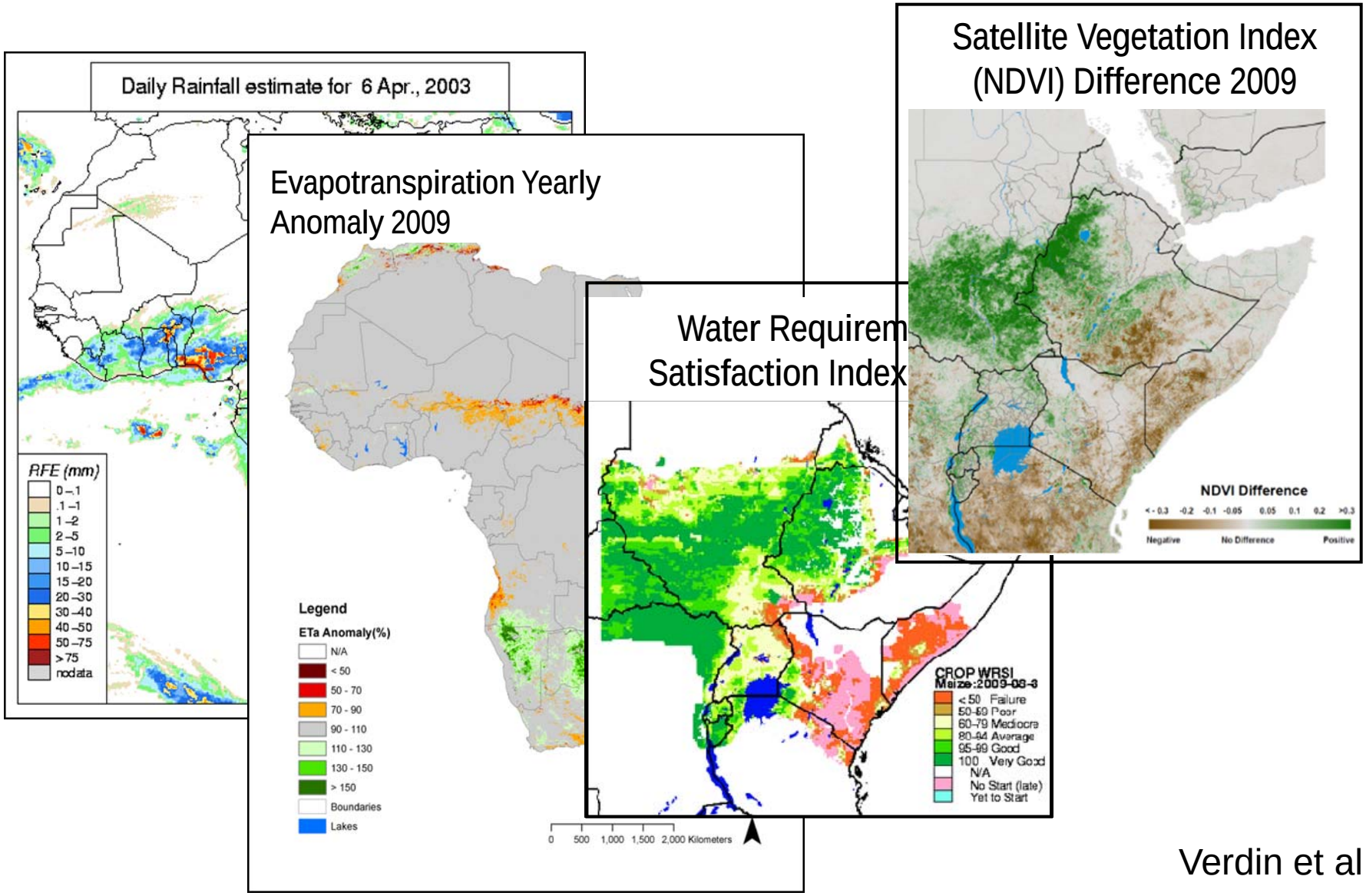
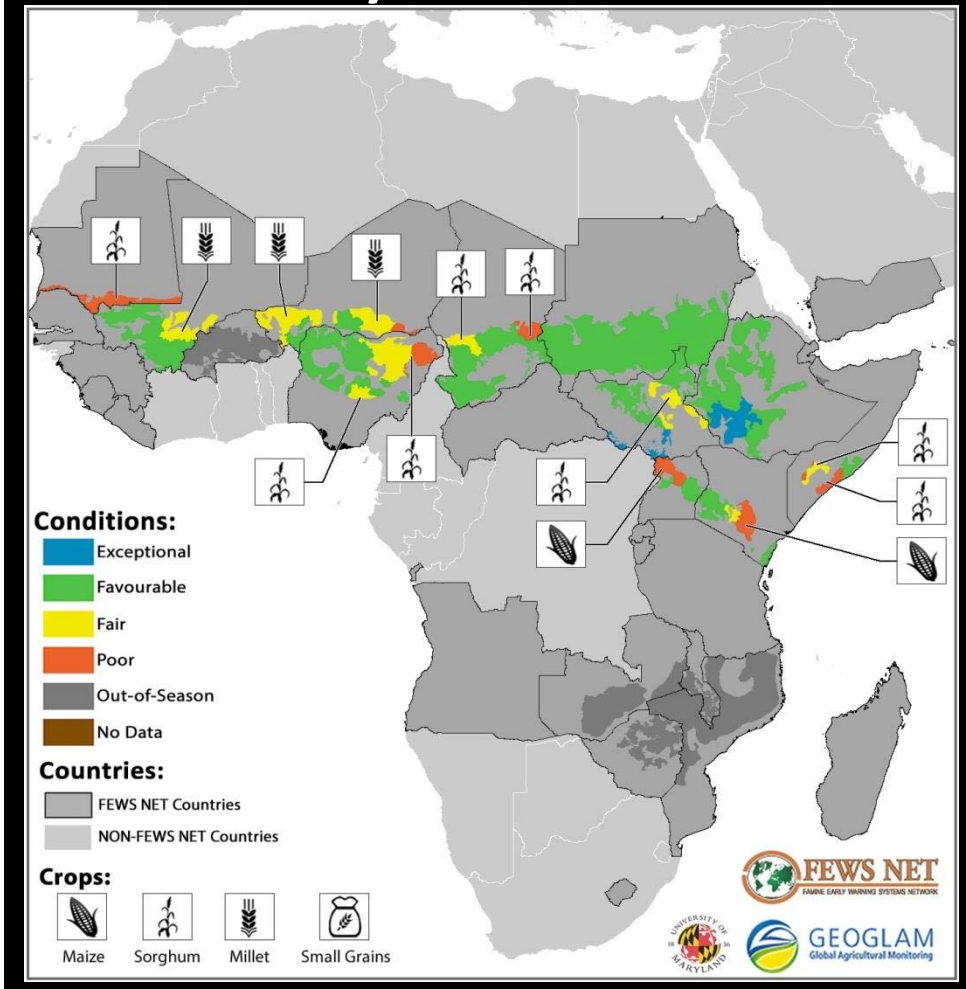
Satellite Information for Crop Monitoring



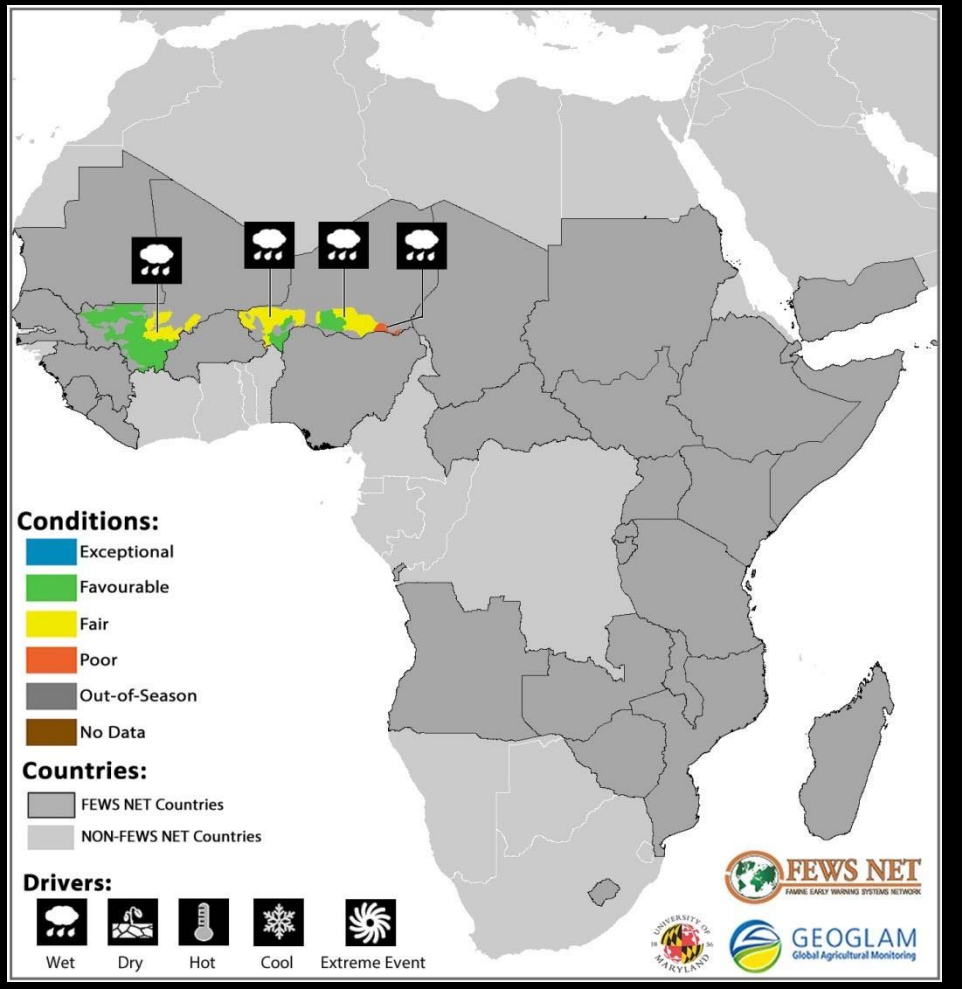
Verdin et al .

First Prototype FEWS NET Crop Condition Maps as of 30 September 2014

Synthesis:



Millet:



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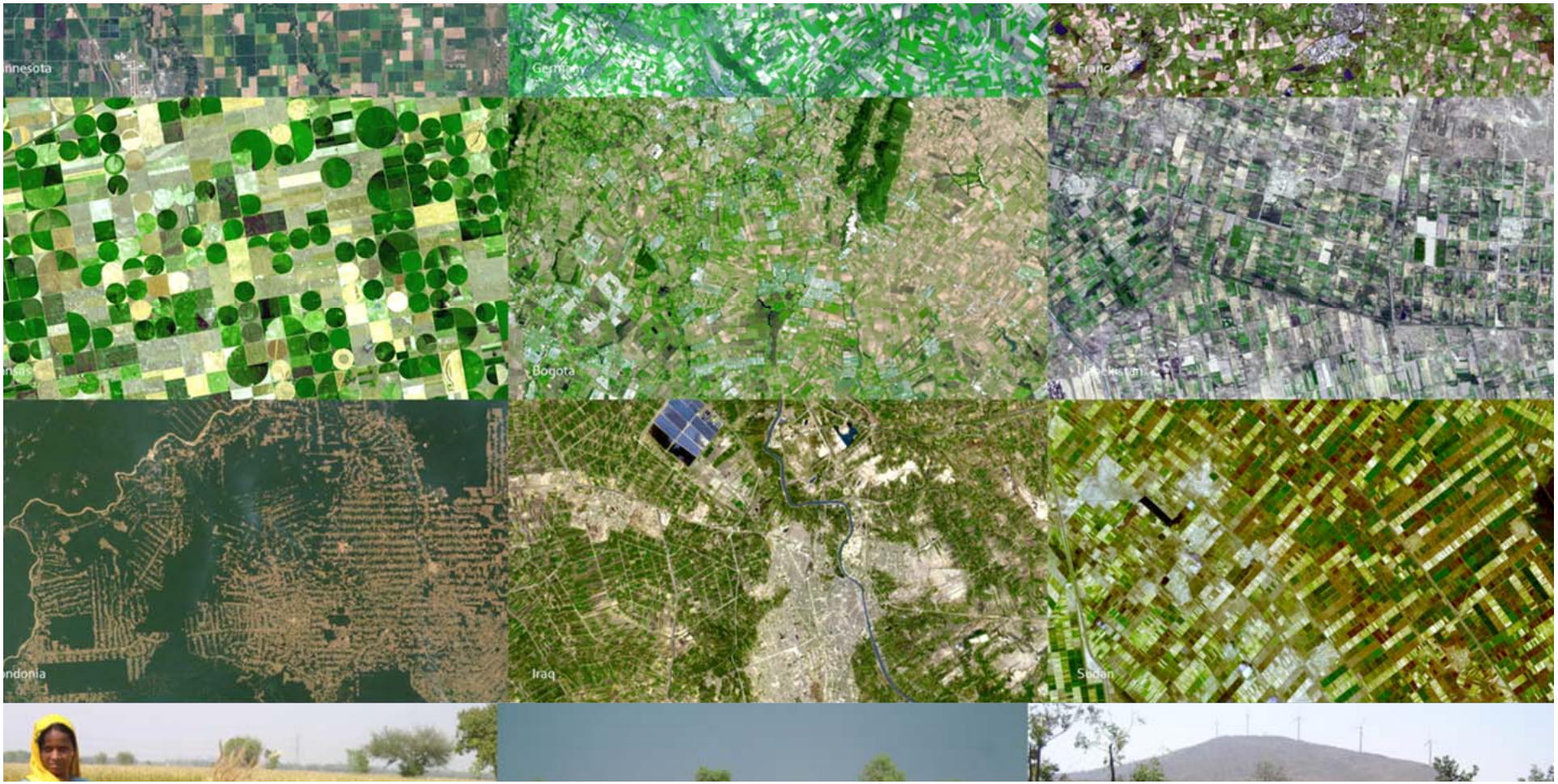
GEOGLAM Component #4
Cooperation with Space Agencies

CEOS – Committee on Earth Observation Satellites

Developing the EO Data Requirements for GEOGLAM: Through a CEOS GEOGLAM Technical Team



Recognition that cropping systems are inherently diverse which dictates the monitoring observations and methods

No one system can meet ag monitoring needs

Identifying Information and Product Types

Information Products

- Crop outlook / Early warning
- Area estimate
- Yield forecast
- Production estimate
- Food Sec/vulnerability report
- Statistics reports

EO Data Products

- Cropland mask /Pasturelands
- Ag practices
- Crop condition indicators
- Crop type
- Biophysical variables
- Environmental variables (soil moisture)
- In-situ Weather

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GEOGLAM Global Agricultural Monitoring

GEOGLAM CEOS: EO Data Requirements Table

developed taking into consideration the observation needs, the derived products they will serve, and regional specificities; CEOS-GEOGLAM

	OBSERVATION & SENSOR TYPE			REGIONAL CHARACTERISTICS & GEOGRAPHICAL EXTENT						DERIVED PRODUCTS & MONITORING APPLICATONS							
	SPATIAL RES.	SPECTRAL RES.	TEMPORAL RES.	WHERE? (+ cropland mask & sampling scheme)				WHEN?									
Sensor Mission	Spatial resolution	Spectral range	Effective observ. frequency (cloud free)*	Swath / Extent	Sample (s), Refined (rs) or Wall -to-Wall (w2w)	Large, Medium, Small fields	Crop types diversity	Calendar/ Multiple cropping	Cloud coverage	Use (Primary or Secondary Source)	Cropland s mask	Crop type area	Crop cond. indicators	Crop bioph. var.	Env. variables (reservoir, water, soil moisture)	Ag. Practices / Cropping systems	Crop yield
MODIS (aqua/Terra), VIIRS(NPP), Vegetation (SPOT-5)	2000 - 500 m	thermal IR + optical	few per day	global	w2w					NRT products (PS)			x	x (L)			
MODIS (optical not SWIR), Sentinel 3? (future), CMA FY series?, Proba-V (future)	100-300m	optical + SWIR	2 to 5 per week	global	w2w	L/M/S		*		NRT products (PS)	x	x	x	x (L)		x (L)	x (L)
FUTURE	1-15km	passive microwave	daily	global	w2w					NRT products (PS)					x		
FUTURE	50-150 m	SAR dual pol. (X,C,L) ****	5 per season	main crops	s	L/M/S	rice area	entire growing season	high cloud cov.	NRT products (SS/PS)*	x	x	x	x (L)	x	x (L)	
FUTURE	5-20m	SAR dual pol. (X,C,L) ****	5 per season	main crops	s	L/M/S	rice area		high cloud cov.	NRT products (SS/PS)*		x	x	x	x	x	
FUTURE	Footprint	RADAR Altimetry	weekly		s					NRT products (PS)					x		
ETM+ (Landsat-7), ASTER (Terra), TIRS(LDCM), IRMSS (CBERS-3)	50-100m	thermal	daily ?	main crops	s	L/M/S		entire growing season		NRT products (PS)			x				
All Optical Mid-Resoltuion (Landsat, Terra, EO-1, ResourceSat-2, CBERS-3, Sentinel-2)	20-70m	optical + SWIR	1 per month (if possible same sensor) (min 2 out of season + 3 in season)	croplands	w2w	all M/S		year-round, focus on growing season		annual products (PS)	M/S	M					
All Optical Mid-Resoltuion (Landsat, Terra, EO-1, ResourceSat-2, CBERS-3, Sentinel-2)	20-70m	optical+SWIR	1 per week (min. 1 per 2 weeks)	main crops	s	country specific (see phasing) L/M/S		entire growing season		NRT products (PS)	L/M/S	M/S	x	x	x	x	
HGR (SPOT-5), Rapid Eye (optical)	5-10 m	optical (+SWIR)***	1 per month (if possible same sensor) (min 2 out of season + 3 in season)	croplands	rs	L/M/S (focus on S)		year-round, focus on growing season		annual products (PS)	L/M/S	L/M/S					
HGR (SPOT-5), Rapid Eye (optical)	5-10 m	optical (+SWIR)***	1 per week (min. 1 per 2 weeks)	main crops	rs2	country specific (see phasing) S		entire growing season		NRT products (PS)			x	x	x	x	
HIRI (Pleiades), IKONOS, GeoEye, WorldView2 (optical)	< 5 m	optical	1 to 2 per month	croplands	rs3	demo. case (2 - 5% of croplands L/M/S)		2 - 4 coverages per year		annual products (PS)		x				x	x

spatial & spectral

How often ?

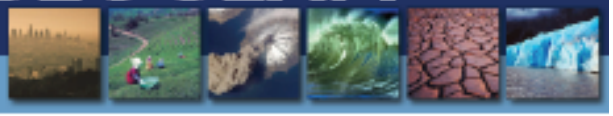
Where?

When?

For What?

SDCG-3 Meeting
Sydney, Australia
7-9 February 2013

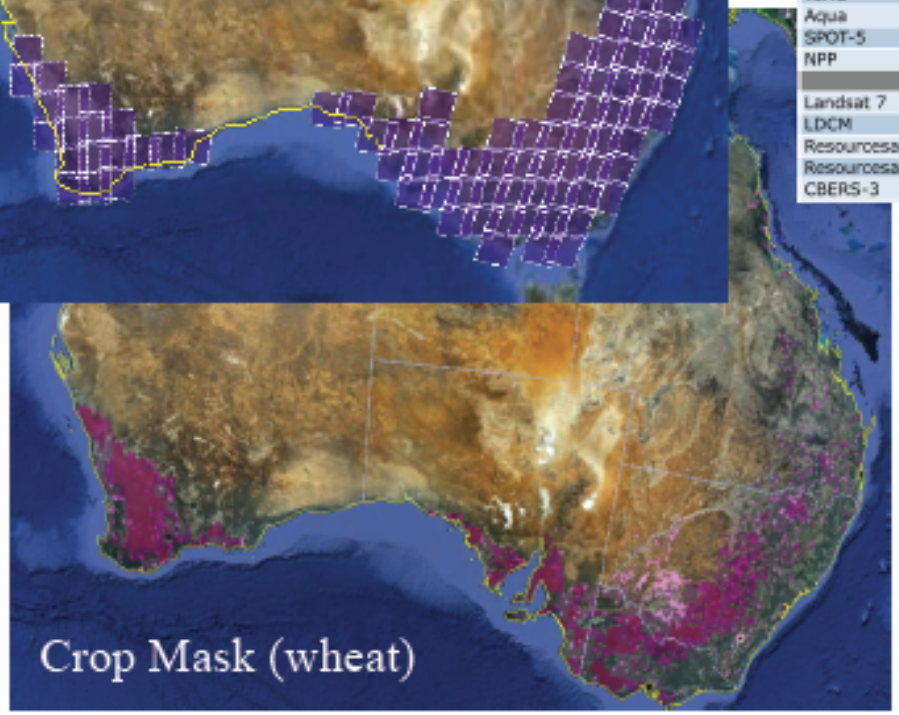
CEOS SEO Support to GEOGLAM

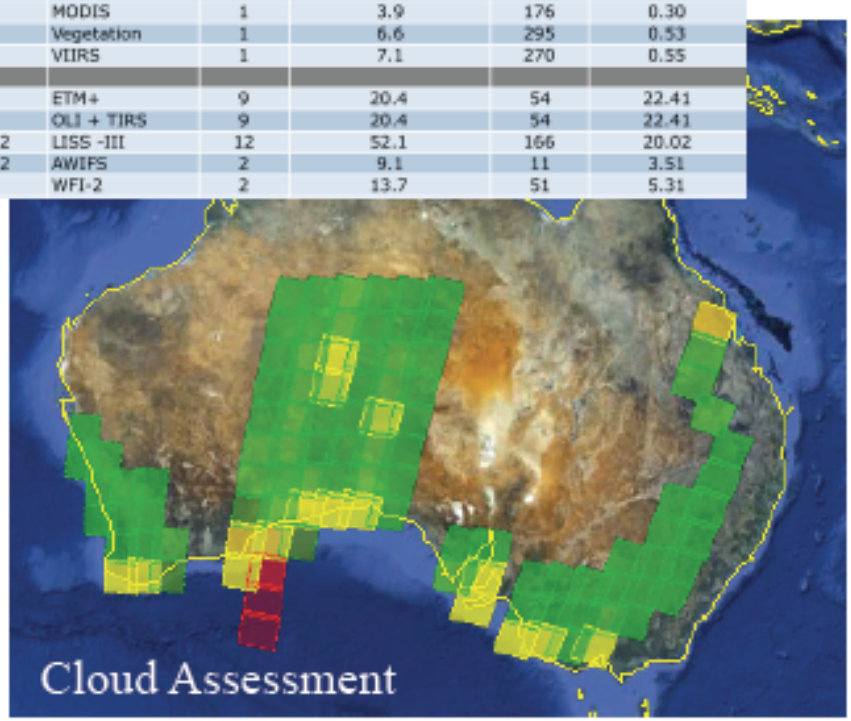


Data Acquisition Planning and Analysis

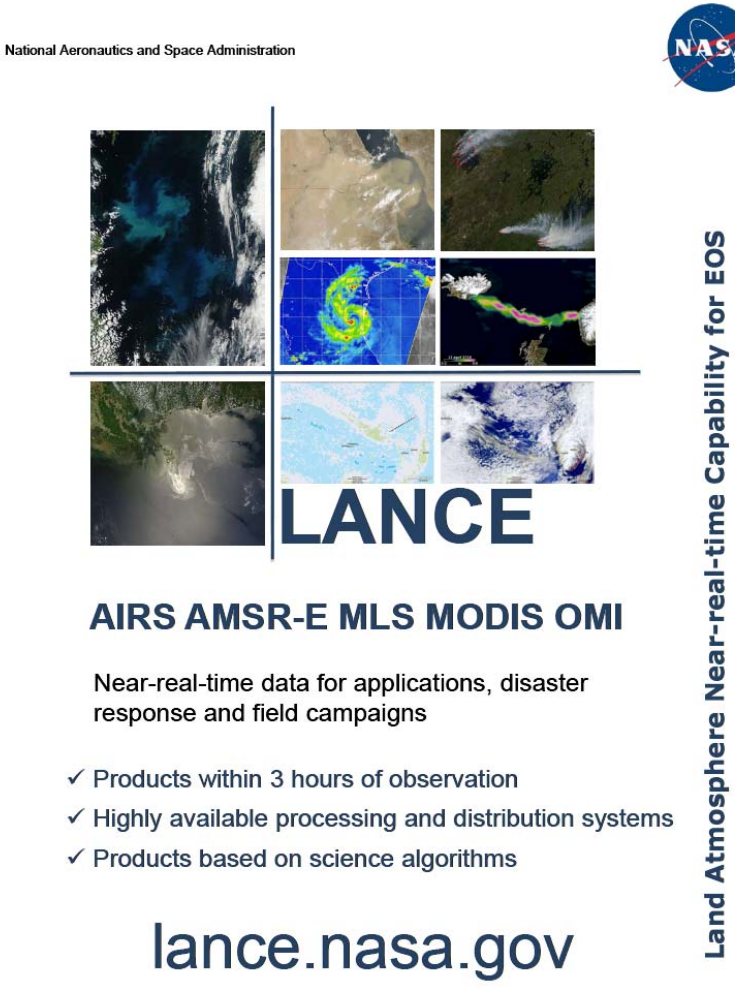
- Crop Masks, Crop Calendars
- Cloud Statistics (MODIS and ISCCP)
- Data Volume (# paths, duration, # scenes)

Mission	Instrument	Total Paths	Total Duration of Acquisitions (min)	Total Scenes	Total Data Volume (GB)
Terra	MODIS	1	3.9	176	0.30
Aqua	MODIS	1	3.9	176	0.30
SPOT-5	Vegetation	1	6.6	295	0.53
NPP	VIIRS	1	7.1	270	0.55
Landsat 7	ETM+	9	20.4	54	22.41
LDCM	OLI + TIRS	9	20.4	54	22.41
Resourcesat-2	LISS -III	12	52.1	166	20.02
Resourcesat-2	AWIFS	2	9.1	11	3.51
CBERS-3	WFI-2	2	13.7	51	5.31





Requirement for Near Real Time Data for Agricultural Monitoring



Timely data is critical for crop monitoring!!

NASA EOS near-real-time daily observations are processed and integrated into USDA FAS system
(< 3 hours from observation)

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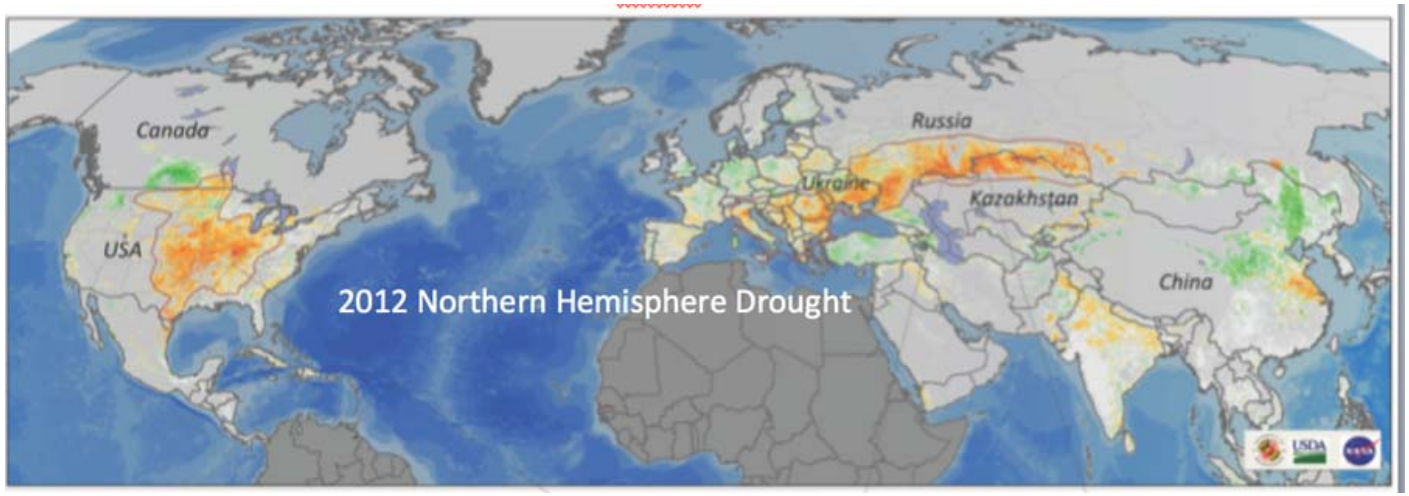
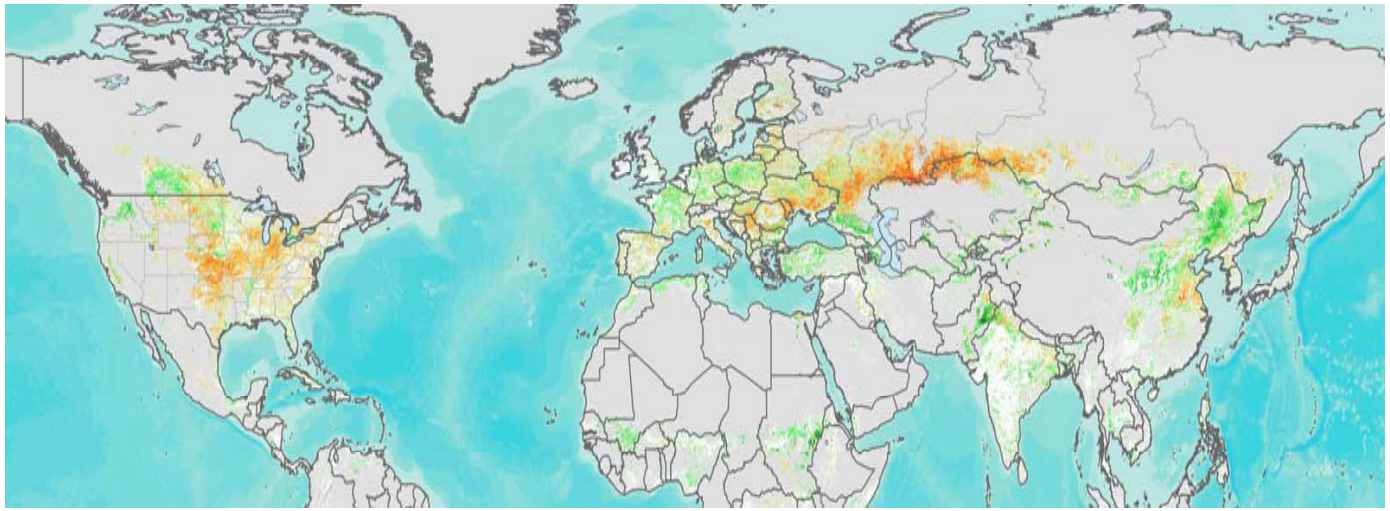
Anomaly Product Continuity/Consistency



July 30 2012

EOS MODIS



JPSS VIIRS

Vermote (GSFC)

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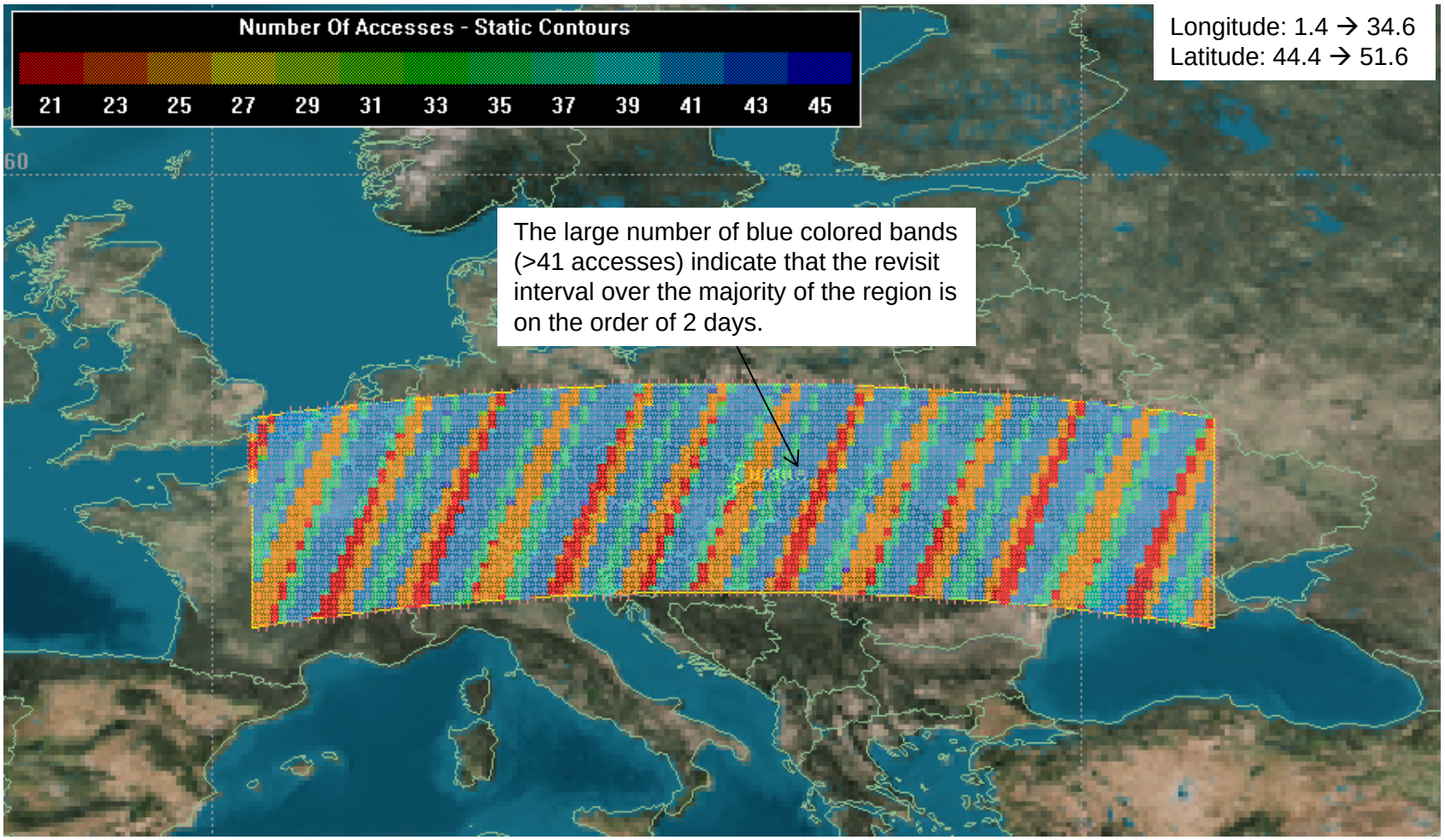
Pilot Study on Data Interoperability

NASA, CESBIO, ESA

GEOGLAM Global Agricultural Monitoring

Sentinel-2A and 2B - LDCM Europe



The picture shows the number of times LDCM and the Sentinel 2 satellites accessed areas on the ground over an 80 day period of time.

- 21 accesses indicates a maximum revisit interval of ~3 days 19 hours
- 46 accesses indicates a minimum revisit interval of ~1 day 18 hours

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GEOGLAM Component #5
Research & Development

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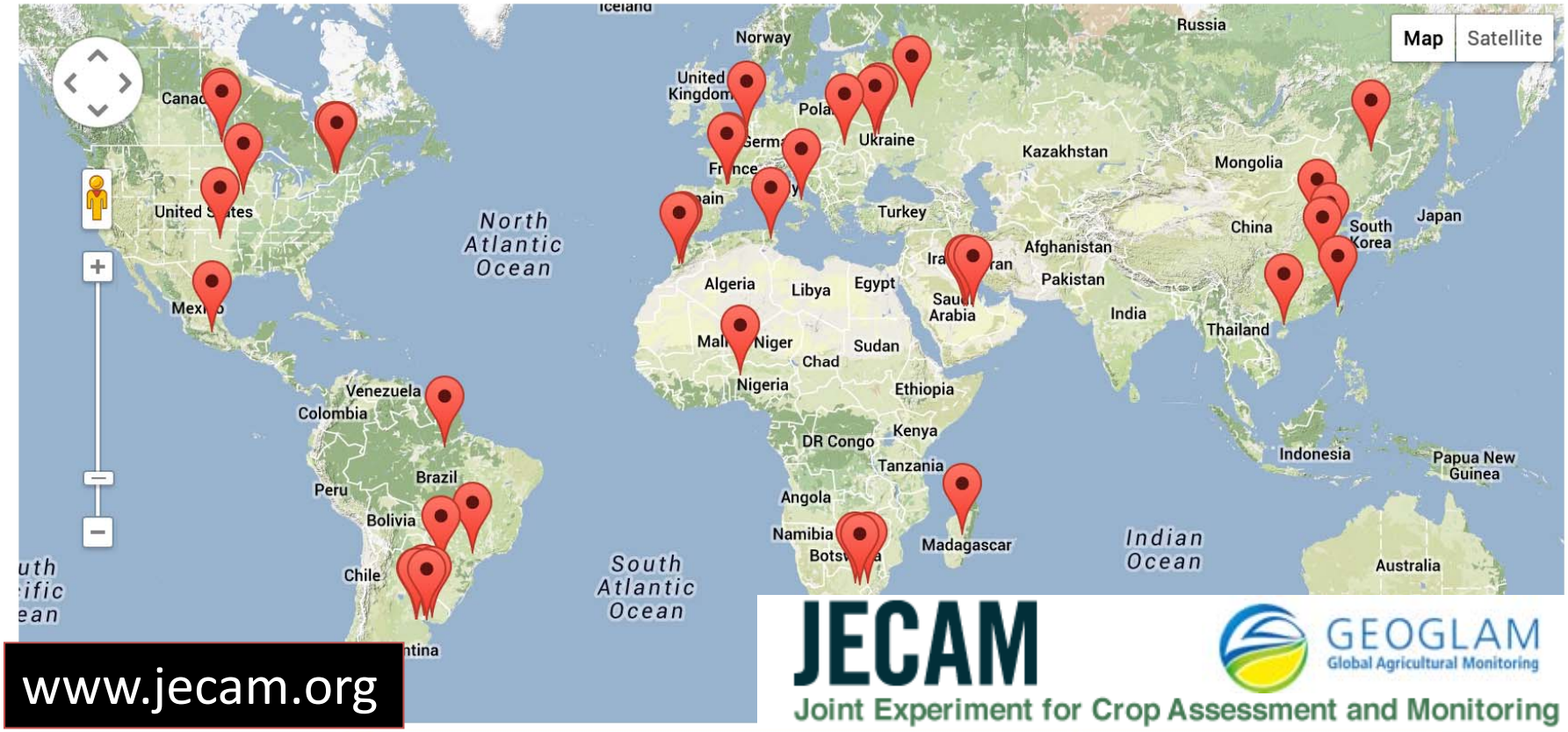
JECAM: Joint Experiment for Crop Assessment and Monitoring

- A network of sites representative of the world's cropping systems
- A focus for international satellite data acquisition by CEOS
- R&D to support enhancements for operational agricultural monitoring systems
- JECAM Program Office coordinated by AAFC-Canada and UCL-Belgium
- Developing linkages with AgMIP sites and modeling community



www.jecam.org

JECAM
Joint Experiment for Crop Assessment and Monitoring

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JECAM.ORG

JECAM
Joint Experiment for Crop Assessment and Monitoring

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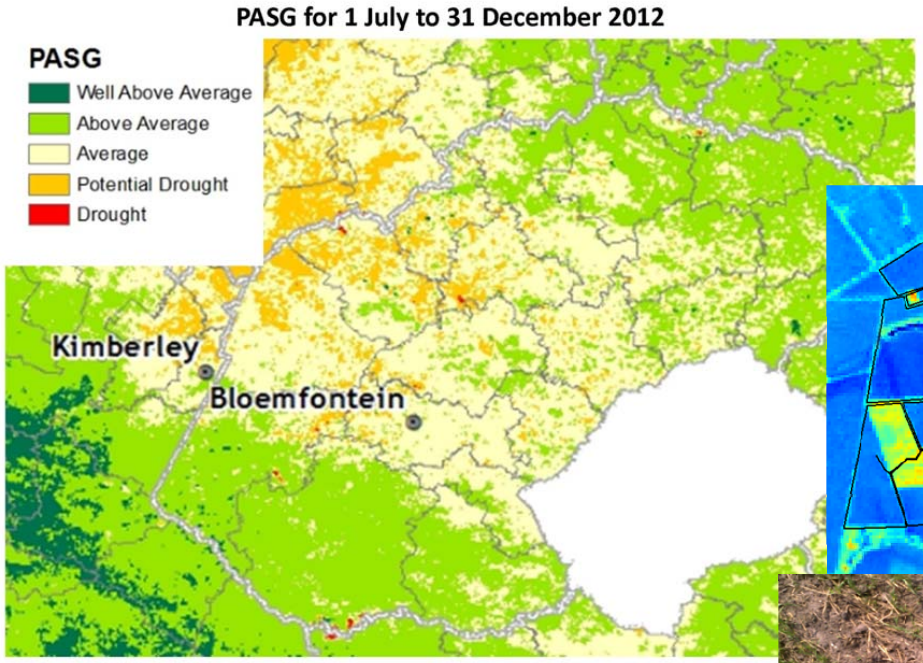
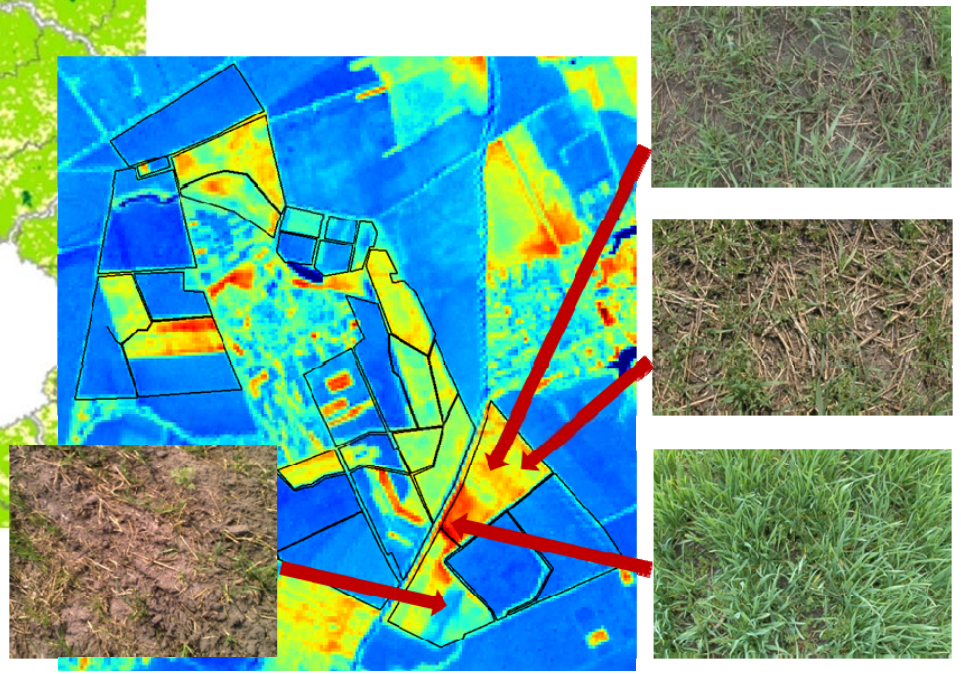
GEOGLAM
Global Agricultural Monitoring

Current Status – Research Activities
Crop Condition – Crop Growth Parameters

2012 PASG Map, South Africa Site



2012 Ukraine Site



Conclusion

- Interested in expanding GEOGLAM participation in Central and Eastern Europe e.g.
  - Routine involvement in Crop Monitor
  - Participation in JECAM – Field Site for method development and testing
  - Identifying priorities for National Capacity Building in the use of EO for Agriculture
  - Agricultural Land Use Change