FIJI USER GROUP

GIS AND REMOTE SENSING NEWS

Number 3; January 1994

DECEMBER NEWS

The last meeting was held Tuesday 7 December at FLIS headquarters, Gorrie Street, Suva.

- It was mentioned by FLIS that there will be a GIS course held again in Australia in 1994. The decision as to who will participate is open. In 1993, the criteria for selection of suitable candidates seemed to be unclear which was highlighted in the discussion during the meeting.
- Josua Wakolo, MSD, explained the meaning of scale in relation to maps and aerial photographs. The misinterpretation of this term has previously created misunderstandings in Fiji.
- Neil Pullar, the New Zealand specialist at FLIS went back to New Zealand in December.
- The AIDAB financed foresters in MSD gave a brief overview of their program, which was published in the last newsletter. One important part of their work will be the mapping at 1:10,000 scale. It was clarified during the discussion that this activity is not in conflict with the Lands Department. The production of basic maps for forestry is an additional activity which will be done only for selected areas with ongoing logging activities.
- Mike Poidevin (one of the Australian experts at MSD) explained that he is working on a program transforming geographical coordinates or any other grid system or projection used here into the Fiji Map Grid. This will be no "black box" program, it will be clearly documented and available for all other users in Fiji.
- FLIS planned to convert the information layers "river system" and "road network" from NLTB GIS to the agreed standard in Fiji which is the DXF file format. This' will be made available to other users. It was announced that this activity will be postponed to March 1994. The mataqali boundaries will be available at an even later stage.
- Franck Martin, SOPAC explained mapping of raster data in true colour while Mr T. Bainimarama from the Census office detailed their activities and in particular the assistance provided by FLIS.
- Wolf Forstreuter, MSD, outlined the need for data sharing among government departments to minimise the cost to end users. He stated that EOSAT has advised that satellite data held at MSD is owned by the Fiji Government which means that sharing is feasible.
- The next meeting will be at 2:30 pm on Tuesday 11 January at NLTB, Victoria Parade, Suva.@

Welcome to the thira monthly newsletter of the GIS and Remote Sensing User Group in Fiji and best wishes for the New Year. The dateline has been changed to reflect the actual month of publication and there was never a December 1993 newsletter. The first article in a series on an inventory of remote sensing satellites is provided by MSD and SOPAC as well as a report on a meeting of users requiring high resolution data is in the regular Urban Users column authored by PWD. Timely high resolution data may not be far away, as reported in the Satellite News section, and the days of high priced, low resolution, historical imagery may be a thing of the past within the next three years.

A detailed explanation on printing raster files at a precise scale is provided by SOPAC and MSD explains scale and resolution. The recent workshop on wave and wind climate data is reported by one of the lecturers from OCEANOR in Norway.

The final section includes the organisations on the mailing list as well as those who are in the Fiji user group. The address, telephone and fax number where you can request to be included in the mailing list for future copies and where you can submit articles is provided.@

SATELLITE NEWS

The loss Of Landsat 6 has spurred increasing interest in the supply of high resolution data by Private companies and consortiums which is ultimately targeted at PC based end users at an affordable price. The loss during launch in October 1993 of this 228 million US dollar satellite and concerns over the continuing reliability of Landsat 5 as well as the delay in the launch of Landsat 7 until 1997 and SPOT 4 and 5 until 1996 has left a demand for satellite data which may be filled by new entrants in the remote sensing market.

WorldView Imaging Corp, USA, will be launching the first of its 4-satellite constellation in mid 1995 and will provide grey scale imaging at 3 metre panchromatic and multi-spectral resolution at 15 metre resolution. The company states that its goal is to allow users to download data to their PC'S which is less than 2 hours old and anticipates superseding 3 metre resolution in 1996.

A strategic alliance has been formed by Orbital Sciences Co., Litton's Itek Optical Systems Division and GDE Systems, which are all US companies, to produce imagery of 1 metre resolution from their satellite system named "Eyeglass". This system should be operational by 1996.

If licenses are approved and if no technical problems are encountered then GIS users could have ready access to world-wide 1 metre class imagery by 1996 where precise stereo imaging data will enable the creation of geodeticaly correct 1:25,000 scale maps while the planned revisit time of 1.5 days would allow for timely and accurate news coverage and environment change detection.@

WORKSHOP ON THE
USE OF WAVE AND WIND CLIMATE DATA IN THE SOUTH PACIFIC

This workshop was held during 6-10 December 1993, with participants from the Cook Islands, Fiji, Tonga, Western Samoa, Vanuatu and Tuvalu, to mark an important milestone in a project to collect wave climate data in the Southwest Pacific. The project is co-ordinated by SOPAC and with funding from the Norwegian aid and development organisation, NORAD. The workshop was led by Professor Johannes Falnes, an expert on ocean wave power, from the University of Trondheim, Norway and Dr Stephen Barstow, an ocean wave climatologist, from the Oceanographic Company of Norway (OCEANOR).

SOPAC's wave measurement programme started almost 10 years ago with the initiation of visual wave observations (a primitive form of remote sensing) at Funafuti in Tuvalu. At that time it was not foreseen the large role that satellite observations of ocean waves would play in describing the wave climate of the region just a decade later.

The US Navy's GEOSAT satellite was launched in March 1985. For the first 19 months the satellite orbit had a 72 day ground track repeat giving a dense coverage of the oceans for geodetic purposes. These data have recently been partly declassified and include data on wave height, wind speed and dynamic surface height. At the end of the GEODETIC mission the satellite was manoeuvred into its final 17 day Exact Repeat Mission. It is these data which have been used in the wave climatology study. The data cover the world's oceans up to 72" latitude from November 1986 to September 1989.

OCEANOR in Norway have been working with these data for several years in wave climate studies around the globe and various reports are available describing the validation and calibration, quality control and presentation of the data. OCEANOR are currently working on a global wave and wind atlas which will run on a PC and use GIS data presentations.

The wave sensor is an altimeter with a 13.5 GHz near-nadir pointing radar which measures the range to the sea surface. The characteristics of the return signal are modified according to the wave and wind conditions over the illuminated area, and from analysis of the return signal, significant wave height can be determined to better than 10%.

Wave and wind data can be presented in various ways. Contour plots can be prepared showing the variations of average significant wave height across the region for various specified time intervals. It was shown that the highest wave conditions occur around the southern Cooks, south of Fiji, Tonga and Samoa. The influence of island sheltering on ocean waves can also be observed around the Fiji group, on the leeward side of the Vanuatu group and to the west of Western Kiribati.

One can also present average wave heights along the exact repeat tracks where it can be shown that significantly lower wave conditions

URBAN USER'S SECTION

SUVA AUTHORITIES MEET

On 29 November at the FLIS offices in Suva, an informal meeting was held for the major authorities to discuss common goals and directions for future use of computers.

Representatives were present of the following: Suva City Council, Fiji Post and Telecommunication Limited, Public Works Department - Roads and Hydraulics, FLIS including Lands, Fiji Electricity Authority and Housing Authority. There were 15 people in attendance.

The meeting was very general with the intention of making all involved aware of common problems and the future development of computer use that each organisation is planning for.

The major factor to emerge was how advanced the Housing Authority are in sections of computer use. Now that they have developed their own programs, they are in a position to be competitive with private consultants to deliver a wide a variety of services to the other organisations.

Broad Topics

The meeting was conducted under the following topics:

1. Broad Outline of each Authority's Use of Computer Drawings,
2. Information Available from FLIS,
3. General Discussion on Capture of Level Information:
   i. process to capture,
   ii. sharing of captured information,
   iii. using FLIS as the holder of information.
4. Storage of Old Drawings,
5. Future Meetings.

Conclusions/Actions

1. An agreed intention to continue dialogue on a regular basis, with the suggestion of every second month.
2. An understanding that the immediate answer to the problem of storage of old drawings is the use of microfiche and that the price of 6Oc per drawing from Melbourne was competitive but the freight costs and risk of loss was too high. The action required is to seek out prices for photographing Al and A0 drawings in Fiji.
3. The issue that was discussed the longest was the need for digital information of existing services. The action that was suggested was that all authorities mark on a FLIS 1 :l,OOO map their assets. These drawings can be given to a any interested surveyors to quote for detailed surveys with a total station. The prices as submitted would be discussed by all authorities that saw a need for information. The intention is that a funding arrangement is worked out where several authorities make an annual allocation over a long interval, say ten years, and eventually all details can be called up on PCs or through a land information line.

For further information contact Phil Wright, PWD, Phone 315244, Fax 303023.

occur in the relatively sheltered Lau group and on the northern shores of Fiji which are sheltered from the easterly trades and southerly swells.

Much valuable cyclone wave data has also been obtained and analysed. In particular, significant wave heights exceeding 10m were registered close to Rarotonga in the Cook Islands during the passage of cyclone Sally in December 1986.

It is hoped that funding will be available in 1994 to enable SOPAC to continue this work, extending the data base to include data from the ERS-1 and Topex-Poseidon missions.

More information from SOPAC or Sbarstow @ OCEANOR.NO.

PRINTING A RASTER FILE WITH A PRECISE SCALE

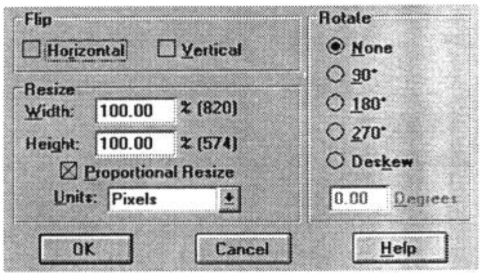
GIS, as its name indicates, deals with geo-referenced data. Ultimately, the data would finish up on a printed map. The problem is simple in the case of vector data. The software MapInfo, ArcInfo, AutoCAD handle linear geographical objects, each one defined by latitude and longitude or Eastings and Northings. The transformation to put the drawing into an accurate scale is more or less simple stretching.

It is a different situation for raster data which consist in a grid of values, usually without any internal explicit geo-reference. As a result, printing with precise reference is difficult. The solution that we present here is neither straightforward nor simple, but the one most likely to work. It uses the same philosophy that underlies the choices of hardware and software at SOPAC, i.e., it is impossible to find a tool that does everything, therefore the best solution consists of choosing a series of tools so that each one can communicate with the other through a standardised format. In the case of raster data, it can be either PostScript, TIFF, Bitmap, . . . The one that proved to be the most reliable is TIFF. It also has the added advantage of being able to be compressed.

Example: We start with an image that is the result of a classification under ERDAS. The data are exported as a .TIF file to be printed. This file is then read under Core1 PHOTO PAINT. The Core1 family is composed of a drawing software, CorelDRAW and a painting module, PHOTO PAINT. The difference between them is that CorelDRAW is the equivalent of a vector module whereas PHOTO PAINT is a raster module. Both share the capability to open .TIF files, but in our case, the paint module only will handle accurate printing of the final document, and therefore the scale.

In our case the file is 820*574 pixel, each, 25*25 meters. We can verify the size of the file in PHOTO PAINT.

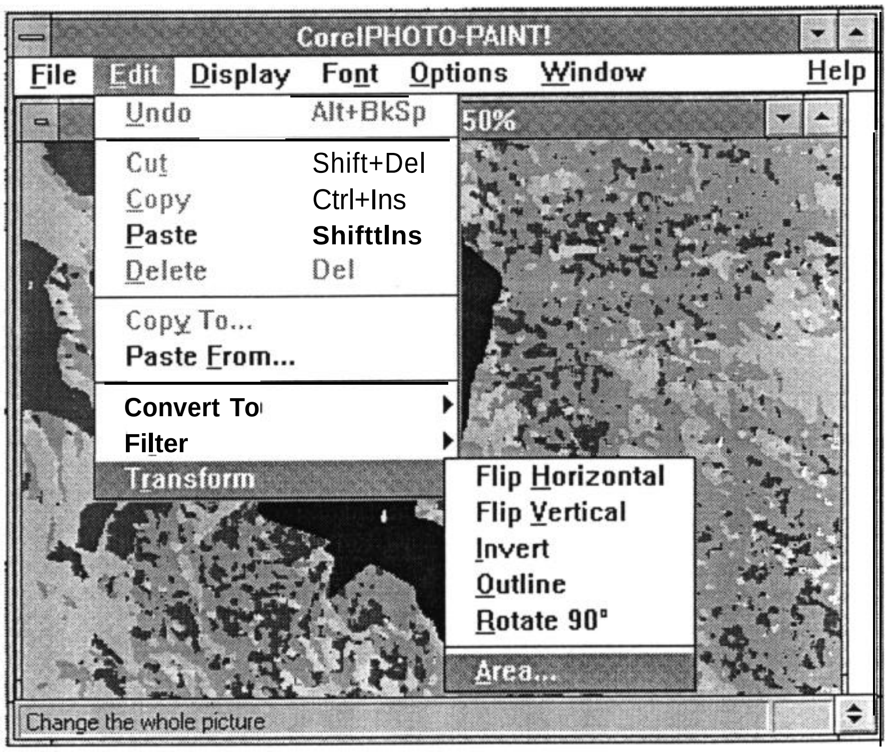
The result is :



As the selected printer has a resolution of 300 DPI, the size of the document will be (see table at the bottom of the page).

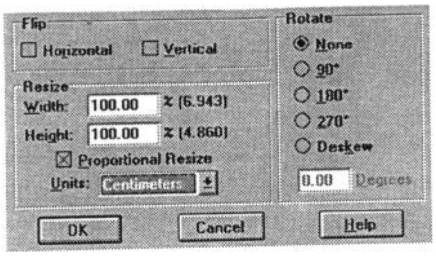
We can verify this by changing the **Units** in COREL PHOTO PAINT (see first menu on page 4).

We want to print this image at a scale l/50,000 which is equivalent to a size of 28.7*41 cm.



Size	v1 image	v2 printout	v3 printout	V4 Ground	v5 final map
Unit	PIXEL	inches	cm	meters	mm
Operation		VI/300	V2*2.54	V1*25	V4/50 000
Width	820	2.73	6.93	20500	410
Height	574*25	1.91	4.85*25	14350/50 000	287

There are two ways to print this image at the exact scale: one is to transform the image itself so that it has the exact size and the second is to blow up during

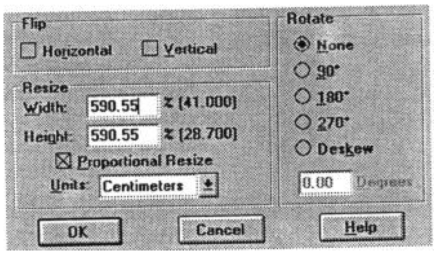


printing. The two operations give similar results but are not equivalent.

Resizing the Image

To transform the image, we use the Resize function in the above window. The advantage of this method is that it can handle one hundredth of a percent, and can be very precise (10^{-4}) as we will show later. Resizing creates a new file with the appropriate number of pixel.

The disadvantage is that the file created is huge. In the above example, the size of the new file would be 4843*3390. The size of such a file would be 32202 KB, and it would take time to generate it. The print file generated, for instance a POSTCRIPT one, would have about the same size. Therefore there should be about 100 MB of disk space available to carry out such an operation.



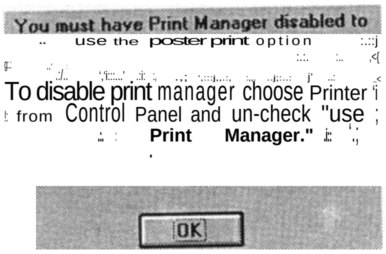
Blowing up at Printing

This option is offered by COREL PAINT,under the Print menu.

The advantage of this method is that it does not generate a new file, therefore it is fas and does not require a large amount of available disk space. The main disadvantage is that the limit of accuracy is one percent. Most of the time this is acceptable, as it is within the variations of the paper.

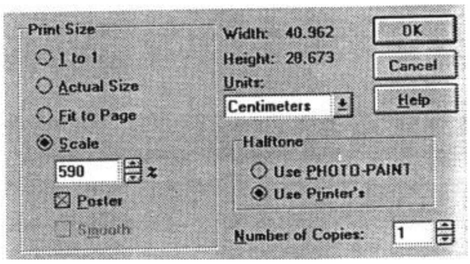
We have to be careful because all printers do not have the same border size. On the HP Paintjet, the minimum size is 5 mm. It can be different for other printers. COREL PHOTO PAINT will not print if the size of the document is larger than that of the paper, so adjustments have to be made before printing.

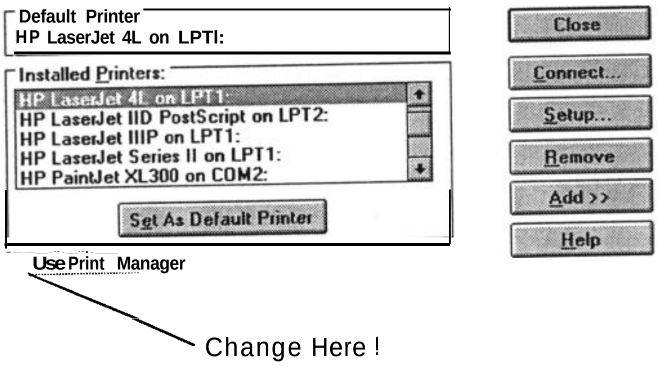
If the size is not sufficient, there is a way to overcome that, it is by printing as a poster. This is an option under COREL PHOTO PAINT. In this case, Print Manager has to be disconnected.

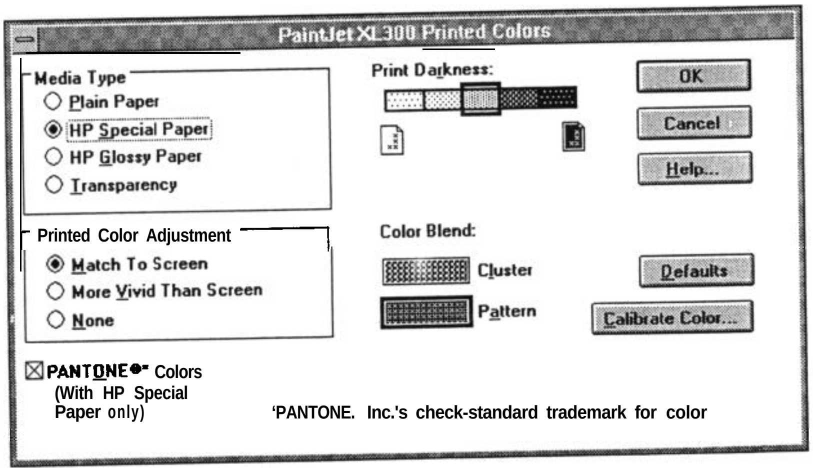


Special Note about Color Prints

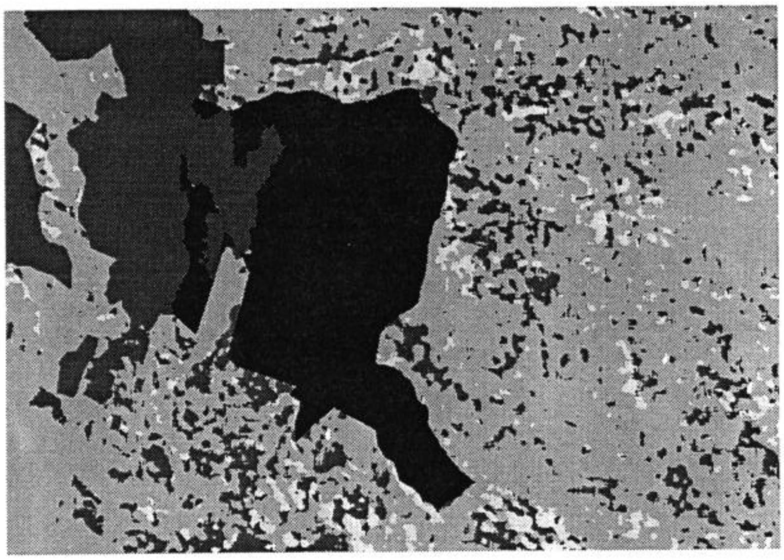
The HP Paintjet XL300 need to be set up for each print. When photo-paint loads the image, it changes the color palette, and you need to set up this color palette for the printer. The way to do that is to go to Printer Setup and select the Colors ... option, then you select the attribute Pantone (which provides the best results in colors in the professional world) and you calibrate colors by using the Use Standard Screen option. When you print you don't select the PHOTO PAINT halftone option but rather the Printer halftone option because PHOTO PAINT doesn't drive the printer too well. Don't forget that this will need to be done every-time PHOTO PAINT changes the color palette which is everytime it loads an image.







There is one example hereafter of the same file at 1/200,000, in black and white. As the work was prepared for a color printer, the results in terms of scale accuracy was not as good as was expected. For this particular report, we could not print accurately, because the whole exercise was carried out for A3 color. Nevertheless the differences between the two methods are only a few percent, which is within the general accuracy of printing and paper stretching.@



SPACE BORNE REMOTE SENSING DATA OVERVIEW ON SENSORS AND DATA

W. Forstreuter[1], L. Allinson[2]

1. Introduction

There are manv satellites and sensors in orbit, but most users are only aware of data from SPOT and Landsat satellites. This article should give a preliminary overview on data available now or in the near future. In addition, the difference between the data types will be detailed where the source of can be opto electronic (scanner), radar or opto chemical (photographic).

2. Scanner Data

Scanner data is digital data remotely sensed **by** a variety of opto electronic instruments which record the reflection of light or active thermal radiation.

2.1. ***Landsat*** Data

At the moment there is only one working Landsat satellite after Landsat 4 reached **its** lifetime and Landsat 6 was lost during launch. The user can order, in advance from EOSAT[4], scenes[5] for a specific area. The control station in the USA will then program the satellite to take images whenever the satellite passes over this-area. This service is free of charge. but the customer then has **to** buy data if-the satellite receives usable data.

The Landsat 5 satellite is in a sun-synchronous orbit at an approx. height of 705 km. It passes over every point on earth at 9:45 local **sun time and repeats the same cycle every 16 days.**

The user has several possibilities for ordering Landsat data:

1. directly from EOSAT in the USA
2. directly from a ground station which **covers the** area of interest with its antenna
3. from any local official EOSAT data distributor

The term "Landsat data" is used for two different scanner data, because Landsat 5 **has two systems on** board:

1. a Multi Spectral Scanner (MSS)
2. a Thematic Mapper (TM)

Both scanners provide data of different spectral and soatial resolution from the same area of earth surface (175 x 185 km).

2.1.1. MSS ***data***

MSS data **covers fours different spectral bands:**

Band 4: 0.5 µm to 0.6 µm (green)
Band 5: 0.6 µm to 0.7 µm (orange-red)
Band 6: 0.7 µm to 0.6 µm (near-infrared)
Band 7: 0.8 µm to 1.1 µm (near-infrared)

This spectral resolution is better than that given by **SPOT data or infrared film material.** The pixel size of digital scanner data defines the soatial resolution. If an object is covered by four pixels and has sufficient contrast to its surroundino pixels. it is visible in the data **set.** The pixel size of MSS data is 56 x 79 m on the ground. Areas of five ha can be mapped confidently.

2.1.2. ***TM Data***

TM data covers seven different spectral bands:

Band 1: 0.45 µm to 0.52 µm **(blue)**
Band 2: 0.52 µm to 0.60 µm (green)
Band 3: 0.63 µm to 0.69 µm (red)
Band 4: 0.76 µm to 0.90 µm (near-infrared)
Band 5: 1.55µm to 1.75µm (mid-infrared)
Band 6: 10.40 µm to 12.50 µm (thermal Infrared)
Band 7: 2.08 µm to 2.35 µm (mid-infrared)

For land use and forest mapping, TM data has the best radiometric resolution of all satellite scanner data. The thermal band (6) is not often used while the mid-infrared channels are very important as they provide useful information by registering plant water content. The high radiometric resolution has another advantage. Often there is already a haze over tropical rain forests in the morning which is the time of over flight. In many cases bands 4,5 and 7 can still orovide a usable image, whereas the shorter wave lengths of the visible bands (1. 2 and 3) can be worthless. The spatial 'or ground resolution of TM data is 30 x 30 m which enables clear mapping of areas as small as 1 ha.

Products available:

a) photo products as dia positive or photo print in different scales (l:lOO,OOO to 1:1,000,000) for full scenes as well as for sub-scenes (MSS only full scenes)
b) digital TM data path oriented as full-scene, sub-scene or if geocoded also map sheet wise
c) digital **MSS** data as full scene path oriented.

"Geocoded" data is already georeferenced to maps delivered by the customer. A "sub-scene" contains a area somewhere within the path of 100 x 100 km.

2.2. ***SPOT Data***

The term "SPOT" means Systeme Pour l'Observation de la Terre. **The repeat coverage of one satellite is 26** days. **However. there are two identical SPOT satellites, both of which have off-nadir viewing capability. This means they can move the optic to scan the area on either side of their track. Such a special acquisition is expensive, but.**

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1 GOPA consultant, **MSD, Forestry Department Fiji**

2 System Manager, SOPAC, Suva, Fiji

3"Landsat" = Land Use Satellite, Landsat satellite is the common but not correct ten

4 EOSAT = Earth Observation Satellite Company, the Landsat data selling Company 4300 Forbes Boulevard, Lanham, Maryland 20706 U.S.A, Fax: CO1-301-5520507

5A "scene" is the data set covering an area of 175 x 185 km **(SPOT 60 x 60 km) on the ground. A scene is defined by path and row.**

6 The sequence starts with 4 because the numbers 1,2,3, designated the video bands. New MSS data sets are numbered starting by 1.

theoretically, makes it possible to get nearly daily coverage.

The off-nadir viewing also allows the system to produce stereo images, but these are of very limited land use application.

There are two satellites in orbit, SPOT 2 and SPOT 3 which both have two identical sensors on board. Both of them can operate in either of two modes:

1. 10 m ground resolution, panchromatic (black and white) 0.51 -0.73µm, usable for mapping of roads.
2. 20 m ground resolution, multispectral:

0.50 - 0.59 µm (green)
0.61 - 0.68 µm (red)
0.79 - 0.89 µm (near-infrared)

There are no relay satellites transferring SPOT data to the control centre in Toulouse (France). However, the SPOT satellites are eauiooed with tape-recorders which can store data until they pass the control centre, at which ooint thev transmit the data to the ground: One SPOT scene covers approx. 60 x 60 km[7], so the satellite has to pass over more frequently than Landsat in order to receive a whole inventory area.

Products available:

a) SPOT photo products as black and white or in colour in different scales (1:400,000 to 1:50,000) (it can also be ordered in form of a dia positive or paper print for full or quarter scenes),
b) digital multispectral or pan-chromatic data sets.

SPOT quarter or movable scenes are not available, but geocoded scenes, stereo scenes, digital terrain models derived from stereo scenes are. For the above mentioned special acquisition, the customer has to pay a basic fee of approx. 80 % of a scene and receiving mode, and must buy the image if SPOT receives it with less than 10 % cloud-cover. SPOT is then obligated to try (maximum 10 times) to receive the area[8], but, the customer has to pay again another approx. 10 % for every try, whatever the result.

2.3. NOAA

Several satellites in the NOAA[9] series also provide digital scanner data for land use application. The orbit is similar to the Landsat, but the main difference is that NOAA satellites provide daily coverage. This frequent coverage rate, and the large area covered (2,400 km swath), is possible because the ground resolution, at 1 .1km[10], is much lower than the scanner on board Landsat and SPOT. There are many forest applications for this data involving large area mapping. The Advanced Very High Resolution Radiometer (AVHRR) on board NOAA receives data in five different channels:

0.58 µm - 0.68 µm (orange - red)
0.72 µm - 1 .10 µm (near-infrared)
3.55 µm - 3.93 µm (thermal infrared)
10.30 µm - 11.30 µm (thermal infrared)"
11.5Oµm - 12.50 µm (thermal infrared)

The first two bands are of special interest for land use mapping. They allow mapping of vegetation change that has taken place over large areas. The thermal channel can be used for forest fire detection.

2.4. *Other* **Satellite** *Scanner* **Data**

There are two *Indian Remote Sensing Satellites* presently in orbit, IRS-l A and IRS-1 B which give together an 11 day repetition. Each of them has two on board sensors named LISS-I and LISS-II. LISS stands for Linear Imaging Self-scanning System. LISS-I has a spatial resolution of 73 m while that of LISS-II is 36.5 m. The spectral bands covered are:

Band 1 0.45 to 0.52 µm (blue)
Band 2 0.52 to 0.59 µm (green)
Band 3 0.62 to 0.68 µm (red)
Band 4 0.77 to 0.86 µm (near infrared)

EOSAT, the Landsat data distributing agency signed an aareement with India to receive data with their ground antennas. However, there is no antenna covering the South Pacific Island countries. At present it is impossible to receive data from IRS-1 or IRS-2 via relav satellite.

Historical data is available from the *Modular Optoelectronic Multispectral* Scanner(MOMS) which used to provide data in two spectral bands and a ground resolution of 20 m. MOMS will become imoortant aqain when this sensor is installed in the Russian space station MIR in 1994. Then, this digital scanner data will be available for Pacific Island Countries.

Japan operates satellites called MOS-1 and MOS-1 b which record 50 m resolution and cover the following spectral bands

Band 1 0.51 to 0.59 µm (green)
Band 2 0.61 to 0.69 µm (red)
Band 3 0.72 to 0.80 µm (near infrared)
Band 4 0.80 to 1.10 µm (near infrared)

The area covered is 100 km and the satellites can download data to 10 ground antennas world wide.

The Japanese satellite JERS-1 is equipped with a visible and infrared radiometer on board. Further details will be provided in the next newsletter.

3. **Radar Images**

Radar instruments for application in land use, actively transmit a beam to the object and analyse the echo. Most of the radar frequencies used penetrate clouds and are not affected by the weather. Although this characteristic is very important for surveys in the tropics, the use of Radar has been very limited until now.

The term "Radar" is an abbreviation of RAdio Detection And Ranging. All radar systems send microwaves to an object. From the strength and sometimes polarisation of the echo, the properties of the object can be deduced. The distance the system determines to the object, from the return time of the echo.

The elements of image interpretation, such as colour (tone) or shape, lose importance. It is dangerous to use traditional image interpretation for radar images which look similar to photographic or scanner images.

The *European Remote Sensing Satellite* ERS-1 is equipped with Active Microwave Instrumentation (AMI) which records radar data with a 30 m ground resolution. AMI works in the C-Band with 5.3 GHz. The instrument is a Synthetic Aperture Radar which can produce images. The ERS-1 flies in a polar, sun-synchronous orbit with 98.5° inclination and a-repetition rate of 35 days, at a height of 785 km.

For the time being the data can only be received by ground antennas, receiving via relay satellite is not possible, at the moment.

The Japanese satellite JERS-1 is also equipped with Synthetic Aperture Radar which records data with 18 m ground resolution in the L-Band (1275 GHz).

4. Aerial Photographs from Space

Aerial photographs from space are taken by a variety of cameras which use opto chemical medium (film). The wavelength recorded cannot be more than 0.9 µm and all film at present is returned to earth for development.

4.1. *KOSMOS-Satellites*

Up to date photographs from space are available from the KOSMOS-Satellites. They normally have two camera types on board, KFA-1000 and KATE-200. After taking the photographs the camera and film is send down to Russia by parachutes and the satellite disappears in the space.

1. KFA-1000
   focal length: 1000 mm
   ground resolution: ca. 5 to 10 m
   coverage: 80 x 80 km
   mean scale: 1:270,000[12]
   film types:
   a) spectrozonal film 0.56 to 0.68 µm and 0.68 to 0.81 µm
   b) panchromatic film 0.50 to 0.70 µm

2. KATE-200
   focal length: 200 mm
   ground resolution: 10 - 30 m
   coverage: 180 x 180 km
   mean scale: 1 :1,000,000
   spectral bands covered:
   0.5 to 0.6 pm, 0.6 to 0.7 µm and 0.7 to 0.9 µm

4.2. *Space Station MIR*

Beside the KOMOS satellites Russia has cameras in space on board of the space station MIR. These are operated and marked by the NPO Energia with its headquarters in Kaliningrad. MIR has repetition rate of two days, an altitude of approx. 400 km. The overflight is about 45 minutes earlier every two days, so that a certain area is overflown every two months at the same time of day. In order to take photographs the station has to be turned upside down which can be done for the time necessary for three orbits.

There are several different cameras on board:

1. KPA 350
   focal length: 350 mm

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[7] Depending on the angle of view, the off-nadir scenes cover more area on the ground.

[8] This is the special acquisition request "red", there is also the cheaper special acquisition request "blue". Ask SPOT for more details. SPOT IMAGE, Toulouse, France, Fax: (33) 62194011

[9] NOAA = National Oceanic and Atmospheric Administration

[10] 1 1 km measured at nadir, there are data recorded in full resolution and there are sampled data with 4 km resolution available.

[11] The last two bands covered by the AVHRR on board NOAA6,8, and 9 are slightly different

[12] Ground coverage and scale vary, depending on the flying height, see also KFA-1000 mounted in space station MIR

[13] forward motion compensation: camera is moving against flight direction during shutter open time.

[14] multispectral cameras or multi band cameras are camera systems which record a number of images by several cameras from the same object on black and white film at the same time. Each image covers a different spectral band through use of different spectral filters.

ground resolution: ca. 40 m
coverage: 200 x 200 km

2. KFA-1000
   focal length: 1000 mm
   mean image scale: 1:400.000
   ground resolution: ca. 7.5 m
   coverage: 120 x 120 km
   film: SN 10 Spectrozonal
   0.56 to 0.68 µm and 0.66 to 0.81 µm
   forward motion compensation[13]
   film capacity: 1500 images
   60 % stereo coverage in flight direction

3. MKF-6
   multispectral camera[14] from ZEISS Jena
   focal length: 125 mm
   ground resolution: 25 m
   coverage: 175 x 260 km
   forward motion compensation
   spectral bands:
   0.46 to 0.50 µn, 0.52 to 0.56 µm
   0.58 to 0.62 µm, 0.64 to 0.68 µm
   0.70 to 0.74 µm 0.79 to 0.89 0181m

The spectrozonal film (colour infrared) is transported by SOJUS-TM or PROGRESS spacecrafts into the space station MIR and after three months the film is returned to ground by the same spacecrafts.

4.3. ***Historical Photographs***

Historical photographs from space are available from the ***Large Format Camera*** and the Metric ***Camera*** which were mounted in the space shuttle in 1984. Neither camera system recorded images from the South Pacific.

Summary

This should provide the first overview of space borne remote sensing data. There is a rapid change in this technology and investigations are being to find new data sources and this will be the subject of subsequent articles in this newsletter. This article has not covered the cost of data and this also will be covered in future newsletters.

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"Landsat Data User Handbook"

"SPOT User's Handbook%

SCALE OF MAPS AND AERIAL PHOTOGRAPHS

Josua Wakolo, MSD

Introduction

There is still some misunder-standing about the meaning of the term scale of a map or scale of an aerial photograph which should be clarified briefly.

Scale is the ratio of a distance on a map or aerial photograph to the corresponding horizontal distance on the ground. But the scale defines also the accuracy of a map and the information content of an aerial photograph, at the same time.

Scale of a Map

The scale of a topographic map defines also the size of the symbols used and the generalisation of areas. If e.g. a l:lO,000 map was produced by 5 times enlargement of a 1:50,000 map the symbols are enlarged as well. The outline of areas show a generalisation not adequate for l:lO,000 scale.

However, a map is not only the physical printed paper which is used in the field, it also describes the digital information layer of a GIS. Within a ***raster data*** based GIS the scale defines the pixel size e.g. for 1:50,000 map scale the Forestry Department uses 25 x 25 m pixel which is ¼ on the map. If the map is enlarged, the pixel size will be the same and the information content will not be enlarged! Within a ***vector data*** based GIS, the scale defines the number of necessary points of a polygon. For the same area there are less points required in 1:50,000 than in l:lO,OOO. An enlargement will distort the shape.

Scale **of an Aerial Photograph**

The scale of an aerial photograph is the mean scale of the photograph. Within one aerial image the scale is different because of the central projection, see Figure 1.

The mean scale of an aerial photograph is the

$$\frac{\text{flvine height above ground}}{\text{focal length}}$$

of original negative film used.

However, the scale also defines the visibility of objects. e.g. at 1:25,000 scale it is possible to distinguish between plantation and natural forest whereas at 1:50,000 scale it is practically impossible. It is impossible to increase the visibility of objects by photographic enlargement of the film. The scale is the scale of the original film.

Conclusion

It is impossible to increase the scale of a map or aerial photograph by simple enlargement. You only increase the size of the objects but not the information content and the accuracy.

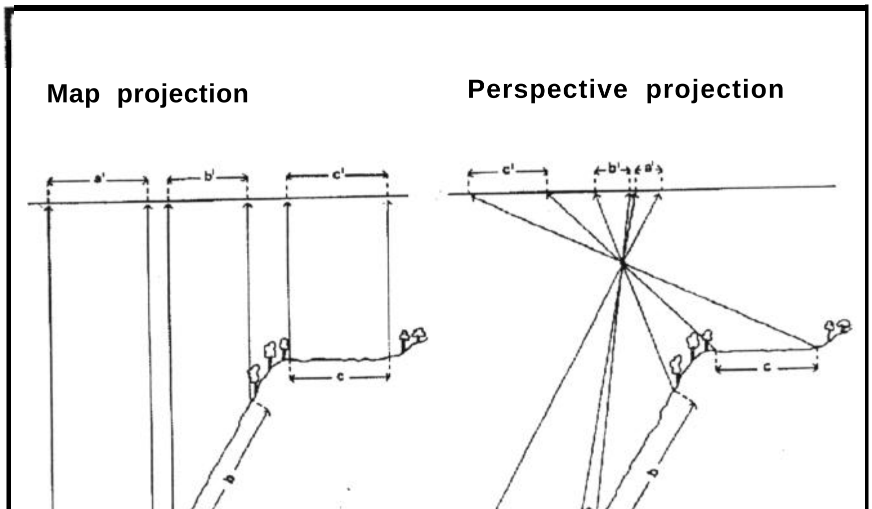

Figure 1. Within an aerial photograph (perspective projection) the size of an area ***depends on the altitude. The area on top of the mountain is recorded bigger than the same area in the valley.***

CONTACTS

Listed below are the organisations in Fiji who receive this newsletter.

ORGANISATION/FAX

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It would be appreciated if contributions could be sent on floppy disk in Word for Windows (preferred), WordPerfect for Windows or Wordperfect for DOS format.@

ACRONYMS

Acronyms, love them or hate them, are here to stay and we will attempt to expand every one used in this and previous newsletters.

AIDAB	Australian International Development Assistance Bureau
CSIRO	Commonwealth Scientific and Industrial Research Organisation
ESCAP	Economic and Social Commission for Asia and the Pacific
FA0	Food and Agriculture Organisation
FLIS	Fiji Land Information System
FSM	Federated States of Micronesia
GIS	Geographic Information System
GOPA	Gesellschaft fuer Organisation Planung und Ausbildung (Agency for Organisation Planningand Education)
GPS	Global Positioning System
MAFF	Ministry of Agriculture Forests and Fisheries
MIF	Maplnfo Interchange Format
MRD	Mineral Resources Department
MSD	Management Services Division
NLTB	Native Land Trust Board
ORSTOM	Institut Francais de Recherche Scientifique pour le Developpement en Co-operation
PWD	Public Works Department
SOPAC	South Pacific Applied Geoscience Commission
SPC	South Pacific Commission
SPOT	Satellite pour l'observation de la Terre
SPREP	South Pacific Regional Environment Programme
TM	Thematic Mapping
UNDP	United Nations Development Program
USP	University of the South Pacific