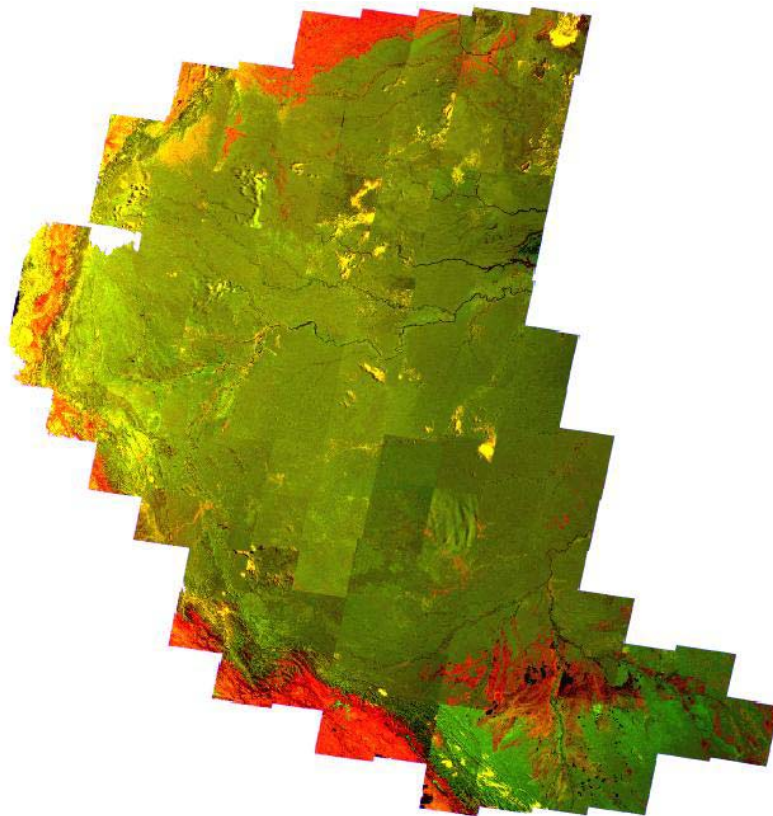


# **WESTERN AMAZONIAN GIS: Creation process of Landsat TM image mosaic and Internet map service**



Tuuli Toivonen, Risto Kalliola & Albert Driesprong



University of Turku



Amazon Research Team

UTU-LCC Publications  
University of Turku – Laboratory of Computer Cartography

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# **Western Amazonian GIS**

## **Creation process of Landsat TM image mosaic**

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Amazon Research Team  
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## Table of contents

Table of contents	3
Tiivistelmä	4
Summary	5
1. Introduction	6
2. Work strategy	7
3. Acquisition of Landsat data	8
4. Import and pre-check	10
5. CD filing system and access database	11
6. Image preprocessing	14
Georeferencing and rectification	14
Sources of ground coordinates	15
Rectification	15
Cleaning of the images	16
Quality of purchased images	17
Atmospheric effects	17
Removing the gradient	18
7. Mosaicking	19
Geographical re-adjustment of the entire mosaic	19
The final mosaic product	20
8. Building the Internet map service	22
Structure of the map service	22
Building the map service	22
Using the map service	24
9. Discussion	26
10. Acknowledgements	27
11. Cited and related literature	28
Appendix A) Metadata example	29
Appendix B) Database structure	45
Appendix C) Working instructions	30
Appendix D) Map of the WAGIS scenes	45

## Tiivistelmä

Vuosina 1999-2002 Turun yliopiston Amazon tutkimusryhmässä toteutettiin Internet-pohjainen Länsi-Amazonian paikkatietojärjestelmä, Western Amazonian GIS (WAGIS). Järjestelmän perustana on koko tutkimusalueen kattava satelliittikuvamosaiikki ja lisäksi on toivottavasti kasvava määrä erilaista paikkatietoaineistoa.

Amazonin alue on yksi maailman heikoimmin tunnetuista maa-alueista ekosysteemiensä sekä niiden kehittymisen ja dynamiikan osalta. Myös ihmisen prosesseja, kuten maankäytön suunnittelua ja kaavoitusta ajatellen tutkimustietoa ja kartografisia tuotteita on heikosti saatavilla. Kaukokartoitus, etenkin satelliittikuvat, tarjoavat kuitenkin nykyisin luotettavan aineistolähteen laajoista ja vaikeasti saavutettavista alueista.

WAGIS -mosaiikkia varten hankittiin kahdesta eri satelliittikuva-arkistosta n. 150 Landsat TM ja MSS kuvaa vuosilta 1984 - 1996. Näistä koottiin kuvamosaiikki, joka valmistuessaan sisälsi 126 kuvaa ja peitti n. 3.5 milj. km<sup>2</sup> sadan metrin pikselikoolla. Tavoitteena oli luoda mahdollisimman yhtenäinen satelliittikuvapinta Amazon ryhmän tutkijoiden – biologien, ekologisten, geologisten ja maantieteilijöiden – käyttöön. Kuvapinnan tuottaminen kuvien valinnasta ja tilaamisesta mosaiikkituotteen viimeistelyyn sisälsi useita erillisiä työvaiheita ja vaati lukuisia testauksia parhaan työtavan ja tuloksen saavuttamiseksi sekä monia keskusteluja tutkimusryhmän jäsenten kanssa.

Ensimmäinen työvaihe oli eri aineistolähteiden kartoitus. Varsinainen kuvien valinta ja tilaaminen perustui Eros Data Center –arkiston sekä Michigan State Universityn Tropical Rain Forest Research Institutun Internet-palveluihin. Kuvat tilattiin ns. quicklook kuvien ja pilvisyystietojen perusteella. Kuvat saapuivat postitse kevään ja kesän 2000 aikana nauhoilla tai CD-ROMeilla. Kuvat importointiin Erdas Imagine –formaattiin, niiden laatu varmistettiin ja kukin kuva talletettiin omalle CD:lleen ja sijoitettiin kuva-arkistoon. Tämän jälkeen kuvat oikaistiin maantieteelliseen pituus-leveysaste –koordinaatistoon käyttäen referenssipintana GTRF-projektin JERS-1 SAR tutkakuvamosaiikkia sekä tarkempia mosaiikkeja Iquitosin ympäristöstä ja Madre de Diosin alueelta.

Mosaikointiprosessi itsessään oli yksinkertainen, mutta eri vuosina ja vuodenaikoina otettujen kuvien arvojen sovittaminen yhteen vaati lukuisia testauksia ja kompromisseja. Pienten erojen havaitseminen tasaisesta metsäpinnasta vaati voimakkaita venytystä (stretching) -operaatioita, jotka korostivat ilmakehän aiheuttamia ja sensorien teknisiä häiriöitä. Lopputulos on tyydyttävä, vaikka kuvien rajat näkyvätkin vaihtelevasti mosaiikin eri osissa.

Kuvamosaiikki ja joukko muita GIS-aineistoja on käytettävissä WAGIS-käyttöliittymän kautta Internet-selaimella. ArcIMS-palvelimeen perustuva järjestelmä tarjoaa keskeisimmät paikkatiedon käsittelyssä tarvittavat toiminnot, kuten kartan näkymän muutokset, tasojen hallinnan, etsinnät, kyselyt ja tiedon haun. Projektin yhteydessä toteutettiin myös CD-arkisto ja tietokanta Landsat TM –kuvia ja Amazon-ryhmän muita aineistoja varten. Tietokannan tietoja voidaan selata ja päivittää Internet-käyttöliittymän kautta. Karttapalvelu ja CD-tietokanta ovat löytyvät Amazon-ryhmän Internet-sivuilta osoitteesta [www.utu.fi/ml/amazon](http://www.utu.fi/ml/amazon).

## Summary

At present the Amazonian area is poorly known and the amount of scientific information about the patterns, processes and history of the area is scanty. There is a clear lack of reliable cartographic products. The University of Turku Amazon Research Team (UTU-ART) has developed a Western Amazonian GIS (WAGIS) to overcome some of these problems and to facilitate the easy access of biologists, ecologists, geologists and geographers to relevant data over the area.

Earth observation and particularly space-borne remote sensing, has made it possible to acquire reliable data even from inaccessible and previously poorly known areas. Between the years 1999 and 2002 the WAGIS project of UTU-ART collected, harmonized and mosaicked a set of c. 120 Landsat TM images over the Western Amazonia. The mosaic and other data sets within the information system cover an area of 3.5 million km<sup>2</sup> extending to areas of Brazil, Bolivia, Colombia, Ecuador, Peru and Brazil. The Landsat mosaic, forms the basis of the system by providing a continuous map surface extending over the area. Landsat TM and MSS scenes from years between 1984 and 1996 were purchased from three large image archives: Eros Data Center, Michigan State University TRFIC and Maryland University archives.

After searching for several image archives, four separate image orders were made during spring 2000. After arrival of the imagery CDs and tapes, the different file formats were imported to Erdas Imagine format. Each scene was checked and put on CD archive. Images were rectified and georeferenced to the Longitude/Latitude coordinate system with WGS84 datum. A JERS-1 SAR mosaic created by the GRFM project was used as a source of coordinate information. The final mosaic was re-georeferenced using spatially more accurate mosaics from Iquitos and Madre de Dios areas. Later, some cloudy images were replaced.

The final mosaic was published in June 2001 and an improved version in August 2002. It provides a data set usable for both examinations of the patterns of the entire Western Amazonia and smaller more local patterns. The goal in creating a consistent image surface was achieved relatively well. In some areas image borders are difficult to detect, but in other areas, the differences between image scenes are striking. Nevertheless, the mosaic enables us to examine large natural patterns over the area and the experience gained in the mosaicking process can be used to later improve the final product.

To access the mosaic and additional data, an Internet map service was set up on the server of the Laboratory of Computer Cartography (UTU-LCC). This service has been developed using ArcIMS software and it is accessible through the Internet pages of the Amazon Research Team ([www.utu.fi/ml/amazon](http://www.utu.fi/ml/amazon)). Additionally, the CD storage of the Amazon Team can be browsed using an Access database, which is linked to the project pages as well.

## 1. Introduction

Satellite image archives are useful sources for research and monitoring efforts in extensive land areas. Sometimes, space-borne Earth Observation (EO) archive data is provided for users with low cost, making it possible for even small and medium budget projects to acquire several images. Consequently, the existing EO archives act as an unparalleled source of material for innovative approaches in basic and applied research.

Internet-based information systems enable the use of large GIS and remote sensing data sets with standard tools independently from geographical location. The novel software makes it relatively easy to produce an Internet map service through which users can access and analyze shared data sets. If built as open systems, they also provide the possibilities for distribution of spatial information among institutes thus bringing together the data fragments available from the interest area.

The University of Turku Amazon Research Team (UTU-ART) has taken the advantage of these possibilities and created a mosaic of Landsat TM images over the western Amazon and published it in the Internet. Including parts of Colombia, Ecuador, Peru, Bolivia and western Brazil, the mosaic covers 3.5 million km<sup>2</sup> in area and is expected to support scientific basic research carried out in the region by providing comprehensive data that extends over the country borders.

The image mosaicking work was completed during the years 1999-2002 using 126 Landsat TM images. The steps needed in the image processing and the methodologies to be used were compared in the beginning of the project, and the most suitable methodologies were then applied in the processing of the imagery. The present document summarizes these work phases from image orders to the creation of the Internet service for its presentation. Appendices present more technical information of image processing and mosaicking, CD filing, and modification of the Internet map service site.

The work team consisted of researchers and auxiliary assistants of the University of Turku Amazon Research Team (UTU-ART). Risto Kalliola has been the leader of the process and from June 2000 Tuuli Toivonen has been the main researcher. Amazon Team members Sanna Mäki, Hanna Tuomisto, Kalle Ruokolainen and Matti Räsänen have been most involved in the planning and evaluation of the product, where also comments and ideas of the other team members have been essential.

All image analyses were carried out using facilities of the University of Turku Laboratory of Computer Cartography (UTU-LCC). Johan Hendriks and Lizardo Fachin participated in the first image orders and imports. Albert Driesprong continued with the image ordering, importing and building of the archive system as well as writing this document. Riikka Koskinen and Johan Hendriks made most of the image rectifications.

In Peru, collaboration has been made with the *Instituto de Investigaciones de la Amazonia Peruana* (IIAP, Iquitos, Peru) within the framework of the project [BIODAMAZ](#) (Biological Diversity in Peruvian Amazonia Project). This project is a joint venture of the Finnish and Peruvian governments and it has produced a similar mosaic of Landsat TM images from the Peruvian Amazon (BIODAMAZ 2002).

The Peruvian mosaic has been published in the Internet and it forms part of the Peruvian Amazonian environmental and biodiversity information system, [SIAMAZONIA](#).

## 2. Work strategy

The satellite image mosaic was planned to support scientific research and form an integral part of an internet-based map service. Its creation has involved thorough planning of the specific demands and criteria for the final product, as defined by the scientific team:

- 1) The area of the mosaic should cover the lowland Amazonia (< 500 m a.s.l.) between 17°S and 7°N and longitudes from 59°W to 80°W.
- 2) The mosaic should be usable for regional examination of the Western Amazon. Images should be as clear from clouds as possible and scene borders should not interfere interpretation.
- 3) Cost for the images should be low; all images are purchased from international data archives.

After agreeing on the thematic and technical criteria for the desired image mosaic, the following tasks were identified within the process:

- Search and selection of images from available image sources and their purchase
- Creation of a system for naming of image files and their archiving
- Importing of the received images into standard file format and pre-checking them
- Geometric and radiometric corrections if needed
- Creation of and improvement of the image mosaic
- Putting up the Internet service for viewing the mosaic with other data sets.

Because of the large number of images to be used, the work phases needed to be well tested before the production phase. As several persons were involved in the process, special attention was paid to systematic working conventions and reporting. Figure 1 presents the phases of the project, which are described in detail in the following chapters.

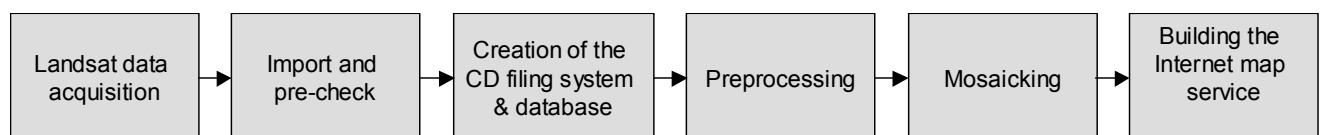


Figure 1. Phases of the project from acquisition of data to distributing it via Internet map service.



### 3. Acquisition of Landsat data

Records of several satellite image archives can be browsed in the Internet. These sources were searched systematically by using some well-known search engines (e.g. Yahoo, Google, Altavista) to look for the availability of original satellite images covering the Amazon region. Main data archives found to fulfill these criteria were Michigan State University's TRFIC, Nasa's EDC-DAAC and University of Maryland GLCF (Table 1).

Table 1. Properties of the Internet-based services, which were used to access satellite image archives of the western Amazon region.

	<b>EROS DATA CENTER</b>	<b>MICHIGAN STATE UNIVERSITY</b>	<b>UNIVERSITY OF MARYLAND</b>
Description	NASA data archives	Michigan State University, tropical rain forest research institute Landsat archives.	University of Maryland, Global Land Cover Facility.
Acronym	EDC-DAAC	TRFIC	UMD GLCF
Internet address	<a href="http://edcimswww.cr.usgs.gov/pub/imswelcome/plain.html">http://edcimswww.cr.usgs.gov/pub/imswelcome/plain.html</a>	<a href="http://www.bsrsi.msu.edu/trfic/">http://www.bsrsi.msu.edu/trfic/</a>	<a href="http://glcf.umiacs.umd.edu/">http://glcf.umiacs.umd.edu/</a>
Available imagery	Several image types, Landsat TM & MSS	Landsat TM	Landsat, Terra-Modis, NOAA Avhrr & several landcover products
Spatial coverage	Disassembled over the globe	Amazon basin, Kongo basin, South East Asia & U.S.A	North and South America, Africa
Temporal coverage	1984 -	-	-
Restrictions	Only images older than 10 years are available	No restrictions	No restrictions
Price	15 USD	25 USD	Free
Format	3 formats, NLAPS, MEDIPS, FAST	Erdas Imagine IMG	BSQ
Media	8mm high density tape	CD-ROM	Download in zip-files
Contact person	Michael Struck struck@edcmail.cr.usgs.gov	Jay Samek samekjay@pilot.msu.edu	

Browsing of the Internet sites of different data producers showed that obtaining satellite images is easiest by browsing the on-line catalogues on the Internet. In most cases these browsers provide both quicklooks and metadata of the available scenes. Appendix A presents an example of the metadata attached to each image. Orders can often be placed on-line. Prices of the images vary a lot and range from free to about US\$ 25,00 a piece, and up to a couple of thousands US\$ a piece.

The main objective of this assignment was to order an image set, with high quality and low cost, covering the western half of the Amazon region. In order to find the best images the catalogues of EDC-DAAC and the TRFIC were searched systematically, according to single path-row combinations. For each location the metadata provided in the website and the quicklooks of the available images were compared with each other. Selection was made based on the amount of cloud cover, and the presence of haze, smoke and possible missing values (present in some archive imagery). Furthermore, attention in the selection was paid to the distribution restrictions and processing levels.

Only systematically corrected images were considered useful, since they do not restrict the user in any way. After selecting the most appropriate scenes, an order proposal containing price information and metadata was made. Before making the final decisions, the order proposals were discussed with members of the Amazon Research Team. After the first set of purchased images had arrived, new orders were made to replace cloudy or otherwise poor quality images. The last orders from TRFIC and downloads from University of Maryland were made during spring 2002. Table 2 presents the images ordered from different archives.

Table 2. Image orders from the EDC-DAAC and TRFIC archives.

Place	Number of img	Order month	Arrival	Other
EDC-DAAC	36 TM & 7 MSS	March 2000	April 2000	Peruvian Amazon
TRFIC	12 TM	May 2000	June 2000	Replacement
TRFIC	38 TM	May 2000	June 2000	Other regions
EDC-DAAC	45 TM	May 2000	July 2000	Other regions & replacement
TRFIC	16TM	Dec 2001	Jan 2002	Replacement
UMD GLCF	c. 10	April 2002	April 2002	Replacement

The images that were selected for the mosaic were acquired during 13 years in between 1984 and 1997 (Figure 2). Due to the ordering restrictions of the EDC-DAAC archive, most of the images, 72 in total, were from the 1980's. Images ordered from TRFIC and downloaded from University of Maryland were newer. The long time span of the acquisition of the imagery caused variation in the sensor properties and in the landscape in the form of advancing human constructions and river movement. Additionally, phenological states of vegetation were sometimes somewhat different in adjacent images. Different acquisition months caused also differences in sun azimuths and sun elevation. Furthermore, the changes in vegetation and at places river channels caused discontinuities at image borders.

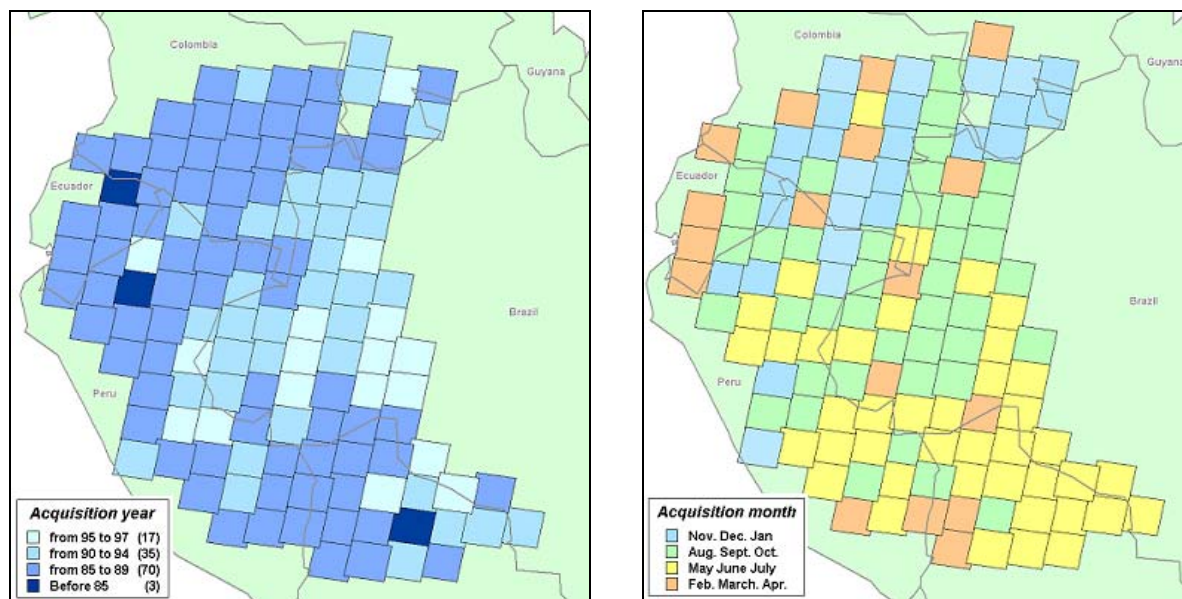


Figure 2. Acquisition year and month of the scenes in the mosaic. The maps give the general impression of the situation, but some of the scenes may later have been replaced with newer or better images.

## 4. Import and pre-check

Landsat satellite images were received in different formats and specific procedures were required for their import into a standard file format (Erdas Imagine):

- EDC-DAAC archives provided images on 8 mm high density tapes, in three different formats: EOSAT Fast Format, NLAPS and MEDIPS (MSS image format). The tapes were imported using Erdas Imagine in UNIX system. The time needed for importing an image varied between 1.5 and 2 hours, depending on the amount of bands, rows and columns the image contained. For each format the data import procedure was slightly different (see Appendix D and Erdas Imagine manuals for more information). In case the quality was intolerable the import process was carried out again, which in some cases resulted in a better image.
- Data obtained from the TRFIC-Archive was received on CDs in Erdas Imagine format and did not, therefore, require any special processing.
- University of Maryland GLCF images can be downloaded in zipped BSQ-format. The download is made band by band. Additionally, a metadata file is needed for information on number of rows and columns in each image. Download time was approximately 7 minutes per band. Files were unzipped and imported to Erdas Imagine.

After import each image was checked layer by layer. Image quality, namely cloudiness, striping, banding and missing values, was evaluated on the computer screen. This evaluation was used to define the usability of each obtained image. Each image was stored to a separate CD ROM together with related metadata. In order to keep track on the CDs and their metadata, a CD filing system and database for handling the image data was created. Finally a duplicate of each CD was made for sharing the data with the Peruvian Amazon Research Institute (IIAP).

## 5. CD filing system and access database

Each Landsat TM image obtained from the data producers or modified during the mosaic work was stored to individual CD ROM. Each CD was numbered with a running number and placed to UTU-ART archive folder in LCC. Each folder contains 50 CDs, which are all stored together with an information sheet, providing a quicklook and some basic metadata (for example of metadata, see Appendix A).

In order to maintain this archive and to create a possibility to search for specific data, a relational database was constructed with Microsoft Access. The structure of this database has been designed in such a way that many types of data can be included, varying from e.g. text files and multimedia to GIS and Remote Sensing Information. This is of specific importance since in future the UTU-ART archive is expected to contain a large variety of data sets. However, at this stage the core of the database consists of Remote Sensing data related to the purchased Landsat images. Thus, this part of the database is described in this document. A simplified table structure of the database is presented in Figure 3. The database consists of the following three main tables. Their structure is described in more detail in Appendix C, page 45.

- *FILES* table is used to store basic information about all records entered to the database regardless of their type. For example, the CD number, file name and file type.
- *LANDSAT\_ORIGINAL* table stores the basic information about all purchased images. For example sensor, path, row and acquisition date. This table is linked to the *FILES* table on a one-to-one basis.
- *PROCESSED\_IMAGES* table is used for any type of processed Remote Sensing images. This table stores details about the applied processing types and provides the CD-number of the original image. A connection to the *FILES* table exists, based on a one-to-one basis.

Next to the three main tables, there are 9 smaller tables, which are used to store the options of available pull down lists. Further, two information files were created for each original Landsat image. The first is a metadata file in text format, containing all available information about the image, and the second is a quicklook picture in JPEG format. Hyperlinks connect both files to the database. The metadata is normally provided by the image producers, while the quicklooks were created by taking a screen capture of each image.

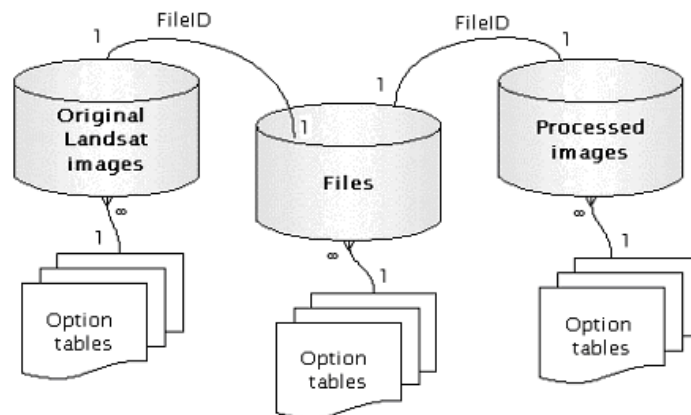


Figure 3. A simplified table structure of the WAGIS images CD database.

Data entry is possible through the intranet by using Data Access Pages, which can be opened in the Internet Explorer browser (version 5 or higher). For each type of data there is a different page to fill. In order to keep the entering of data as simple as possible, selection lists are provided whenever appropriate. Additional information is given by the different links clickable on each of the pages. They will either open a new page containing information, or just a short alert message. Figure 4 shows the page used for entering data on original Landsat images to the database.

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Amazon Research Team  
University of Turku  
Finland

## Adding Original Landsat Images

**Basic File Information** ⓘ

File ID:  File Name:

CD Number:  Data Group:

File Format:  Source Organization:

**Topographical Info**

Country:  Place Name:

**Specific Info Original Landsat Images**

Sensor:  Path:

Metadata:  Row:

Quicklook:  Acquisition Date:

**Notes:**

Files 1 of 1

Figure 4. Page for adding original Landsat images to the database.

Searching for data in the database is based on a two-step approach. For each data type there's a page that lists some key variables per record (Figure 5). The user is able to adjust the order of the list in various ways by clicking the titles of the key variables. Doing so, it is rather easy to find a certain record. Once found, a complete data page for that one record can be accessed from the *more info* link. Figure 6 gives an example of such a page.

## Browse Original Landsat Images

FileName	CountryName	Path	Row	AcquisitionDate	CDNumber	
Rio Alto Purus	Peru	4	67	10/7/1989	1	<a href="#">More Info</a>
Rio Napo	Peru	6	62	11/1/1987	2	<a href="#">More Info</a>
Iquitos	Peru	6	63	11/1/1987	3	<a href="#">More Info</a>
Rio Aguaytia	Peru	7	66	13/11/1986	4	<a href="#">More Info</a>
Rio Pastaza Arriba	Peru	8	62	22/12/1989	5	<a href="#">More Info</a>

Figure 5. List of key variables for original Landsat images.

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 Finland

## Original Landsat Images

### General Information

**FileName:** Rio Alto Purus  
**CD Number:** 1  
**Data Group:** Original Landsat Image  
**File Format:** Erdas Imagine Image  
**Source Organization:** EDC-DAAC  
**CountryName:** Peru  
**PlaceName:** Rio Alto Purus

### Image Specific Information

**SensorName:** Landsat TM  
**Path:** 4  
**Row:** 67  
**AcquisitionDate:** 10/7/1989  
**Metadata:** [Metadata\UTU\\_1.txt](#)

### Notes

### Quicklook

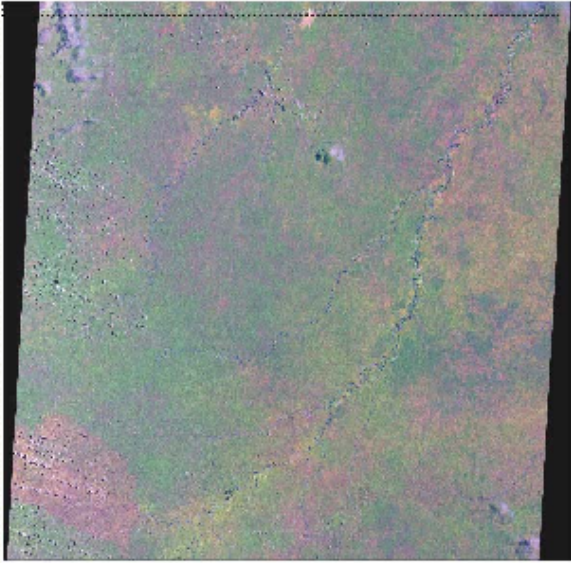


Figure 6. Example of a data page, which provides data on a particular original Landsat image. Note also the metadata link, which will open the metadata file mentioned above.

More detailed information on the technical solutions related to the database entry and search pages can be found from Appendix D starting from page 47.

## 6. Image preprocessing

Preprocessing of the imagery after import consisted of a few successive steps from rectification and cleaning to matching of the images. Before the preprocessing started, several tests were made to find out the most beneficial ways to proceed. Pre-tests were made with small sets of images to compare different processing software, rectification methods, make comparisons between sources of coordinate information and possible atmospheric correction methods. Figure 4 presents the processing steps from import to the actual mosaicking. Technical instructions of all the steps can be found from Appendix B, starting from page 30.

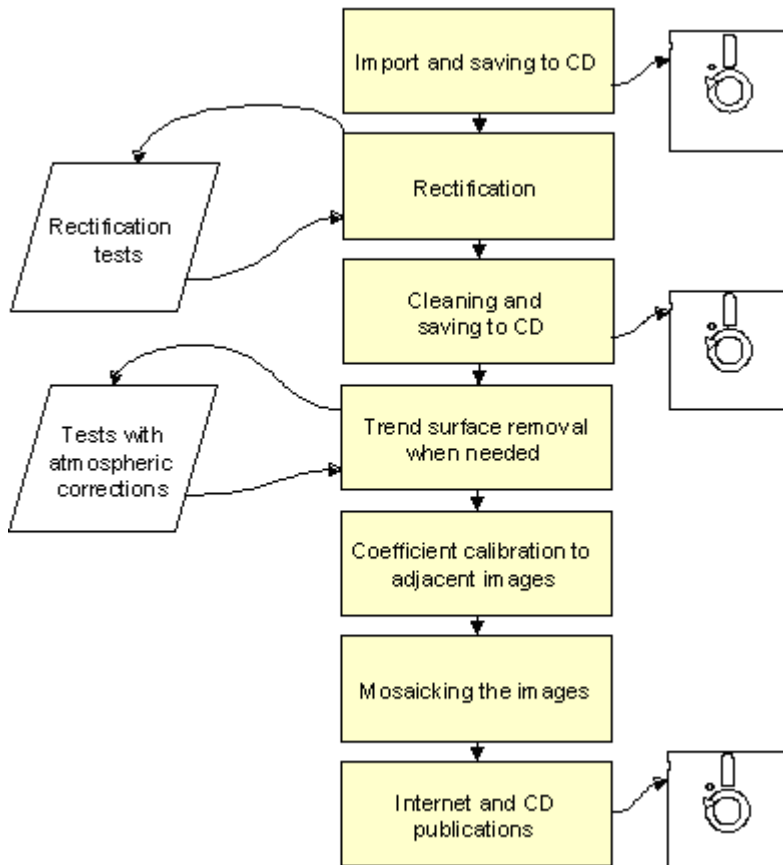


Figure 4. Processing steps between import and finalizing the mosaic product. Rectangles indicate actual processing steps and oblique polygons the main tests made. Diskettes show the steps where the information was systematically stored on CD.

### Georeferencing and rectification

The goal was to georeference the images with as consistent and high spatial accuracy as possible. In order to present the entire western Amazonia in one coordinate system and to ensure the usability of the mosaic together with most GIS data, the geographical coordinate system Longitude/Latitude was selected. The world geodetic system 1984 (WGS84) was used as datum and ellipsoid. A Cartesian coordinate system, like UTM, was also considered due to its ability to present locations using meters. UTM system uses, however, 6° wide zones. Thus, several different zones would have been needed to cover the entire area.

## Sources of ground coordinates

Two approaches were possible in acquiring the ground coordinate information: 1) rectification of all images first together with their overlapping areas (see e.g. Rosenqvist et al. 2000) and then to Earth coordinates 2) rectification of each scene straight to Earth coordinates. The first option would have ensured the continuity of features from scene to another, on the expense of spatial accuracy. Thus, the second option was selected to prevent distortion of the mosaic. Individual registration of 126 scenes required, however, a good source of coordinate data. Different sources of Earth coordinates were evaluated and tested.

Table 3 shows a comparison of the most interesting options for collecting coordinate information. Paper maps were considered too inconsistent source of information. Metadata related to scenes occasionally contained image corner coordinates, but they were provided in different coordinate systems, datums and ellipsoids. Not all the images had this information. Furthermore, tests showed that this information was fairly unreliable. The third option is to apply a ready-made mosaic such as the one created by the GRFM project of JERS-1 SAR images with 100 meter pixel size over the entire basin of Amazonia (Rosenqvist et al. 2000).

Table 3. Results of the evaluation of ground control points (GCPs) from different sources.

GCP source	Evaluation
Coordinates from paper maps	+ accurate – slow and laborious – good maps are not available for the entire area
Coordinates provided in metadata	+ easy to acquire – not available in all images – several coordinate systems used – unreliable testing required for individual images – discontinuous objects at image borders
JESR-1 SAR mosaic from GRFM project	+ Continuous and consistent surface + Control points relatively easy to locate + Digital format – Locational errors are repeated

Despite the fact that already existing and at places quite severe locational errors were repeated, the ease of use of digital imagery and the consistency of the surface justified the use of the GRFM mosaic as our reference. All images were georeferenced using six ground control points (GCPs). After selecting the GCPs, their image and earth coordinates were saved to separate files. In most cases, the control points were selected only from the JERS mosaic. Some mountainous images needed, however, also ground control points from adjacent images to fit to the mosaic. Centers of oxbow lakes and other relatively stable points were selected and if such were not available, also river meanders having distinctive shapes were used.

## Rectification

Each image was rectified and resampled according to the GCPs. Table 4. presents the methods used in rectification of the imagery. First order polynomial transformation was considered good enough as Landsat images cover only a relatively small area of the globe. Some tests made on imagery showed that nearest neighbor method was



adequate for resampling the imagery during rectification. With bilinear and cubic convolution resampling narrow linear objects retained better, but in general the significance of this was small. The fact that nearest neighbor resampling only required half of the processing time requires by bilinear and cubic convolution resampling methods was considered more important.

Table 4. Methods and options used in rectification of the imagery.

METHOD	OPTION
GCP source	JERS-1 SAR mosaic from GRFM project
RMS error	Errors less than 1 pixel were tolerated.
Transformation	First order polynomial
Resampling method	Nearest neighbour
Pixel size	100 meters

In order to keep the mosaic file size reasonable, the pixel size of the imagery was set to 100 meters instead of the original 30 m or so. This dropped file size for each scene from c. 400 MB to c. 30 MB. Due to larger pixels size some details of the landscape such as small rivers and lakes, and patterns formed by the convex-concave topography were lost. On the other hand, this pixel size is justified due to the relatively rough rectification of the images using the GRFM data as described above. Figure 5 presents an example landscape with 30-meter and 100-meter pixels sizes.

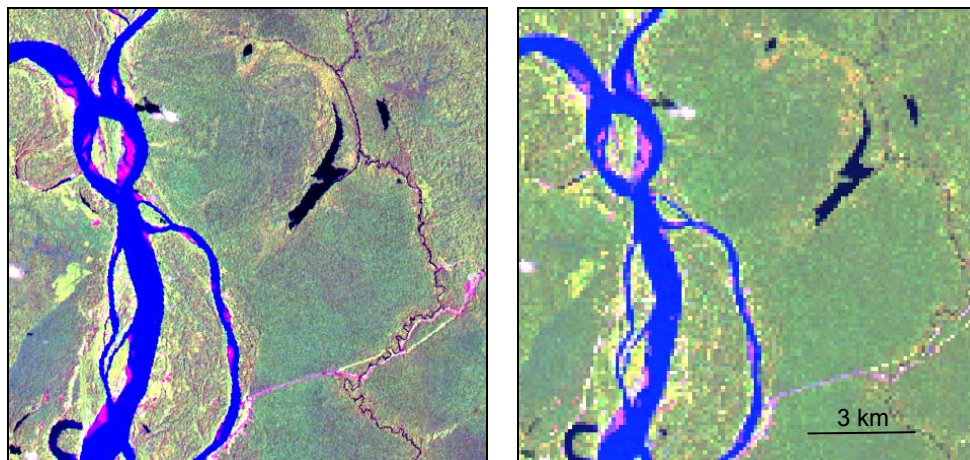


Figure 5. The same landscape with original 30-meter pixel size (left) and new, 100-meter pixel size (right).

### Cleaning of the images

Many images contained white edges and possibly some marks on the corners. After rectification, the actual image area was delineated and needless edge areas were cut away. At the same step, the thermal band 6 was dropped out of all images. To ensure the possibility to trace the original image from the mosaic of images, an info “band” was added as the 7<sup>th</sup> layer of each image. This was simply a layer where all the pixel values had the same number as the original image, thus ranging from 1 to 138.

Original CD number is in our system unambiguous and it can be linked to comprehensive information of the image's source (e.g. path/row/year).

### **Quality of purchased images**

Standard problems of striping, banding, line drops, bit errors etc. are discussed in many scientific articles (e.g. Crippen 1989) and remote sensing textbooks (e.g. Mather 1987, Lillesand & Kiefer 1994). Despite the long discussion and available end user software algorithms and filters to correct these defects (e.g. destripe, noise removal functions in Erdas Imagine, ER Mapper or PCI) in many cases the problem is difficult to solve without removing some significant variation of the pixel values. Striping and banding caused by variations in response of individual sensors are present particularly in old Landsat MSS scenes, but they can be disturbing occasionally also in TM bands 2 and 3. The tests made with our imagery showed that the ready-made corrections available in the commercial software packages were too arbitrary and caused artificial features like river or road shifts to the imagery. Therefore, these corrections were not systematically performed.

### **Atmospheric effects**

The atmospheric effects, namely scattering, path radiance, haze and clouds, are the most serious factor affecting the image quality of sensors operating in the optical spectrum. Among others, Tanre et al. (1987), Vermote et al. (1997) and Richter (2000) have dealt with the problem and developed tools for atmospheric correction and haze removal. To correct our imagery, an extension to Erdas Imagine called ATCOR was tested. The software operated with earth-sun distance, atmospheric model coefficients, sensor calibration coefficients and with estimation of visibility. It was, however, noticed that too many assumptions had to be made and if parameters were falsely selected, loss of relevant data would occur. Therefore, finally no atmospheric correction algorithm was applied to images.

Moreover, the atmospheric correction methods did not seem to affect the most severe image-matching problem we faced. In most images the one edge was clearly lighter than the other one (Figure 6). The direction of this gradient varied from scene to scene but it was recognizable in almost all images. The gradient was most severe on band 1 and it lessened to almost invisible on band 4. TM bands 5 and 7 again suffered from the gradient.

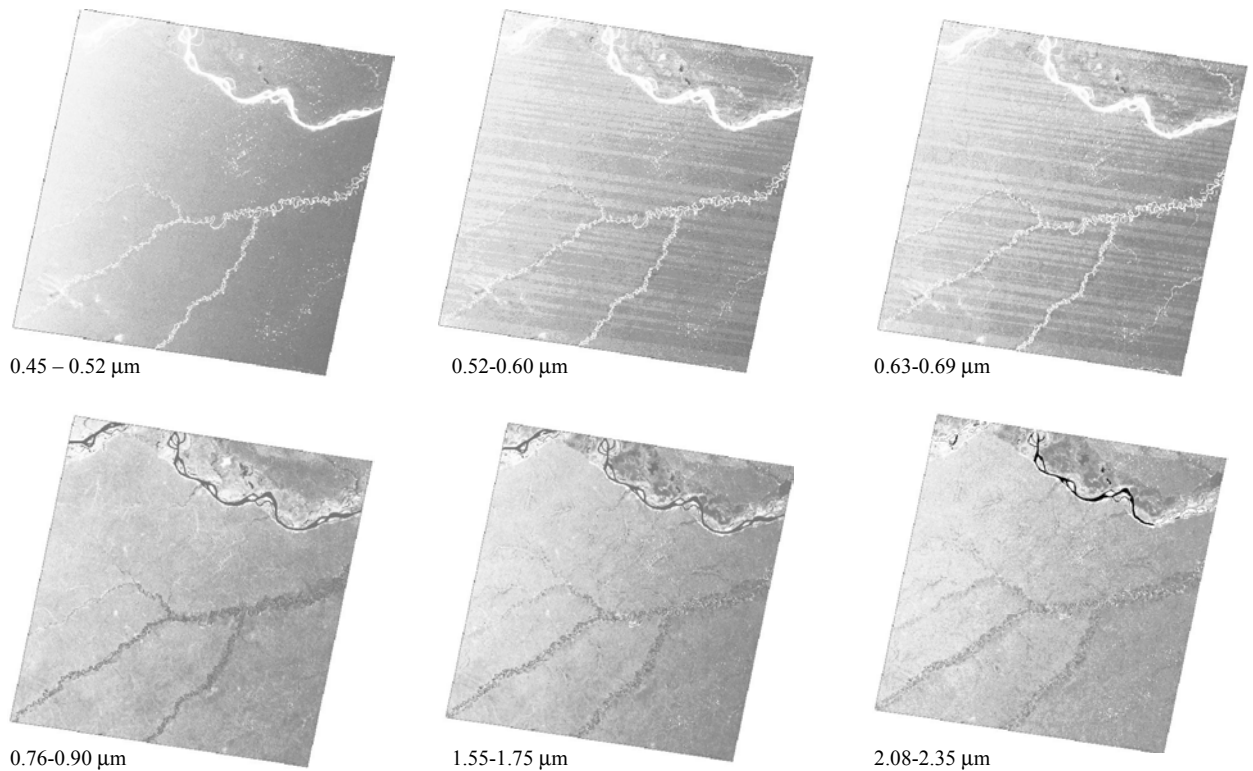


Figure 6. Directed gradient in Landsat bands 1,2,3,4,5 and 7 in scene acquired 30<sup>th</sup> August 1993 in 5°S 70°W.

### Removing the gradient

The gradient was removed from those images that clearly suffered from it. The correction was based on a calculation of a reverse trend surface to even out the phenomenon. ArcInfo software was used for the trend surface calculation and correction of the images. First, areas with seemingly similar forest were delineated as areas of interest in Erdas Imagine and these were exported as ArcInfo grids each containing one band of the Landsat image. In ArcInfo, the grid was transformed to set of points and a trend surface was calculated for the area using the point values (DNs of the original image). The trend was reversed and imported to Erdas imagine. There, the reversed trend surface was added to the original image values. The results of this process turned out to be quite satisfactory in most cases.

In the Peruvian image mosaic, the gradient was corrected following the same basic idea. However, the trend surface was created using the interpolation option of the Erdas Imagine software on the basis of 60-100 selected points covering the same type of surfaces across the entire image. This method, which is described thoroughly in BIODAMAZ 2002, will most likely be used if mosaic is improved with new images in the future.

## 7. Mosaicking

The preprocessed images were mosaicked to form a comprehensive coverage over the study area. Images had very different DN ranges and the pixel values had to be matched before the mosaicking. There were several sets of adjacent images that had been acquired during the same day and the matching was started from simple unification of all these sets of images. Thereafter, images and image sets acquired in different days were adjusted to each other individually.

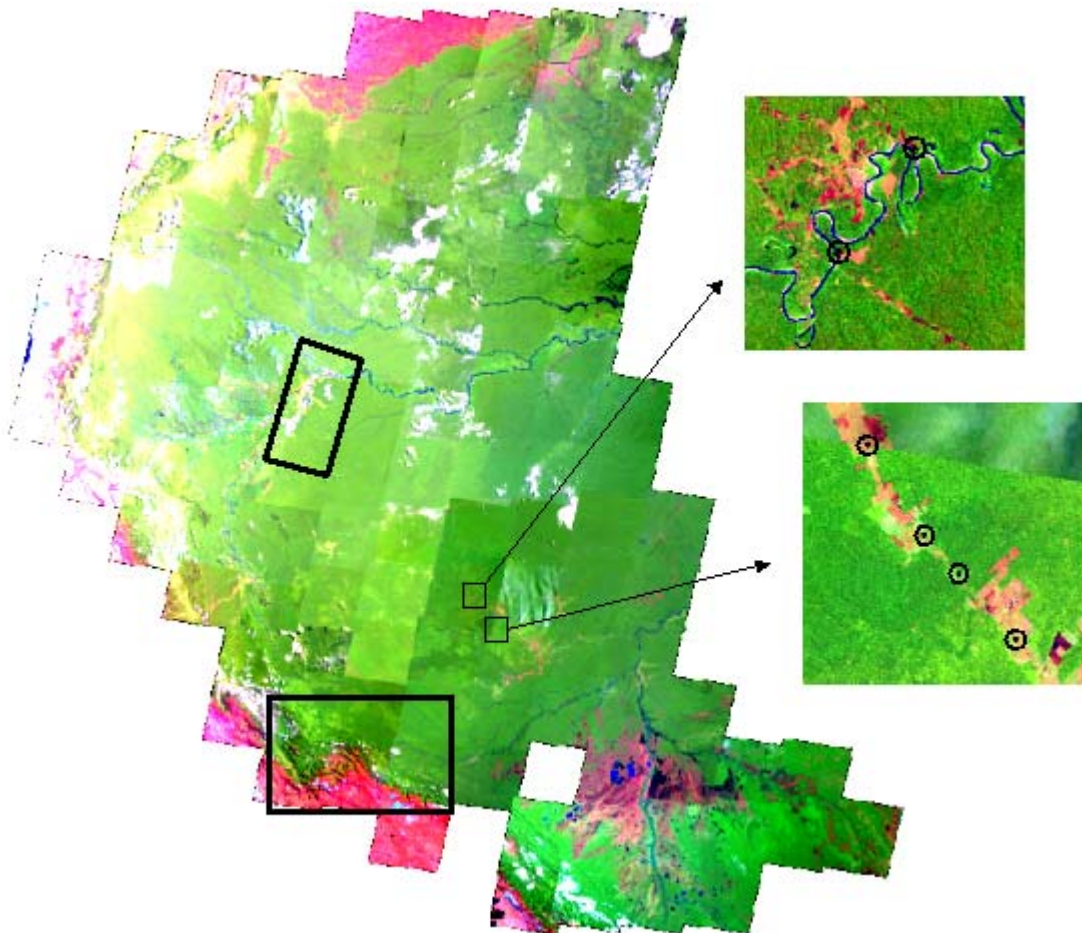
Clear (not cloudy) areas were delineated from overlapping areas of images and mean DN values for each band was calculated. A correction coefficient was calculated for the image to be corrected and all of its values were multiplied with the coefficient. This method produced several matched image clusters, which were first mosaicked together and then matched to their neighbors using the same method.

As the images overlapped each other on the scene borders, it was possible to try to organize them so that cloudy areas would be under the adjacent scene. No image matching or edge feathering was performed anymore at this stage.

### **Geographical re-adjustment of the entire mosaic**

When the mosaic was finalized it was noticed that there were errors in the spatial accuracy of the mosaic. These originated from the errors present in the JERS mosaic, which was used as a reference. The use of this mosaic ensured, however, a good consistency of the mosaic (i.e. the images fit relatively well to each other). The problem was solved using approximately 40 control points from regions of Iquitos and from Madre de Dios and rectifying the image according to these points. The control points are shown in Figure 7. The same transformation and resampling methods as earlier were applied.

The quality of the final georeferencing was estimated using field point data from Brazil and map data (1:250 000) from Bolivia near Río Beni and Colombia. In all cases, errors were less than one kilometer and approximately 100 meters in most cases (see Figure 7). The true accuracy was however, difficult to measure owing to the uncertainty of the actual location on the GPS points on the map.



*Figure 7. The mosaic was re-adjusted using geographically accurate mosaics from Madre de Dios and Iquitos region (large black squares). These mosaics were created for other purposes of the team with accurate ground data. The rectification accuracy was evaluated using GPS measurements from the ground. The two example areas presented with greater detail show the location of GPS points measured at the river and along the road. These measurements suggest a relatively good spatial accuracy for the mosaic (error c. 1 pixel = 100m). The missing images in the SW have later been added.*

### **The final mosaic product**

The first version of the mosaic was published in the August 2002 (Figure 8). It is available in one Erdas Imagine file and reserves approximately 3.5 GB of disk space. Additionally, it is available in the WAGIS map service in the UTU-ART web pages as image file with band combination 5,4,2. The first version of the mosaic is still an evolving product – some cloudy images could be replaced, and a more advanced method used for the removal of the gradient and harmonization of the images.

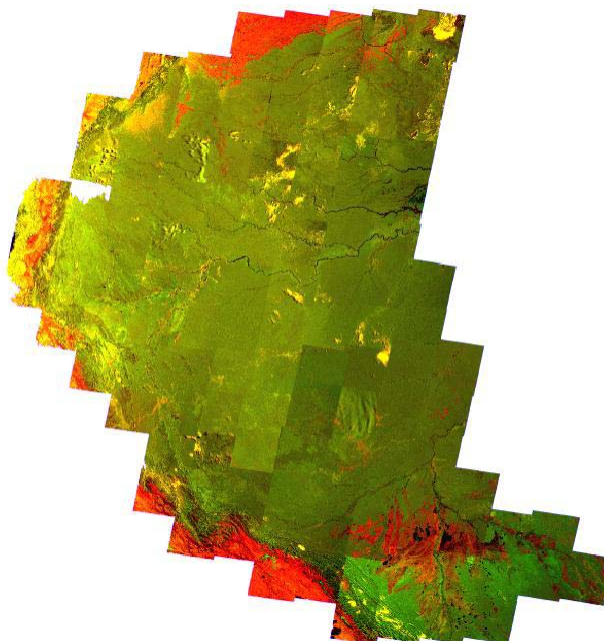


Figure 8. The first version of the mosaic was published in August 2002 in the UTU-ART Internet pages as a part of the Western Amazonian GIS (WAGIS).

Table 5 presents the properties of the Landsat TM mosaic, which is accompanied with a vector layer containing metadata on each scene within the mosaic. Attributes of this layer provide the path, row, acquisition date, sun angles and other information for each scene. Additionally, as each image is stored individually to CDs during its processing steps, also this information can be found from the attribute table.

Table 5. Properties of the Landsat TM mosaic over the Western Amazonia.

Topic	Specification
Aerial coverage	Lowland Amazonia (< 500 m a.s.l.) between 17°S and 7°N and longitudes from 59°W to 80°W. The total area is c. 3.5 million km <sup>2</sup> .
Data	Landsat TM, Bands 1 to 5 and 7. Thermal infrared band (TM6) excluded.
Pixel size	100 m
Coordinate system	Longitude/Latitude coordinates with WGS-84 datum.
Time of image acquisition	Late 1980s or newer; images acquired in different years/seasons can be tolerated.
Data quality	Some clouds and haze is present in the images. The borders of the scenes are visible in many places.
Rectification	Using JERS SAR-1 mosaic and 6 GCPs per scene
Spatial accuracy	Approximately < 500 meters
Resampling method	Nearest neighbor
Media	Internet mapserver, Erdas Imagine file

## 8. Building the Internet map service

An Internet-based map service was established to deliver the mosaic and additional data layers to the users as easy as possible. Evaluation version the service is usable in the intranet of UTU and it provides basic GIS tools such as zooming, panning, measuring distances on a map and querying the attribute tables of GIS layers.

The service is based on mapping engine called ArcIMS 3.1 provided by ESRI, which is a software package containing a spatial server for publishing GIS data in the Internet and a set of wizards for creating map sites. The following presents phases and principles applied in the creation of the map service, and it mostly reflects the situation of August 2002.

### Structure of the map service

A simplified representation of the structure of the service is given in Figure 9. Basically there are two important parts, the server side and the client side. The server side consists of several components of which the web server and the ArcIMS application server are most important. Both servers are able to communicate through a servlet, cold fusion or other type of connector. The information the client requests are sent through the web server to the ArcIMS application server. There the request is processed and the resulting information is passed back to the client, again through the web server. A more detailed description of the structure of ArcIMS can be found on the [ESRI Internet pages](#)

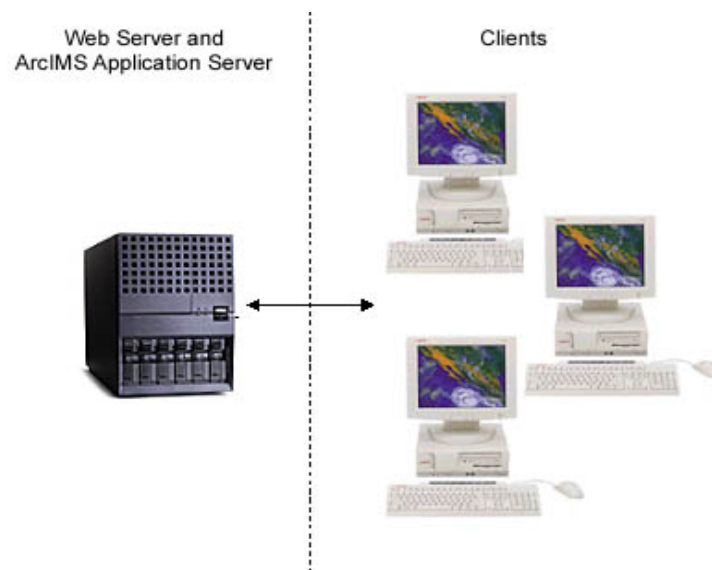


Figure 9. The architecture of the Internet servers for ArcIMS and Internet map server.

### Building the map service

The map service creation included two subsequent phases. First, ArcIMS wizards were used to create the mapservice and the first draft of the website. Secondly, the HTML pages, an XML file and a few Javascript files created by the wizard were modified manually to improve the interface and functionality of the service.

**ArcIMS author** was first used to select the data sets to be displayed in the service and to create the related AXL file. The most important layers that were added to the preliminary map service are:

- Four image layers containing the Landsat TM mosaic (see below)
- A GIS layer containing rivers
- A GIS layer containing cities
- A GIS layer containing roads
- A GIS layer containing administrative borders

In future many more data layers will probably be added. For purposes of the researchers, addition of digital elevation models, climatological data, field plot locations, geological interpretations, vegetation and soil maps and layers describing human activities would be valuable.

The Landsat TM mosaic was added multiple times in separate layers. The pixel sizes vary per layer and are 1000 m, 500 m, 250 m and 100 m respectively. When creating the map service these different layers were assigned to different zoom levels, so that when scale factors are high large pixels are shown and when zooming in, smaller pixels. Applying this technique has two advantages:

- When zooming to higher scale factors ArcIMS uses a smaller image file to process the request, which saves time.
- When zooming to higher scale factors the larger pixel sizes result is less speckled images.

Once the data sets were selected and their properties were set, a mapservice was set up in the spatial server using **ArcIMS Administrator**. Thereafter, the **ArcIMS designer** wizard was used to create HTML pages and the Java scripts and XMLs for the website. The site was modified by editing these script files. The most important changes were related to:

- Frame sizes.
- Background colors.
- The toolbar position.
- The toolbar contents
- The size of the overview map in the top left.
- The presentation of search results. Now it uses pop up windows.
- The scale bar. It has different colors and rounds values now.
- The Layers frame layout. A folder system is included.
- The names of the layers. Now they are hyperlinks to metadata files

A more detailed description of the exact changes that were made to the scripts is presented in Appendix E, starting from page 53. A screen capture of the resulting service is presented in Figure 10.



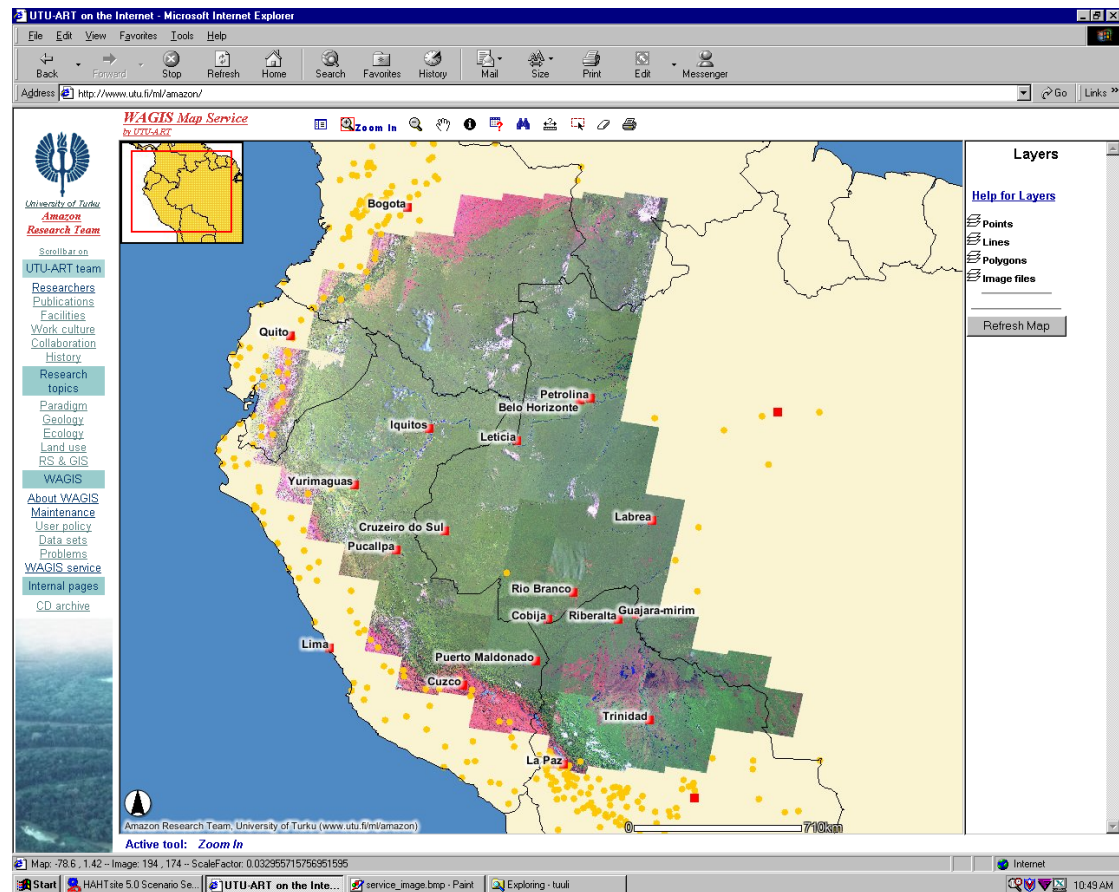














Figure 10. A preliminary version of the WAGIS map service by UTU-ART.

## Using the map service

The foreseen application value of the map service is that it will provide easy access to the image mosaic, covering the entire Western Amazonia, to a wide range of users. Accompanied with general cartographic information such as names, political borders and road network, the use of this facility should be rather easy even for those who are not fully acquainted to utilize enhanced satellite images as base maps. Moreover, as new thematic data layers will be implemented into the system, such as those on climate, geology, or field study sites, comparisons among different spatial data contents is simple and any of them can be related to the image mosaic itself, which is, finally, the only available spatial information that shows genuine data collected across the entire region, not just from selected example areas with interpolated or interpreted values in between. In order to enable efficient exploratory work along these lines, the user interface of the system will be developed further within the limits provided by future resources, both financial and human capacity.

When using the map service different layers can be switched on and off. Furthermore, each GIS layer can be made active after which it is possible to query the attribute table belonging to that layer. Hyperlinks in the layers frame open up web pages that provide extra information about the layer. Most of the functionality in the map server is however provided by the different tools in the tool bar. The tools available in the current version of the UTU-ART service are further explained in Table 6.

Table 6. Tools available in the WAGIS map service in August 2002.

Icon	Tool Name	Tool Function
	Legend/Layer	Toggles between legend and layer. These are shown to the right of your map. Legend shows what map colors and symbols mean. Layer lists available data themes, called "layers," for the map service you are viewing.
	Overview Map	The overview is a thumbnail window of the overall map view. The overview button toggles the window on or off.
	Zoom In	Zoom in is used two ways: click the map or draw a rectangle to define your new view.
	Zoom out	Zoom out is used two ways: click the map or draw a rectangle to define your new view.
	Pan	Click, hold, and drag to move the map with your mouse.
	Identify	Click a feature to see a list of its attributes in a table.
	Query Builder	Query the database of attributes for map features.
	Find	This searches the database to locate and list features of the active layer.
	Measure	Select this tool, then click, drag, and click on the map to measure the distance between two points on the map. The distance is displayed using the units you specify.
	Select by rectangle	Click this button, then draw a rectangle (click and drag diagonally) on the map to make selections.
	Clear Selection	Deselect, similar to "Undo"
	Print	Click print to open your map view to a new browser window. The window includes a title that you specify, and a legend. Click File/Save or File/Print in your browser menu.

## 9. Discussion

We consider that the resulted Landsat TM image mosaic is satisfactory for broad-scale studies in the Western Amazon region. It is able to express extensive habitats and vegetation patterns in the region and it also allows effective zooming that can reach the scale of 1:250 000, approximately. As such, the mosaic is the first product to our knowledge where large and medium-scale environmental heterogeneity across the entire sub-Andean belt of the Amazon can effectively be studied.

However, the August 2002 version of the mosaic still includes quality restrictions that need to be conquered. Differences in the brightness values among the individual images still remain, and also the internal illumination gradient residue in some of the images to a degree that causes disturbing artifacts in the mosaic. The methodology for correcting this problem should be further developed based on the actual causes of the phenomenon. Along with problems caused by clouds and haze, these problems restrict stretching operations and thus also the interpretation of delicate reflectance patterns in the forest canopy. Further, the geographic precision of the mosaic, as it is based on a secondary source, may be unsatisfactory at places. This may possess obstacles for such uses as on screen digitizing of interpreted vector layers or comparing precise GPS-based locations with reflectance patterns shown in the mosaic. Also the 100 meters pixel size hinders the utility of this mosaic in very local studies.

The University of Turku does not currently possess resources for continued update of the mosaic. The detailed documentation of its making in the present report will hopefully facilitate its later improvement if resources for such purpose will become available. Also the easy user interface of the image metadata archive was designed to support the same purpose, particularly if authors of the first version of the mosaic will not be available to participate its future update.

Basic Internet browser technology was chosen to be the main platform for viewing the mosaic because it does not require any special software installed in the client computer. It also allows sharing of this information regardless of place and time.

The user right policy of the mosaic has not been entirely settled at the time of writing of this report. After transitional period free viewing will probably be made available for anyone interested. Those who intend to use the mosaic at large extent for scientific research are expected to seek ways for collaboration with its creators in form of for example shared authorship in selected publications.

## 10. Acknowledgements

The creation of the Landsat TM mosaic would not have been possible without the data archive services of Michigan state university, Eros data center and Maryland University. The development of WAGIS mosaic and its Internet service was made in close collaboration with the *Instituto de Investigaciones de la Amazonia Peruana* (IIAP). UTU LCC provided the working facilities and assistance both for the creation of the mosaic and setting up and running the map service. The project was funded by the Finnish Academy and FIBRE programme.

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## Appendix A) Metadata example

The following presents one structure of metadata file related to each image scene. Also other formats are present owing to the differences in the practices of the image providers.

UTU-ART 011

Sensor: Landsat TM  
ID: HT5007068009002410002624  
A.D.: 1990/01/24  
restrictions = No restrictions  
project\_source = Humid Tropical Forest Project TM  
old\_scene\_id = Y5215514330X0  
path\_nbr = 7  
row\_nbr = 68  
product\_size = FULL\_SCENE  
wrs\_type = 2  
cloud\_cover = 10% but less than 20%  
edc\_processing\_level = Systematically corrected (See Guide)  
map\_projection = Universal Transverse Mercator  
sun\_azimuth = 107  
sun\_elevation = 51  
resampling\_tech = cubic convolution  
data\_format = TTRANSFER  
data\_file\_interleaving = band sequential  
user\_orientation = satellite heading  
horizontal\_datum = WGS84  
spectral\_bands\_avail = 1234567  
orientation\_angle = 8.029948  
pixel\_width = 28.5000  
pixel\_height = 28.5000  
radiometric\_enhancement = No  
radiometric\_calibration = NASA algorithm  
map\_zone = -18  
ellipsoid\_semi\_major\_axis = 6378137.000  
ellipsoid\_semi\_minor\_axis = 6356752.314  
upper\_left\_lat = -10.62081  
upper\_left\_lon = -77.12510  
upper\_right\_lat = -10.87843  
upper\_right\_lon = -75.33021  
lower\_right\_lat = -12.51748  
lower\_right\_lon = -75.56754  
lower\_left\_lat = -12.25725  
lower\_left\_lon = -77.37233

## Appendix B) Working instructions

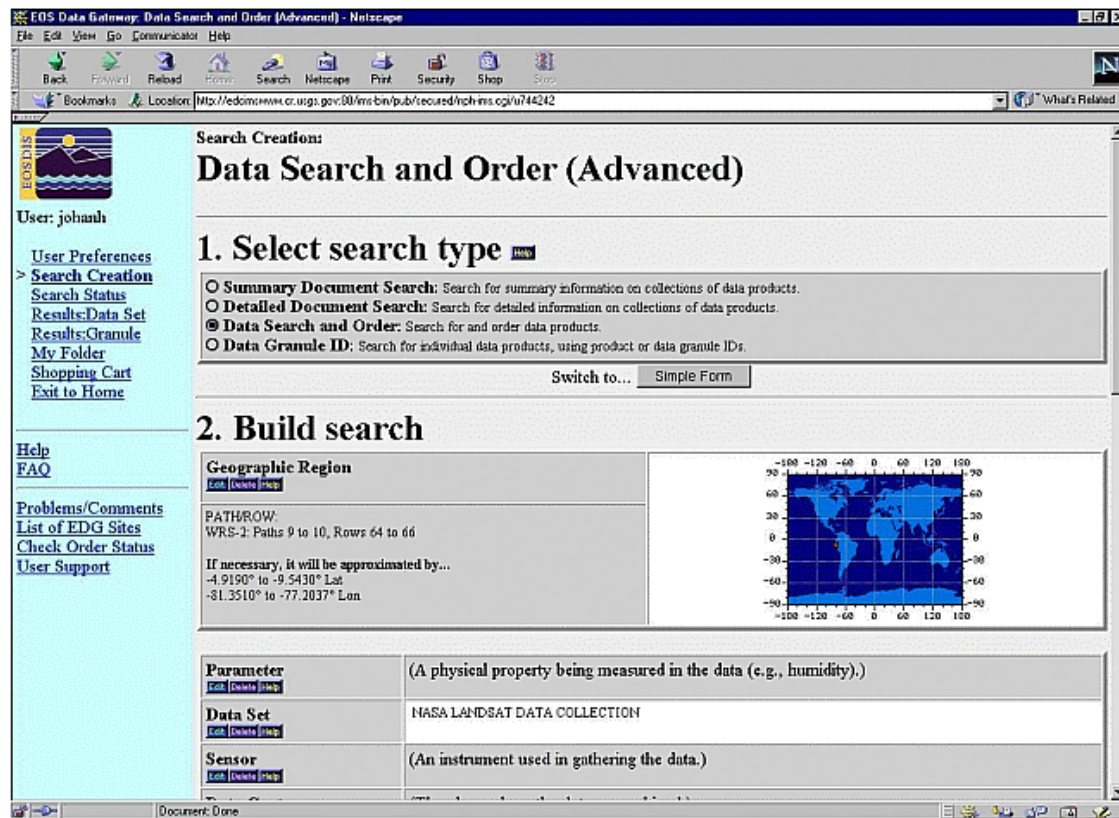
### Viewing, selecting and ordering archive images

Images for WA-GIS mosaic were ordered from two sources: EROS Data Center (EDC) and Michigan State University TRFIC archives. Both orders were made using Internet pages. The following describes how to use the pages of these two archives.

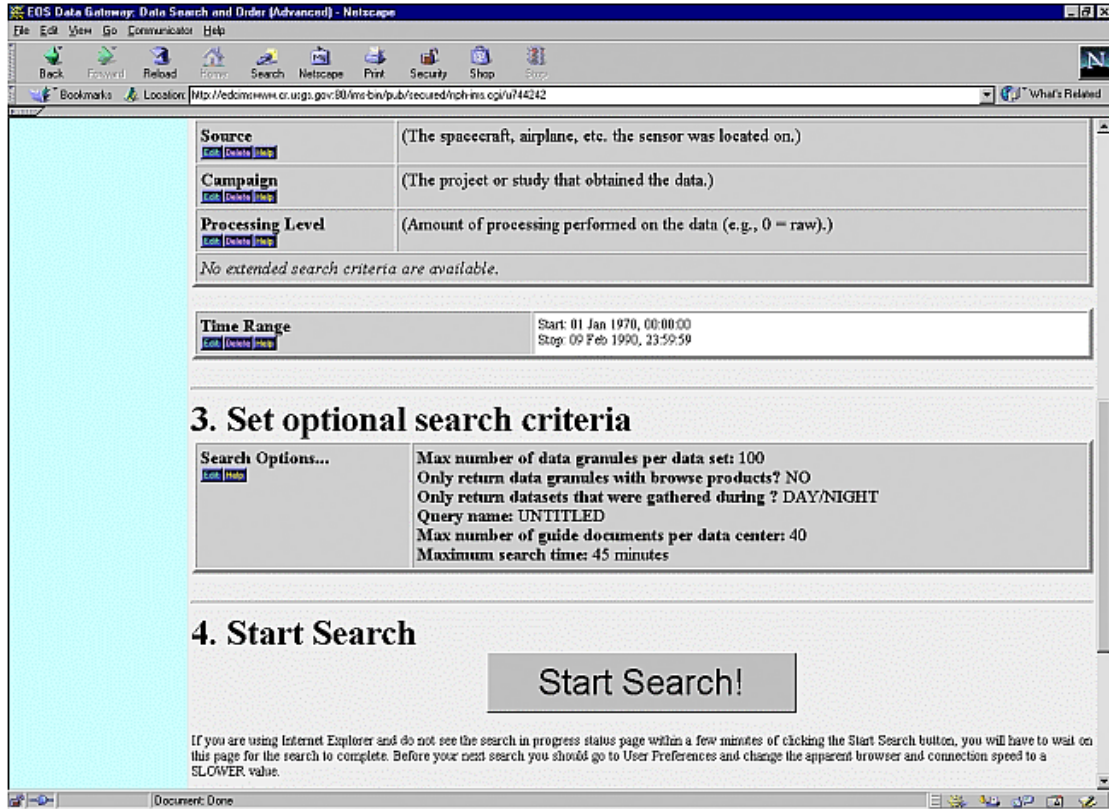
#### EDC archive Internet pages

Address: <http://edcimswww.cr.usgs.gov/pub/imswelcome/plain.html>

1. Enter as a 'guest' or sign up as a registered user.



2. Set the 'Select search type' option to **data search and order**  
NOTE: if you want to find an image of which you know it's original ID, select **Data Granule ID** in 'select search type' and go directly to the bottom and 'SEARCH'.
3. Set geographic region to the desired path/row – range (or select graphical by a box) by clicking **edit** at the geographic region option.
4. Set 'Data set' option to **NASA Landsat Collection**. This is necessary to find images that are 15 USD each.



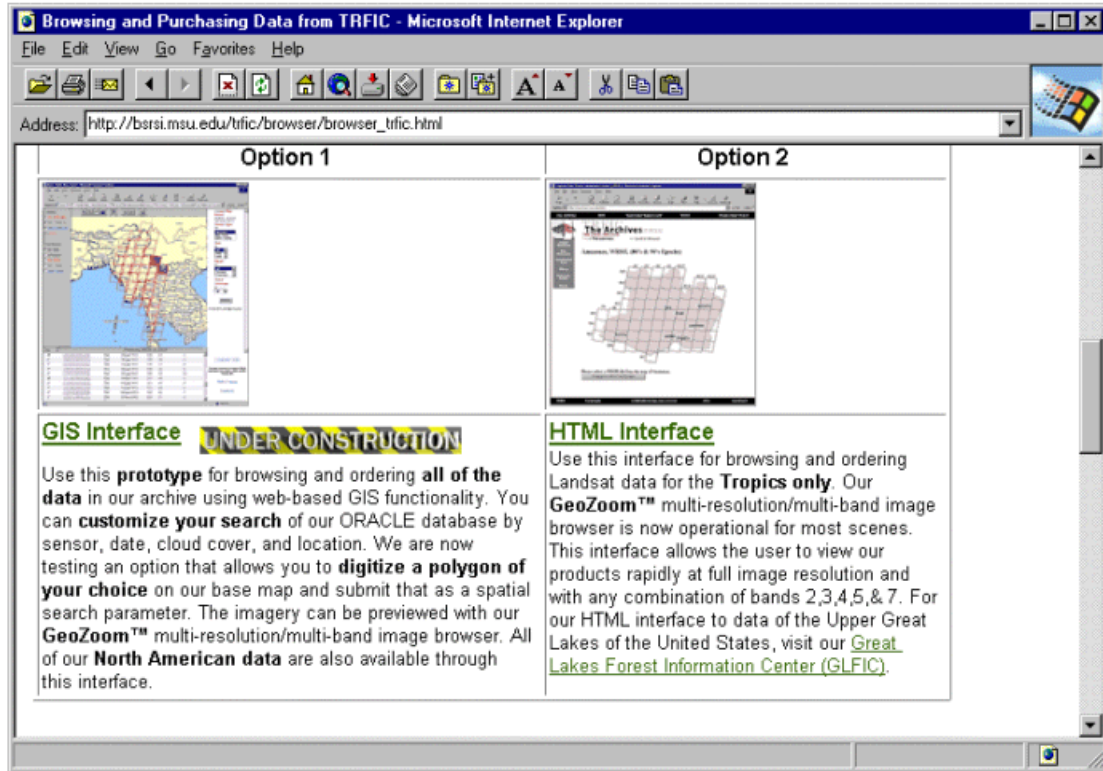
5. Set the 'time range' option from the desired start time of which you want to purchase images until a current month ten years ago. Less than ten years old images are more expensive.
6. Start the search.
7. Found data granules will be listed and you can view them in preview window or in metadata window.

**Michigan State University archive pages**

Address: <http://bsrsi.msu.edu/trfic/>

1. Select 'Data Port' / 'Data Archive' and choose option 1, GIS-Interface





2. Create your own folder by entering E-mail Address and Password.
3. Log in and select your preferences.
4. After submitting the login information a map will be build and the available images coinciding your preferences are shown.
5. By double clicking a scene ID you can see a picture of an image and add it to your order if you like.
6. Image orders can be made trough the browser, but it is also possible to copy the image metadata (at least path, row and date) in a text document and send it by e-mail to: [orders@bsrsi.msu.edu](mailto:orders@bsrsi.msu.edu). Answers are normally rather quick (within two days).

## Importing the EDC images

The images from the EDC archives arrived in 8mm tape in three different formats:

- 1) EOSAT Fast Format,
- 2) NLDAPS format (National Landsat Archive Production System) and
- 3) in MEDIPS format (MSS images).

An import process was required to view these images in Erdas Imagine software. All formats had slightly different import procedures. In order to successfully import the imagery, at least the following things need to be known:

- Data format
- Image size, columns and rows
- Number of bands

We used a UNIX station and Erdas Imagine 8.3 to import the images. The following lists the import phases with all three different data formats.

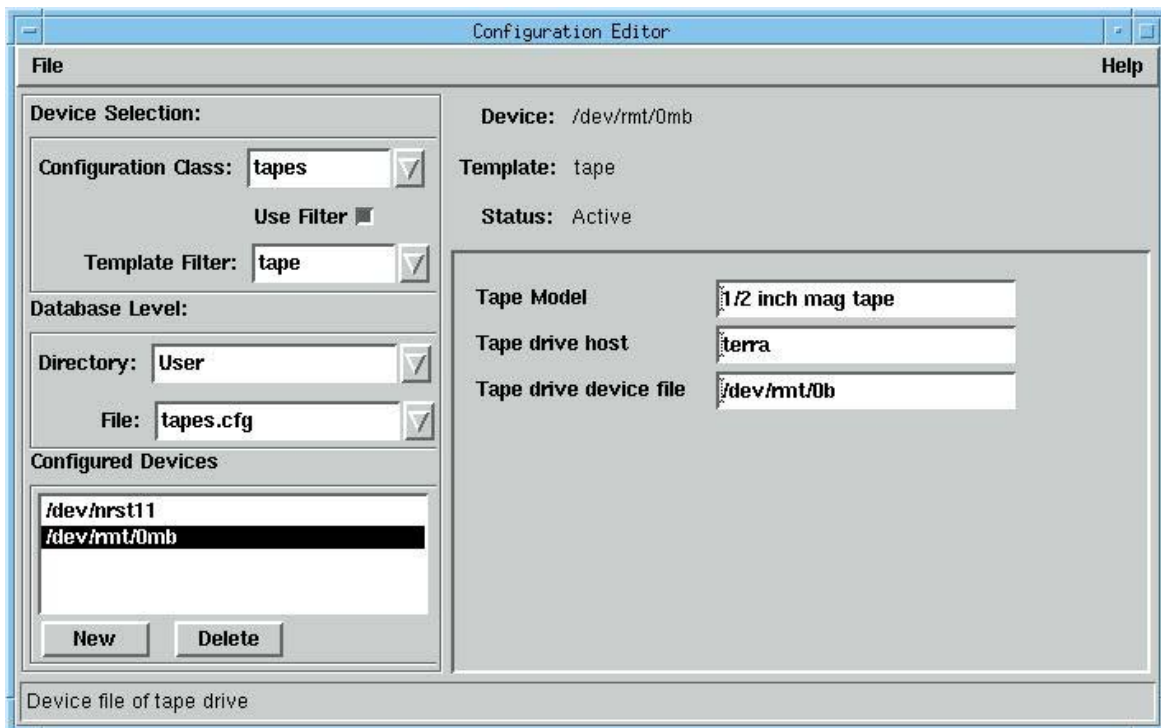
## Importing FAST format

The following gives step-by-step instructions for importing images provided in FAST format.

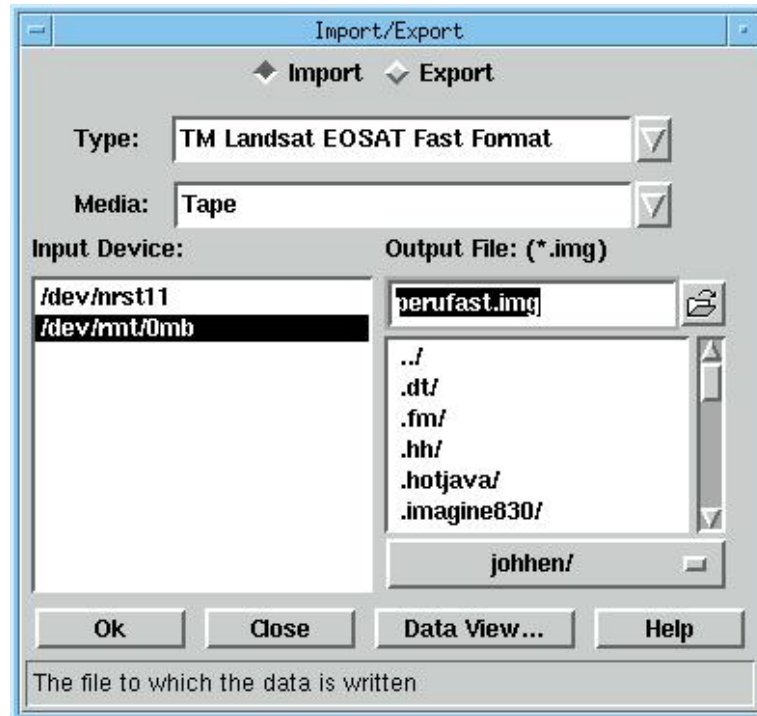
1. Put the right tape in the tape drive
2. Start Erdas Imagine by typing Imagine in the UNIX terminal window.
3. Click the button IMPORT on the Erdas Imagine taskbar.



4. Select TM Landsat EOSAT Fast Format in the 'Type' list of the Import dialog.
5. Select the option **tape** in the 'Media' list of the Import dialog. Select the tape drive as the 'Input device'. At LCC, the name is `/dev/rmt/0mb`. If this option is not available in the list, the drive needs to be added:
  - Select *Session > Configuration* in the Imagine main task bar.
  - In 'configuration class', select the option 'tape'.
  - To the 'tape drive device file' box, type `/dev/rmt/0mb` (at LCC) or the right file name.
  - Return to the Import dialog.



6. Give a file name in the 'Output file' edit box and click OK.



7. The next dialog will prompt you for further information. The opening of the dialog might, however, take a while.
8. Click 'OK'. The import is starting. This may take a up to two hours. You don't have to specify any other things like interleaving, rows and columns because the computer reads it automatically from the FAST format header. The program is reading first all bands (fig. 4 = 7) and then it is calculating statistics, pyramid layers and closing all layers.

### Importing MEDIPS format

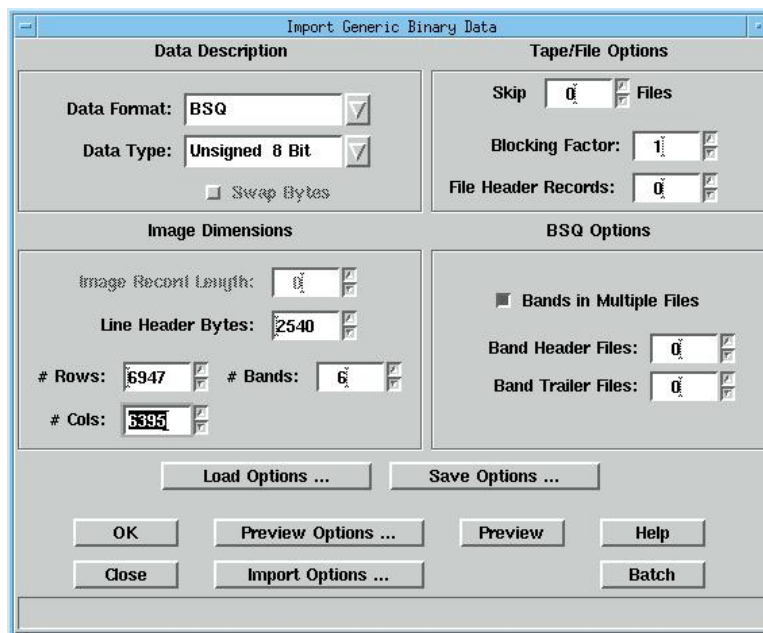
MEDIPS format is used on Landsat MSS images. The import process is very similar to the import of FAST format imagery. The following gives the instructions to import data in MEDIPS format.

1. Put the right tape in the tape drive
2. Start Erdas Imagine by typing Imagine in the UNIX terminal window.
3. Click the button IMPORT on the Erdas Imagine taskbar.
4. Select MSS Landsat in the 'Type' list of the Import dialog.
5. Select the option **tape** in the 'Media' list of the Import dialog. Select the tape drive as the 'Input device'. At LCC, the name is `/dev/rmt/0mb`. **If** this option is not available in the list, the drive needs to be added (see the instructions in Importing of FAST format in page 33).
6. Give your image a name in the 'Output file' box and click 'OK'.
7. The next dialog will prompt you for further information. The opening of the dialog might, however, take a while.

- The popup window shows the information read from tape. Clicking 'OK' will do the rest of the job.

### Importing NLAPS format

- Put the right tape in the tape drive
- Start Erdas Imagine by typing Imagine in the UNIX terminal window.
- Click the button IMPORT on the Erdas Imagine taskbar.
- Select TM Landsat Generic Binary in the 'Type' list of the Import dialog.
- Select the option **tape** in the 'Media' list of the Import dialog. Select the tape drive as the 'Input device'. At LCC, the name is */dev/rmt/0mb*. **If** this option is not available in the list, the drive needs to be added (see the instructions in Importing of FAST format in page 33).
- Give an output name to your image and click OK.
- You are prompted with a dialog where data format, data type and image dimensions need to be filled. The opening of the dialog may take a while.



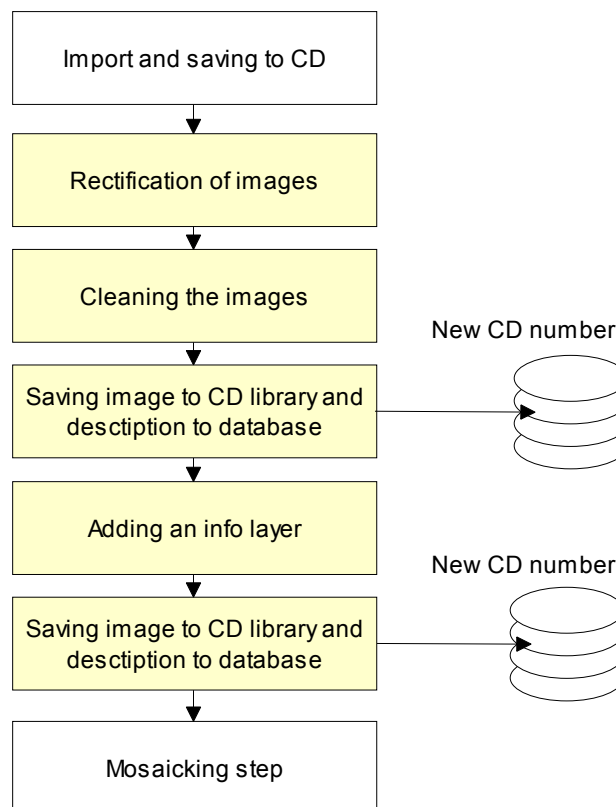
- Select 'BSQ' as the data format and make sure data type is 'unsigned 8-bit'.
- Mark the check box 'bands in multiple files'.
- Fill in the right amounts of rows, columns and bands. You can find these on the meta-data sheet for the images that have NLAPS format.
- Leave the amount of header bytes on zero.
- Click 'OK' to start the import.

## Creation of folder system for WA-GIS image processing

The image files created during the process were

Folder	Processing step	Naming convention
<b>A_Original</b>	Copied here from CD before any processing.	As is.
<b>B_Rectified</b>	Saved here during the rectification process.	"TM" + New CD number + "_" + original image code e.g. TM202r_56086.img
<b>C_Cleaned</b>	Saved here during the cleaning process.	"TM" + CD number + "r_" + original image code e.g. TM202_56086.img
<b>D_InfoLayer</b>	Saved here during the Info Layer creation.	"TM" + CD number + "a_" + original image code e.g. TM327_56086.img
<b>H_Mosaicfile</b>	Saved here after mosaicking.	

It is suggested that the actual processing tasks will be performed in the local computer disks due to the large file sizes. All data not yet stored to the CD ROMs should be placed to the local disk.

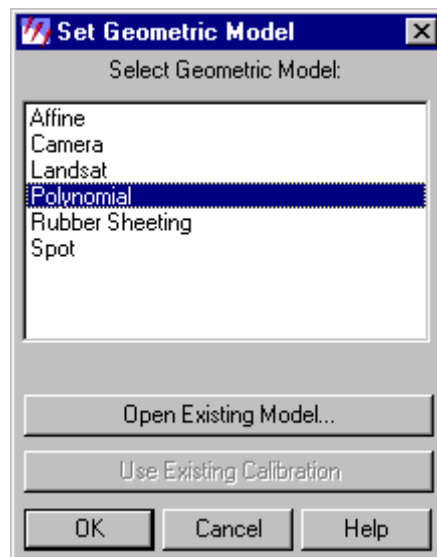


## Georeferencing of the imagery

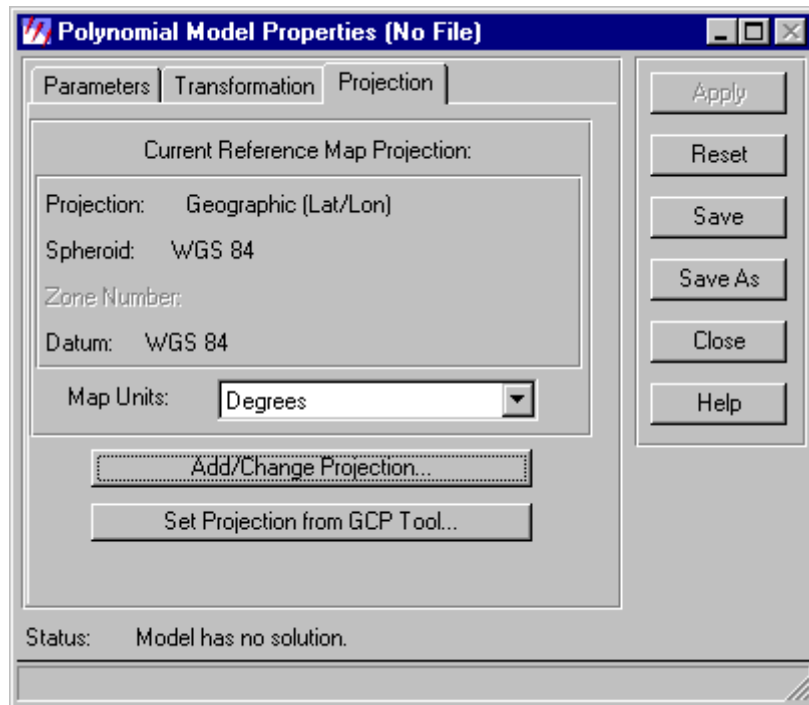
All the images are georeferenced to Geographical WGS84 coordinate system with 100 meters pixel size. Scenes are georeferenced using JERS SAR mosaic as a reference. In the border zone of these two georeferencing methods, an effort is made to match the adjacent images as well as possible using both reference data sets. Each scene is georeferenced using 6 ground control points (GCPs). Rectification is done using first order polynomial and nearest neighbour resampling.


The following describes step by step the rectification process.

1. Open the image to one Imagine viewer and JERS mosaic to another viewer.
2. It may help in the processing if you could see tile satellite image tiles on top of the JERS mosaic. For this, open the mosaic tiles in Shape format.
3. Change the styles by selecting **Vector > Viewing Properties**. Change the polygon colour to transparent by clicking the color selection box and by selecting **Other** and uncheck the **Use solid colour** option.
4. When in need for information about the path, row or CD Number, select the tile using the arrow tools and check the attributes by selecting **Vector > Attributes**. The selected scene is marked with yellow.
5. Start rectification by selecting **DataPrep > Image Geometric Correction**.
6. From **Set Geocorrection Input File** dialog, select **From viewer > Select Viewer** and click the image to be rectified.
7. From **Set Geometric Model** dialog, select option Polynomial and click OK





8. From **Polynomial Model Properties** dialog, select the **Projection** sheet and then **Add/Change Projection**. Define the projection to be Geographical, Datum WGS84 and Spheroid WGS84. First time, use the custom sheet for definition and save to projection settings with **Save**-button. Later, you can select this projection from Standard sheet. Click OK and return to **Polynomial Model Properties** dialog and click **Close**.



9. The **GCP Tool Reference Setup** dialog appears. Select the **Existing Viewer** option and click OK. Click the window containing the JERS mosaic and Click OK in the **Reference Map Information** dialog. The GCP tool and two chip viewers open. If the Fully Automatic GCP Editing  is on, toggle it off.

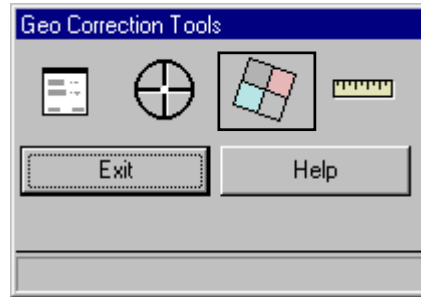
Use the **Create GCP** tool  to pick GCP and its reference point from the two viewers one after another.

10. Add altogether 6 control points to the image to places you can easily and reliably recognise from both images and which do not seem to change in the course of time (e.g. the centre of an oxbow lake, small islands, etc.). Select the GCPs as far apart from each other as possible.

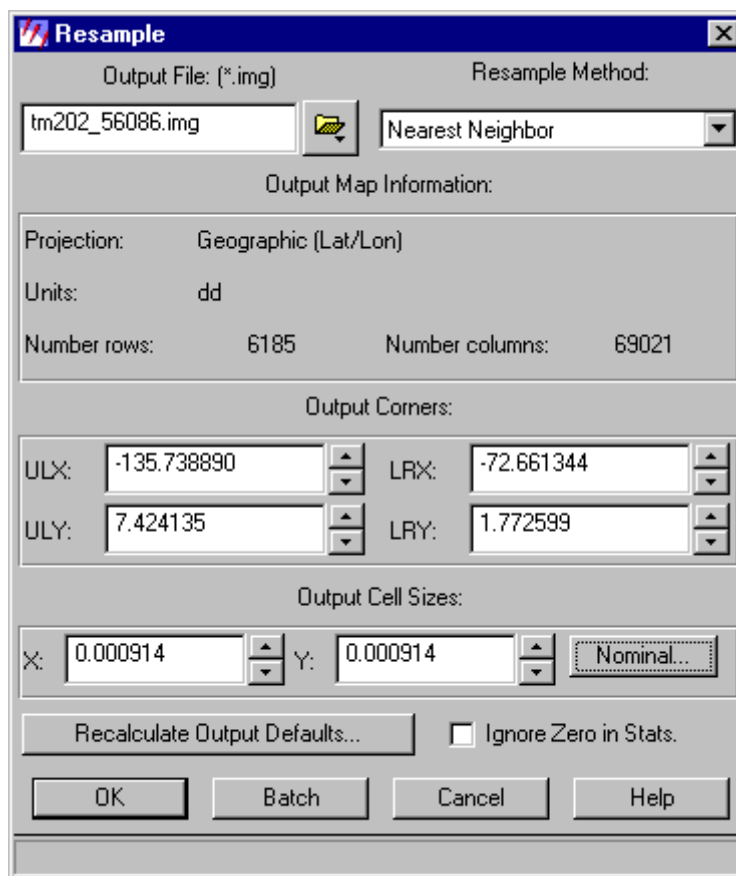
After adding at least 4 control points, use  button to calculate the RMSE. Try to keep the error smaller than 3 pixels. If needed, move the points using select tool  or delete an existing point by selecting its row and choosing Delete selection option from the **Row Selection** popup menu.

11. After adding all control points, use **File > Save Input As** and **File > Save Reference As** options to save the GCP information to separate files. Name the files with  
*Original CD Number + TM\_input* and *Original CD Number + TM\_ref*  
 (e.g. 27TM\_input.gcp)

12. Start resampling from GeoCorrection tool's **Display Resample Image dialog** button.



13. In **Resample** dialog select output file name and location: Store image to B\_ Rectified folder with name *New CD Number* + “rTM\_” + *original image code*, e.g. 202rTM\_56086.img. Select **Nearest Neighbour** as resampling method and give output cell size (100 meters) in meters by clicking **Nominal** button and entering the pixel size. Start resampling by clicking OK.




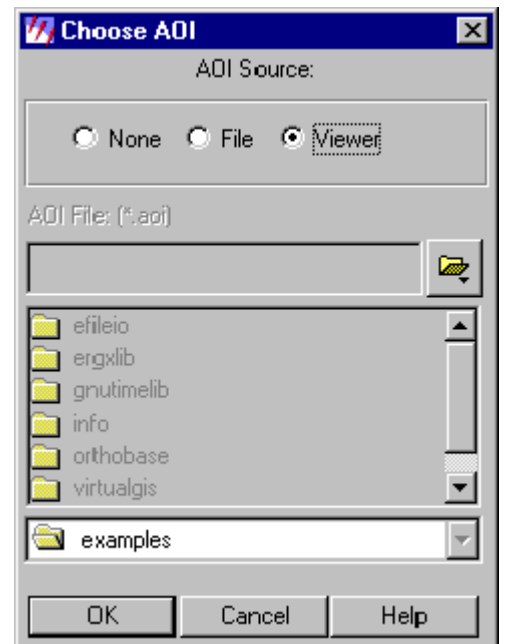
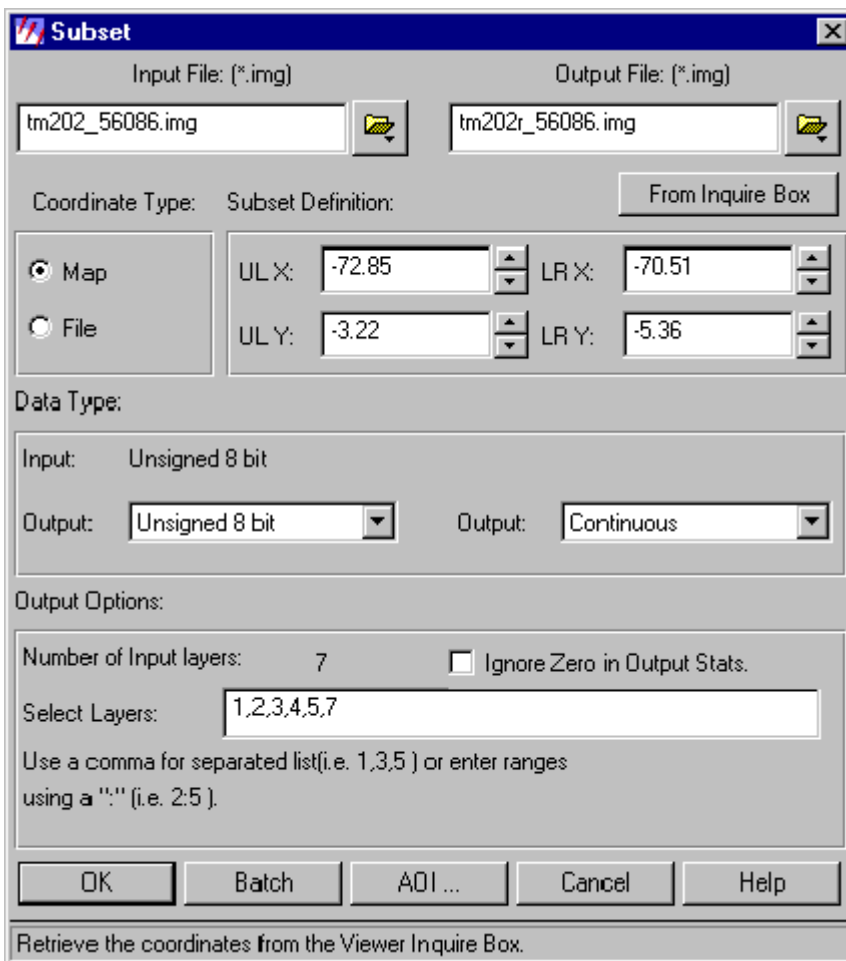
14. Close the **Geometric Correction** tool by clicking **Exit**. Do not save the current geometric model.



## Cleaning the scene

After rectification the areas outside the actual image are cut off and the TM band 6 (thermal band) is removed, leaving only 6 bands to the image. For cleaning the scene:

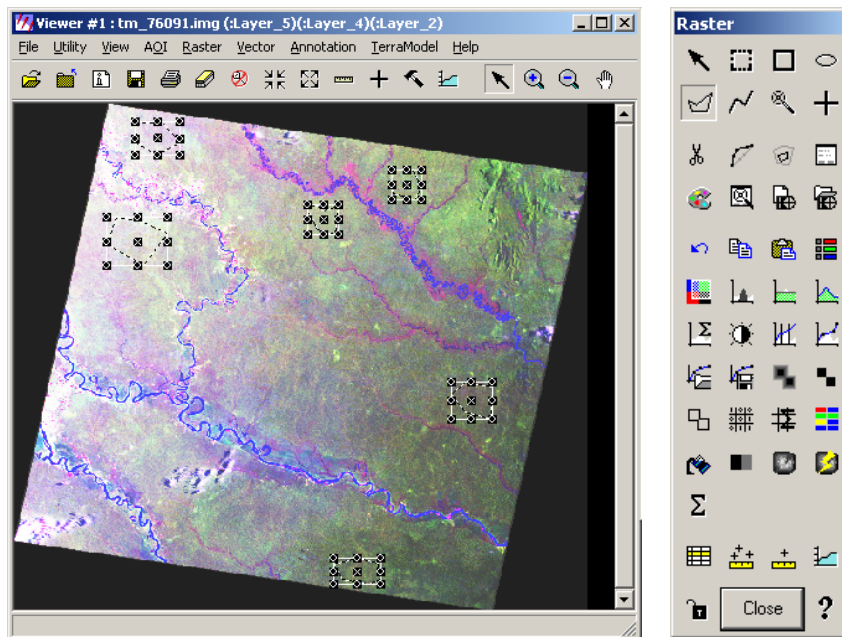
1. Open the scene to a viewer.
2. Open the Raster Toolbox (Hammer button in the top of the Viewer) and delineate the actual image area *using Create Polygon AOI tool*  .
3. Select **DataPrep > Create Subset Image**. Define the input file to be the rectified scene, name for the output file, layers to be included and the Area of Interest (AOI) from the viewer. Save the output file to **C\_Cleaned** folder with previous name as earlier but remove the character R after the CD number (TM202\_56086.img).



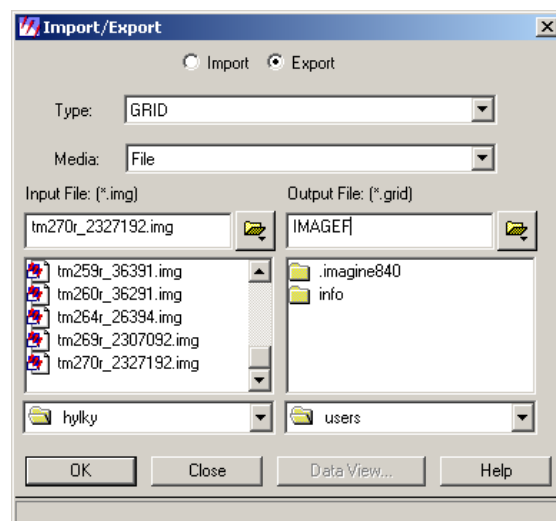
## Removal of the trend from the images

The gradient was evened out for those images that most suffered from the phenomenon. The gradient removal was done in ArcInfo as explained in the following. However, as later experienced in Peru, the similar processing can be done also within Erdas Imagine.

1. Delineate areas of interest (AOI) from the image that contain supposedly similar forest. The calculation of the trend surface is later based on these images. Search for AOIs from different parts of the image, as far apart as possible.



2. Save the AOIs to a file (File > Save > AOI Layer As).
3. Subset the image with the AOI: Data Prep > Subset Image. Select the AOI using the AOI button.
4. Export the resulting image to ArcInfo Grid format (Erdas Imagine > Import). In the Import/Export dialog box, select the Export option and fill in the boxes. Export the file to a folder of its own with a name IMAGEF (image file).



5. Start ArcInfo and run the script below. The ArcInfo macro that calculates the trend surface and provides the statistics for the aspect and strength of the trend. It would have been more elegant to build a loop within the macro, but with only 6 bands, it worked nicely even like this.

```

temp_oL1 = select(imagef_l1, "value >
0")
kill imagef_l1 all
temp500_L1 = resample(temp_oL1 , 0.01,
cubic)
kill temp_oL1
temp_dot = gridpoint(temp500_L1, value)
kill temp500_L1
trend_L1 = trend(temp_dot, value, 1,
linear, 0.01)
kill temp_dot all
temp_max = ZONALMAX(maskimg , trend_L1)
sumimgl1 = (temp_max - trend_L1)
kill temp_max
asp_l1 = aspect(trend_l1)

temp_oL2 = select(imagef_l2, "value >
0")
kill imagef_l2 all
temp500_L2 = resample(temp_oL2 , 0.01,
cubic)
kill temp_oL2
temp_dot = gridpoint(temp500_L2, value)
kill temp500_L2
trend_L2 = trend(temp_dot, value, 1,
linear, 0.01)
kill temp_dot all
temp_max = ZONALMAX(maskimg , trend_L2)
sumimgL2 = (temp_max - trend_L2)
kill temp_max
asp_l2 = aspect(trend_l2)

temp_oL3 = select(imagef_l3, "value >
0")
kill imagef_l3 all
temp500_L3 = resample(temp_oL3 , 0.01,
cubic)
kill temp_oL3
temp_dot = gridpoint(temp500_L3, value)
kill temp500_L3
trend_L3 = trend(temp_dot, value, 1,
linear, 0.01)
kill temp_dot all
temp_max = ZONALMAX(maskimg , trend_L3)
sumimgl3 = (temp_max - trend_L3)
kill temp_max
asp_l3 = aspect(trend_l3)

temp_oL4 = select(imagef_l4, "value >
0")
kill imagef_l4 all
temp500_L4 = resample(temp_oL4 , 0.01,
cubic)
kill temp_oL4
temp_dot = gridpoint(temp500_L4, value)
kill temp500_L4
trend_L4 = trend(temp_dot, value, 1,
linear, 0.01)
kill temp_dot all
temp_max = ZONALMAX(maskimg , trend_L4)
sumimgL4 = (temp_max - trend_L4)
kill temp_max
asp_l4 = aspect(trend_l4)

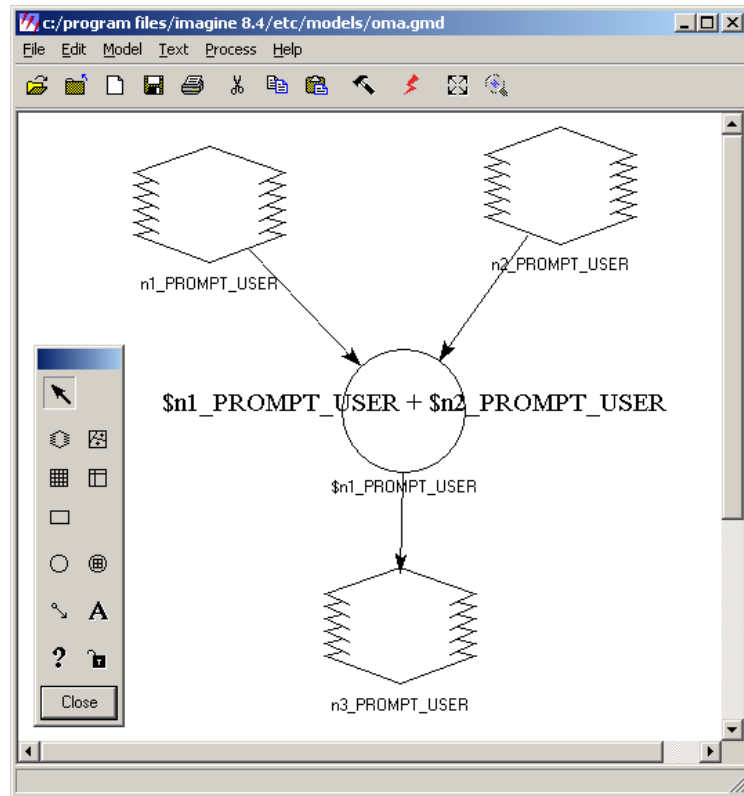
temp_oL5 = select(imagef_l5, "value >
0")
kill imagef_l5 all
temp500_L5 = resample(temp_oL5 , 0.01,
cubic)
kill temp_oL5
temp_dot = gridpoint(temp500_L5, value)
kill temp500_L5
trend_L5 = trend(temp_dot, value, 1,
linear, 0.01)
kill temp_dot all
temp_max = ZONALMAX(maskimg , trend_L5)
sumimgL5 = (temp_max - trend_L5)
kill temp_max
asp_l5 = aspect(trend_l5)

temp_oL6 = select(imagef_l6, "value >
0")
kill imagef_l6 all
temp500_L6 = resample(temp_oL6 , 0.01,
cubic)
kill temp_oL6
temp_dot = gridpoint(temp500_L6, value)
kill temp500_L6
trend_L6 = trend(temp_dot, value, 1,
linear, 0.01)
kill temp_dot all
temp_max = ZONALMAX(maskimg , trend_L6)
sumimgL6 = (temp_max - trend_L6)
kill temp_max all
kill maskimg all
asp_l6 = aspect(trend_l6)

&setvar imgnumb [response 'Enter a
IMAGENUMBER']
&type imagenumber is %imgnumb%
makestack tr_%imgnumb% list trend_l1
trend_l2 trend_l3 trend_l4 trend_l5
trend_l6
stackstats tr_%imgnumb%
I:\arc\stats\trendd_%imgnumb%.txt
detail
stackstats tr_%imgnumb%
I:\arc\stats\trend_%imgnumb%.txt
makestack sum_%imgnumb% list sumimgl1
sumimgl2 sumimgl3 sumimgl4 sumimgl5
sumimgl6
stackstats sum_%imgnumb%
I:\arc\stats\sumlistd_%imgnumb%.txt
detail
stackstats sum_%imgnumb%
I:\arc\stats\sumlist_%imgnumb%.txt
makestack asp_%imgnumb% list asp_l1
asp_l2 asp_l3 asp_l4 asp_l5 asp_l6
stackstats asp_%imgnumb%
I:\arc\stats\aspectsd_%imgnumb%.txt
detail
stackstats asp_%imgnumb%
I:\arc\stats\aspects_%imgnumb%.txt
q
q

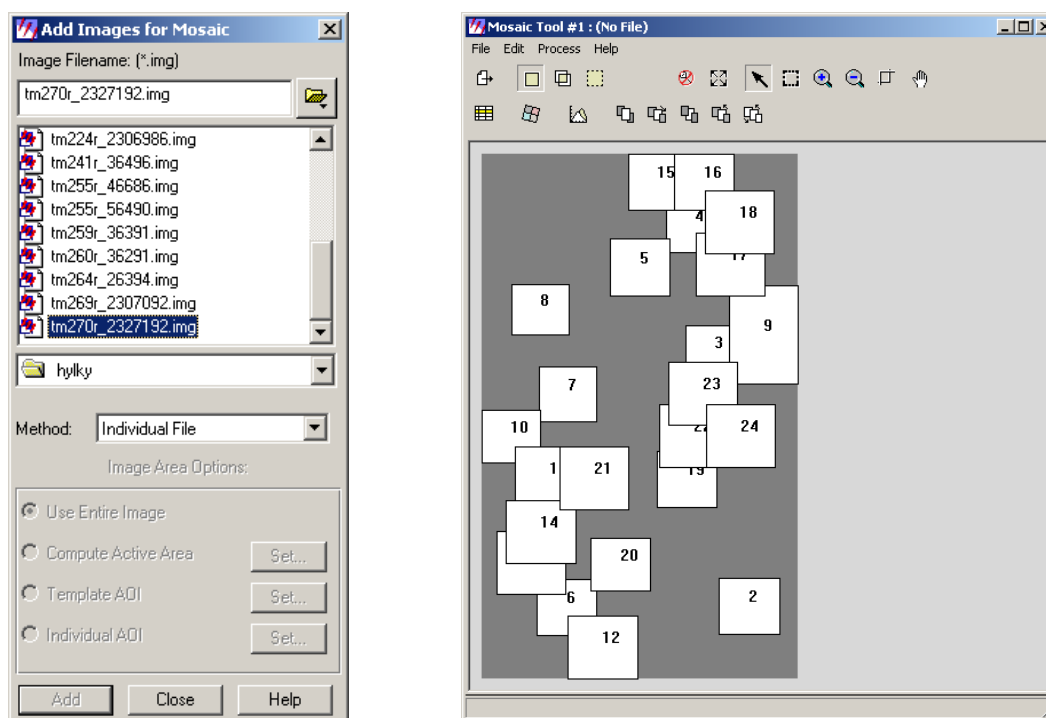
```

6. Import the stack SUMIMG to Erdas imagine and sum the stack with the original image using the Imagine modeler.

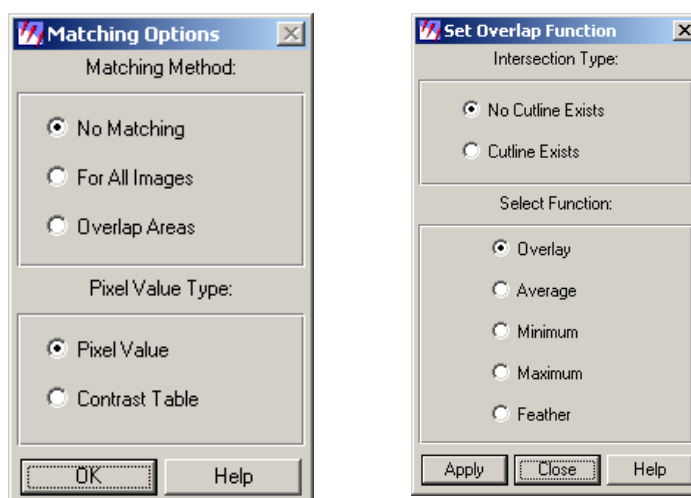


## Mosaicking the images

1. Select **Data Prep > Mosaic Images**, Mosaic tool opens.
2. Start adding images to be mosaicked with **Edit > Add Images**, *Add Images for Mosaic* dialog box opens. Start building the mosaic by selecting images files to be included. Newly added images will overlay the images added earlier, so start from the cloudiest ones and proceed to better quality images. Images can also be ordered later.





3. After all images have been added to the mosaic tool, set or check the **Image matching** option and **Overlap function** from the **Edit** menu. For the WAGIS mosaic options No matching was used and original pixel values were taken to the mosaic. Intersection was done without a cutline with an Overlay function.



4. Start the mosaicking by selecting **Process > Run mosaic**.

## Appendix C) CD database structure

This appendix presents the structure of the Amazon CD database. The structure of the three tables (see also Figure 3) is presented in the tables below.

Table 7. Fields of the FILES table in the database. Symbol  indicates that the field is a primary key of the table, while  identifies fields that are used as links to small option tables.






COLUMN NAME	PROP.	TYPE	DESCRIPTION
File ID		Counter	Running number given to each item in the database.
CD number	•	Number	Number of the CD.
File Name	•	Text	Descriptive name of the entered item or actual file name.
Data Group ID		Number	Code indicating whether the item is an original Landsat image, a processed RS image, a text document etc.
File Format ID		Number	Code indicating the file format, e.g. Erdas Imagine file, ER Mapper file text file etc.
Source Organization ID		Number	Code for the organization that provided the file.
Country ID		Number	Code specifying the country or area the item covers.
Place Name	•	Text	Names of one or more places, rivers or lakes within the covered area.
Notes	•	Memo	Space for any additional notes.

Table 7. Fields of the ORIGINAL LANDSAT IMAGES table in the database. Symbol  indicates that the field is a primary key of the table, while  identifies fields that are used as links to small option tables.










COLUMN NAME	PROP.	TYPE	DESCRIPTION
File ID		Number	Code linking this table to the Files table with a one-to-one relationship.
Nothing Really	•	Counter	Used for creating links between different pages. Of no importance for the database user.
Sensor ID		Number	Code specifying the Landsat sensor
Path	•	Number	Path of the scene in Landsat WRS system.
Row	•	Number	Row of the scene in Landsat WRS system.
Acquisition Date	•	Date	Acquisition date of the image.
Metadata	•	Hyperlink	Hypelink to a TXT file containing the original metadata.
Quicklook	•	Hyperlink	Hypelink to a JPEG file containing the quicklook of the image.

Table 8. Fields of the PROCESSED IMAGES table of the database. Symbol  indicates that the field is a primary key of the table, while  identifies fields that are used as links to small option tables.

COLUMN NAME	PROP.	TYPE	DESCRIPTION
File ID		Number	Code linking this table to the Files table with a one-to-one relationship.
Nothing Really	•	Counter	Used for creating links between different pages. Of no importance for the database user.
Image Type ID		Number	Code presenting the remotely sensed data type (e.g. Landsat TM, Landsat MSS, JERS-1 SAR, NOAA, AVHRR)
Original Images		Text	Number(s) of the original image(s) used in the scene.
Pixel Size	•	Number	Pixel size of the image in meters.
Rectified	•	Boolean	Yes/No selection indicating if the image has been rectified and georeferenced.
Projection		Number	Code indicating the projection used in georeferencing.
Datum		Number	Code indicating the datum used in georeferencing.
Atmospheric Correction		Boolean	Yes/No selection indicating if the image has been atmospherically corrected.
Subset		Boolean	Yes/No selection indicating if the image is a subset of the original.
Mosaicking		Boolean	Yes/No selection indicating if the scene is a mosaic of more than one original image.
Other Processing Types		Text	Description of applied processing types not specified in the database.

## Appendix D) Notes on UTU-ART database pages

### ***Functionality in HTML***

The functionality of an MS Access database can be used through the Internet when 'Pages' are used instead of 'Forms'. In principle a Page is very similar to a Form, however, there are a few important differences:

- A Page is written in HTML, a Form is written in Visual Basic.
- A 'Page' is stored outside the database and only has links to it, while a 'Form' is stored within the database.

### ***Bound Combo Boxes (drop down list) in a Page***

Create a bound Combo Box as follows:

- Add a Combo Box to the Page in the Design View, while the Wizard Button in the Toolbox window is switched on.
- In the wizard select: I want the combo box to look up values in a table or query.
- Select the source table or query
- Select the field that is linked to the table your building a Page from
- Go through the rest of the wizard and push Finish
- Now select the combo box in the design view and open the properties window
- At Data/ControlSource, select the field in which to open the external data
- If you like you can change the field 'ListDisplayField' if you do not want the data from the linked field, but from another field in the external table/query to show.

Now it should work. Change the view and try.

### ***Hyperlinked fields in a Page***

One of the ways to create a hyperlinked field to a stored file on a page is as follows:

- In the table that contains the hyperlink data, create a text field with the relative paths to the data (e.g. Metadatasheets\UTU\_95.txt). Paths are relative to the position of the database.
- Create a Page of the table that contains your links and add a hyperlink to the page.
- Under 'Data' in the hyperlink properties, set the option ControlSource to the field that holds the link.
- Under 'Anchor' in the hyperlink properties, set the option ControlSource (Anchor) to the field that holds the link
- Under 'Anchor' in the hyperlink properties, set the option Href so that it forms a prefix for the linked data (e.g. file:///D:/Albert/Amazon/database/)

Thus, the two examples in above make a link to the following file:

- file:///D:/Albert/Amazon/database/Metadatasheets\UTU\_95.txt)



## ***Specifying the characteristics of the window that opens when clicking a hyperlink***

When adding a hyperlink, Access does not give any standard properties to set the characteristics of the opening window (except for Target). You can set the characteristics in the Microsoft Script Editor. Follow the next steps:

- Open you page in design view
- Right click the hyperlink from which you want to edit the opening window
- From the element properties, check the Id (from the All tab)
- Open the Microsoft Script Editor
- From Edit/Find search from the Id and look for the following string (note that in your case this string might be slightly different):

```
<A href="Processing.html" id=ImageHyperlink1_Anchor
target=parent><IMG id=ImageHyperlink1
src="Original Data Entry_files\image009.jpg"
style="BORDER-BOTTOM: 0px; BORDER-LEFT: 0px; BORDER-RIGHT: 0px;
BORDER-TOP: 0px; HEIGHT: 0.608cm; LEFT: 15.001cm; POSITION:
absolute; TOP: 0cm; WIDTH: 0.714cm; Z-INDEX: 1"
tabIndex=35></IMG></A>
```

- In this string you can add an On Click command. When doing so, the name of the file you refer to moves from straight after A href= to the On Click string. The on click string looks as follows (note the different window settings you can change)

```
<a href="#" onClick="MyWindow=window.open('Processing.html
','MyWindow','toolbar=no,location=no,directories=no,status=no,
o,menubar=no,scrollbars=no,resizable=no,width=375,height=190
,left=20,top=20'); return false;">
```

- So, integrated in the script it looks as follows:

```
<A href="#" id=ImageHyperlink1_Anchor
target=parent onClick="MyWindow=window.open('Processing.html
','MyWindow','toolbar=no,location=no,directories=no,status=no,menu
bar=no,scrollbars=no,resizable=no,width=375,height=190,left=20,top
=20'); return false;"><IMG id=ImageHyperlink1
src="Original Data Entry_files\image009.jpg"
```

```
style="BORDER-BOTTOM: 0px; BORDER-LEFT: 0px; BORDER-RIGHT:
0px; BORDER-TOP: 0px; HEIGHT: 0.608cm; LEFT: 15.001cm; POSITION:
absolute; TOP: 0cm; WIDTH: 0.714cm; Z-INDEX: 1"
```

```
tabIndex=35></IMG></A>
```

## ***Adding alerts to a Page***

Instead of a normal hyperlink one can add an alert to a page, which means that after clicking a certain word or sentence a windows alert window opens (presented below) giving a certain message.



Add an alert as follows:

- Open you page in design view
- Open the Microsoft Script Editor (button in top menu bar)
- Search for the string that contains the word or sentence you would like to add the link to. The string looks as more or less as follows (the word to link to is **Path:**):

```
style="HEIGHT: 18px; LEFT: 159px; POSITION: absolute; TOP: 64px;
WIDTH: 48px">Path:</SPAN>
```

- Add an 'On Click' command as follows:

```
style="HEIGHT: 18px; LEFT: 159px; POSITION: absolute; TOP: 64px;
WIDTH: 48px">
```

```
<A onclick="alert('Enter the Worldwide Reference System (WRS) path
number. ')"><U>Path:</U></A></SPAN>
```

- Save the file in the Microsoft Script Editor

Note 1: Replace the words between ( ' ' ) to change the text in the alert.

Note 2: the <U> </U> command does not belong to the on click command, but just underlines the word **Path:**

### ***Adding a Find button to a Page***

One can add a Find button to a page by following the steps below. The resulting Find button will query one field of your page for a specific string.

- Open a data access page in Design view.
- Make sure the **Control Wizards** tool in the toolbox is not selected. This turns off the wizard.
- In the toolbox, click the **Command Button** tool.
- On the data access page, click the command button in the header section that corresponds to the recordset that you want to search.
- Click the **Microsoft Script Editor** button in the top menu bar.
- On top of the editor's main window there are two pull down lists. In the left one, select the button you added and in the right one, select **On Click** to go to the part of the text that describes what happens after clicking the button.
- Edit the **On Click** script in the main window (see example below, it shows the script of a button that finds a specific Path)
- Save your edits and close the **Microsoft Script Editor**.
- Now you can change the looks of your button from the Command button properties.

Search for specific Path script (note that all the lines starting with (')) are ruled out and do not influence the characteristics of the button):

```
<SCRIPT language=vbscript event=onclick for=btnFind>
<!--
' Clone the recordset.
Dim rs
Set rs = MSODSC.DataPages(0).Recordset.Clone

On error resume next
' This line assumes that the value you are filtering on is an integer.
' If the search value is a string, use slightly different syntax.
' For example, "CustomerID = '" & CStr(InputBox("Please enter customer to
find", "Find")) & "'"
rs.find "Path=" & cLng(inputbox("Enter a Path number","Find"))

' Custom error handling.
If (err.number <> 0) Then
    MsgBox "Error: " & err.number & " " & err.description, "Invalid Search"
    Exit Sub
End If

' Check search results for success.
If (rs.bof) or (rs.eof) Then
    MsgBox "No Product found", "Search Done"
    Exit Sub
End If

MSODSC.DataPages(0).Recordset.Bookmark = rs.Bookmark
-->
</SCRIPT>
```

### ***Quickly create a reasonable looking page to start with***

You can very quickly create a reasonable looking page as follows:

- In the database window, click the Pages tab
- Push the New button
- Select AutoPage: Columnar and define the source table or query from the dropdown list
- Click OK

### ***Adding controls to a page***

Probably the easiest way to add data to a page is as follows:

- Open or create a page in designview
- Make sure the Field List is open (View/Field List)
- Drag tables or table columns to the Page

### ***Creating a page (in Wagis database) that only shows records of one datatype, but includes information from the Files table***

When creating pages that show info from one data type, including info from the Files table, it is important to add the controls of that data type first and then add the controls of the Files table. In case you do it the other way around, the resulting page will show all records from the Files table, including those that do not belong to the data type you actually want to browse.

### ***Creating a tabular page with a row for each record***

If you want to create a tabular page with a new row for each record,

- Open or create a page in designview
- Make sure the Field List is open (View/Field List)
- Drag your table of interest to the page
- In the wizard that appears, select tabular

### ***Creating a Page for data entry only***

When creating a standard page, one can enter data as well as browse through the different records. If you want a page that will only allow for data entry, follow the next steps:

- Open the page in design view
- Right click your mouse and select Page Properties
- In the properties, select the Data Tab
- Set DataEntry to through

### ***Create a non editable textbox***

You can set the properties of a textbox so that the data becomes non-editable. Just select the text control box in design view and change the Read Only option, under the Others tab of the properties, to true.

### ***Adding and removing buttons from the Page toolbar***

In order to add or remove buttons from the Page toolbar, do the following:

- Open the page in design view and right click the toolbar
- Go to Navigation Buttons and customize as you wish

### ***Creating a hyperlink that connects two pages***

You can create a hyperlink that connects two pages as follows:

- Open the page to which you want to put the link in design view
- From the toolbar, select Hyperlink
- Click the page on the position where you want to add the link
- In the wizard type the name of the link in Text to display
- At Look in, browse to the Page you want to link to.
- Click OK.

Note, you can also make the link such that it filters the goal page so that you will only see the record related to the record in which you clicked the hyperlink. Set this filter as follows:

- In design view, open the properties of the hyperlink
- Select the Anchor tab
- Fill an SQL statement in the ServerFilter box.

Notes: The SQL statement links the one page to the other, so basically you have to tell which field in the one table equals which field in the second table. So far I could it only get working with number fields. For example like this:

```
CDNumber=[CDNumber]
```

In case you do not have fields you could use for linking, you could also add an autonumber to one of the table present in both pages and add it to both pages as a hidden control. This will create a unique link for each record.

***Specifying the connection between Pages and the Database (connection files).***

You can connect the pages and the database in two different ways, either by setting the connection information in each Page separately, or then by creating a connection file. The advantage of a connection file is that it sets the connection properties for several pages at once. So when you later move the Database, or the Pages, it is relatively easy to update the connections. Simply open the connection file in a text editor and change the Source information.

You can create a connection file as follows:

- If a database is open in Microsoft Access, close it.
- On the **File** menu, click **New**.
- In the **New File** dialog box, click **Blank Data Access Page**.
- In the **Select Data Source** dialog box, click **New Source**.
- In the **Data Connection Wizard** dialog box, select the data source that you want to connect to.
- Follow the directions in the wizard dialog box.
- Access creates a connection file with the information you specified.
- In the **Select Data Source** dialog box, click **Cancel**.
- Access creates a blank data access page.
- Close the data access page.
- You can use the connection file with existing or new data access pages.

See the Access help files for more information.

## Appendix E) Various Instructions for ArcIMS site modification

Most of the information below was obtained from [ESRI's ArcIMS Forum](#). In case you have questions about ArcIMS, it's a good idea to check these pages.

- Adding images to services
- Taking away the overview map
- Changing letter size of the field names in the 'Layers' frame
- Making links of the field names in the 'Layers' frame
- Displaying a layer info button next to each layer name (info will be shown search result window).
- Modification to aimsIdentify.js to correct hyperlinkprefix and hyperlinksuffix bug
- Changing the appearance of the copyright text
- Changing the appearance of the scale bar
- Changing the rounding of the scale bar to more appropriate numbers
- Getting rid of the table borders of the tool menu
- Changing the standard tool bar button menu to one long vertical row
- Defining the position of the toolbar buttons
- Changing background color of the toolbar frame
- Changing background color of the bottom frame
- Changing background and text color of the mode frame
- Setting the background color of the map frame
- Rearranging the toolbar buttons in one horizontal line in the bottom frame
- Rearranging the toolbar buttons in a horizontal line in the right of the top window
- Changing sizes of the different frames
- Taking off the frame borders
- Setting characteristics of the overview map
- Using external window for Identification Info
- Using external window for Search and Query forms
- Changing the colors of find, query and identify forms/windows:
- Change zoomfactor
- Replacing ArcIMS logo in top left with other logo and change link
- Adding a folder like grouping system to the layer list

### ***Adding images to services***

ArcIMS recognizes different image formats (see also ArcIMS Help files, chapter 'Authoring Map Services/Data Formats for ArcIMS'). Images can be used as a background. ArcIMS subsets the original image files and converts them into JPEG before sending them over the Internet. Because of this procedure the original images can be fairly large.

### **World files**

In order to project the images in the correct coordinate space most image types need a world file (see also ArcIMS Help files). This file contains information about the cell

sizes and the coordinates of the top left pixel. World files are very easy to program yourself. A typical world file looks like this:

```
0.0045
0.0
0.0
-0.0045
-82.06759695
6.69
```

Line one and four are cell sizes, line two and three probably represent the top left corner (though I'm not sure), line five and six are coordinates of the top left corner.

It's easy to identify the world file that should accompany an image file: world files use the same name as the image, with a "w" appended. For example, the world file for the image file mytown.tiff would be called mytown.tiffw, and the world file for redlands.rlc would be redlands.rlcw. For workspaces that must adhere to the 8.3 naming convention, the first and third characters of the image file's suffix and a final "w" are used for the world file suffix. Therefore, if mytown.tif were in an 8.3 format workspace, the world file would be mytown.tfw. If redlands.rlc was in an 8.3 format workspace, its world file would be redlands.rcw.

#### **Adding very large images (such as Landsat TM Mosaic)**

In order to add the Wagis mosaic to the Amazon Team Internet site, the original Erdas Imagine file was recalculated into three new Imagine files. One with a pixel size of 1000m, one with pixel size 500m and one with a 250m pixel size. These three Imagine files were then exported to a RGB image in TIF format. World files were added as well. In the ArcIMS Author the different image files were then assigned to different zoom levels, so that with high scale factors broad pixels are shown and when zooming in, smaller pixels.

This procedure has the following advantages:

- When zooming out, ArcIMS uses a smaller file to calculate the JPEG image. This saves time.
- When zooming out, the larger pixel sizes result is a less fuzzy and more clear image.

Note: When the image files grow too big, the ArcIMS Author is not able to handle and project them anymore. It may then be necessary to add the largest images into the AXL file manually. Just open the file in a text editor and copy and adjust the string of the smaller images you could add using the Author. Once added to the AXL file, the images will show correctly on the Internet. When working in the Author afterwards, it's better not to zoom in too much since the program may again get stuck trying to open the largest files (you can also find some info in the ArcIMS Help files on this topic. It's in the chapter 'Authoring Map Services/Data Formats for ArcIMS').

### ***Taking away the overview map***

Taking off the Overview Map is very quick and easy, just follow the following steps:

- In the ArcIMSParam file change line 32 to: `var has OVMMap = false`
- In the Mapframe.html change line 79 to: `ovIsVisible = false`

### ***Changing letter size of the field names in the 'Layers' frame***

You can change the letter size by filling a new value for 'Size' in line 164 of the toc.htm file.

### ***Making links of the field names in the 'Layers' frame***

In toc.htm:

#### **replace**

```
document.writeln('<td><font face="Arial" size="-1">' +
t.LayerName[i] + '</font></td>');
```

#### **with**

```
if (t.hrefLayer[i]) {
document.writeln('<td><a href=' + t.hrefLayer[i] +
'target="_BLANK"><font face="Arial" size="-1">' +
t.LayerName[i] + '</font></a></td>');
} else {
document.writeln('<td><font face="Arial" size="-1">' +
t.LayerName[i] + '</font></td>');
}
}
```

#### **note**

If you want the layer names to appear as a link, underline them by putting the tags `<u></u>` in the above string like this:

```
if (t.hrefLayer[i]) {
document.writeln('<td><a href=' + t.hrefLayer[i] +
'target="_BLANK"><font face="Arial" size="-1"><u>' +
t.LayerName[i] + '</u></font></a></td>');
} else {
document.writeln('<td><font face="Arial" size="-1">' +
t.LayerName[i] + '</font></td>');
}
}
```

Furthermore, you can change letter size and color e.g. like this:

```
if (t.hrefLayer[i]) {
document.writeln('<td><a href=' + t.hrefLayer[i] +
'target="_BLANK"><font face="Arial" size="-2"
color="blue"><u>' + t.LayerName[i] +
'</u></font></a></td>');
} else {
document.writeln('<td><font face="Arial" size="-1">' +
t.LayerName[i] + '</font></td>');
}
}
```

#### **In ArcIMSParam.js:**

add the following lines of code somewhere near the top of this file

```
// href info for layers list in TOC
var hrefLayer = new Array();
hrefLayer[0] = "put url here";
hrefLayer[1] = "put url here";
hrefLayer[2] = "put url here";
hrefLayer[3] = "put url here";
hrefLayer[4] = "put url here";
```



**Example:**

```
hrefLayer[5] = "http://map1.ngdc.noaa.gov/index.html";
```

**NOTE:** A common error is the single and double quotes are improperly placed. The format for the hreflayer line is single quote, double quote, url, double quote and single quote.

In the above lines, substitute **put url here** with the metadata url that you want to reference. Fill out the array above with the url for each layer that you have in the TOC area. If a layer is turned off at the global level, the scale dependent layer needs to be a item in the array above.

If you have six layers in the TOC area:

The **first layer** corresponds to **hrefLayer[0]**

The **second layer** corresponds to **hrefLayer[1]**

The **third layer** corresponds to **hrefLayer[2]**

The **fourth layer** corresponds to **hrefLayer[3]**

The **fifth layer** corresponds to **hrefLayer[4]**

The **sixth layer** corresponds to **hrefLayer[5]**

When the end user clicks on the field name a separate window will appear with the associated metadata for that layer.

***Displaying a layer info button next to each layer name (info will be shown search result window).***

In the MapFrame.htm file, change the following string (line 78) to true:

```
displayLayerInfoButton= false;
```

***Modification to aimsIdentify.js to correct hyperlinkprefix and hyperlinksuffix bug***

There seemed to be an error in the default code in the aimsIdentify.js file. You should make a correction to one line of code at line 256. Here is the corrected code:

```
if (showHyper) {
    for (var s1=0;s1<hyperLinkFields.length;s1++) {
        if (hyperLinkFields[s1]==fName1[f]) {
            var theLinkURL = hyperLinkPrefix[s1] + fValue1[f] +
            hyperLinkSuffix[s1];
            Win1.document.write('<a href="' + theLinkURL + '" target="_blank">');
            isHyper=true;
        }
    }
}
```

***Changing the appearance of the copyright text***

Most of the settings can be changed in the lines 144-155 of the ArcIMSparam.js file. They look as follows:

```
// Copyright blurb
var drawCopyright = true;
var CopyrightFont = "Arial";
var CopyrightStyle = "Bold";
var CopyrightSize = "8";
var CopyrightCoords = "4 4";
var CopyrightColor = "0,0,0";
```

```

var CopyrightBackground = "False";
var CopyrightBGColor = "255,255,255";
var CopyrightGlow = "True";
var CopyrightGlowColor = "255,255,255";
var CopyrightText = "Map created with ArcIMS - Copyright (C) 1992-
2001 ESRI Inc.";

```

However, if you want to get rid of the nasty shadow, you have to adjust the aimsXML file. Change line 736 from:

```
theString += 'shadow="32,32,32" overlap="false" ';
```

to:

```
theString += 'shadow="false" overlap="false" ';
```

### ***Changing the appearance of the scale bar***

The style in which the scale bar appears can be set in the ArcIMSparam.js file. Just edit the ScaleBar parameters (somewhere around line 135). The parameters look as follows:

```

var drawScaleBar = true;
    // MapUnits=DEGREES,FEET,METERS
    // can MapUnits be changed by user?
var setMapUnits=false;
    // ScaleBarUnits=KILOMETERS,METERS,MILES,FEET
var ScaleBarBackground = "TRUE";
var ScaleBarBackColor = "0,0,0";
var ScaleBarFontColor = "255,255,255";
var ScaleBarColor = "192,192,192";
var ScaleBarFont = "Arial";
var ScaleBarStyle = "Bold";
var ScaleBarRound = "1";
var ScaleBarSize = "14";
var ScaleBarWidth = "7";
var ScaleBarPrecision = 2;
var numDecimals = ScaleBarPrecision;

```

### ***Changing the rounding of the scale bar to more appropriate numbers***

In order to do this, two things should be done. Add the following script to the aimsXML.js file:

```
theString += 'round="' + ScaleBarRound + ' ';
```

You can put it at line 762, just above the string:

```
if (MapUnits!="DEGREES") {
```

Then open the ArcIMSParam.js file and set the variable ScaleBarRound (probably in line 139). The number you fill stands for the amount of kilometres/meters/feet you round to.

### ***Getting rid of the table borders of the tool menu***

Open the toolbar.htm file and change in line 70:

```
TABLE BORDER="1"
```

To

```
TABLE BORDER="0"
```

### ***Changing the standard tool bar button menu to one long vertical row***

(to create one horizontal row, please check “Rearranging the toolbar buttons in one horizontal line in the bottom frame”)

In order to do this, two things should be done in the toolbar.htm file. First, from all the lines quoting:

```
if (isSecond) document.write('</tr><tr>');
```

delete the part

```
if (isSecond)
```

Then, add the following line:

```
document.write('</tr><tr>');
```

under (probably lines 82-86):

```
// Legend toggle. . . requires aimsLegend.js
document.write('<td align="center" valign="middle">');
document.write('');
isSecond = !isSecond;
document.writeln('</td>');
```

### ***Defining the position of the toolbar buttons***

To some extent you can influence the position of the toolbar buttons by changing the settings in the following string of the toolbar.htm file (line 70):

```
<TABLE BORDER="0" CELLSPACING="1" CELLPADDING="1" ALIGN="CENTER"
VALIGN="MIDDLE" BGCOLOR="White" BORDERCOLOR="Gray"
BORDERCOLORLIGHT="Silver" BORDERCOLORDARK="Black">
```

**Changing background color of the toolbar frame**

You can change the background color of the toolbar frame from the toolbar.html file by changing the definition of the following code (line 68):

```
<BODY BGCOLOR="Silver">
```

You can e.g. change “Silver” to “White”

**Changing background color of the bottom frame**

The background color of the bottom frame can be set in the bottom.htm file. From line 7 you can delete the link to the image and change the BGCOLOR code. For example like this:

```
<BODY BGCOLOR="#0033CC" LEFTMARGIN=0 TOPMARGIN=0>
```

**Changing background and text color of the mode frame**

The background and text color of the mode frame can be set in the ModeFrame.htm file. From line 7 you can change the background color by deleting the link to the image and change the BGCOLOR code. The TEXT tag defines the color of the link text. Edit the line for example like this:

```
<BODY BGCOLOR="White" TEXT="#0033CC" LINK="Black" VLINK="Black"
LEFTMARGIN=0 TOPMARGIN=0>
```

Note: for some reason do changes to the ModeFrame.htm not always update with a normal refresh (Ctrl+F5) in the browser. You will probably have to close and reopen it.

**Setting the background color of the map frame**

You can set the background color of the map frame in the ArcIMSParam file. In order to do so, change the color code in the following line (25):

```
var mapBackColor = '225,225,225';
```

**Rearranging the toolbar buttons in one horizontal line in the bottom frame**

If you do not like the standard toolbar on the left side of the screen, you can move and rearrange the buttons in another frame, like the bottom frame for example. In order to do so, two things should be done. First one has to move the buttons to the bottom frame and second the buttons have to be rearranged into one horizontal row in order to fit the frame.

## Moving the toolbar buttons to the bottom frame

This is very easy and can be done in the viewer.htm file. Here the basic frames are defined. The script can be read as follows: Line 46 states that in the top of the screen there's one row. This row is defined as the top frame in line 47. Then line 48 states that the second row consists of 3 columns. On the left the Toolframe, in the middle a frame set with the Mapframe and the Textframe and on the right the Tocframe. The rest of the frames is described below this.

A very easy way to get the tools from the Toolframe to the Bottom frame is to just switch the frame names. In line 50, change (always use a text editor to change the viewer.htm frame file. Dreamweaver for some reason does not save changes correctly):

```
<FRAME NAME="ToolFrame"
```

To:

```
<FRAME NAME="BottomFrame"
```

And then in line 59, change:

```
<FRAME NAME="BottomFrame"
```

To:

```
<FRAME NAME="ToolFrame"
```

The first change makes that the bottom frame is projected at the place of the toolframe. By setting it's width to 0 you can now prevent it from showing at all. To do so, change line 48 as follows:

```
('<FRAMESET COLS="' + (50+addNS)
```

To:

```
('<FRAMESET COLS="' + (0+addNS)
```

Note that it's also possible to completely take out the original ToolFrame, however the solution above works as well.

## Showing the tools in one horizontal row

If after making the changes above you reload the ArcIMS page, you'll note that the toolbar moved to the bottom frame, but only one button shows because the others do not fit. You can make them fit by putting the buttons in one horizontal row. This can be done as follows:

In the Toolbar.htm file, set the following quote (line 10) to false:

```
var isSecond=true;
```

Then command out all the lines that read:

```
isSecond = !isSecond;
```

Save the Toolbar.htm file. Now when you reload the IMS page, the toolbar should show correctly.

### ***Rearranging the toolbar buttons in a horizontal line in the right of the top window***

If you do not like the standard toolbar on the left side of the screen, you can move and rearrange the buttons in another frame, like the top frame for example. In order to do so, two things should be done. First one has to move the buttons to the top frame and second the buttons have to be rearranged into one horizontal row in order to fit the frame. Rearranging the buttons into one horizontal row is explained in the paragraph "Rearranging the toolbar buttons in one horizontal line in the bottom frame". Below will be explained how to move the toolbar to the right of the TopFrame

In principle one has to adjust the viewer.htm file so that the top frame is subdivided in two columns. In the right of these two columns the toolbar will be placed. The subdivision is to be made directly under the following line (45):

```
document.writeln('<FRAMESET ROWS="' + (30+addNS) + ',*,30,0"
FRAMEBORDER="Yes" FRAMESPACING="0" onload="doIt()" BORDER=0 ' +
moreStuff + '>');
```

Furthermore the old toolbar frame width is set to 0 by setting:

```
('<FRAMESET COLS="' + (50+addNS)
```

To:

```
('<FRAMESET COLS="' + (0+addNS)
```

Then in the old line defining the contents of the Toolbar frame, the Frame name, linking to the tool bar is removed:

```
<FRAME NAME="" SRC="blank.htm" MARGINWIDTH="0" MARGINHEIGHT="0"
SCROLLING="No" FRAMEBORDER="Yes" NORESIZE FRAMESPACING="0"
BORDER="0">
```

However, have a look at it yourself. The frame definition below does the trick!!:

```
document.writeln('<FRAMESET ROWS="' + (30+addNS) + ',*,30,0"
FRAMEBORDER="Yes" FRAMESPACING="0" onload="doIt()" BORDER=0 ' +
moreStuff + '>');
```

```
document.writeln('<FRAMESET COLS="*,600" FRAMEBORDER="No"
FRAMESPACING="0" BORDER=0>');
```

```
document.writeln('<FRAME NAME="TopFrame" SRC="top.htm"
MARGINWIDTH="5" MARGINHEIGHT="0" SCROLLING="No" FRAMEBORDER="0"
NORESIZE>');
```

```
document.writeln('<FRAME NAME="ToolFrame" SRC="blank.htm"
MARGINWIDTH="5" MARGINHEIGHT="0" SCROLLING="No" FRAMEBORDER="0"
NORESIZE>');
```

```
document.writeln('</FRAMESET>');
```

```
document.writeln('<FRAMESET COLS="' + (0+addNS) + ',*,180"
FRAMEBORDER="Yes" FRAMESPACING="0" BORDER=0>');
```

```
</SCRIPT>
```

```
<FRAME NAME="" SRC="blank.htm" MARGINWIDTH="0" MARGINHEIGHT="0"
SCROLLING="No" FRAMEBORDER="Yes" NORESIZE FRAMESPACING="0"
BORDER="0">
```

```

<FRAMESET ROWS="*,0">

<FRAME NAME="MapFrame" SRC="MapFrame.htm" MARGINWIDTH="0"
MARGINHEIGHT="0" SCROLLING="No" FRAMEBORDER="Yes" RESIZE="YES">

<FRAME NAME="TextFrame" SRC="text.htm" MARGINWIDTH="0"
MARGINHEIGHT="0" SCROLLING="Auto" FRAMEBORDER="Yes" RESIZE="YES">

</FRAMESET>

<FRAME NAME="TOCFrame" SRC="TOCFrame.htm" MARGINWIDTH="0"
MARGINHEIGHT="0" SCROLLING="Auto" FRAMEBORDER="Yes" RESIZE="YES">

<FRAMESET COLS="180,*" FRAMEBORDER="0" BORDER=0 FRAMESPACING="0">

<FRAME NAME="ModeFrame" SRC="bottom.htm" MARGINWIDTH="0"
MARGINHEIGHT="0" SCROLLING="No" FRAMEBORDER="Yes" NORESIZE>

<FRAME NAME="BottomFrame" SRC="bottom.htm" MARGINWIDTH="0"
MARGINHEIGHT="0" SCROLLING="No" FRAMEBORDER="Yes" NORESIZE>

</FRAMESET>

<FRAME NAME="PostFrame" SRC="jsForm.htm" MARGINWIDTH="0"
MARGINHEIGHT="0" SCROLLING="No" FRAMEBORDER="Yes" NORESIZE
FRAMESPACING="0" BORDER="0">

<NOFRAMES>

```

Note 1: as already mentioned above, after redirecting the tools to the top right of the screen, the tools should be put in one horizontal line in order to fit the frame

Note 2: In order to make the top bar look better, change the title color and background of the left part in the Top.htm file. You can edit the following line (22):

```

<BODY BGCOLOR="Silver" LEFTMARGIN=0 TOPMARGIN=0 TEXT="#000099"
BACKGROUND="images/grad_gray.jpg">

```

It is for example possible to just delete the Background command containing the image and set the Background color (BGCOLOR) to White.

Note 3: If you don't want the new tool frame to load the grey background color at first, set the BGCOLOR in Blank.htm to e.g. White

Note 4: If you want to further organize the buttons, please read the paragraph "Defining the position of the Toolbar Buttons"

### ***Changing sizes of the different frames***

Some frame size settings can be changes in the viewer.html file. When doing this it's probably best to open the file in Notepad and not in Dreamweaver. When saving the frames file in Dreamweaver something goes wrong and the site does not work anymore. Examples of changes you can make:

- Adjust the toolbar frame. Make it e.g. narrower by changing:

```

(' <FRAMESET COLS="' + (50+addNS)

```

To e.g.:

```
(' <FRAMESET COLS=" ' + (30+addNS)
```

- Adjust the text frame (under map). Make it e.g. narrower by changing:

```
<FRAMESET ROWS="*,110">
```

To e.g.:

```
<FRAMESET ROWS="*,70">
```

- Adjust the layers frame from:

```
<FRAMESET COLS=" ' + (50+addNS) + ',*,180"
```

- The top frame from:

```
(' <FRAMESET ROWS=" ' + (16+addNS
```

- The bottom and mode frame from:

```
(' <FRAMESET ROWS=" ' + (30+addNS) + ',*,30,0
```

### ***Taking off the frame borders***

You can take away the frame borders from the overall page by changing all frameborder strings in the viewer.html to “No”. Thus:

```
FRAMEBORDER="Yes"
```

becomes:

```
FRAMEBORDER="No"
```

It’s best to do this in Notepad since Dreamweaver seems to alter the frames document so that it doesn’t work anymore.

### ***Setting characteristics of the overview map***

#### **Contents**

The easiest way to define the contents of the overview map is to use the ‘Overview contents option’ given in the Designer when publishing your map. Here you are able to specify which map service to use. If needed you can create a special service, just for the overview map.

#### **Setting the size of the overview map**

The size of the overview map is calculated from the size of the map window by codes given in the MapFrame.html file. In order to change the size of the overview map you only have to change the ratio parameter in the following line (108):

```
var locHeight = parseInt(mHeight/5);
```

In order to get the overview map smaller, change the 5 to a larger number. In order to make it bigger, decrease the number.



### **Using external window for Identification Info**

In order to get information obtained from e.g. the Identification tool into an external window instead of the bottom info window, switch the following option in the ArcIMSparam.js file to true:

```
var useExternalWindow=false;
```

### **Using external window for Search and Query forms**

In order to open the search and query options in external windows instead of in the information window in the bottom of the screen one can set the following option in the ArcIMSparam.js file (line 209):

```
var useTextFrame=true;
```

You should change the value to false

**Note 1, windows on top:** When switching off the TextFrame, some of the external form windows open under the map because the Window Focus is not correct. You can make all form windows open on top of the map window by following the next steps:

- Open the Toolbar.htm file in a text editor or Dreamweaver and go to line 228, just below the “if (parent.MapFrame.useQuery) {“ statement. Reverse the order of functions called by the onmousedown event so that the setToolPic function is called prior to the clickFunction:

```
if (parent.MapFrame.useQuery) {
// Query . . . requires aimsQuery.js
// IE 5.0 has big problems with the query stuff
document.write('<td align="center" valign="middle">');
document.write('');
isSecond = !isSecond
document.writeln('</td>');

document.write('</tr><tr>');
```

- Go to line 246, just below the “if (parent.MapFrame.useFind) {“ statement. Switch the order called by the onmousedown event so that the setToolPic function is called prior to the click Function. For example.

```
if (parent.MapFrame.useFind) {
// Find . . . requires aimsQuery.js
document.write(' <td align="center" valign="middle">');
document.write('');
isSecond = !isSecond
document.writeln('</td>');
```

```
document.write('</tr><tr>');}
}
```

- In order to make the buffer tool open on top of the map, change line 296 of the Toolbar.htm file as described above.
- Save the toolbar.htm file.

**Note 2, no Active Layer message in external window:** Once you've switched off the TextFrame, ArcIMS starts opening a window when changing the active layer. The window shows the name of the active layer. You can switch this functionality off by deleting the lines 72-89 from the aimsLayers.js file. However, it should be mentioned that I'm not yet a 100% sure this does not negatively influence any other functionality. The exact text to delete is the following:

```
if (queryOpen) {
queryForm();
} else {
if ((useExternalWindow) || (!useTextFrame)) {
Win1 =
window.open("", "QueryWindow", "width=575,height=120,scrollbars=yes,resizable=yes");
theFrame = "opener";
if (parent.MapFrame!=null) theFrame = "opener.parent.MapFrame";
} else {
Win1 = parent.TextFrame;
Win1.document.open();
}
Win1.document.open();
Win1.document.writeln('<html><meta http-equiv="Content-Type"
content="text/html; charset=' + charSet + '><head><title>' +
titleList[1] + '</title></head>');
Win1.document.writeln('<body bgcolor="' + tableBackColor + '"
text="Black" link="Blue" vlink="Gray" LEFTMARGIN=0
onload="window.focus()">');
Win1.document.writeln('<center><FONT FACE="Arial" SIZE="-1"><b>' +
LayerName[ActiveLayerIndex] + msgList[20] + '</b>');
Win1.document.writeln('</font></center></body></html>');
Win1.document.close();
}
}
```

After deleting, save the aimsLayers.js file.

### **Changing the colors of find, query and identify forms/windows:**

#### **Find form colors**

Open the .htm file representing the form, e.g. findForm. Search for color tags, like those in line 34 and 38. Change the color, preferably using color names (e.g. Blue, White) of #.... Notations (e.g. #000099).

An example of a script turning the background color of the findForm to bright blue is as follows:

```
<BODY BGCOLOR="#0033CC" TEXT="White" TOPMARGIN=0 LEFTMARGIN=0>
  <DIV ALIGN="center">
    <FONT FACE="Arial" SIZE="-2"><B>
```

```

        <FORM ACTION="" NAME="theFindForm" onsubmit="setStyle();
return false;">
        <TABLE CELLSPACING="2" NOWRAP BGCOLOR="#0033CC"
WIDTH=100%>

```

### Query form colors

Changing the query form colors is a bit different from changing the colors of the Find form. In this case the color parameters are set in the aimsQuery.js file. Basically one should replace all

```
' + textFrameBackColor + '
```

color statements in the lines 430-520. You can change the colors of the texts: Field, Operator and Value by adding color parameters to the following lines (about 440):

```

Win1.document.writeln(' <tr><td align="CENTER"
bgcolor="#0033CC"><font face="Arial" size="-2" Color="White">' +
msgList[72] + '</font></td>');

Win1.document.writeln(' <td align="CENTER" bgcolor="#0033CC"><font
face="Arial" size="-2" Color="White">' + msgList[73] +
'</font></td>');

Win1.document.writeln(' <td align="CENTER" bgcolor="#0033CC"><font
face="Arial" size="-2" Color="White">' + valueTitle +
'</font></td>');

```

### Identify result window colors

Colors of the Identify result window can be set in the ArcIMSParam.js file, lines 213-218. The strings that are to be set look as follows:

```

// colors for tables
var textFrameBackColor="#0033CC";
var tableBackColor="White";
var textFrameTextColor="Black";
var textFrameLinkColor="Blue";
var textFrameFormColor="Gray";

```

However, the color of the Layer name in the Identify window should be set from the aimsIdentify.js file (about line 175). Here you can add a color statement as follows:

```

Win1.document.writeln('<FONT FACE="Arial" SIZE="-1"
Color="White"><b>' + LayerName[ActiveLayerIndex] + '</b></FONT>');

```

### Alert form colors (alert form shows when there are no object available for identification)

The color characteristics of the Alert form can be set in the aimsIdentify.js file (about line 355-360). In the following example the background color was changed to blue and the text to white:

```

Win1.document.writeln(' <title>' + titleList[8] + '</title>');
Win1.document.writeln('</head>');
Win1.document.writeln('<body BGCOLOR="#0033CC" TEXT="White"
LEFTMARGIN=0 TOPMARGIN=0>');

```

```
Win1.document.writeln('<FONT FACE="Arial"><B>' +
LayerName[ActiveLayerIndex] + '</B></font><FONT FACE="Arial" size="-
2">');
```

### Set units form color

Colors of the set units form can be set in the setUnits.htm file. Background and text colors in the lines 145:

```
<BODY BGCOLOR="#0033CC" TEXT="White" TOPMARGIN=0
onload="window.focus(); setValues();" LEFTMARGIN=0>
```

More background color in line 166:

```
document.writeln('<TABLE CELLSPACING="2" NOWRAP BGCOLOR="#0033CC"
WIDTH=100%>');
```

### Set measure layer color

Characteristics for the Measure layer are set in the MapFram.htm file. You can change them in the following line (195-198):

```
// measure display

content = '<form><table bgcolor="#0033CC"><tr><td><font face="Arial"
size="-2" color="White"><b>Total:</b><INPUT TYPE="text"
NAME="theMeasTotal" VALUE="0" SIZE="25"></td>';

content = content + '<td><font face="Arial" size="-2" color="White"
><b>Segment:</b><INPUT TYPE="text" NAME="theMeasSegment" VALUE="0"
SIZE="25"></td></tr></table></form>';

createLayer("measureBox",0,0,500,25,false,content);
```

Use 'bgcolor' and 'color' to set background and text colors. Note that if you want to change the texts to white, one color strin should be added behind size="-2" in line 197.

### Set Buffer form color

In order to set the background color of the Buffer form the Buffer.js file should be changed.. In the shapeBuffer.htm, adjust the 'bgcolor' variables in the following string. Replace the following quote in line 69:

```
' + textFrameBackColor + '
```

with a color notation, e.g #0033CC in order to change to Blue.

### Set Selection by line/poligon form color

Colors in this form can be set in the Select.htm file by changing the color statements in the lines 60-64. In the following example the color was set to blue:

```
<BODY BGCOLOR="#0033CC" TEXT="White" TOPMARGIN=0 LEFTMARGIN=0
onload="window.focus()">
```

```
<DIV ALIGN="center">
<FONT FACE="Arial" SIZE="-2"><B>
<FORM NAME="Measure">
<TABLE WIDTH="100%" CELLSPACING="2" NOWRAP BGCOLOR="#0033CC">
```

### Set Print form color

Colors in this form can be set in the Printform.htm file by changing the color statements in line 39. In the following example the background color was set to blue and the text to white:

```
<BODY BGCOLOR="#0033CC" TEXT="White">
```

### Find form size and position

When opened in a separate window, the size and position of the find form can be changed in the aimsQuery.js file. The variables are stored in lines 48-59. They look as follows:

```
// find Form
function findForm() {
if (checkIfActiveLayerAvailable()) {
setLayerFields(ActiveLayerIndex);

if (useTextFrame) {
parent.TextFrame.document.location= appDir + "findForm.htm";
} else {
var Win1 =
open("findForm.htm", "QueryWindow", "width=575,height=120,left=200,top=
92,scrollbars=yes,resizable=yes");
}
}
}
```

Just change the width,height,left,top parameters. Furthermore you can give in whether the window should have scroll bars, location and resizability options.

### Query form size and position (if separate)

You can make changes to the parameters in the 'open string' of the following lines in the aimsQuery.js file ( around line 300):

```
if (useTextFrame) {
var Win1 = parent.TextFrame;
Win1.document.open();
var t = "parent.MapFrame";

} else {
var Win1 =
open("", "QueryWindow", "width=575,height=130,left=200,top=92,scrollbar
s=yes,resizable=yes");
var t = "opener";
if (parent.MapFrame!=null) t = "opener.parent.MapFrame";
}
```

In the standard code the parameters 'left' and 'top' are not included. You can add them yourself.

### Identify result window size and position

Edit the parameters in the following string (about line 164) of the aimsIdentify.js file:

```
if (showSelectedData) {
//alert("displayAttributeData()[opening html page]");
if ((useExternalWindow) || (!useTextFrame)) {
Win1 =
window.open("", "QueryWindow", "width=575,height=120,left=200,top=92,sc
rollbars=yes,resizable=yes");
theFrame = "opener";
```

In order to define the position, the parameters 'left' and 'top' were added.

Note: in case no objects are identified ArcIMS doesn't open an identify window, but an alert window instead. See Alert window notes for more information.

### Alert window size and position (shows when no objects are available for identification)

The alert window size and position, together with some other window parameters, can be set in the aimsIdentify.js file (about line 350). The string looks like this (after editing pop up position):

```
//alert(tempString);
if ((useExternalWindow) || (!useTextFrame)) {
Win1 =
window.open("", "QueryWindow", "width=575,height=120,left=200,top=92,sc
rollbars=yes,resizable=yes");
} else {
```

### SetUnits form size and position

In case the setUnits form opens in a separate window, window properties can be set from the aimsClick.js file, lines 345-350:

```
case "setunits":
if (useTextFrame) {
parent.TextFrame.location = "setUnits.htm";
} else {
window.open((appDir +
"setUnits.htm"), "OptionWindow", "width=575,height=120,left=200,top=92,
scrollbars=yes,resizable=yes");
}
```

### Set Measure layer size and position

Size and position of the Measure Layer can be changed in the MapFrame.htm file, line 198. In the following example the position is shifted 200 pixels to the right.

```
createLayer("measureBox", 200, 0, 500, 25, false, content);
```

**Set Buffer form size and position**

In case the buffer form opens in a separate window, the window size and position can be set in the aimsBuffer.js file. In order to do so, one should adjust line 36. In the following example both window position and size were changed:

```
} else {

var Win1 = open(appDir +
"text.htm", "QueryWindow", "width=575,height=120,left=200,top=92,scroll
bars=yes,resizable=yes");
```

**Set Select by line/polygon form size and position**

In case this form opens a separate window, the window size and position can be set in the aimsClick.js file. In order to do so, one should adjust line 491. In the following example both window position and size were changed:

```
Win1 =
open("select.htm", "QueryWindow", "width=575,height=120,left=200,top=92
,scrollbars=yes,resizable=yes");
```

**Set Print form size and position**

In case this form opens a separate window, the window size and position can be set in the aimsPrint.js file. In order to do so, one should adjust line 34. In the following example both window position and size were changed:

```
if (useTextFrame) {

parent.TextFrame.document.location = "printform.htm";

} else {

var Win1 =
open("printform.htm", "PrintFormWindow", "width=575,height=200,left=200
,top=92,scrollbars=yes,resizable=yes");

}
```

**Change zoomfactor**

The zoomfactor can be set in the ArcIMSParam.js file. Just change the value in the following string (line 105):

```
var zoomFactor = 2
```

Note that the zoom will not work at all when you put the zoom factor to 1.

***Replacing ArcIMS logo in top left with other logo and change link***

The ArcIMS logo in the top left of the screen can be replaced with another logo (e.g. that of the university) and one can alter the link to show the universities pages.

**Changing logo**

Changing the logo is very simple. Just replace the ArcIMS logo in the Image folder. The file to replace is called: aimslogo1x2

## Changing link

The link can be changed in the top.htm file, lines 12-17. One can for example replace:

```
function showInfo() {
if (parent.TextFrame!=null) {
parent.TextFrame.document.location="arcimsInfo.htm";
} else {
var Win1 =
open("arcimsInfo.htm", "InfoWindow", "width=575,height=150,scrollbars=y
es,resizable=yes");
}
}
```

With:

```
function showInfo() {

var Win1 =
open("http://www.utu.fi", "InfoWindow", "width=700,height=700,scrollbar
s=yes,resizable=yes");

}
```

## ***Adding a folder like grouping system to the layer list***

It is possible to add a grouping system to the layer list. Though it is rather though to program it yourself, ESRI provides you the code for free. It works very easy and can be downloaded from:

[http://caromap.esri.com/Website/BB/ScriptsTips/CARO\\_ArcIMS\\_Scripts.htm](http://caromap.esri.com/Website/BB/ScriptsTips/CARO_ArcIMS_Scripts.htm)

Just unzip the file and read the readme file. You can add the functionality to an already existing service. It will not take more than half an hour work (if you at least do not have an incredible amount of layers).

However, installing this takes the old functionality of the Active Layer toggle box away, which is nasty when you want to use the layer names as links to metadata. Hope I can figure it out.

## **Using folders in combination with the standard Active Layer toggle boxes**

The method above changes the system of selecting the active layer, if you want to use the old system with the toggle boxes you have to make changes to the 'toc.html' file.

Delete the lines 263 – 271:

```
document.writeln('<A href="JAVASCRIPT:setActiveLayer(' + iLyrFound +
')" name="LayerLink' + iLyrFound + '" ');
document.write('onmouseover="window.status=\'Set active layer to ' +
t.LayerName[iLyrFound] + '\';return true"');
document.write('onmouseout="window.status=\'\'" target="_self"');
if (iLyrFound==t.ActiveLayerIndex) {
document.write('style="background-color: cyan"');
} else {
document.write('style="background-color: white"');
}
document.writeln('>');
```



And replace it with:

```
document.write('<input type="Radio" onclick="setActiveLayer(' +
iLyrFound + ')" name="Active"');
if (t.ActiveLayerIndex==i) document.write(' checked');
document.write('>');
```

Then delete line 289 – 297:

```
document.write('<A href="JAVASCRIPT:setActiveLayer(' + i + ')"
name="LayerLink' + i + '" ');
document.write('onmouseover="window.status=\'Set active layer to ' +
t.LayerName[i] + '\';return true"');
document.write('onmouseout="window.status=\'\'" target="_self"');
if (i==t.ActiveLayerIndex) {
document.write('style="background-color: cyan"');
} else {
document.write('style="background-color: white"');
}
document.writeln('>');
```

And replace it with:

```
document.write('<input type="Radio" onclick="setActiveLayer(' + i +
')" name="Active"');
if (t.ActiveLayerIndex==i) document.write(' checked');
document.write('>');
```

This should do the trick.

### Including user info to the layers frame

When adding the active layer radio button option to the folder system the column headings ‘Visible’ and ‘Active’ will not show. It seemed to be troublesome to add them so that they show properly. In order to solve this problem some user info can be added to the layers frame. You can for example add a table, with invisible borders, just under the word LAYERS. Here is an example:

About line 195, in between:

```
<SCRIPT LANGUAGE="JavaScript1.2">
<!--
TocWriteFixedWidth(false,400);
TocInitPage();
//-->
</SCRIPT>
```

And:

```
<TABLE CELLSPACING="0" CELLPADDING="1" NOWRAP>
<!-- <TR>
```

Add a table like this:

```
<table width="173" border="0" cellspacing="1" cellpadding="1">
<tr>
<td width="30"> <font face="Arial" size="-2">Check</font></td>
<td width="25">
```

```

<div align="center"><font face="Arial" size="-1"></font></div>
</td>
<td width="108"><font face="Arial" size="-1"> <font size="-2">to set
layer
visibility</font></font></td>
</tr>
<tr>
<td width="30"> <font face="Arial" size="-2">Check</font><font
face="Arial" size="-1">
</font></td>
<td width="25">
<div align="center"></div>
</td>
<td width="108"><font face="Arial" size="-2">to set active
layer</font></td>
</tr>
</table>

```

### **Making hyperlinks of the layer names when using the folder system (with active layer toggle boxes).**

First, in the **Toc.html** file:

Replace the following strings (about line 270):

```

document.writeln('&nbsp;' + arrLyrs[k] + '</A></NOBR></P>');
} else {
document.writeln('&nbsp;' + arrLyrs[k] + '</NOBR></P>');
}

```

With:

```

}
document.writeln('<a href=' + t.hrefLayer[iLyrFound] +
'target="_BLANK"><font face="Arial" color="#0033CC" size="-2"><u>' +
t.LayerName[iLyrFound] + '</u></font></a>');

```

Then replace the following strings (about line 298):

```

document.writeln('<font face="Arial" size="-1">' + t.LayerName[i] +
'</font></span></A></td></tr>');
} else {
document.writeln('<font face="Arial" size="-1">' + t.LayerName[i] +
'</font></td></tr>');
}

```

With:

```

document.writeln('<a href=' + t.hrefLayer[i] + 'target="_BLANK"><font
face="Arial" color="#0033CC" size="-2"><u>' + t.LayerName[i] +
'</u></font></a></span></A></td></tr>');
} else {
document.writeln('<a href=' + t.hrefLayer[i] + 'target="_BLANK"><font
face="Arial" color="#0033CC" size="-2"><u>' + t.LayerName[i] +
'</u></font></a></td></tr>');
}

```

Note that the `<a href=` statements contain size, color and underline information with which you can change the looks of the layer names.

Second, in the **ArcIMSParam.js** file

add the following lines of code somewhere near the top of this file

```
// href info for layers list in TOC
var hrefLayer = new Array();
hrefLayer[0] = '"put url here"';
hrefLayer[1] = '"put url here"';
hrefLayer[2] = '"put url here"';
hrefLayer[3] = '"put url here"';
hrefLayer[4] = '"put url here"';
```

```
Example: hrefLayer[5] =
'"http://map1.ngdc.noaa.gov/index.html"';
```

**NOTE:** A common error is the single and double quotes are improperly placed. The format for the hreflayer line is single quote, double quote, url, double quote and single quote.

In the above lines, substitute **put url here** with the metadata url that you want to reference. Fill out the array above with the url for each layer that you have in the TOC area. If a layer is turned off at the global level, the scale dependent layer needs to be a item in the array above.

If you have six layers in the TOC area:

```
The first layer corresponds to hrefLayer[0]
The second layer corresponds to hrefLayer[1]
The third layer corresponds to hrefLayer[2]
The fourth layer corresponds to hrefLayer[3]
The fifth layer corresponds to hrefLayer[4]
The sixth layer corresponds to hrefLayer[5]
```

When the end user clicks on the field name a separate window will appear with the associated metadata for that layer.

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