A PROJECT ON GLOBAL ENVIRONMENTAL SATELLITE DATABASE BASED ON NETWORKS

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ABSTRACT

Five institutions, which are very active in data utilization of environmental satellites NOAA and GMS, are connected via high speed networks to construct the databases based on the observations of AVHRR (Advanced Very High Resolution Radiometer) of NOAA satellite and VISSR (Visible and Infrared Scanning Radiometer) of GMS (Geostationary Meteorological Satellite) and to create scientific data sets for land, ocean and atmosphere. And vegetation index, sea surface temperature, cloud distribution maps and so on are generated by high speed and huge volume data processing for studies on long term variations of land, ocean and atmosphere in Asia. In this paper the concept of this project and the activities at the Science University of Tokyo are briefly introduced

1. INTRODUCTION

Earth observation from satellites offers very huge information on global environment. And it is expected that long term, various and complex phenomena of global land, atmosphere and ocean can be analyzed utilizing satellite information. A project has started, connecting five institutions, which are very active in data utilization of environmental satellites such as NOAA and GMS via high speed networks, to construct the databases of AVHRR of NOAA satellite and VISSR of GMS and to create scientific data sets for land, ocean and atmosphere. And vegetation index, sea surface temperature, cloud distribution maps and so on are generated by high speed and huge volume data processing for studies on long term variations of land, ocean and atmosphere in Asia from polar region to tropical region and from India to northeast Pacific region.

2. ORGANIZATION

NOAA satellite data are received and archived at the Institute of Industrial Science, University of Tokyo, Center for Atmospheric and Oceanic Studies, Faculty of Science, Tohoku University, National Institute for Environmental Studies , Center for Environmental Remote Sensing, Chiba University, and Asian Institute of Technology and GMS satellite data is received and archived at the Institute of Industrial Science, University of Tokyo as shown in Table 1. Since these data are archived and processed independently at each facility, it has been difficult to promote long-term analysis and studies covering wide area merging these data. In this project, connecting the above mentioned five institutes via high speed networks as shown in Figure 1, NOAA AVHRR (Advanced Very High Resolution Radiometer) and GMS VISSR (Visible and Infrared Spin Scan Radiometer) data are integrated on a cyberspace and scientific data sets of land, ocean and atmosphere by

Table 1 AVHRR and VISSR Data Archives in the Project

| Institution	Receiving Station	Starting Year of Reception	Data Volume (TB)
NOAA Data			
Institute of Industrial Science, University of Tokyo	Tokyo	1983	2.5
Center for Atmospheric and Oceanic Studies, Faculty of Science, Tohoku University	Sendai	1988	2.0
Center for Environmental Remote Sensing, Chiba University	Mongolia Chiba	1997 1997	0.3
National Institute for Environmental Studies	Tsukuba Kuroshima	1995 1995	0.3 0.3
Asian Institute of Technology	Bangkok	1997	0.5
GMS Data			
Institute of Industrial Science, University of Tokyo	Tokyo	1995	4.5
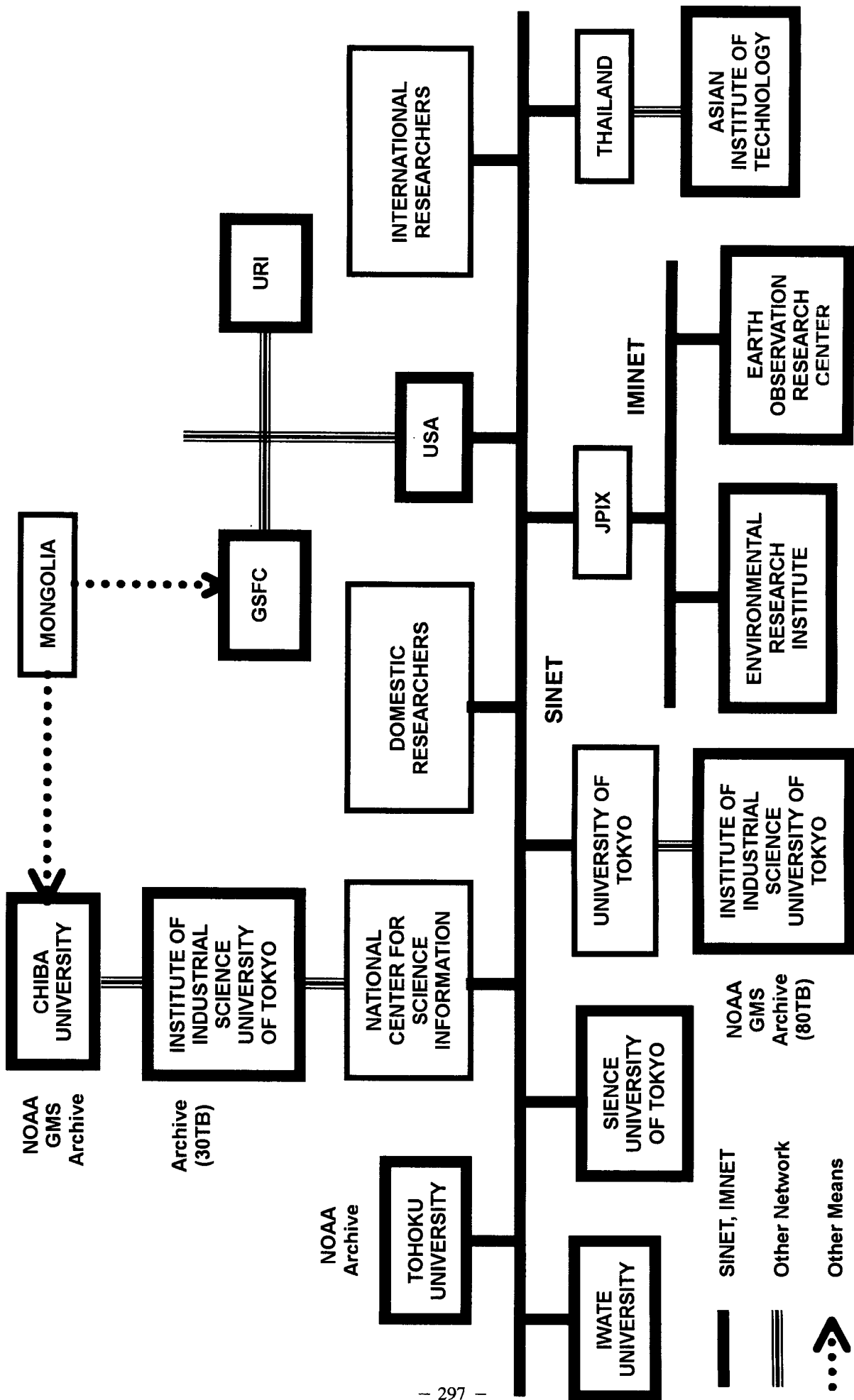
Figure 1 Network Configuration

processing these data, which cover wide area from East Asia to South East Asia for more than 10 years. Applying high speed huge volume data processing using latest physical parameter estimation algorithms to the AVHRR data base, daily vegetation index map and sea surface temperature map are generated at 1 km spatial resolution. Cloud distribution map at every hour is generated using the VISSR data base. And long-term variations of land, ocean and atmosphere in wide Asian region are studied using these data base.

The volume of archived raw data is over 10 TB as shown in Table 1 and the volume of processed data is estimated to be 20 to 30 TB.

Exchanging these satellite data by network and merging, the following new researches become possible:

(1) Merging AVHRR data received by stations of this project, a long-term and continuous data base is generated for long-term observation of changes of phenomena.

(2) Merging data received by stations in Japan, Mongolia and Thailand, observations of land, ocean and atmosphere covering wide Asia region as shown in Figure 2.

(3) AVHRR features observation with high spatial resolution and multiple wave lengths and VISSR features frequent observation every hour. Merging both features high spatial and temporal observations become possible.
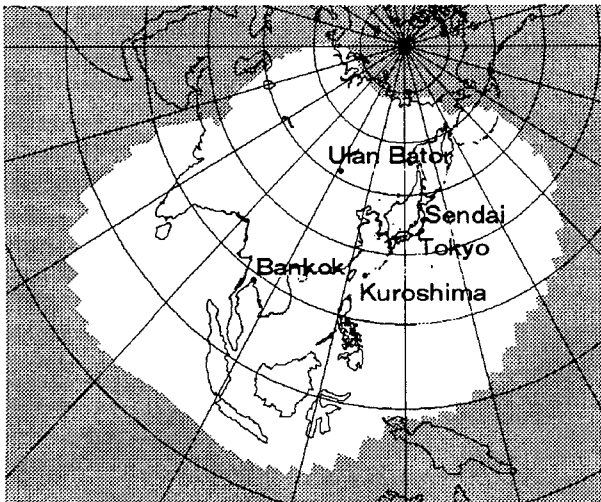

Figure 2 Coverage of Stations

3. RESEARCH PLAN

The following 6 sub-themes are planned:

1) AVHRR and VISSR image data transfer via high speed network (SINET) and data base construction
   ● University of Tokyo, Iwate University, National Institute for Environmental Studies
   ● Masaru Kitsuregawa (University of Tokyo): Network design
   ● Kiyoshi Honda (Asian Institute of Technology): Processing of data received at AIT

2) Generation AVHRR basic data set of Asian region

● University of Tokyo, Iwate University, National Institute for Environmental Studies
● Yoshibumi Yasuoka (University of Tokyo): Vegetation index
● Ryosuke Shibasaki: (University of Tokyo): Geometric correction
● Ryuzo Yokoyama (Iwate University): Atmospheric correction
● Masayuki Tamura (National Institute for Environmental Studies: Mosaicing

3) Generation of land cover map of Asian region based on AVHRR data
● Chiba University
● Yasuhiro Sugimori and Yoshiaki Honda: Land cover classification

4) Generation of sea surface temperature maps of sea surrounding Asian region and Western North Pacific
● Tohoku University
● Hiroshi Kawamura: Estimation of sea temperature

5) Generation of cloud parameter and sea surface temperature maps using VISSR
● Science University of Tokyo
● Mikio Takagi: Estimation of cloud and sea surface temperature

6) Environmental change studies of Asian region using long-term, wide and high spatial resolution vegetation index, sea surface temperature and cloud parameter
● All institutions

4. ACTIVITIES AT THE SCIENCE UNIVERSITY OF TOKYO

The following topics are carried out at the Science University of Tokyo:
● High speed data transfer via SINET
● Geometric correction of GMS images
● GCP (Ground Control Point) data base
● Precise geometric correction
● Cloud Classification And Sea Surface Temperature
● Rainfall estimation using TRMM and GMS data
● 1 km AVHRR global land data set.

5. CONCLUSION

A five year project, to connect five institutions receiving and archiving environmental satellites NOAA and GMS via high speed networks, to construct AVHRR of NOAA satellite and VISSR of GMS databases, and to create scientific data sets for land, ocean and atmosphere, is introduced. This project will demonstrate huge volume high speed satellite image data transfer via networks and generate fundamental spatial data sets based on satellite observations by high speed and huge volume data processing for studies on long term variations of land, ocean and atmosphere in most part of Asia. And it is expected for these data sets to promote domestic and international researches for global environment and to contribute international programs such as IGBP, IHDP and so on.