APAN Earth Monitoring and Disaster Warning Working Group

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1. Introduction

The Asian Pacific Advanced Network (APAN) is a non-profit international consortium established on 3 June 1997. APAN is intended to be a high-performance network for research and development on advanced applications and services. APAN provides an advanced networking environment for research community, and promotes international collaboration. APAN has already established a substantial set of network connections for use by the scientific community (Figure 1).

The Asia Pacific region contains 60% of the planet's population. The region is correspondingly rich in its marine and terrestrial biotic resources, many of which are increasingly impacted by anthropogenic activities.

The APAN Earth Monitoring and Disaster Warning Working Group was established in July 1998. The mission of this working group (WG) is to implement remote sensing applications within APAN which promote sustainable economic development, preservation of the region's biotic resources, and early identification of events or conditions which may lead to disasters.

2. Environmental Issues of the Asian Pacific Region

There are a number of pressing environmental issues in the region, including deforestation, coral reef degradation, and pollution of air and water resources. In addition, there are major questions regarding the sustainability of fishery resources, which have supplied the region's people with protein for millenia, but are now being heavily exploited with an array of technologies.

The region is subjected to a wide range of natural disasters. The region is a part of the circum-pacific "ring of fire", with hundreds of potentially active volcanoes and a significant history of earthquakes. Monsoons bring torrential rains and flooding. When monsoons falter, due to events such as El Nino, drought and devastating fires can occur.

3. Observation, Processing, and Distribution

Satellite remote sensing technologies have proven capabilities for environmental monitoring and disaster warning. However, the full value and benefit of current sensor systems is seldom realized due to limited
distribution of the data and derived products, which are constrained, in part, by large data volumes. Recent advances in high performance networking technologies opens up new opportunities for wider access and utilization of remotely sensed data.

The WG will utilize APAN to distribute remote sensing data and derived information products to new sets of data users which will be developed through the APAN nodes. The WG will seek to democratize the decision making impact of the distributed data through local media outlets, universities, government laboratories, and non-governmental organizations (NGOs).

The WG will monitor the feedback from data users and attempt to respond through changes and adjustment in the products and delivery patterns to better serve the objectives of the end users.

The WG has established a set of implementation objectives detailed below, tapping into capabilities available at WG member institutions. In the longer term, the WG will seek out collaborations with a broader range of remote sensing data and product providers to serve as a regional hub for
distribution of earth observations into the Asian Pacific region.

4. Implementation

The WG plans to focus initially on the remote sensing of three phenomena which have wide impact on the region: 1) wildfires (biomass burning), 2) the intensity of fishing effort, and 3) torrential rains.

Fire is used to clear land, as a tool of agriculture and forestry. Other burning may be of religious or cultural origin. However, during drought years it is difficult to control. Fire is closely associated with
deforestation, land cover change, land degradation, and losses in species diversity. Smoke from fires can become a regional health and navigation issue. Anthropogenic fires are the second largest source of greenhouse gas emissions, only exceeded by fossil fuel combustion as a source.

Because of their distinct spectral emissions, fires can be directly observed in data from certain meteorological satellite sensors such as the Defense Meteorological Satellite Program - Operational Linescan System (DMSP-OLS) and NOAA Advanced Very High Resolution Radiometer (NOAA-AVHRR). Smoke can be spectrally distiguished from clouds in data from Japan's Geostationary Meteorological Satellite (GMS) and NOAA-AVHRR. GMS data was used successfully to monitor smoke sources and smoke movement during the 1997 fires of Indonesia. Figure 2 shows a DMSP-OLS fire

We propose to develop a multisource program to monitor fires and smoke in Southeast Asia. Initially this will be based on the near real-time distribution of DMSP-OLS fire products (processed by NOAA-NGDC) and digitally enhanced GMS data for monitoring of smoke sources, extent and movement. APAN nodes for data delivery and distribution will be the Asian

Institute of Technology (AIT), Bangkok, Thailand, the Institute of Technology, Bandung (ITB), Sumatra, Indonesia, and Australian institutes.

Fisheries provide a major source of protein for people in Asia Pacific countries. The cumulative impacts of overfishing using advanced technologies could lead to a major loss in food security for the region.
Monitoring of fishing effort, in terms of the number of fishing vessels which are active, when combined with total catch, can be used to assess the population of the fished species.

As a proof of concept we propose to implement a monitoring program for the regions squid fishing activities. Squid fishing vessels use large banks of high intensity lights to attract squid to the ocean surface for netting. The squid fishing boats can be detected using night time data from the
DMSP-OLS. We propose to generate and distribute nightly georeferenced visible and thermal band OLS products (at NOAA-NGDC) of squid fishing areas in the Sea of Japan (Figure 3). If successful, this effort will later be expanded to the Philippines and Gulf of Thailand.

Torrential rains can be observed directly with data from the DMSP Special Sensor Microwave Imager (SSMI) and with data from the NASA-NASDA Tropical Rainfall Mapping Mission (TRMM). We propose to distribute SSMI and TRMM data and data products in near real-time using APAN. By rapidly distributing these products the WG intends to enhance the available information on powerful storm systems prior to landfall.

The initial WG data delivery or mirroring services in the APAN nodes will be accomplished through the Ministry of Agriculture, Forestry and Fisheries Research Network (MAFFIN) of Japan.

5. Conclusion

In reviewing the available satellite remote sensing programs we conclude that substantial capabilities for earth observation and disaster warning are being under utilized. The vast majority of satellite remote sensing data enters digital archives having limited accessibility rather than being widely distributed for open use by the scientific community. This is the legacy of decades in which the electronic transport of image data was cumbersome and limited to small data volumes. With today's advanced bandwidth networks, such as APAN, it is possible to distribute significant volumes of satellite image data on a daily basis. The APAN Earth Monitoring and Disaster Warning Working Group has initiated a set of international scientific collaborations to tap in to satellite remote sensing data streams, performing processing to make usable products, and then distribute the data products. This will greatly enhance the benefit that society receives from the massive investments made to develop, launch, and operate satellite remote sensing programs.

6. References

APAN (1997).
http://apan.net

Elvidge, C.D (1998). APAN Earth Monitoring and Disaster Warning WG, http://apan.net/groups/earth-monitoring.html

Fujita, H., Prakoso, J.H. and Aziz, L.H. (1998). Development of wild fire monitoring by APAN, Proceedings of IWC98, 51

Fujita, H., Ueda, T., Prakoso, J.H. and Otsuka, M. (1998) Development of fast dissemination of remote sensed and GIS data of fires by APAN. Proceedings of the 27th International Conference on Remote Sensing of Environment.

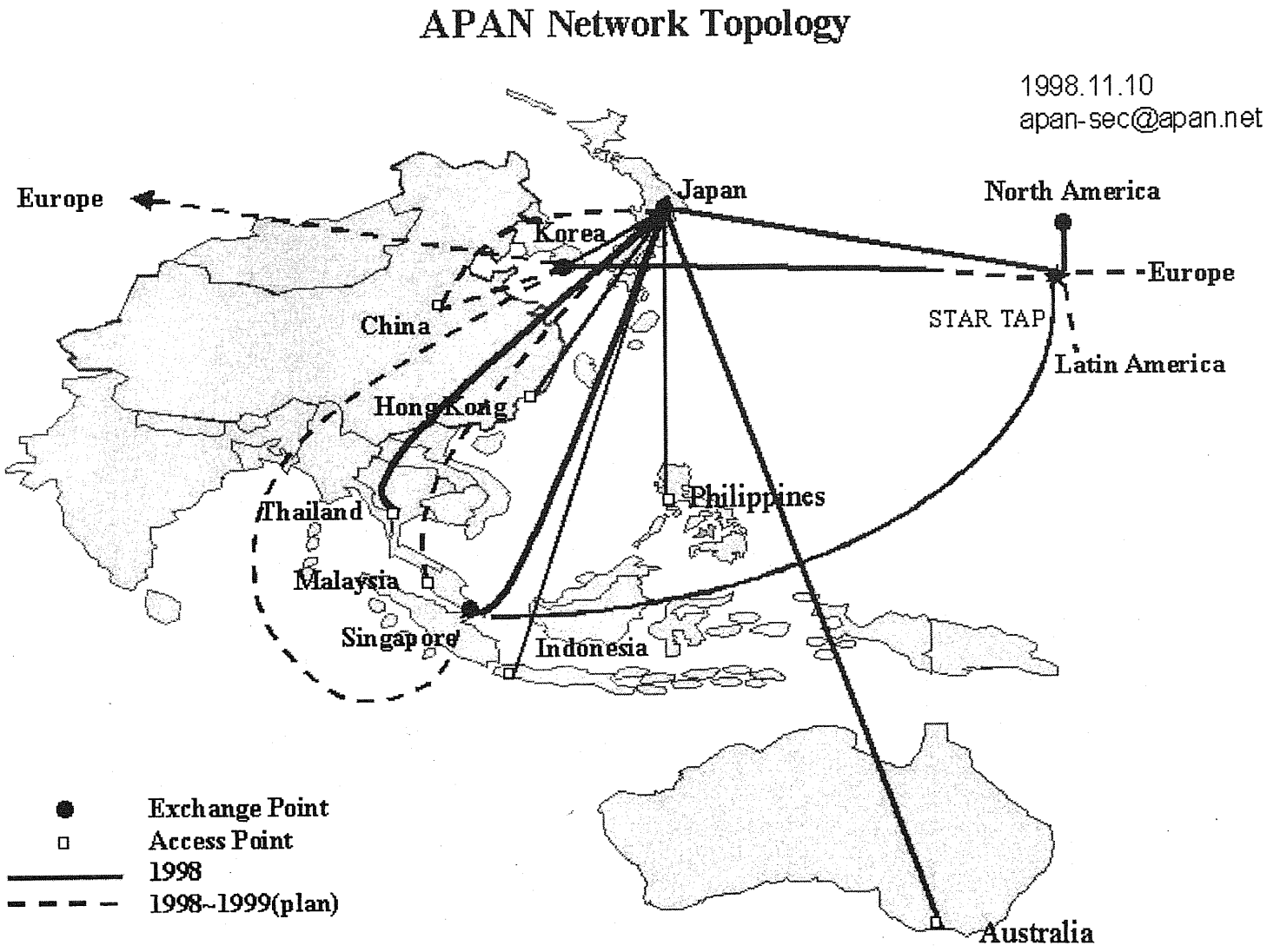

Fig. 1 Network connections of APAN (file APAN.JPG).

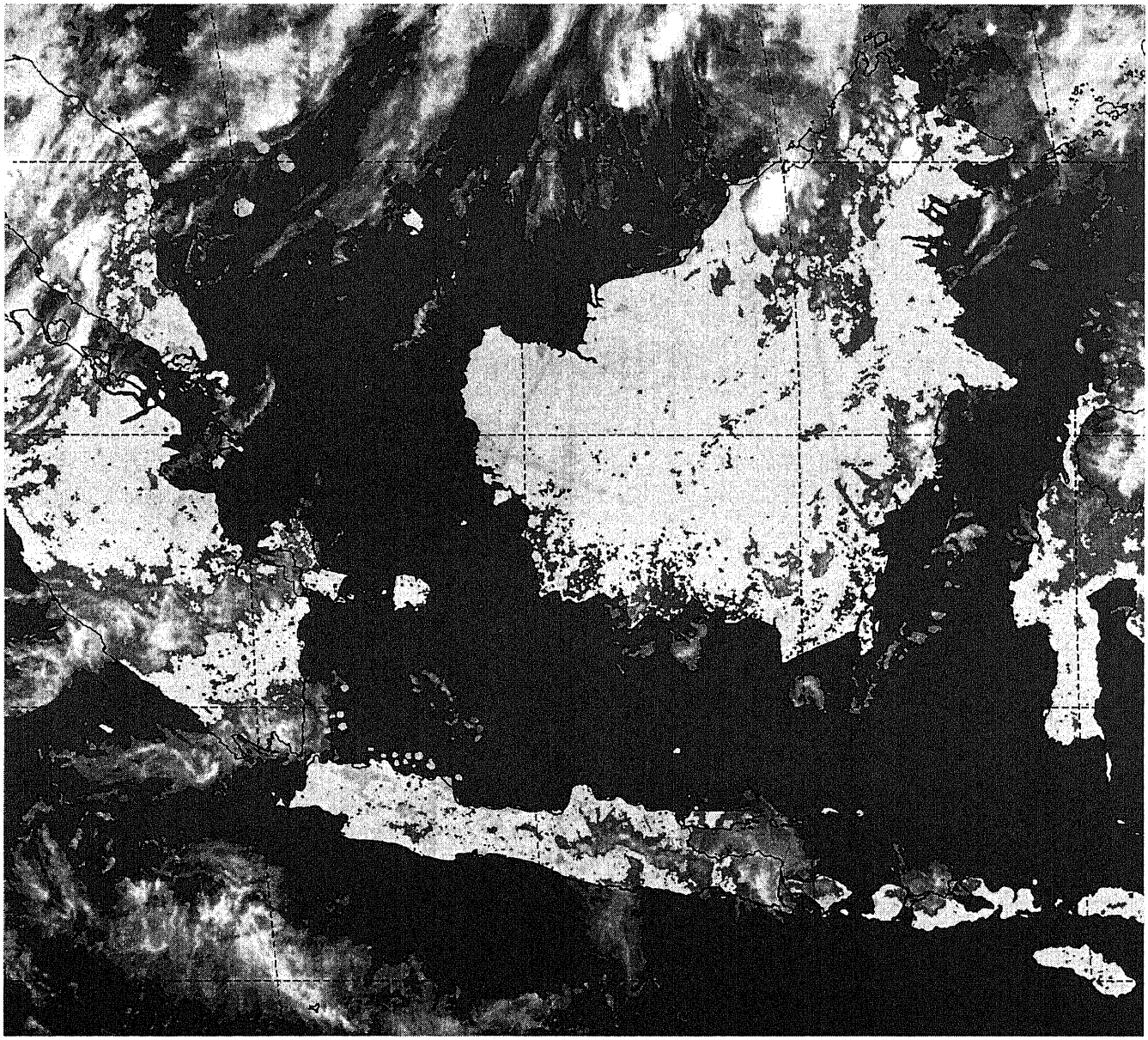

Fig. 2 DMSP-OLS and fire detection over Indonesia from September 21, 1997 (file I970921.GIF).

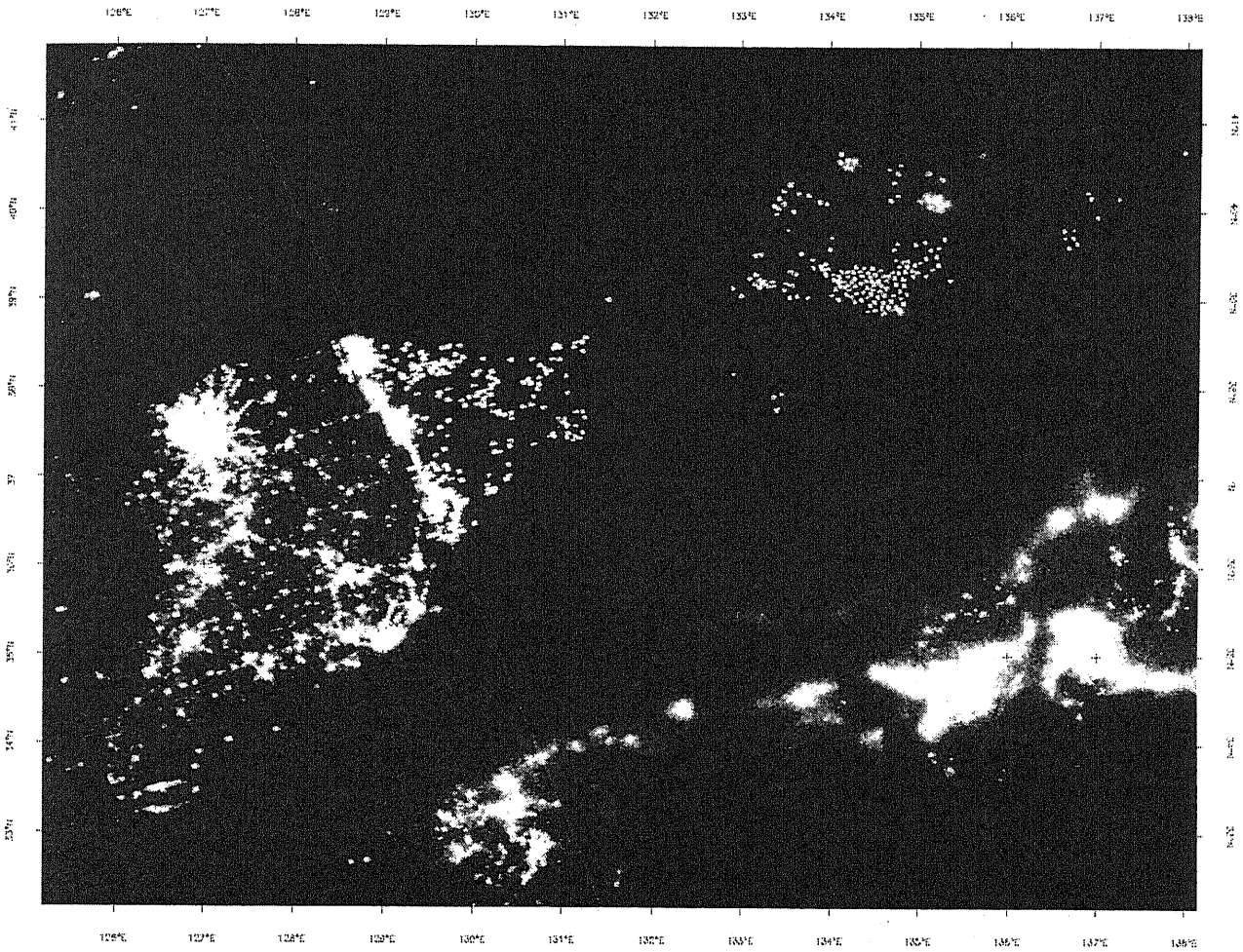

Fig. 3. Georeferenced DMSP-OLS image of lights from squid fishing boats in the Sea of Japan from September 19, 1998 (file J98919A.GIF).