GEOGLAM international cooperation activities

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GEO: an International Coordinating Framework using Earth Observations for societal benefit
GEOGLAM: A GEO Agriculture Initiative

• **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

• **Approach:** Building on existing monitoring systems – strengthening international and national capacity

• **Emphasis on:** Producer countries (G20+), Countries-at-Risk & National Capacity Building (demand driven)

• **Vision:** ...the use of coordinated and sustained EO to inform decisions and actions in agriculture

http://www.earthobservations.org/geoglam.php
**GEOGLAM is implemented through 6 Components**

1. **Global / Regional Monitoring Systems**
   - International/Global

2. **National Monitoring Systems**
   - National / Subnational

3. **Monitoring Countries at Risk**
   - Food Insecure and Most Vulnerable

4. **EO Data Acquisition & Dissemination Coordination**

5. **Research & Development toward Operations**

6. **Capacity Development for EO**
Context For GEOGLAM
Monthly Wheat Prices 1960-2011($/Metric Ton)
Source: World Bank

1971/2’s price hike
Landsat 1 Launched (1972)
1996 price hike
2008 Price hikes
Droughts: Australia & Ukraine
2010/11 Price hikes
Drought: Russia USA
GEO Ag Task
International recognition of critical need for improved real time, reliable, open information on global agricultural production prospects

Critical for agricultural policies, stabilizing markets, averting food crises

Need to increase food production by 50%-70% by 2050 to meet demands
Policy Framework for GEOGLAM

G20 Final Declaration

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" (GEO-GLAM) 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 and weather forecasting data.
GEOGLAM Crop Monitor for AMIS

- **Objective**: transparent, timely, crop condition assessments in primary agricultural production areas
  - highlighting potential hotspots of stress or bumper crop
- **Focus**: stabilizing/calming markets - context of price volatility
- Response to G-20 AMIS request for an international consensus on crop conditions, building on existing systems
- **4 crops**: Wheat, maize, soybean, rice
- **AMIS Countries** account for 90% of global production of the 4 crops
- **End Users**: AMIS Community

[http://www.geoglam-crop-monitor.org](http://www.geoglam-crop-monitor.org)

Coordination by the University of Maryland on behalf of the GEO Secretariat – with NASA Applied Sciences support
GEOGLAM Crop Monitor Partners

> 35 Partners and Growing
Condition Synthesis Maps Covering All AMIS Crops

Crop Conditions & Drivers as of October 28, 2015

Quick and easy to interpret crop conditions oriented for non RS community

Crops that are in other than favorable conditions are displayed with their crop symbol & driver. Separate maps are also provided for each crop.
Asia Rice Crop Conditions as of October 28th
Operational Monthly Bulletin since 2013
Published in the AMIS Market Monitor

The Market Monitor is a product of the Agricultural Market Information System (AMIS). It covers the international markets for wheat, maize, rice and soybeans, giving a synopsis of major market developments and the policy and market trends behind them. The analysis is a collective assessment of the market situation and outlook by the ten international organizations that form the AMIS Secretariat. Ultimately, the report aims at improving market transparency and detecting emerging problems that might warrant the attention of policy makers.

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No. 27 – April 2015
www.amic-outlook.org

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

Highlights
Wheat: In the northern hemisphere winter wheat has mostly resumed vegetative growth and conditions are generally favorable. In the US conditions are generally good. In the US North it is still sunny due to dry conditions in the Southern Plains. In China, conditions are favorable and in the Russian Federation and Ukraine, conditions remain mostly favorable through some concerns remain over dry establishment conditions in the autumn. In Canada and India, conditions are mostly favorable.

Maize: In the southern hemisphere, conditions are generally favorable. In Brazil, despite earlier concerns over dryness, conditions are favorable and harvested is in progress. Conditions in Argentina, conditions remain mostly favorable except for a few areas in the south that suffered water stresses.

Maize: In the southern hemisphere conditions are favorable in Brazil, conditions are generally favorable. In Brazil, harvested conditions have improved and are favorable, harvested is complete for the main crop and good to very good for the second crop. Conditions in Argentina are favorable with recent rains supporting development. Improvements occurred on planted areas and conditions have moved to the upper range of favorable to good. Argentina is moving to anticipated increased yields. In Argentina, conditions are favorable for most regions. There is some concern over lack of moisture in the central region and over winter season in northern regions. Nevertheless, conditions are generally favorable for most regions. In Argentina, conditions are generally favorable. In Brazil, conditions are favorable and harvested is in progress. Despite earlier concerns over dryness, conditions are favorable and harvested is in progress. Conditions in Argentina, conditions remain mostly favorable except for a few areas in the south that suffered water stresses.

Soybeans: In the southern hemisphere, conditions are favorable in Argentina, conditions are generally favorable. In Brazil, conditions are favorable and harvested is in progress. Despite earlier concerns over lack of rain in part of the southern, harvested and harvested in progress. Conditions in Argentina are favorable with recent rains supporting development. Improvements occurred on planted areas and conditions have moved to the upper range of favorable to good. Argentina is moving to anticipated increased yields. In Argentina, conditions are favorable for most regions. There is some concern over lack of moisture in the central region and over winter season in northern regions. Nevertheless, conditions are generally favorable for most regions. In Argentina, conditions are generally favorable.
Asia Rice Crop Mask: a work in progress
Crop Mask Viewer

Crop Calendar Viewer

Also, currently available at:
GEOGLAM is seeking greater involvement of countries from S and SE Asia in the Crop Monitor - providing up to date information on rice-crop distribution, crop calendars and monthly crop condition
GEOGLAM Asia-RiCE
- Regional Coordination Example -

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Scope of Asia-RiCE

• Agencies in Asia launched Asia-RiCE (Asia Rice Crop Estimation & Monitoring) program as support to GEOGLAM component 1.

• Asian countries = approx. 90% of world rice production & consumption.
  – Rice is not just a food, but closely related to culture.

<table>
<thead>
<tr>
<th>ID</th>
<th>Target Agricultural Products</th>
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<tbody>
<tr>
<td>P1</td>
<td>Rice Crop Area Estimates/Maps</td>
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<td>P2</td>
<td>Crop Calendars/Crop Growth Status</td>
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<td>P3</td>
<td>Crop Damage Assessment</td>
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<td>P4</td>
<td>Agro-meteorological Information Products</td>
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<td>P5</td>
<td>Production Estimation and Forecasting</td>
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http://www.asia-rice.org
Research and Development
towards Operational use

1. Global / Regional Monitoring Systems
   International/Global

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6. Capacity Development for EO
**Agricultural Monitoring: EO data and Final products**

**Spatial resolution / Revisiting capacities**
- 5km - 1km: hourly images
- 1km - 250m: daily images
- 250m - 60m: 1-3 images / 15 days
- 60m - 10m: 1-2 images / month
- 10m - 1m: 1-2 images / season

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**Crop Growth**
- Agriculture / veg. conditions
- Anomalies detection

**Crop type at parcel level**
- Crop stages
- Crop variables

**Crop growth model**
- Sample point interpretation
- Regression estimate

**Area**
- Area outlook
- Area estimate
- Monthly bulletin
- Early warning
- Precision farming

**Yield**
- Yield estimates
- + field report & socio-economic context by analyst

**Food Security**

**Ag Prod Trade**
- + prod. quality, stocks & demand by info brokers
Requirement for Near Real Time Data for Agricultural Monitoring

Timely data are critical for crop monitoring!

NASA EOS near-real-time daily observations are processed and provided < 3 hours from observation

Steps underway for S-NPP VIIRS LANCE in early 2106
### Sentinel contribution to JECAM & GEOGLAM

**Primary missions for all targets**

<table>
<thead>
<tr>
<th>Req#</th>
<th>Spatial Resolution</th>
<th>Spectral Range</th>
<th>Effective observ. frequency (cloud free)*</th>
<th>Sample Type</th>
<th>Field Size</th>
<th>Target Products</th>
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<tbody>
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**Coarse Resolution Sampling (>100m)**

1. 500 - 2000 m thermal IR + optical
   - Daily
   - Wall-to-Wall
   - All
   - **Sentinel-3**

2. 100-500 m optical + SWIR
   - 2 to 5 per week
   - Cropland Extent
   - All
   - **SMOS**

3. 5-50 km microwave
   - Daily
   - Cropland Extent
   - All
   - **Sentinel-1**

**Moderate Resolution Sampling (10 to 100m)**

4. 10-70m optical + SWIR + TIR
   - Monthly (min 2 out of season + 3 in season). Required every 1-3 years.
   - Cropland Extent
   - All
   - **Sentinel-2**

5. 10-70m optical + SWIR + TIR
   - Weekly (min. 1 per 16 days)
   - Sample
   - All
   - **Sentinel-2**

6. 10-100m SAR
   - Weekly (min. 1 per 2 weeks)
   - Cropland Extent of persistent cloudy areas/Rice
   - All
   - **Sentinel-1**

Source: CEOS ACQUISITION STRATEGY FOR GEOGLAM PHASE 1
Component 4 Phase 1: Pilot Study on Data Interoperability

**Sentinel-2A and 2B and LDCM**

The large number of blue colored bands (>41 accesses) indicate that the revisit interval over the majority of the region is on the order of 2 days.

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
Small Sat optical systems for studying land use
RADARSAT Constellation Mission


• Evolution of the RADARSAT Program → 3 satellites – 600 km orbit, 32 minutes separation
• 15 min/orbit imaging (avg) x 3 satellites
• Average daily global access; 4-day exact repeat
• Focus on Marine Surveillance, Disaster Management and Ecosystem Monitoring (including Agriculture)
Research and Development towards Operational use

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Global network of over 30 voluntary JECAM sites

A collaborative global network of sites, working on common research questions (crop type, area, condition, yield) and representing very diverse agro-ecosystems.
Areas of GEOGLAM R and D

- Improved global EO-based products – cropland, cropping systems, crop type, crop calendars
- New international Earth Observations for agriculture – soil moisture, ET, biomass
- Quantitative EO-based indices related to crop production
- Improved methods and tools for crop production assessment and forecasting (national / sub-national)
- Development of Standards & Best Practices
- Economic impact of improved forecasts
- Global monitoring of agricultural land use change
- Crop model and EO integration
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GEOGLAM CAPACITY DEVELOPMENT COMPONENT

Reinforce National/Regional/Global capacities to conduct agricultural monitoring

MAIN STEPS

➢ Assess national capacity in agriculture monitoring and EO data use;
➢ Define data coverage requirements;
➢ Define activities that can assist national implementation;
➢ Develop customised training at national level;
➢ Conduct a series of regional workshops;
➢ Regional training / information exchange and continued global/regional networking
Pakistan Agricultural Information System
(Collaboration between USDA, FAO, SUPARCO, CRS, & UMD)

Crop type classification

EO Estimated vs. Reported Wheat Production for Punjab
Districts: 2009-2011

$R^2 = 0.9191$
RMSE at district level = 72 [1000 MT] = 14%
RMSE at Punjab level = 48 [1000 MT] < 1%
1038 full-time crop reporters continuously inspect agricultural fields in 1240 villages in Punjab Province.
• Collect data digitally in 1240 villages of Punjab.
• Use GPS-enabled cell phones, location-aware software.
• Automatic upload data to central spatial database.
So in summary what is GEOGLAM doing?

- Increasing communication and sharing experience amongst the Ag Monitoring Community of Practice & with related programs
- Promoting EO-based approaches for operational agricultural monitoring
- Method testing & inter-comparison, developing best practices
- R and D to develop new monitoring capabilities & products
- Translating EO data into policy relevant information
- Articulating and advocating community requirements to EO data providers
- Helping improve national and international agricultural monitoring systems