TRAINING REPORT

SATELLITE CROP MONITORING WORKSHOP

PHILIPPINES

Conducted By

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Training Report

Satellite Crop Monitoring

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Philippines

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TABLE OF CONTENTS

Preface ii

Acknowledgement .....

I. Introduction 1

II. Incorporation of Satellite Data 2
in Crop Monitoring/Assessment Process

III. Proposed Data Products, Flow and 9
Integration for the Philippines

IV. The Assessment Bulletin 10

V. Plan of Follow-up Action in the 11
Country

VI. Summary and Conclusions 13

VII. Appendices

A. Responsible Agencies and Personnels 14

B. Listing of Equipments, Softwares 15
and Data Provided to the Philippines

C. End Users of Climate Impact 16
Assessment Bulletin

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Satellite Crop Monitoring Workshop
Training Report

Philippines

I. Introduction

The Climate Impact Assessment Program for agriculture was implemented mainly to strengthen countries ability to coup with adverse climatic impact on their respective agricultural production capabilities through the use of early warning and monitoring system technology. These system assists policy makers and managers in identifying and tracking imminent treat and to determine when to activate emergency plans to protect food security.

Phase I of this program was initiated in 1985. The system then used rainfall and crop yield/conditions as its main input. This provided policy makers and managers on agricultural crops production and/or yields and yield outlook.

In the Philippines, the lead agency PAGASA organized a unit within its organizational structure to issue a monthly climate impact assessment bulletin for agriculture. This unit is now part of the Climate Impact Assessment and Application Center of PAGASA. An organization whose main objectives are to: (A) minimize the adverse effect of climatic variability through the timely release of information and warnings and (B) to maximize the use of

climatic/meteorological data in the fields of engineering, commerce, industry and health.

Phase II of this program in which the satellite crop monitoring workshop initiates, as the workshop title's denotes, aims at the use of satellite data in crop monitoring. Further, the workshop dealt with the use of satellite data in crop yield modeling, including the use of the necessary tools and technology for satellite data processing. This technology is designed to augment the Present Phase I technology in order to make assessments more accurate and quantitative.

II. Incorporation of NOAA satellite data in the Crop Monitoring/Assessments Process

A. NOAA Satellite and Sensor Characteristic

1. NOAA Satellite Data Characteristics - The NOAA satellites are characterized in a near polar orbit (98.89^{0} inclination) 833 to 870 km. high orbit. It completes about fourteen 102 minutes orbits in 24 hours. The Advance Very High Resolution Radiometer (the satellites sensors) provides a 2700 km (±10.80 ^{0}scan angle from nadir) both twice daily of the earth at 4 km (Global area coverage GAC) and a 1.1 km (Local Area Coverage) resolution regional view. Data can be acquired through local direct read-out (High Resolution Picture Transmission) HRPT in all five channels and in 4 km resolution in two channels at an approximate center

frequency of 137 MHz). For areas beyond the receiving station's acquisition circle, data can be tape recorded onboard the spacecraft for a delayed read-out or transmission. Five channels of data can simultaneously be acquired over an area of interest. The spectral bands and applications of each are as follows:

Channel 1 - 0.58-0.68 mu - Visible reflected light, measures albedo; terrain features, vegetative cover and meteorological (cloud) features.

Channel II - 0.725-1.10 mu - Near-infrared, reflected infrared, defines snow and ice condition; melt; allows vegetation assessment (highly sensitive to the presence of chlorophyll) and meteorological (cloud) monitoring

Channel III -3.55-3.93 mu- Thermal mid-IR (emitted) sensitive to extreme heat sources; forest fire detection; sea-surface temperature analysis and night time cloud mapping.

Channel IV - 10.30-11.55 muThermal Infrared (emitted) day and night land temperature; volcanic flumes, wet cloud features; river, lake and ocean surface temperature,

Channel V - 11.50-12.50 mu - Thermal IR - day and night land temperature; volcanic flumes;

meteorological cloud features and lake, river and ocean temperatures.

B. NOAA SATELLITE DATA/IMAGE PROCESSING/ANALYSIS SYSTEM

The system used for image/data processing are based on the use of and IBM-PC AT Compatible Computer System equipped with hard-disk drives and both a double density (360k) and high density (1.2 Mb) floppy disk drives. The micro-computers are also equipped with a VGA card and a very high resolution colour monitor and math-coprocessor.

The software packages used are as follows:

a. Lotus 123 - used for multiple linear regression analysis and modeling.

b. IMAGE PROCESSING

i. XYFILL - used to "fill in" holes of missing data with values derived from adjacent pixels. It also checks the input file(s) for missing data and uses a linear-fill method which takes the non-missing pixels to either side of the hole (up to 99 pixels wide) and calculates replacement values using linear interpolation.

ii. XYSHIFT - used to perform basic control point registration by shifting the

ata within Plate Carree XY projection image iles. The user is allowed to move the data oth horizontally and vertically.

,ii. XYCOMP - used to composite a specified number of days of Plate Carree XY projection image data in order to select those pixels which are cloud-free or most nearly cloud-free eliminating missing data whenever possible. The pixels channel 1, channel 2, and channel 4 data values will be retained offering the best results in the compositing algorithm calculations.

iv. XYTOPC - used to takes satellite data from channel 1, channel 2 and channel 4 and converts it into a displayable image using the Ambroziak Color Coordinate System (ACCS). This is accomplished by calculating an NDVI value for each pixel and by using channel 4 values for assigning cloud colors (gray and white).

b. Normalized - Vegetation Index (NVI) Program - This program can be used to perform several functions with Normalized Vegetation Index (NVI) data, including the plotting of time series and the printing of actual NVI data.

c. MICVEGI - used for defining and maintaining satellite NDVI time series data. Version 1.0 of the system provides functions to define locations and rectangular polygons, five periods of NDVI data, extraction of polygon values from satellite NDVI files, smoothing of NDVI time series data, and the downloading of NDVI for use in plotting software.

d. NVIAREA - used in NDVI and delta NDVI time series analysis, offers the user the ability to calculate the area under the time series curve for use in yield estimations.

e. DRAGON IMAGE ANALYSIS SOFTWARE - This is the main Image Analysis and Display Software used during the Workshop. With this software, it is possible to display and or more images at the same time, do classification operations and image enhancements, supervised and unsupervised classification operations and Image slicing .

C. Use of Image Products in Assessment

The various methods advised for Satellite Image Processing has the sole purpose of making the work of the Image Analyst easier and more precise. Thus, we may composite an image on the temporal scale to eliminate clouds, subtract or add one Image to another to bring

out features that we are interested in. We may also use supervised Image Classification (instead of using unsupervised methods) to input what we may term us "experience" (training) into the image classification process. Thus, after all this processing, we have what we call Image Products. In the preparation of Assessments we make use of these products by comparing them (Hence we may compare say an image of June this year and of June last year, etc.) By making this comparisons, we can make an assessment of the vegetation/biomass conditions of a particular area. This assessment, should not be made solely with Satellite Image alone whenever possible. The assessor should bear in mind the conditions prevailing in the said area.

Thus, a greener area in the image means a stronger vegetative/biomass condition than an area of lighter green color. Similarly, if the color of a particular area is greener generally say this June than its color last year. we may, say that the vegetative/biomass condition on that area is better this year than the same month last year (the use of ACCS is assumed).

D. Use of NDVI Products in Assessment

Vegetated areas has relatively high NDVI values because of their relatively high near-infrared (channel 2) reflectance and low visible light reflectance

(channel 1). In contrast clouds, water and snow has approximately the same response on both channels (they have greater responses on channel 1 that channel 2) Thus, their NDVI's are negative or near zero. Similarly, bare soils and rocks has similar reflectances. NDVI is computed as follows :

$$NDVI = \frac{CH2-CH1}{CH2+CH1}$$

where : NDVI = Normalized Difference Vegetation Index

CH1 = Reflectance at Channel 1
CH2 = Reflectamce at Channel 2

The above mentioned characteristic of NDVI is used to make assessment of the vegetation on the area of interest. This is done by correlating NDVI values with crop yields/crop condition on the said area. If sufficient amount of data are available a model may be advised with NDVI as one of the independent variables in the model. The model in turn used in making the actual assessments. Due to the characteristics of NDVI however, it can be used as an indicator of vegetative condition of a particular area. However, one should always bear in mind that the area covered by the AVHRR is 1.1 km and 4 km resolution, At NADIR for LAC and GAC scale. With this in mind and knowledge of crop calendar, soil type, etc.. of the area of interest and experience, one can make a good assessments of the crop

in the area.

*NOTE: The assessor should always bear in mind the local condition of the area of interest. Images and NDVI products should be used with due care and verification and/or with other assessment tools should be made whenever possible.

III. Proposed Data Products, Flow and Integration for the Philippines

Data Requirements for Assessment

Climatological/Meteorological informations

Crop Yield/Crop Condition

Satellite Data

Other Data

Data Integration

Meteorological/climatological/agrometeorological data shall be provided by the Climate Impact Assessment and Applications Center of the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA); crop yield data and crop condition shall be provided by the Agricultural Accounts and Statistical Indicators Division of the Bureau of Agricultural Statistics (BAS), while NOAA satellite data shall be provided by the Remote Sensing and Resource Data Analysis Department of the National Mapping and Remote

Sensing Information Authority (NAMRIA).

Data shall initially be integrated by the working group composed of the filipino trainees in this workshop. Latter data integration may be performed by another group (as may be decided by the more senior officials of the various agencies concerned) or by the Climate Impact Assessment and Applications Center of PAGASA, which is currently issuing the monthly Philippine Climate Impact Assessment Bulletin for agriculture which is mainly based on the Phase I technology of Climate Impact Assessment Project.

The preparation of the Climate Impact Assessment Bulletin shall be according to the following outline :

1. Data gathering/upgrading of database
2. Data processing and Data Analysis
   (Meteorological/climatological/agrometeorolgical, crop statistics/crop condition, and NOAA satellite data)
3. Preparation of charts and manuscripts
4. Printing and distribution of bulletins

IV. The Assessment Bulletin

The current Monthly Climate Impact Assessment Bulletin for Philippine Agriculture is produced using mainly the "Phase I Technology", and other climatological data/information from PAGASA field stations, and crop

data/information from BAS. These data/informations are then processed using Apple IIs, NOAA/CIAM "Climate Impact Assessment Software" pakages and PAGASA softwares. Based on the results of these data processing, analysis and other informations, the monthly climate impact assessesssment is prepared, printed and sent to the end users.

It is plan to keep the present assessment format with minor modifications in view of the more recent technology learned in this workshop. In the addition to the charts included in the current assessments, additional charts using satellite data shall be included. The proposed assessments shall also contain statements concerning vegetative/biomass conditions based not only from the traditional assessment tools(GMI,YMI,ETC..,) but also on satellite images and NDVI products.

V. PLAN OF FOLLOW UP ACTION IN THE COUNTRY

Installation of equipment and softwares shall be done immediately upon receipt of the equipments by the respective personnel concerned. An additional two (2-3) weeks might be needed to familiarize additional personnel with the use of the softwares provided in the workshop. Incorporation of Phase II technology in the assessment shall be done immediately upon tne receipts of satellite data. Depending upon the availability of funds, colour images shall be included in limited numbers of assessment copies to be sent

to Philippine Government Policy makers.

The frequency of Assessment Bulletins shall be increased from one (1) per month to two (2) or four (4) per month based upon the country's need or during ~~or~~ imminent Episodic events.

V. Tentative Schedule

Shipping of Equipment from Bangkok	-	July 10, 1989
Arrival of Equipment in Manila	-	July 14, 1989
Release from Customs	-	August 1, 1989
Receipt by Various Personnel concerned	-	August 2, 1989
Installation of Equipment & Software	-	August 2, 1989
Familiarization of Additional Personnel	-	August 3-17, 1989
Receipt of Satellite Data	-	August 18, 1989
Receipt of Crop Data & Meteorological Data	-	September 1, 1989
Preparation of Assessment Bulletins	-	September 1-3, 1989
Release of Assessment	-	September 4, 1989
Technical Training Mission	-	December 4 - 8, 1989
Preparation of Final Evaluation Seminar	-	February 1989

VI. Summary and Conclusions

The Satellite Crop Monitoring Workshop has trained the participants in the use of Satellite Data in Crop Monitoring and Assessment. Further, the participants learned the use of same basic tools that they may use not only in assessment preparation but also in other work that are not necessarily related to Crop Monitoring or Assessment Preparation. Some of this basic tools are:

a. Use of Micro-Computers
b. Use of Image Display and Analysis Software
c. Statistical Model Development
d. Use of Process Model

Based on the knowledge gained in this workshop the participants draws the conclusion that :

* Satellite data/images products are very useful in making assessments, specially in data deficient areas, but one should always bear in mind the limitations of the information that he or she is using.

The participants understood that due to time constraints, some of the subjects are discussed only in passing. However, it is suggested that additional reading materials be provided on such subjects of Supervised Classification, Image Enhancement Procedures, Process Models and other matters pertaining to Satellite Image Processing and Crop Modelling.

APPENDICES

A. Responsible Agencies and Personnel

Agency : **Philippine Atmospheric, Geophysical and Astronomical Services Administration (P A G A S A)**

Personnel : Aida M. Jose
Actng Asst. Weather Services Chief
Climatology Branch, PAGASA

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Climatology Branch, PAGASA

Address : 8th Floor Asia Trust Bank Bldg.
1424 Quezon Ave., Quezon City
Philippines

Telephone Numbers : 922-84-01 to 922-84-10 Local 228

Agency : **Bureau of Agricultural Statistics (B A S)**

Personnel : Roberto M. Dalag
Chief, Agricultural Accounts and Statistical Indicators Division, BAS

Amadeo D. Lucido
Agricultural Development Specialist
AASID, BAS

Address : 10th Floor Ben-Lor Bldg.
1184 Quezon Ave., Quezon City
Philippines

Telephone Number : 99-26-41 to 99-26-51 Local 2270

Agency : National Mapping and Resource Information Authority
(N A M R I A)

Personnel : Virgilio S. Santos
Asst. Director, NAMRIA

Marcelina M. Dumayac
Remote Sensing Technologist I
Physiography and Aquatics Division
Remote sensing and Resource Data Analysis Department
NAMRIA

Telephone Number : 810-48-31 Local 261

Address : Fort Bonificio
Makati, Metro-Manila
Philippines

B. Listing of Equipments, Softwares and Data Provided to the Philippines in this Workshop

Hardwares

*
3 Units NEC Multi-Sync Monitor
*
3 units ETI VGA graphics cards

Softwares

3 Sets Dragon Image Display/Analysis Software

3 program diskettes, sentinel software key and user's manual per set

3 Sets Satellite data processing Softwares

4 program diskettes per set (MICVEGI,NDVI,FCONVERT and XY-programmes)

Data Diskettes 1 set for the Philippines

NVI data diskettes - 53 pcs
Channel data diskettes - 24 pcs
Boundary data diskettes - 6 pcs

Total data diskettes provided 83 pcs. 5-1/2" DSHD floopy diskettes of mixed 3M and Maxell Brands

C. End Users of Climate Impact Assessment Bulletins

1. Office of the President
2. National Food Authority
3. Department of Agriculture
4. Bureau of Agricultural Statistics.
5. Office of Civil Defense
6. Bureau of Plant Industry
7. Bureau of Agricultural Extension