

APEIS Workshop on MODIS and other network opportunities. Report on the Workshop in Beijing, 20-21 September, 2002-09-25

David L B Jupp

Introduction

The APEIS capacity Building Workshop was jointly sponsored by the Ministry of Environment, Government of Japan, The State Environmental Protection Administration (SEPA), Government of China. The Chinese Academy of Sciences (CAS) and the Asia-Pacific Network for Global Change Research (APN).

The meeting had two days and three related topics. The first was to examine the current situation and any problems in the development and use of MODIS data reception and processing in the region. The second was to discuss the development and maintenance of ground-truth observation sites for various ecosystems. The third was in integration of data with some emphasis on the regional flux experiments that have developed and the Millennium Assessment program. A description of the programme with talks and speakers is available and accompanies this report.

An Australian representative (David Jupp) was invited to attend and present a paper on "The Current Situation for MODIS Data Acquisition, Processing and Applications in Australia". It accompanies this report as a PDF file. The talk complemented descriptions of acquisition and processing in China, Japan and Singapore and discussions of processing and products by the NASA representative, Dr Robert Wolfe from NASA Goddard and Profs Shunlin Liang and John Townshend from the University of Maryland.

Linda Stevenson from the APN secretariat attended and described the APN, its objectives and future emphases.

Presentations were collected from the participants and will be made available from the web as part of the Workshop reporting. Copies of the presentations were provided during the workshop and copies of relevant ones can be made available from COSSA.

MODIS Direct Broadcast activity

Acquisition activity

There is a good and growing network of use for MODIS direct broadcast (DB). Possibly due to bandwidth limitations, China has adopted the approach of using DB extensively. It was reported that there were 18 MODIS stations in Beijing among various agencies and University groups. This seems rather high and the needs for

coordination that we are experiencing in Australia are obviously even more acute in China.

However, the primary stations in China, and possibly the ones with the larger dishes, are those being operated by the CAS and the China Meteorological Administration (CMA). In all, there are CAS stations operating in Urumqi (Xinjiang) and Beijing while the CMA has main stations operating in Urumqi, Beijing and Guangzhou and is developing others in Lanzhou, Xi'an and Lasha. That provides a potential for redundant coverage over much of East Asia.

The Urumqi Station(s), for example, cover the extent east to Beijing, west to the Caspian Sea, south to the Indian Peninsula and north to Siberia. To the east, the Chinese stations are complemented by the Japanese Station in Tsukuba and the Russian Far East Satellite Data Processing Center in Khabarovsk (near to China and Japan).

South Asia is obviously only covered to a limited degree from Guangzhou and so the station in Singapore and the possible ABoM station in Darwin are key steps in utilising MODIS DB data in the South Asia region. The Australian coverage from WASTAC and Alice Springs is, however, already useful if it could be obtained in collaboration with Singapore.

The Singapore operations have been proceeding since March 2001 and the IMAPP processing software is used on a Linux platform. There are two dishes operating so that conflicts are reduced. However, TERRA and AQUA data acquisition is shared with other satellite data so conflicts occur. The MODIS coverage reaches from the Northwest coast of Western Australia to India. Operational fire mapping is well established for SE Asia.

There was a lot of interest in this possibility and the reported possible southern hemisphere coverage in Australia in the next three years (as shown in the presentation made on behalf of Australia, courtesy of Paul Tildesley of CSIRO Marine) of:

Alice Springs (2)
TERSS
WASTAC
Darwin (ABoM)
Cribb Point (ABoM)
Casey (ABoM)

This provides a completion of environmental coverage of great interest to many researchers at the meeting. In fact, it seems that Korea plans to install a MODIS receiving station in the Antarctica in the future. That would increase the density to the south as well.

Issues and Software Development

For the interest of the discussions in Australia at the present time, the Russian Station and the Singapore Station both use IMAPP software and I think that is also true of the

Japanese Station at Tsukuba. In China the software is all written by the Chinese – in part this is due to the need for it to be in Chinese language and use Chinese operating systems. IDL seems to be a commonly used software environment for the developments as well as C++.

The issues that were raised are almost identical to those discussed at the Australian MODIS meeting (the summary documents are available from the EOC Web site). They involve the need to ensure ease of data exchange and a consistent basis for the products that will flow from the data. There is an urgent need to convince people of the benefits of standards in processing and to demonstrate them.

In terms of the discussion it also, like the Australian meeting could be looked at as being in two areas. The first is pre-Level 1B where the issues involve data interchange and compatibility between stations and between stations and users. This includes inter-operability between the different sets of meta-data, web-based acquisition tools and quicklook products. The second is post-Level 1B where issues of validation and product consistency become most important as well as the access to the US products software.

There is great interest from Singapore to be involved in discussions involving both the pre- and post- Level 1B areas of concern. This would be of great benefit and, as they are IMAPP users the workshop at the end of November may be an ideal opportunity. The workshop also decided to develop discussions between the major stations in Australia, Singapore, China and Japan to exchange data sets that seek to establish the consistency and exchangeability of data to Level 1B. This may include the current capacity to seamlessly combine data in the overlap regions between the stations.

Calibration and Validation

There was a lot of interest in the validation of the NASA products for the local situations in all of the countries represented. It is recognised that these provide the benchmark and, in many cases, the product best to use. However, a number of cases were presented where the NASA products did not match the measured values. One was LAI which seems to be too high in a number of places in the world. Shunlin Liang, who is on the MODIS team agreed that there is an urgent need for validation and re-calibration of the software.

In addition, the large amount of locally developed software and products means benchmarks will be needed if there is to be any consistency among products. It was pointed out that if the products are inconsistent and without validation for QA the end-users will lose interest in them. The area of fire mapping seems to be the one where the greatest growth on different software and approaches exists. Fires are being routinely mapped and monitored all through Asia now but in different ways from the various MODIS stations.

Robert Wolfe from NASA agreed the slow release of access to the higher level product software and the growth of various sources of the products in the US was the cause of problems. He has taken on board to discuss this with people in NASA and

help speed up the release of the products code. This was also an issue in the Australian Workshop and his offer will also be welcome to us.

Basically, the main question we all face is whether a NASA product is suitable to the local environment or not, whether it can be modified externally (eg by parameter settings) to suit it when that is not the case and where there is a need to either undertake major changes to the code or develop new methods and code for situations of particular interest in East and South Asia?

The need for validation of products fit neatly with the other discussions and presentations at the Workshop where a variety of ecological and environmental flux stations were described and provide a ready current network of potential calibration and validation sites for products.

Environmental Stations and Flux Networks

There was a series of reports from the established stations for ecological and hydrological watershed scale studies and on the utilisation of these for establishing flux towers and instrumentation for water, heat and carbon fluxes.

The number, scope, instrumentation and scale of the measurement programs described was very impressive and well beyond the capacity and funding that we can bring to bear on the issues in Australia. Sites were either water catchments of else boundary data were being taken to characterise the systems for atmosphere, vegetation, soil and groundwater. Not surprisingly, some of these stations could provide excellent bases for ground-truthing and validating MODIS products. MODIS can also provide the means to scale the data from the stations to regional values.

For example, the National Institute for Environmental Studies (NIES) which is a cooperative activity between Japan and China has established five well instrumented sites representing paddy fields (Taoyuan), irrigated dry fields (Yucheng), alpine meadow (Haibei), desert (Fukang) and forested land (Qianyanzhou). Their approach involves scaling from point to regional scale and includes MODIS processing.

These selections have both ecological and economic value and were selected as a result of a detailed study of China's main ecosystems. Extensive modelling is being undertaken at some of these stations (Yucheng has been a major international site for many years) and some have just been established.

A number of these sites (such as the NIES site in Tomakomai in Japan) have very high towers that are fully instrumented. All sites have modern flux measuring instruments. NIES and the CAS in Beijing are cooperating to receive and process the MODIS and other satellite data for the project.

The NIES activity overlaps and complements a network being developed called "ChinaFLUX" in which nine stations are undertaking open or closed path eddy correlation measurements in an operational way. Three of these are part of the NIES set of sites. The sites have towers with 7-level CO₂ profile systems and undertake plant photosynthesis and measurements of greenhouse gases from the soil. A forest

site in the Changbei Mountains has a 68.2 metre tower. China has also, unlike Australia, signed the Kyoto Protocol.

WE heard from Prof Joon Kim of Yonsei University in Korea of the extent and progress in KoFLUX, the Korean flux network. This is already an established part of the global FLUXNET and has two sites operating in Korea and two (Tibet and Thailand) international sites in operation. One Korean site is under construction and there are plans (as mentioned before) for a station at Sejong in Antarctica.

KoFLUX towers in Korea are 120 metres tall with 7-level flux measuring systems installed.

It seems that KoFLUX and ChinaFLUX form part of a developing AsiaFLUX network that itself coordinates into the global FLUXNET. Australia has two stations operating as part of the general FLUXNET (Tumut and Jabiru) and is identified separately as OzFLUX.

There are obviously many linkages that could be developed to this extensive and growing set of sites and environmental data. There was, however, not too much evidence of many outcomes to date apart from what are obviously useful data streams. There are opportunities for people interested in a wide range of ecosystems and climates to cooperate in the analysis of the data.

A special example for people interested in environmental gradients is the Fukang station in Xinjiang where a drop of 5000 metres occurs to provide environments from ice and snow to desert in quite a short distance. A wide range of instruments have been installed, are working and delivering data but the ecosystem study is only getting going. This area is served by the Urumqi MODIS station. Dr Yan Li welcomes collaboration to help make the most of the studies and the unique environment. It is contributing to the “Xinjiang, Tarim River Management Information System”.

Conclusions

Both major aspects of the meeting, the networks of ground stations receiving satellite data and the networks of environmental sites at which flux measurements are being made provide great opportunities for future collaboration and benefits to all of the participants.

For the ground station X-Band network the opportunities exist to share data, avoid acquisition conflicts and extend the range of data acquisition over large areas of East and South Asia. The global significance is clear. The value of cooperation in this activity also rests in its links with the validation studies that the ecological sites can support.

I believe Australians should work with their counterparts in Singapore, China and Japan to establish the consistency of data and processing in the overlapping areas of coverage, seek to develop cooperation in acquisition in the overlapping and extended areas and combine to monitor regional and cross-border events such as volcanic ash, transborder smoke, dust storms and the Asia Brown Cloud. They should also extend

the discussions of the MODIS Meeting in Australia to a regional discussion since the concerns are the same and the value of overcoming them is more widespread than just to the largest continent.

For the flux stations, the value of cooperation for global CO₂ and other fluxes is obvious. The situation in Japan, Korea and China represents an intensity of measurement that we cannot hope to establish in Australia. Australia does, however, have a world-leading reputation in instrument development, use and data analysis and modelling.

A set of possible opportunities for the discussions has been established and will be discussed with the relevant groups. The value of close cooperation with Singapore in the common region of interest is very high and can proceed as quickly as both groups wish.

DLBJ, September 2002