3.6

INTEGRATING REMOTE SENSING AND OTHER PRODUCTS INTO THE DECISION SUPPORT SYSTEMS OF THE UNITED NATIONS WORLD FOOD PROGRAMME

Zhong Liu*[*1], L. Milich[2], W. Teng[3], S. Kempler, and H. Rui[3]
GSFC Earth Sciences Data and Information Services Center
Distributed Active Archive Center (DAAC)
NASA/Goddard Space Flight Center, Greenbelt Maryland, USA 20771
[1] CEOSR, George Mason University, Fairfax, VA
[2]United Nations World Food Programme
[3] SSAI, Lanham, MD

1. INTRODUCTION

Set-up in 1963, the World Food Programme (WFP) is the United Nations frontline agency in the fight against global hunger. WFP depends on donors worldwide. The United States of America has been the largest donor. Natural disasters, such as, floods and droughts, occur every year in third world countries and emergency food aids are often required. Moving large quantities of foods over a long distance is not an easy task. Time and planning are required. Accurate and timely environmental information will facilitate decision-making, food distribution and maximize the use of contributions.

This presentation will describe our collaborative work with the World Food Programme of the United Nations, including web-based information services and tools to address global and regional water related issues, such as, floods and droughts.

2. PRODUCTS, TOOLS AND SERVICES

Few observational data are available for disaster monitoring in remote and poor third world countries. Satellite remote sensing observations provide a unique way in providing such data from space.

The NASA Goddard Earth Sciences Data and Information Services Center (GES DISC) and Dr. Lenard Milich of WFP have been collaborating for the past three years on ways to integrate Tropical Rainfall Measuring Mission (TRMM) data into forward planning exercises for establishing geographic areas (e.g., sub-equatorial Africa, Indonesia, and North Korea) in need of food assistance. To monitor and assess current conditions, the GES DISC has developed a number of rainfall products derived from TRMM and online based tools to facilitate data and information access. These tools will not only benefit the WFP decision-making activities, but also other local agencies and the general public. All data and services are web-based to minimize the cost for data accessing and maximize the use of global rainfall data products.

Table 1 lists the products used in supporting the WFP operation. 3B42RT is an experimental product (ftp://aeolus.nascom.nasa.gov/pub/merged/3B4XRT_README), developed by a research team in the Laboratory of Atmospheres at the Goddard Space Flight Center. 3B43 is a standard TRMM monthly product (http://daac.gsfc.nasa.gov/precipitation/TRMM_README/TRMM_3B43_readme.shtml) archived and distributed by the GES DISC. The gauge derived global rainfall product (Willmott and Matsuura, 1995) has been widely used in various applications.

Table 1. Rainfall Product List

Product	Description	Usage
3B42RT	Near-real-time, 3-hourly, 0.25 deg., 60ºS-60ºN, multi-satellite precipitation analysis. Feb. 2002 - present	Flood monitoring, Gini index, deriving other products (e.g, daily, 10-day)
TRMM 3B43	Monthly, 0.25 deg., 50ºS-50ºN, TRMM and other data sources rainfall estimate. Jan. 1998 - present	Drought monitoring and crop yield estimate, deriving climatology and anomaly
Willmott and Matsuura	Monthly, 0.5 deg., global land, gauge rainfall estimate. Jan 1950 - Dec. 1999	Rainfall anomaly

Accessing these products can be a challenging task to many non data experts. For example, all these products require different software for processing, which could require a significant investment from the user side. To overcome this difficulty and facilitate data access, the GES DISC has developed a web based system, TRMM Online Visualization and Analysis System (TOVAS).

TOVAS is based primarily on TRMM data (Liu et al. 2002a, 2002b, and 2002c; Liu et al. 2002): Three hourly

* *Corresponding author address*: Zhong Liu, GMU/DAAC, NASA/GSFC, Code 610.2, Greenbelt, MD 20771; Email: zliu@daac.gsfc.nasa.gov

TRMM and Other Satellite Rainfall (3B42RT) for Jan 2002-present, TRMM Level-3 Three-hourly Rainfall (3B42) for Jan 1998-present, TRMM Level-3 Monthly Rainfall (3B43) for Jan 1998-present, Willmott and Matsuura Global Precipitation (Willmott and Matsuura, 1995) for Jan 1950-Dec 1999, Global Precipitation Climatology Center (GPCC) Monthly Global Precipitation for Jan 1986-present. TOVAS has been in operation since March 2000.

TOVAS uses a widely used software package, the Grid Analysis and Display System (GrADS), for analysis and visualization. With a web browser and few mouse clicks (Figure 1), users can easily obtain global and regional rainfall information (Figures 2 and 3). Main functions of TOVAS are listed in Table 2.

Table 2. Functions supported by TOVAS

Output Type	Description
Area Plot	Area plot averaged or accumulated over any available data period within any rectangular area
Time Plot	Time series averaged over any rectangular area
Hovmoller Plots	Longitude-time and latitude-time plots
Animations	Animations available for area plots
ASCII Output	ASCII output available for all plot types, suitable feeding GIS or other applications

In addition to the tools described above, the GES DISC also provided customized services to WFP. The services included crop yield estimate using simple formulas, customized plots and analysis for reporting. Few resources are available for receiving and processing raw NASA data. The services, provided by the GES DISC, are particularly important to ensure that NASA data and information can be easily accessed by the organization. On the other hand, comments and suggestions from this collaboration will be an important feedback for the GES DISC to further enhance and improve data services. We will incorporate these services into our online information systems, such as, the Agriculture Online Visualization and Analysis System (AOVAS), to allow a broad access and maximize the use of NASA data.

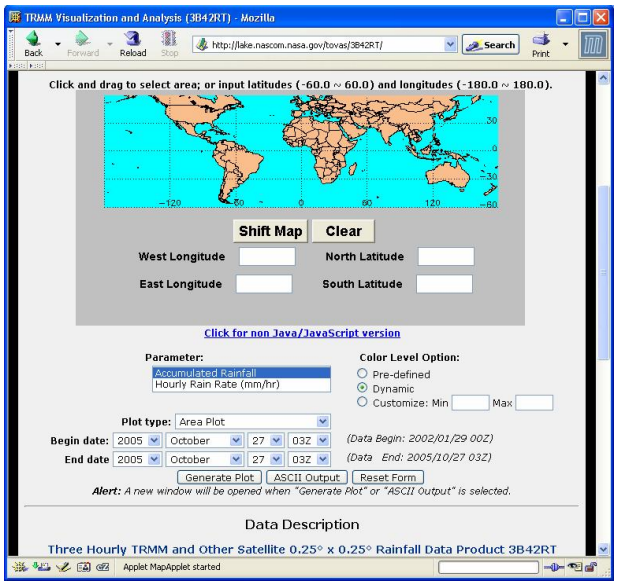

Figure 1. Example web interface of TOVAS for the near-real-time, three-hourly rainfall product, 3B42RT.

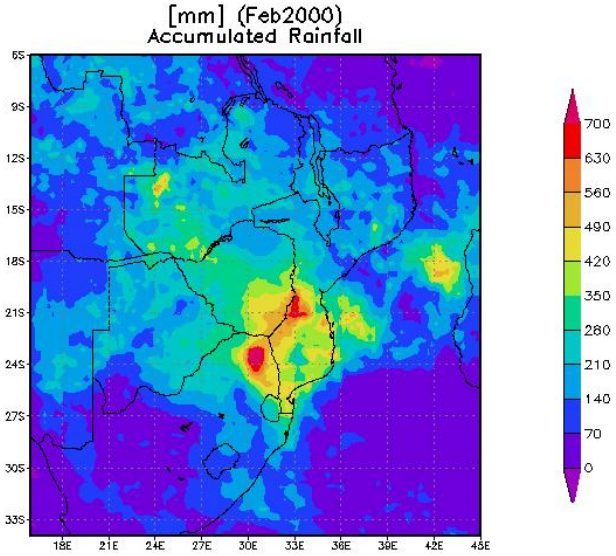

Figure 2. Regional accumulated rainfall (TRMM 3B43) for February, 2000. Parts of Mozambique received rainfall of over 300 mm in one day. Over 300 people died and 2 million had been displaced or affected. The spatial resolution of the newly released monthly TRMM V6 product has been significally improved (from 1 degree to 0.25 degree), making easy to locate affected areas.

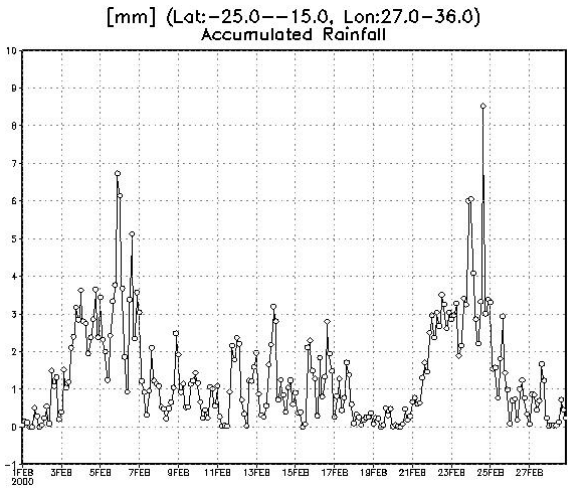

Figure 3. Time series of three-hourly rainfall (TRMM 3B42) for the southern part of Mozambique (see Figure 2). Two major rain events appear in this plot.

3. ONGOING AND FUTURE WORK

The feedback from the 2002-2003 season shows there are still some issues in the NASA products we provided, such as, uncertainty in rainfall measurement, making drought monitoring and forward planning difficult if it remains unsolved. Current and future tasks include:

- Summarize activities during the 2002-2003 season
- Expand the online tools by including local and regional rainfall surplus/deficit
- Expand the online tools by revealing uncertainties in near-real-time and climatological/baseline products to better estimate rainfall for flood/drought monitoring and anomalies
- Derive climatological information for coastal zones
- Derive ENSO rainfall products to understand changes during ENSO events

A new agriculture oriented web site is being developed. In addition to agriculture related data products and services, the web site will include an Agriculture Information System (AIS), based on TOVAS. AIS will include derived rainfall products, such as, daily, 10-day (dekal). New functions will be added based on comments and feedback from the collaborated work with WFP and USDA.

ACKNOWLEDGMENT

The work reported here is supported by NASA through REASoN CAN 02-OES-01.

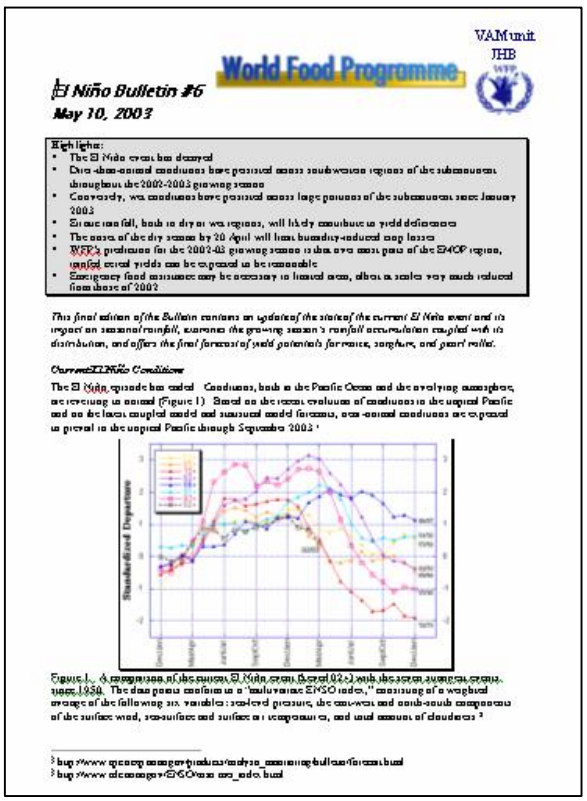

Figure 4. Plots and analysis from TOVAS were used in The WFP El Nino Bulletin.

REFERENCES:

Liu, Z., L. Chiu, W. Teng, H. Rui and G. Serafino, 2002a, TRMM Rainfall Products and Tools for Tropical Infectious Disease Studies. The 15th Conf. On Biometerology/Aerobiology and 16th Congress of Biometeorology, Kansas City, MO.

Liu, Z., L. Chiu, W. Teng, H. Rui, and G. Serafino, 2002b, TRMM Rainfall for Human Health and Environment Applications. *The International Tropical Rainfall Measuring Mission (TRMM) Science* Conference, Honolulu, Hawaii.

Liu, Z., L. Chiu, W. Teng, H. Rui, and G. Serafino, 2002c, TRMM Rainfall Data for Ecosystem Studies and Applications in Arid and Semiarid Regions. *AGU Spring Meeting*, Washington, DC.

Liu, Z., L. Chiu, W. Teng, and G. Serafino, 2002, A Simple Online Analysis Tool for Visualization of TRMM and Other Precipitation Data Sets. *Science Data Processing Workshop* 2002, Greenbelt, Maryland.

Special Issue on the Tropical Rainfall Measuring Mission (TRMM), combined publication of the December 2000 Journal of Climate and Part 1 of the December 2000 *Journal of Applied Meteorology*, American Meteorological Society, Boston, MA.

Willmott, C. J. and K. Matsuura, 1995: Smart Interpolation of Annually Averaged Air Temperature in the United States. *Journal of Applied Meteorology*, 34, 2577-2586.

INFORMATION:

Project Portal:
http://daac.gsfc.nasa.gov/agriculture/index.shtml

Agriculture Online Visualization and Analysis System (AOVAS):
http://agdisc.gsfc.nasa.gov/Giovanni

TRMM Online Visualization and Analysis System (TOVAS):
http://lake.nascom.nasa.gov/tovas

Data in higher temporal and spatial resolutions:
http://eosdata.gsfc.nasa.gov/data/

All TRMM standard data can be searched and ordered via:
http://lake.nascom.nasa.gov/data/dataset/TRMM

For further details about TRMM, visit:
http://trmm.gsfc.nasa.gov

Questions and comments, please email to:
hydrology@daac.gsfc.nasa.gov