An Agricultural Information System Based on Satellite Remote Sensing Data for Decision Making

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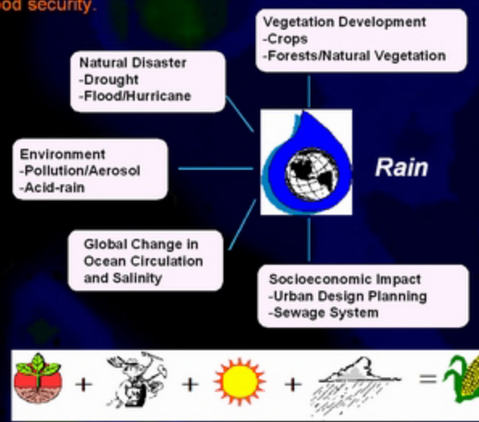
Project Description

- Develop agriculture-oriented land and hydrologic products based on MODIS, TRMM, and other satellite products
  - Assess product bias and error
  - Compare with current capability
- Evaluate products over two sites: Oklahoma and Argentina
- Develop Agricultural Information System
- Integrate products into USDA/FAS and UN/WFP Decision Support Systems

Rainfall influences our daily life and climate. Environmental conditions affect crop yields and thus world food supply. Accurate rainfall measurements are needed for crop yield monitoring and prediction. Global monitoring of crop conditions is critical for global food security.



AIS Partners

UN: World Food Program (WFP)

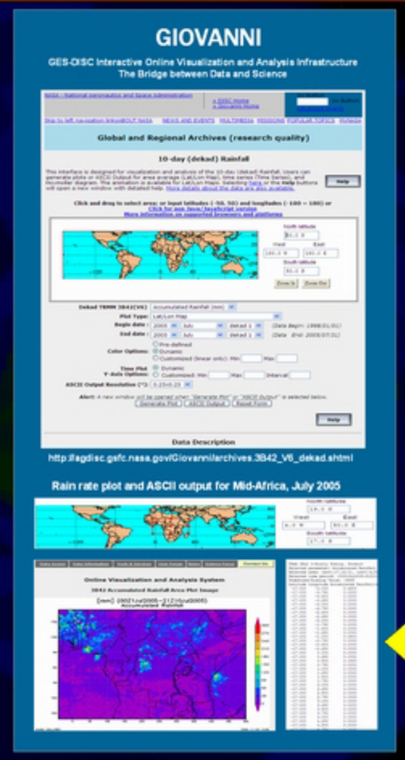
As the food aid arm of the United Nations, World Food Program uses its food to meet emergency needs and support economic and social development, and provides the logistics support necessary to get food aid to the right people at the right time and in the right place.

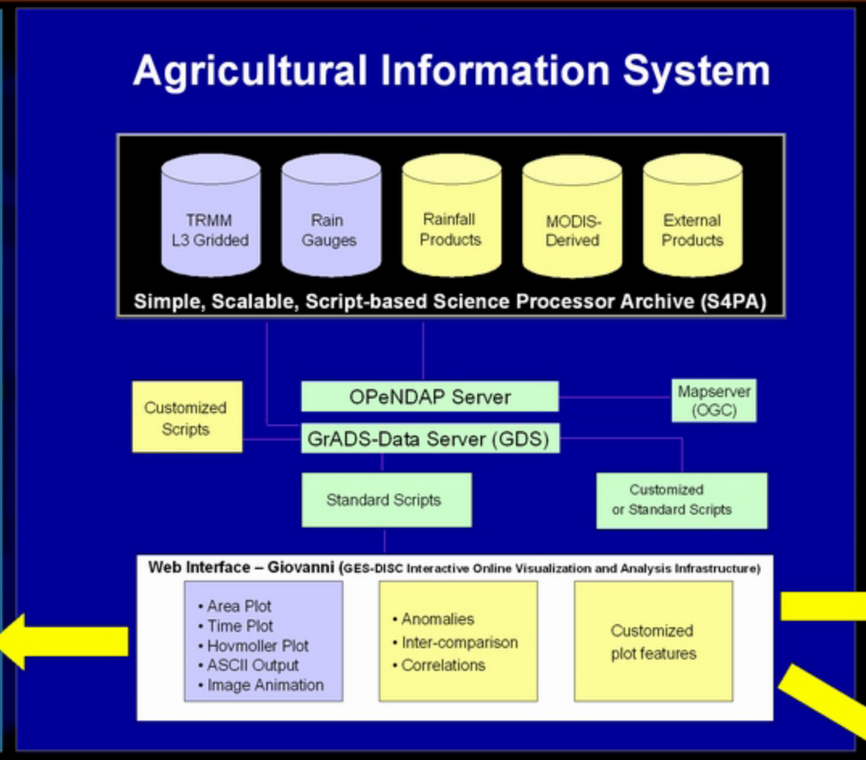
USDA: Foreign Agricultural Service (FAS)

The Foreign Agricultural Service of the U.S. Department of Agriculture works to improve foreign market access for U.S. products, build new markets, improve the competitive position of U.S. agriculture in the global marketplace, and provide food aid and technical assistance to foreign countries.

NASA/GSFC Earth Sciences Data and Information Services Center (GES DISC) provides system development and integration, product generation and evaluation, performance metrics, and inputs to crop model development in selected project areas. **USDA/Agricultural Research Service (ARS)** develops crop yield model using NASA MODIS and rainfall data.

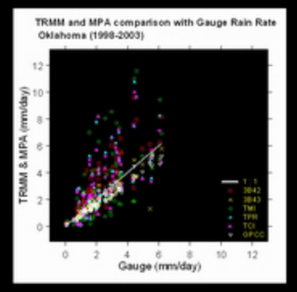
Global satellite and gauge rainfall information are merged to produce high spatial and temporal resolution rainfall product for crop growth/yield modeling by ARS in cooperation with USDA/FAS and UN/WFP. Project aims to effect the sustained operational integration of NASA satellite measurements into the Decision Support Systems of FAS and WFP.



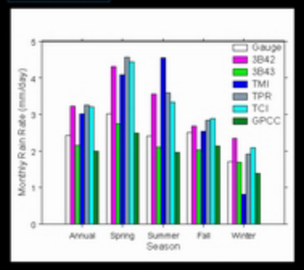


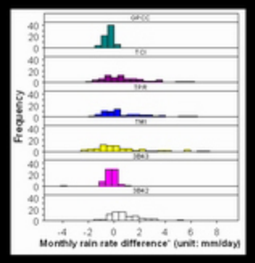
Bias Study: Comparison of 0.25 degree 3-hourly TRMM products with gauge analysis – the key to integration of project results into existing operational Decision Support Systems.

Study Site 1: Oklahoma



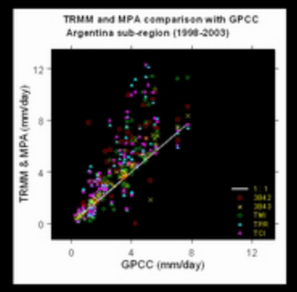
Oklahoma



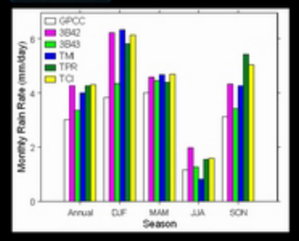


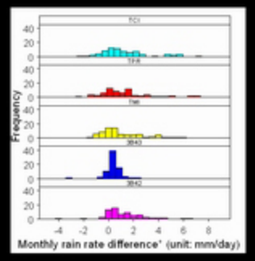
Seasonal precipitation variations and monthly rain rate histograms.

Study Site 2: Argentina



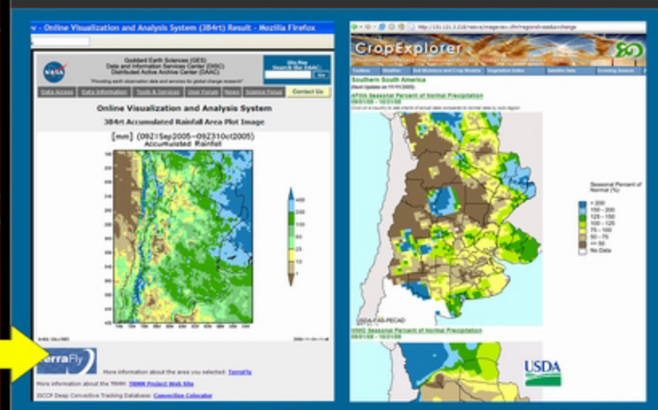
Argentina





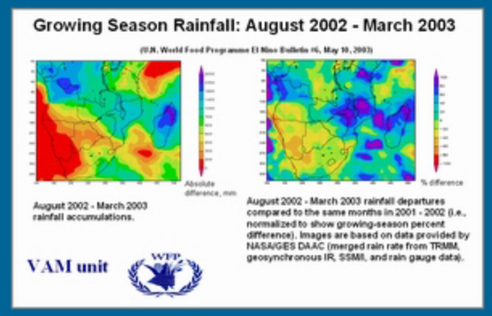
Data Products

Product Name	Temporal Resolution	Temporal Coverage	Spatial Resolution	Spatial Coverage
Global Precipitation Climatology Center (GPCC)	Monthly	1951 to Present	0.5, 1.0, 2.5 deg	Global
Air Force Agricultural Meteorology Modeling System (AGRMET)	3-hourly	Oct 2001 to Present	0.5 deg	Global
Tropical Rainfall Measuring Mission (TRMM) Multi-Satellite Precipitation Analysis (MPA or 3B42)	3-hourly, Daily, Ten-day average, Monthly User-defined-period-accumulation	Jan 1998 to Present	0.25 deg	50N to 50S
Mesonet Climate Division Gauge Analysis	Monthly	<1950 to Present	Climate Division	Oklahoma



TRMM precipitation (NASA/Giovanni) maps can be seamlessly accessed for comparison with AGRMET and other precipitation data used by USDA/FAS analysts.

Giovanni can be customized to support new parameters, such as available soil water, growing season water surplus or deficit, seasonal anomalies, and percent departure.



Summary

Rainfall products generated

Comparison results:

- TRMM MPA incorporates satellite rain estimates and introduces higher spatial structure at 0.25 degree resolution compared with GPCC gauge analysis at 1 degree.
- Daily MPA shows high correlation with AGRMET rain rates (R=0.63) and slightly better correlation with Mesonet (R=0.35) than resampled AGRMET with Mesonet (R=0.31) at 0.25 degree grid.
- TRMM MPA may provide additional rainfall information compared with AGRMET, the latter currently used by USDA/FAS for crop yield forecasting, especially in sparsely gauged regions.

Future work planned:

- Complete evaluation of biases and errors.
- Conduct workshop/demonstration with operational users.
- Provide products via internet from distributed providers.
- Evaluate and benchmark improvements to existing Decision Support Systems.