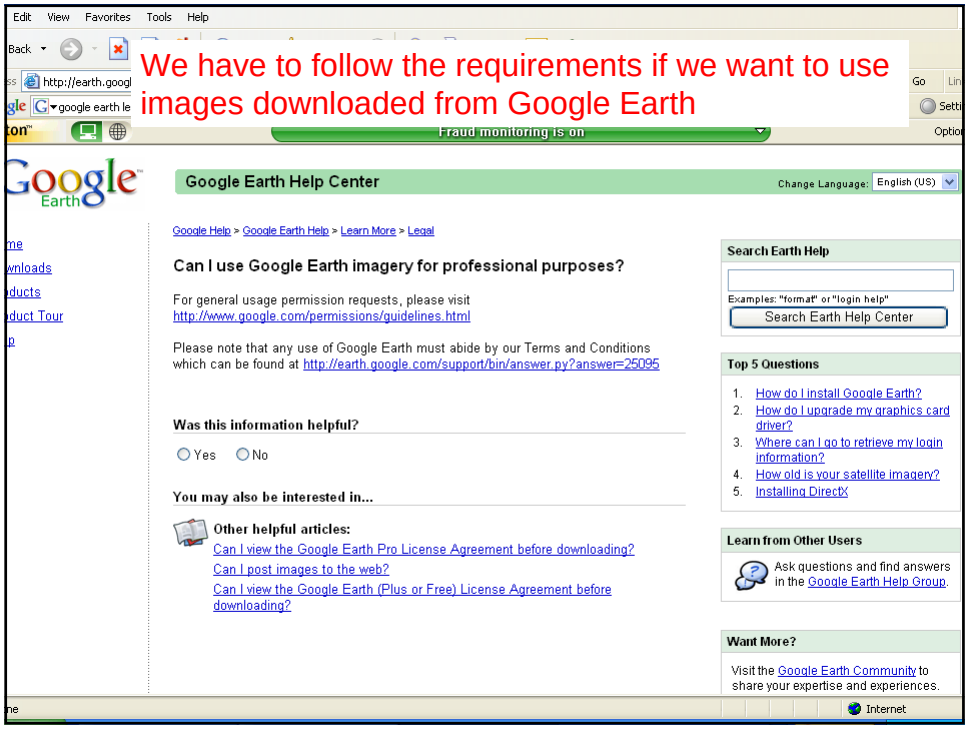
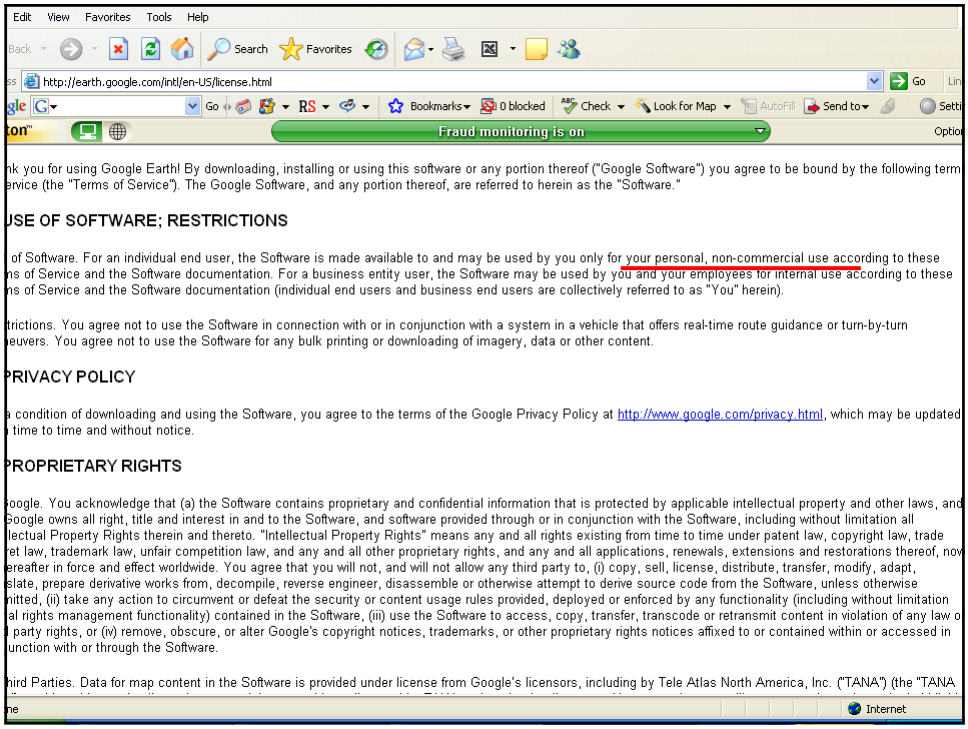
BaseMap:

+ Look for it among the existent digital maps,
  (Easiest & Fastest because no processing required)
  (Therefore, the most desirable, but not always available)
  (It can cost much)

+ Make it from the satellite images in sale,
  (Easier & Faster, but not always available)
  (It does cost much. An astronomical number!)

+ Make it from Google Earth Image “legally” by DIY.
  (Slowest & requires much processing, but costless)




Edit View Favorites Tools Help
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Fraud monitoring is on
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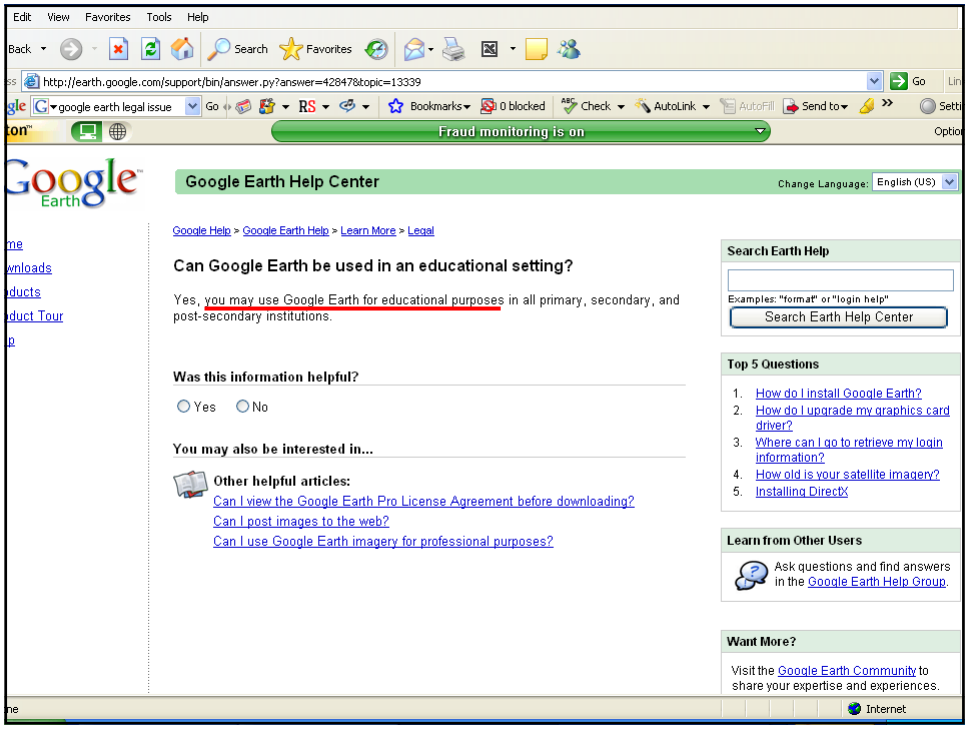
Edit View Favorites Tools Help
Search Favorites
http://earth.google.com/support/bin/answer.py?answer=42847&topic=13339
google earth legal issue
Fraud monitoring is on
Google Earth
Google Earth Help Center
Change Language: English (US)
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Examples: "format" or "login help"
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Top 5 Questions
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3. Where can I go to retrieve my login information?
4. How old is your satellite imagery?
5. Installing DirectX
Learn from Other Users
Ask questions and find answers in the Google Earth Help Group.
Want More?
Visit the Google Earth Community to share your expertise and experiences.
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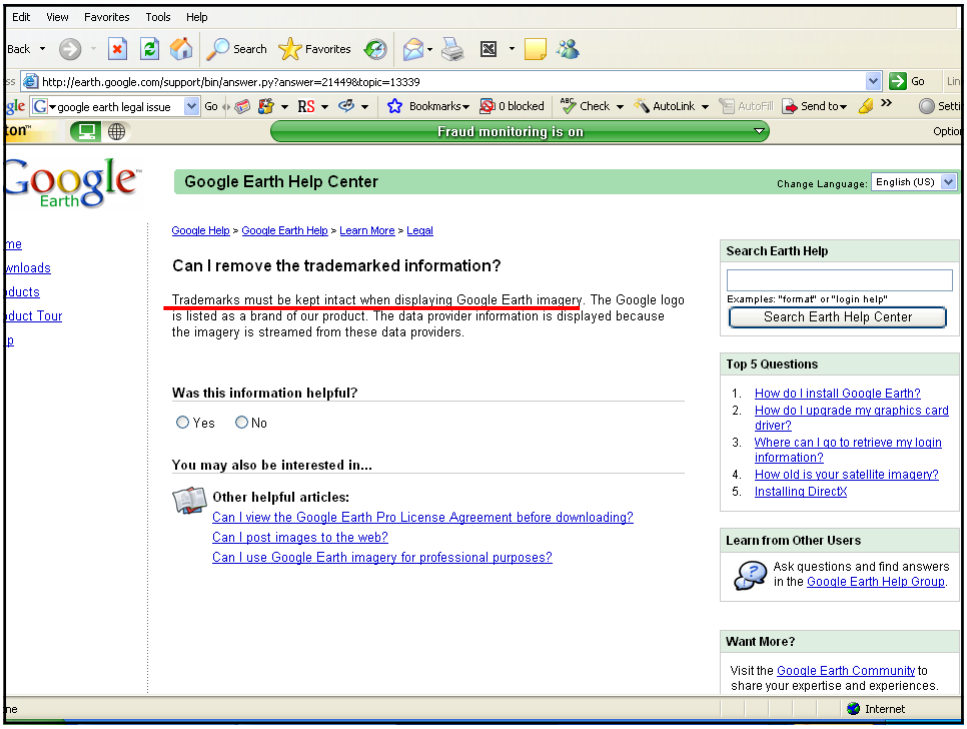


Place Marks of Google Earth are used in place of Ground Control Points. Namely, Place Marks are put on Google Earth browser in grid pattern on and around the target area and used for rectification of the images.

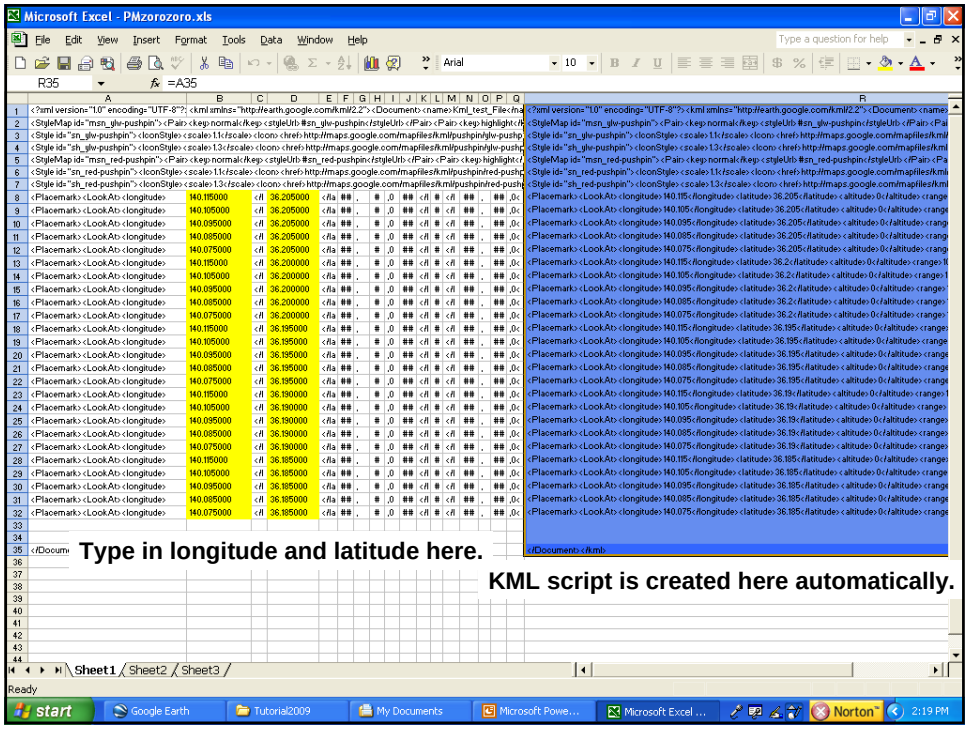
Place Marks in grid pattern can be produced in bulk using Excel spread sheet.

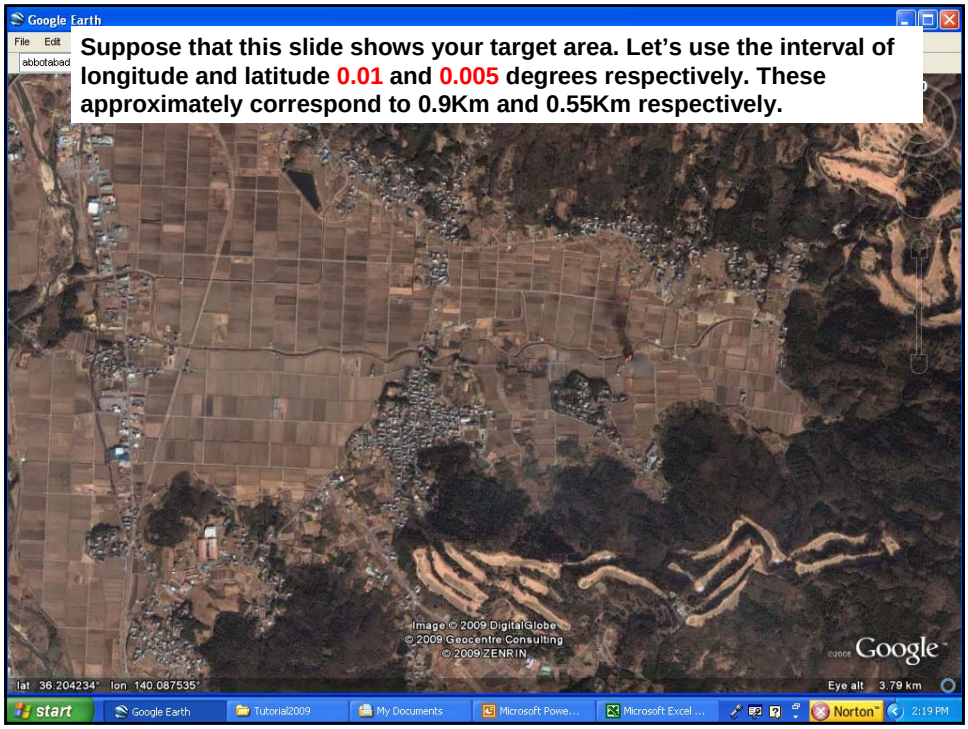
An example is stored in Install CD:
D:¥materials¥Tutorial2009¥PMzorozoro.xls

Copy it in a working directory on HD of your PC and open the copied one.

The spread sheet is shown in the next slide.
The row from #9 to #34 are not locked. Insert rows as much as you need and copy the row #8 on them.
Type in the longitude (column B) and latitude (column D) in the yellow cells.
Every row corresponds to a pair of Place Marks: one is clamped to ground surface ('clamtoground') another clamped to the geoide ('absolute').
After completing it, copy the blue cells into the buffer memory, namely, select all blue cells at once, click the right button and select 'copy'.

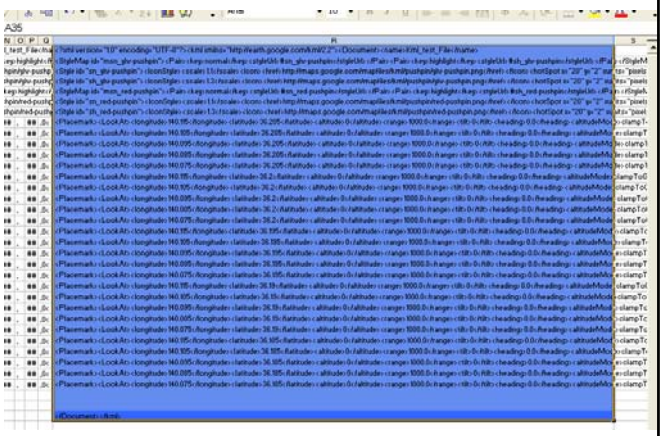
The way how to select the values of longitude and latitude is explained in the following.


Microsoft Excel - PMzorozoro.xls
Type in longitude and latitude here.
KML script is created here automatically.


Google Earth
Suppose that this slide shows your target area. Let's use the interval of longitude and latitude 0.01 and 0.005 degrees respectively. These approximately correspond to 0.9Km and 0.55Km respectively.
Image © 2009 DigitalGlobe
© 2009 Geocentre Consulting
© 2009 ZENRIN
Google

140.115000	</l	36.205000
140.105000	</l	36.205000
140.095000	</l	36.205000
140.085000	</l	36.205000
140.075000	</l	36.205000
140.115000	</l	36.200000
140.105000	</l	36.200000
140.095000	</l	36.200000
140.085000	</l	36.200000
140.075000	</l	36.200000
140.115000	</l	36.195000
140.105000	</l	36.195000
140.095000	</l	36.195000
140.085000	</l	36.195000
140.075000	</l	36.195000
140.115000	</l	36.190000
140.105000	</l	36.190000
140.095000	</l	36.190000
140.085000	</l	36.190000
140.075000	</l	36.190000
140.115000	</l	36.185000
140.105000	</l	36.185000
140.095000	</l	36.185000
140.085000	</l	36.185000
140.075000	</l	36.185000

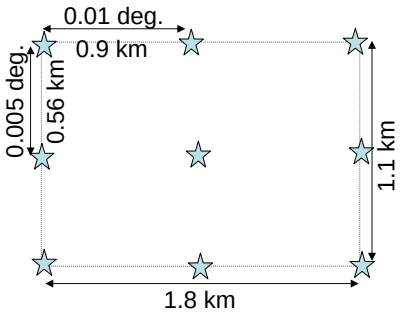
Then, these 25 points are selected and typed in the Excel spread sheet at the left.



Then, produced KML script is copied into the clip board (buffer memory).

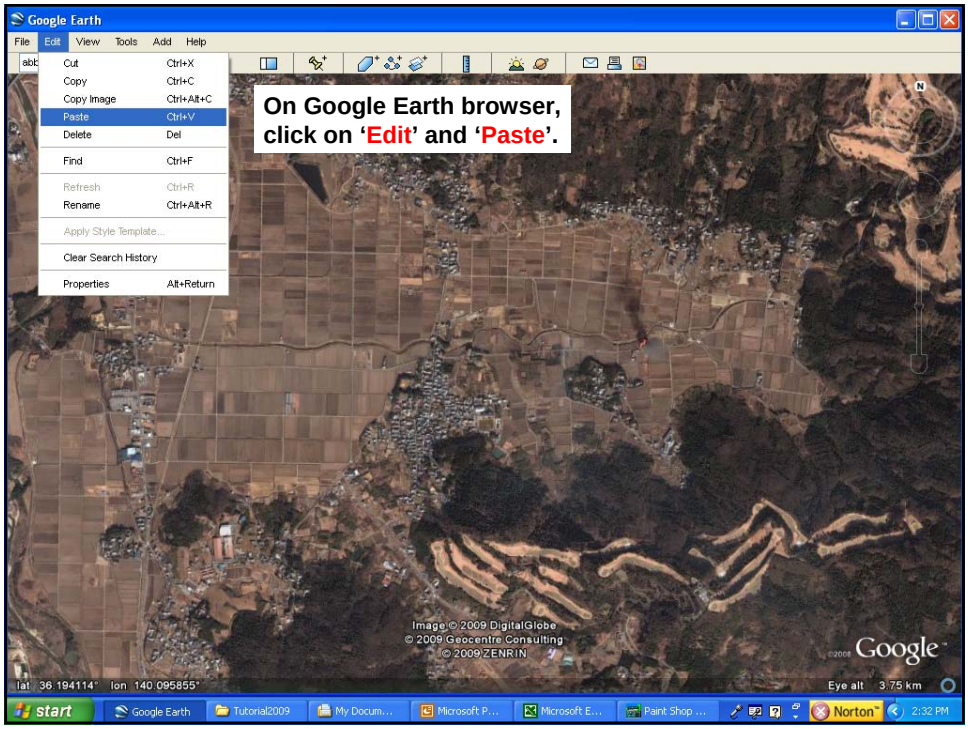
Note:

In the previous slide the intervals of longitude and latitude are 0.01 deg. and 0.005 deg. , respectively. These correspond to 0.9km and 0.56km as shown below.



As shown below, these ones give a image of which resolution is sufficient for 1/5000 map but not enough for 1/2500 one.

Use the intervals of longitude and latitude 0.005 deg. and 0.0025 deg. if a map of 1/2500 is required.


Google Earth
File Edit View Tools Add Help
Cut Ctrl+X
Copy Ctrl+C
Copy Image Ctrl+Alt+C
Paste Ctrl+V
Delete Del
Find Ctrl+F
Refresh Ctrl+R
Rename Ctrl+Alt+R
Apply Style Template...
Clear Search History
Properties Alt+Return
On Google Earth browser, click on 'Edit' and 'Paste'.
Image © 2009 DigitalGlobe
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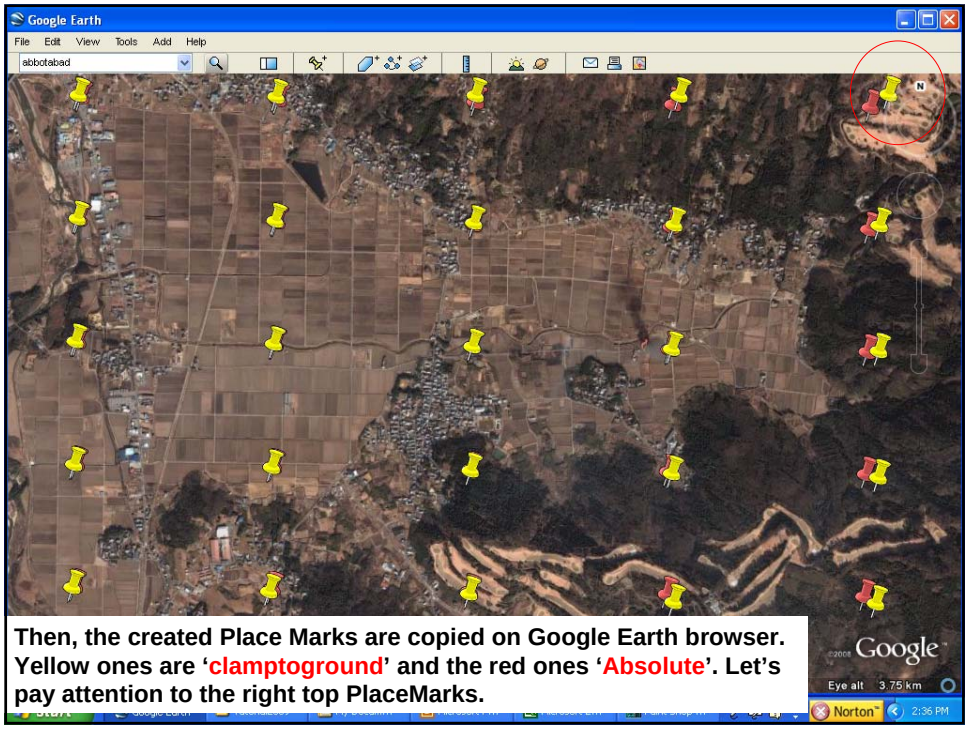
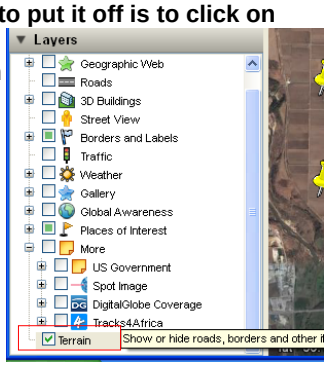
Google
lat 36.194114° lon 140.095855°
Eye alt 3.75 km
start
Norton
2:32 PM


Google Earth
File Edit View Tools Add Help
abbotabad
Then, the created Place Marks are copied on Google Earth browser. Yellow ones are 'clamptoground' and the red ones 'Absolute'. Let's pay attention to the right top PlaceMarks.
Google
Eye alt 3.75 km
Norton
2:36 PM

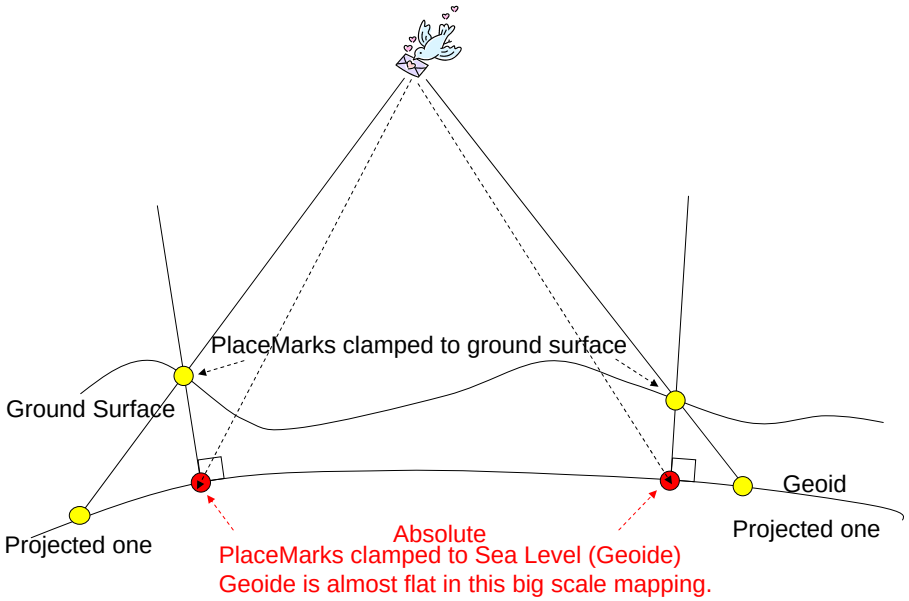
The appearance after 'paste' PlaceMarks differs depending on the setting of Google Earth browser.

If the red and yellow ones are displaced each other, 'Terrain Layer' is on. The way to put it off is to click on 'show slide bar' button and make check mark off from 'Terrain' shown in the right.



Then, click on again.

The displacement is corrected.



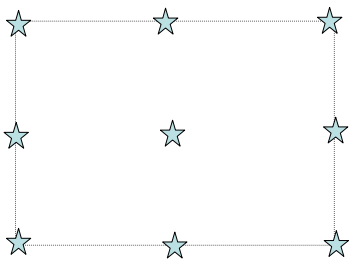
Note: Objects in the image are clamped to the ground surface. The yellow PlaceMark also. Therefore they are affected by the distortion due to the variation of the altitude above Sea Level.
The red pins are clamped to the Sea Level (Geoide). Due to limited height of the view point, the yellow ones do not coincide to the red ones. Especially at high land, the discrepancy is significant.
By checking off 'Terrain' layer, the height above sea level loses its effect on the image shown in the browser. Therefore, yellow PlaceMarks move on to the red ones and the image it self is corrected.
The image is the projection of ground objects on Geoide but looked from a view point with finite height. Geoide is almost flat but not completely. Therefore the equi-longitudinal lines on the image are not completely parallel. They are slightly curved and getting closer at the higher latitude. This must be corrected before merging images (rectifying). Geo-referencing (adding the coordinates) also.

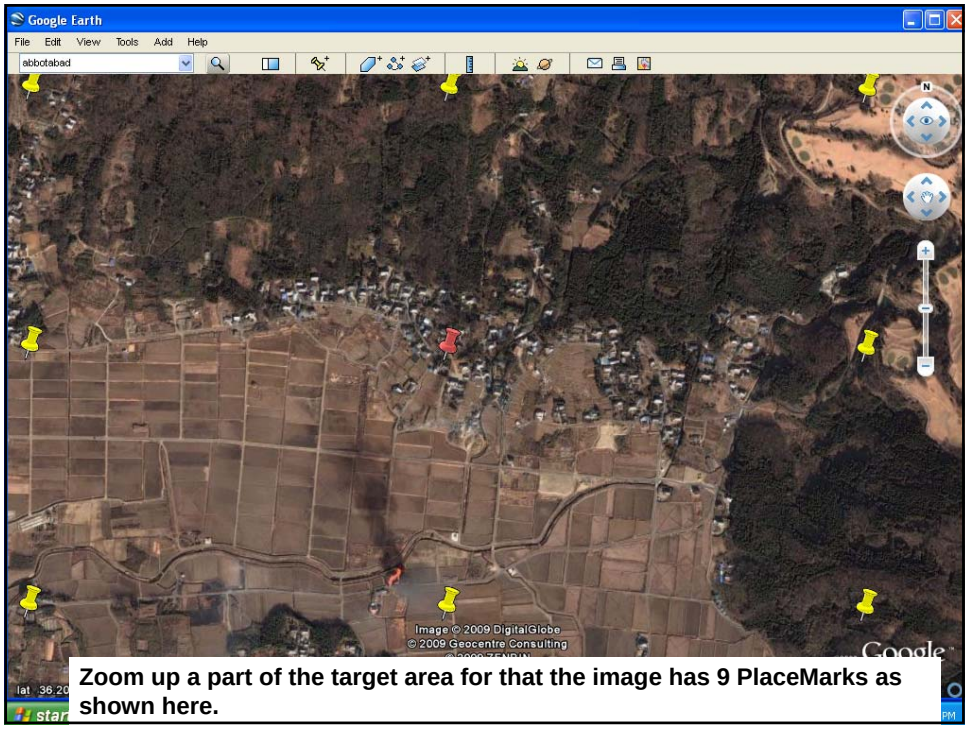
At rectifying:

Afin transform is not enough for this case.

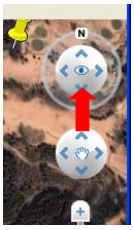
2nd order polynomial requires 9 GCP (Place Marks) at the minimum.

3rd order polynomial requires 16 GCP at the minimum.

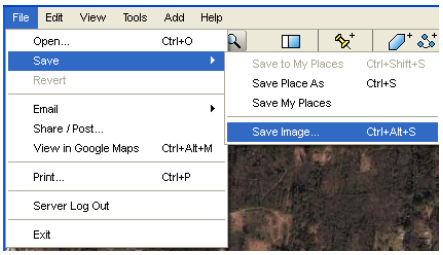




Zoom up a part of the target area for that the image has 9 PlaceMarks as shown here.

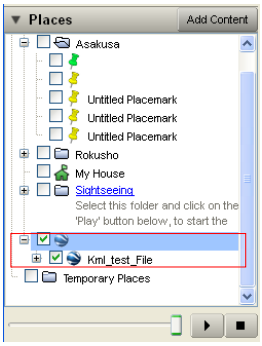


Be sure that the image is not tilted pushing the lower part of the navigator tool shown in the left figure.



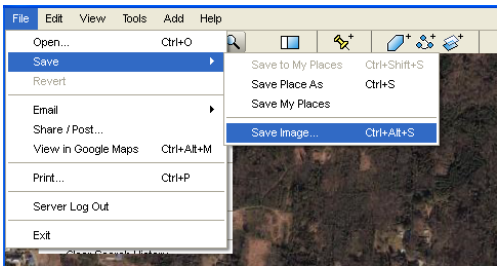
Save the image of this part into a file using ‘File’, ‘Save’ and ‘Save Image’.

Click on ‘show side bar’ button  .



The previously copied PlaceMarks are grouped and named ‘Kml_test_file’ .
Make it check off and click ‘show side bar’ button  again.

All PlaceMarks are erased from the image.

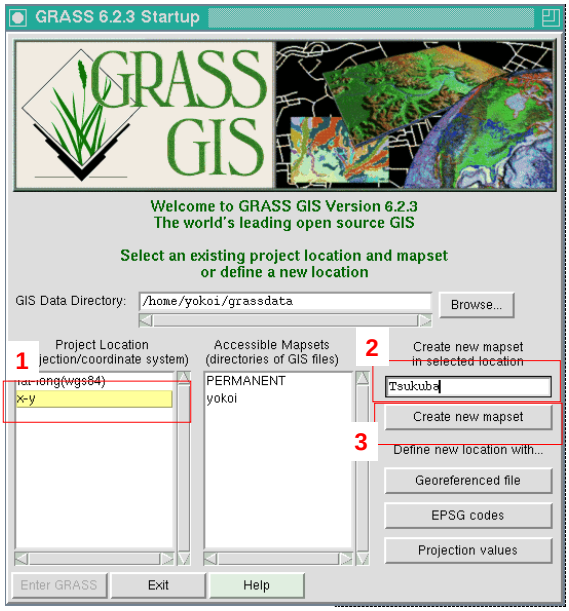


Then, let’s save this image without PlaceMarks. Never move the image.

Two identical images are stored in files, but one with PlaceMarks and another without them. The former is used to define the rule to convert the pixel coordinates to the geographical ones and this rule is applied to the latter for rectifying and geo-referencing.

The pair of images must be downloaded through the target area. In this example, the target area is divided in four partial area.

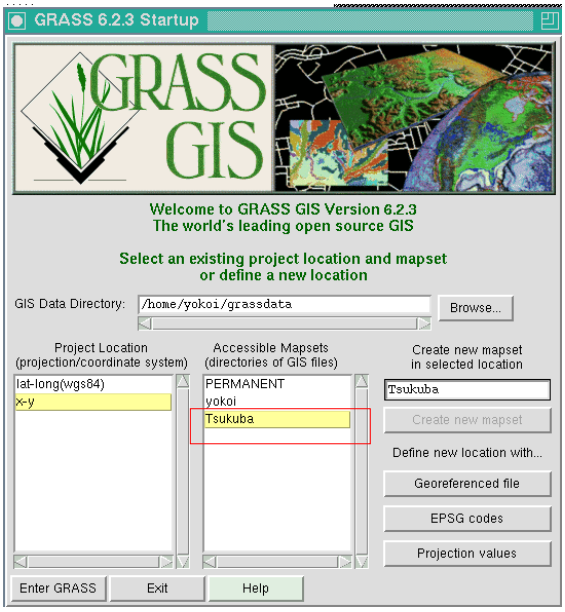
Start ‘Cygwin-GRASS’.



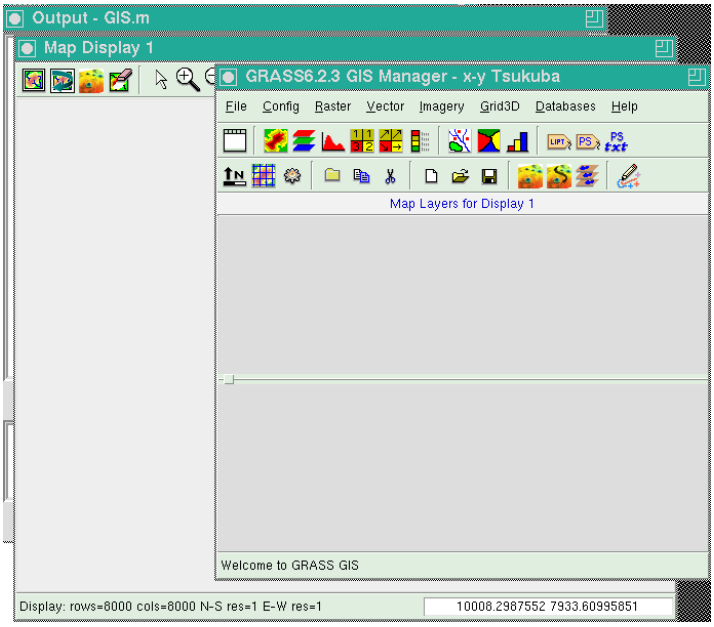
First, the images are imported to a new mapset of the location of x-y coordinates.

'Tsukuba' is the new map set name in this example.

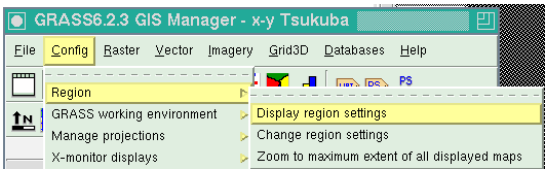
Select 'x-y' in 'Project Location' and type in 'Tsukuba' in 'Create new mapset in selected location'. Then, click on 'Create new mapset' button.



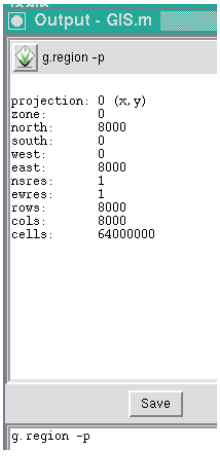
New mapset 'Tsukuba' is created. Select it. Then, click on 'Enter GRASS' button.



GRASS starts with three displays.

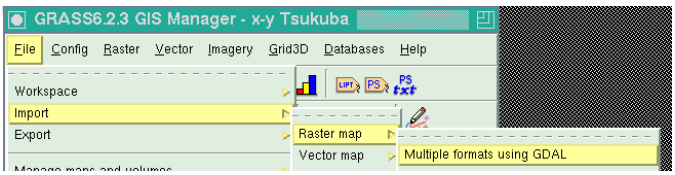


Select 'Config', 'Region' and 'Display region setting' to check the region setting.

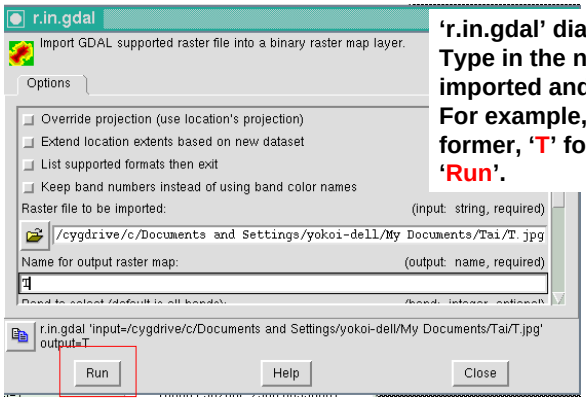


Region setting is displayed in 'Output-GIS.m' display. Pixel sizes of imported images must be smaller than these ones. 8000X8000 seems sufficient.

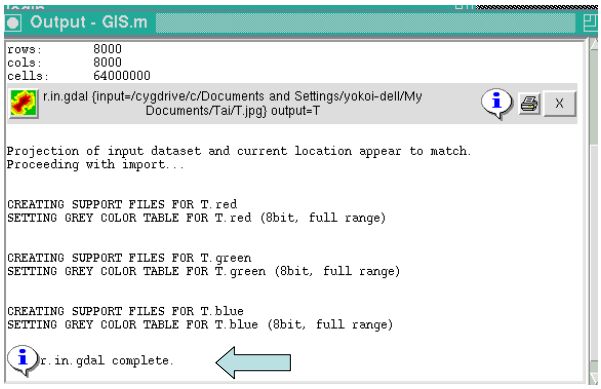
(If peripheral part of imported images are lost by importing, check the Pixel sizes and the region setting again)



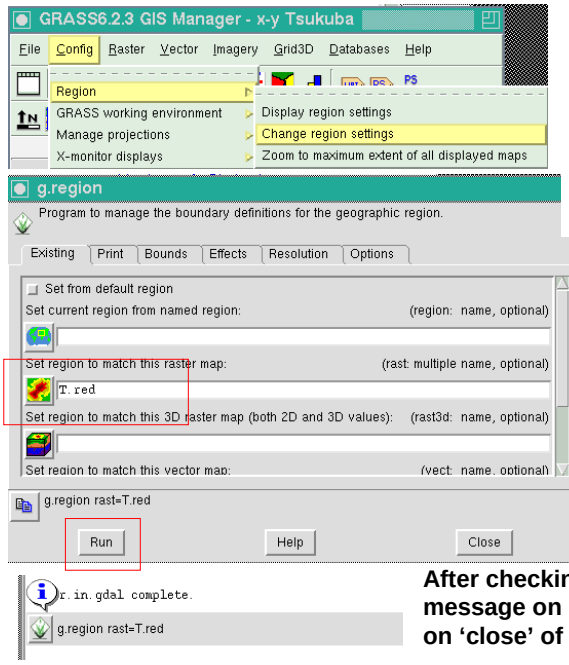
Import image files using 'File', 'Import', 'Raster Map' and 'Multiple formats using GDAL'.



'r.in.gdal' dialog appears.
Type in the name of the file to be imported and that for output raster map. For example, 'T.jpg' with its path for the former, 'T' for the latter. Then, click on 'Run'.

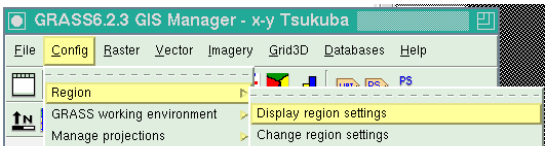


'T.jpg' is successfully imported into three files that correspond to red, blue and green: 'T.red', 'T.blue' and 'T.green'.

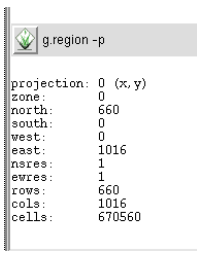


Fit the region to a output raster map.
Select 'Config', 'Region' and 'Change region Setting'.
'g.region' dialog appears.
Type in the name of raster map, for example, 'T.red' and click on 'Run'.

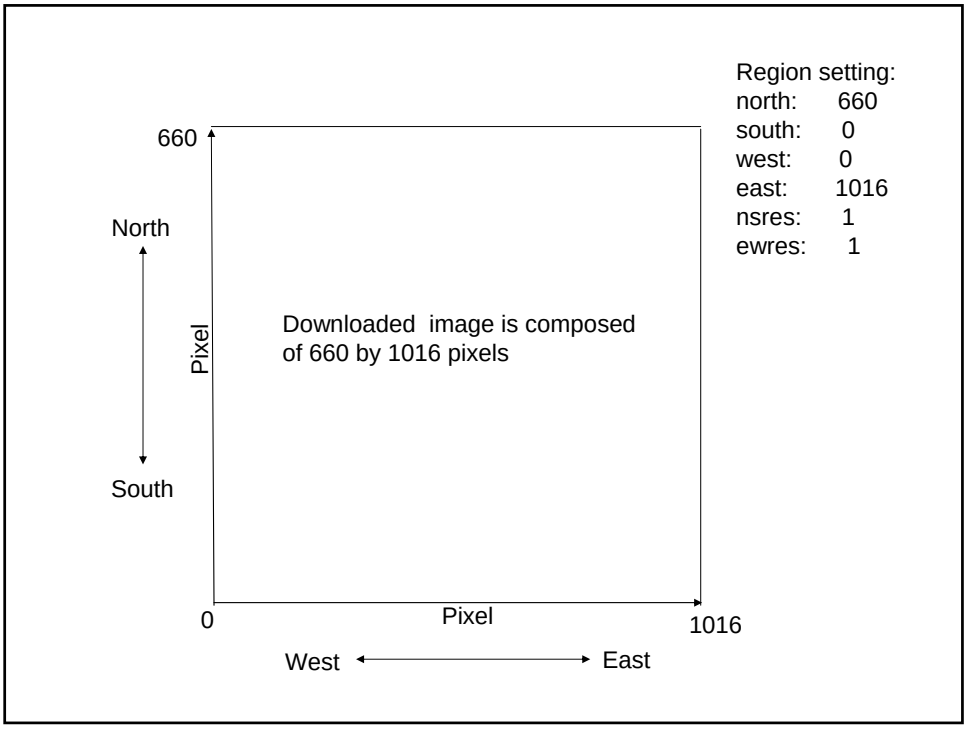
After checking the appearance of this message on 'Output-GIS.m' display, click on 'close' of 'rg.region' dialog.

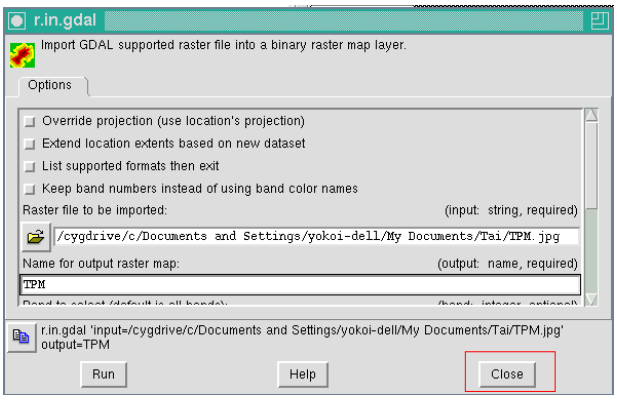


Select 'Config', 'Region' and 'Display region setting' to check the changed region setting.

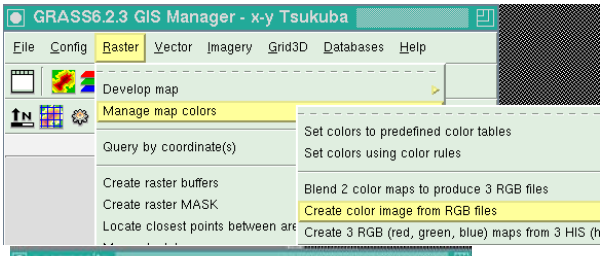


For this example, pixel sizes are 660X1016.

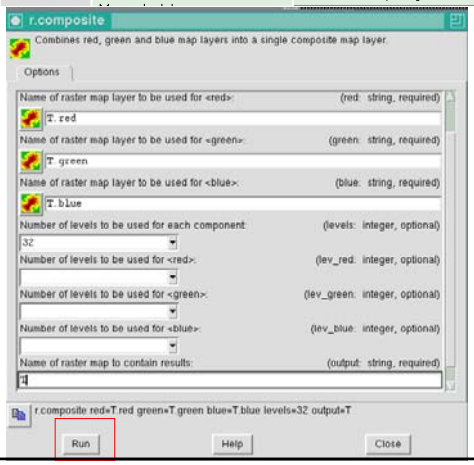




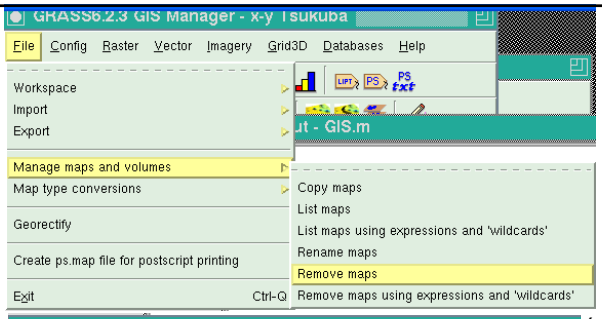
Import 'TPM.jpg' by the similar way. All of the images of the partial area with and without Place Marks are imported one by one.
After importing all of them, click 'close' of 'r.in.gdal' dialog.



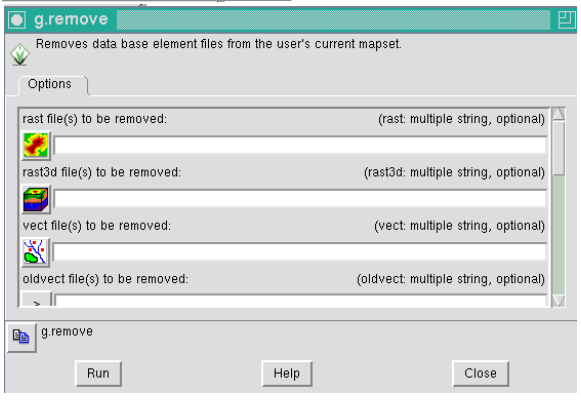
Create color image using ‘Raster’, ‘Manage map Colors’ and ‘Create color image from RGB files’.



‘r.composite’ dialog appears. Type in the name of three color maps and the combined color map.
For this example, ‘T.red’ for <red>, ‘T.green’ for <green>, ‘T.blue’ for <blue> and ‘T’ for raster map to contain result.
Then, click ‘Run’.
Repeat this step for all of images with and without PlaceMarks.
Then, click on ‘close’ of ‘r.composite’ dialog



‘File’, ‘Manage maps and volumes’ and ‘Remove Maps’.

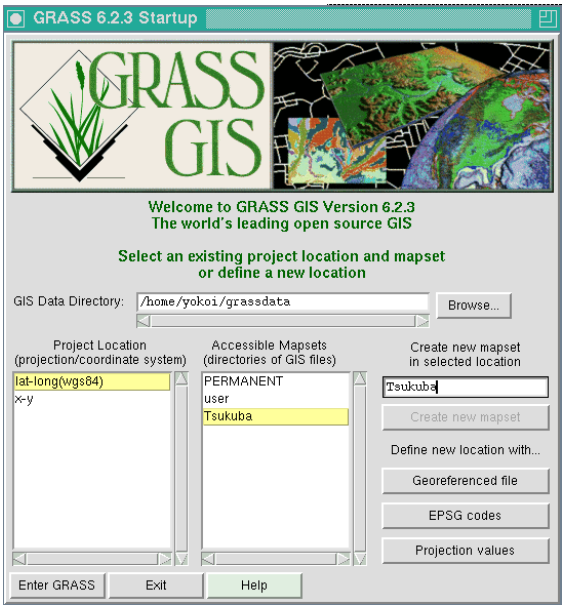


‘g.remove’ dialog appears. Remove all of the maps having extension ‘.red’, ‘.green’ and ‘blue’.

Then, ‘close’ the ‘g.remove’ dialog.

The color raster maps in Pixel coordinates are stored in Location ‘x-y’. These will be projected into Location ‘wgs84’ of which projection is wgs84. Rectifying and Geo-referencing will be done at once. The coordinates given to PlaceMarks are used for this step.

Here, we exit from GRASS once and re-enter it but to Location ‘lat-long(wgs84)’ in order to prepare its region setting. This is necessary to prevent loss of images.



Re-enter GRASS to Location ‘lat-long(wgs84)’ and new map set ‘Tsukuba’.

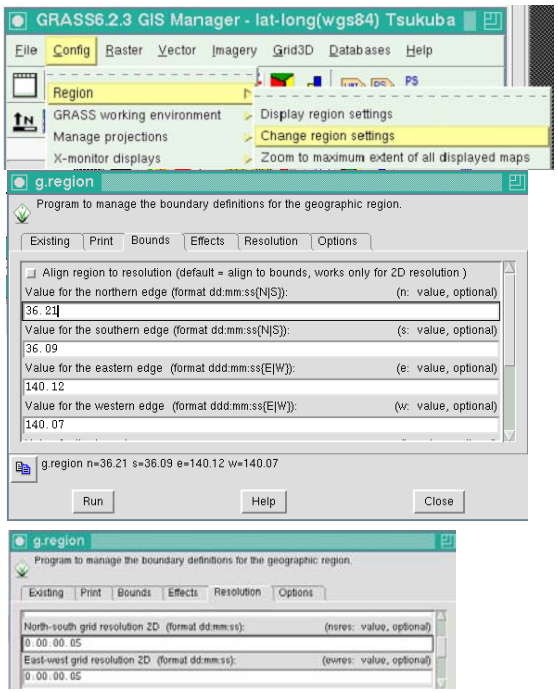
Select Location ‘lat-long(wgs84)’ .

Type in ‘Tsukuba’ for Create new mapset…

Click on ‘Create new mapset’ button.

Select Mapset ‘Tsukuba’.

Click on ‘Enter GRASS’.

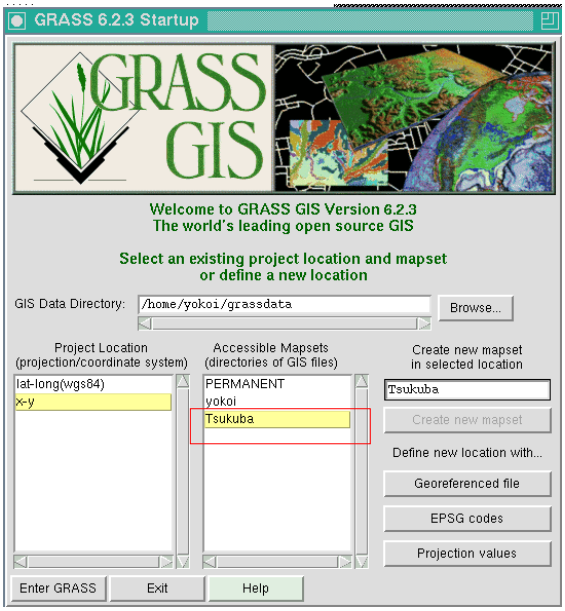


Change region setting using 'Config', 'Region' and 'Change region Setting'.
'g.region' dialog appears.
Select 'Bounds' tag and type in four edges' value.
For this example,
36.210 North
36.090 South
140.120 East
140.07 West

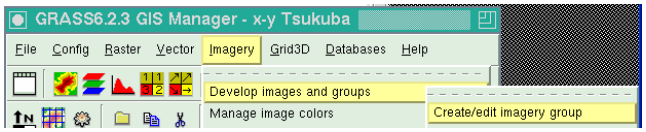
Select 'Resolution' tag and type in the value of Grid resolution 2D. For this example,
ns=ew=0:00:00.05
Fine resolution is recommendable in this step.

Then, click 'Run' of 'g.region' dialog .

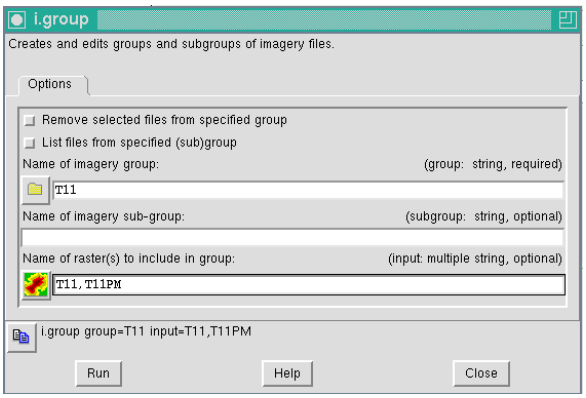
Exit from GRASS.



Re-enter GRASS to Location 'x-y' and mapset 'Tsukuba' .



'Imagery', 'Develop images and groups' and 'Create/edit imagery group'



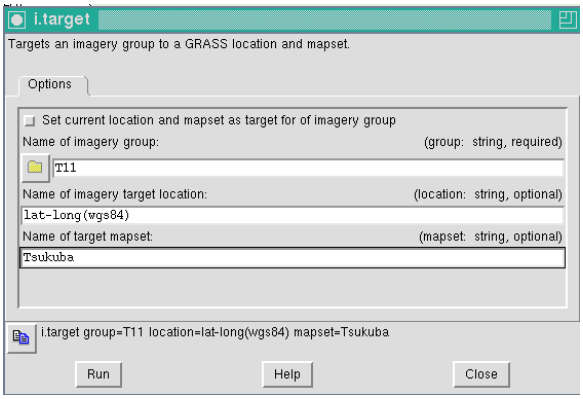
Type in the name of imagery group and select maps to be included.

For this example, name is 'T11' and maps 'T11' and 'T11PM' are included.

All the files included in the same imagery group can be projected to other Location using the same conversion rule.

Repeat this step for all other maps of the partial area. Then, close 'i.group' dialog

'Imagery', 'Develop images and groups' and 'Target imagery group'.



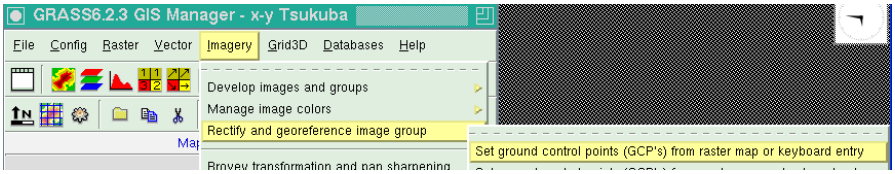
'i.target' dialog appears. Type in one of the imagery group name, target Location and Mapset

For this example,

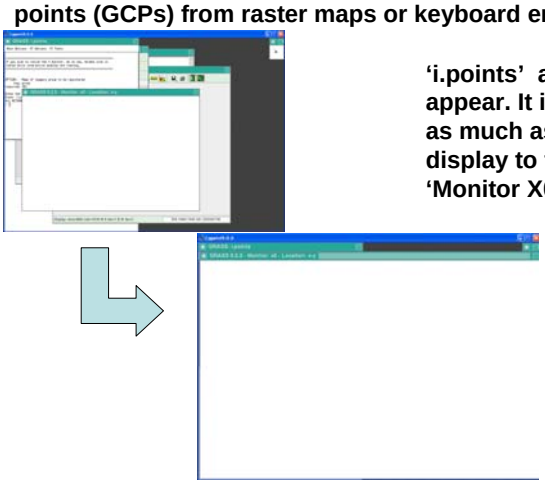
Imagery Group Name='T11'

Target Location =lat-long(wgs84)
Target Mapset=Tsukuba

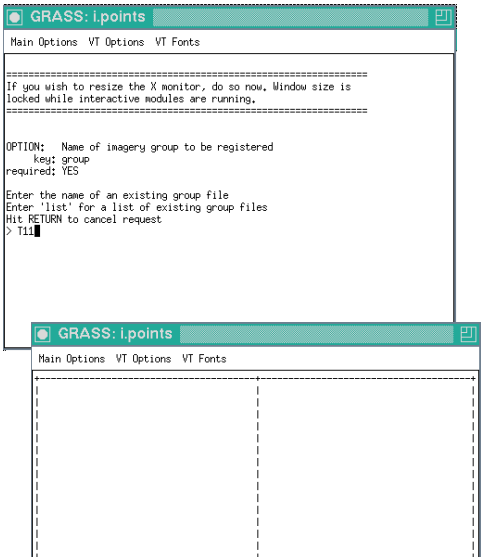
Repeat this step for all imagery groups. Then, close 'i.target' dialog



'Imagery', 'Rectify and georeference image group' and 'Set ground control points (GCPs) from raster maps or keyboard entry.



'i.points' and 'Monitor X0' displays appear. It is better to enlarge the latter as much as possible. Drug 'i.points' display to the top left corner and 'Monitor X0' display a little below.



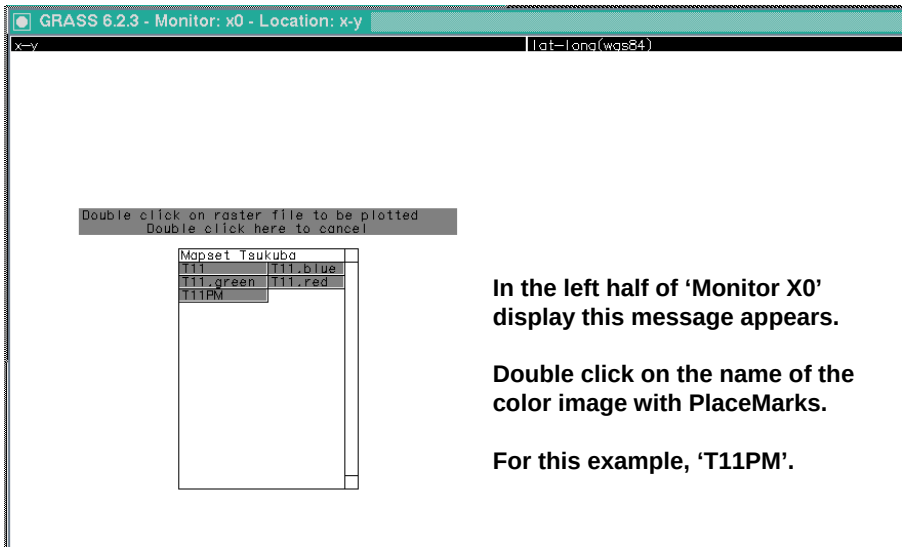
Show 'i.points' display by clicking its top bar.
Type in one of the imagery group name.

For this example, 'T11'.

Then, hit 'Enter'.

The message 'Use mouse now…' appears.

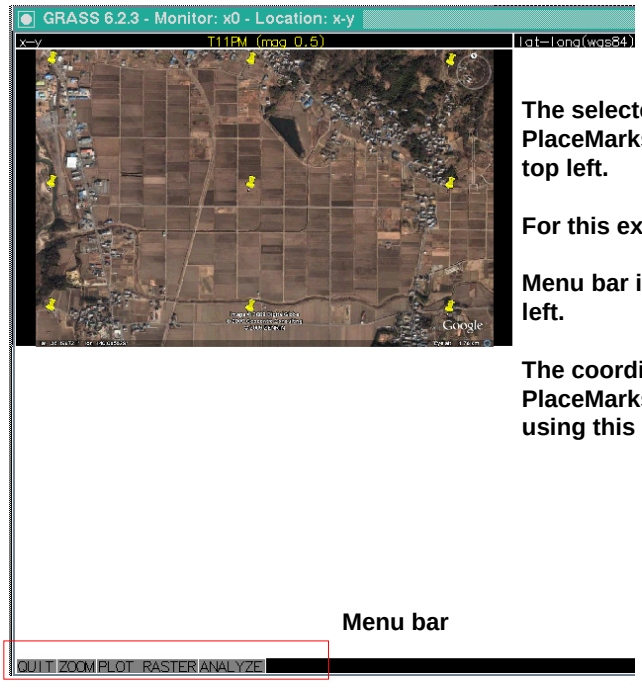
Show 'Monitor X0' display by clicking its top bar.



In the left half of 'Monitor X0' display this message appears.

Double click on the name of the color image with PlaceMarks.

For this example, 'T11PM'.



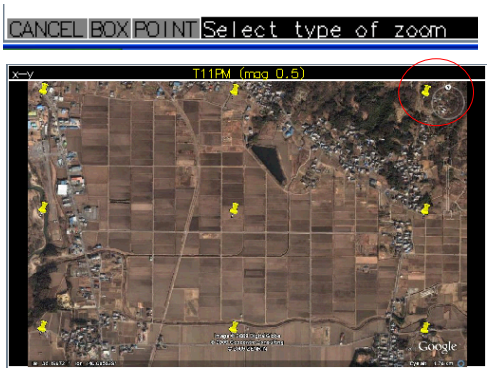
The selected color image with PlaceMarks is displayed in the top left.

For this example, 'T11PM'.

Menu bar is shown at the bottom left.

The coordinates of the PlaceMarks are going to be given using this menu.

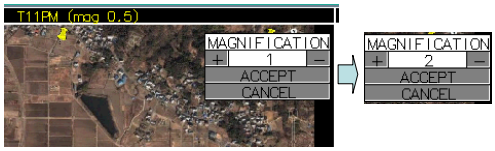
Click only once on ‘ZOOM’.

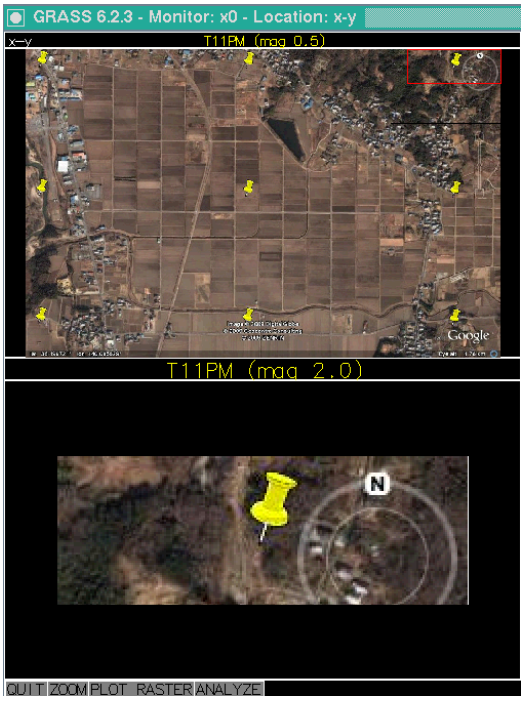


Menu for ‘ZOOM’ appears.
Click on ‘POINT’.

Then, click on one of the displayed PlaceMarks. Clicked position does not require an accuracy.

‘Magnification’ dialog appears. Make it bigger by clicking on ‘+’. For example, ‘2’. Then, click on ‘ACCEPT’.



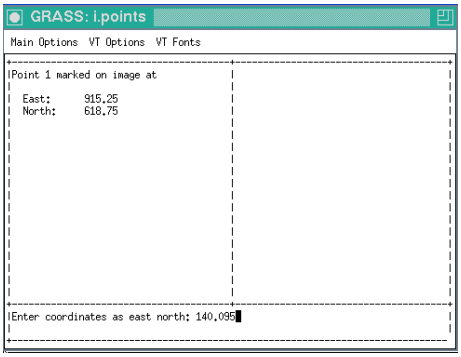


An area around the clicked point is automatically selected and shown in zoomed up way in the bottom left panel.

Click on the tip of the PlaceMark's needle accurately in the bottom left panel.

Message 'Keyboard input required' appears at the bottom.

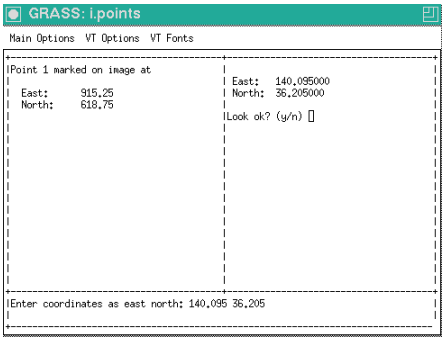
Show 'i.point' display by clicking its top bar.



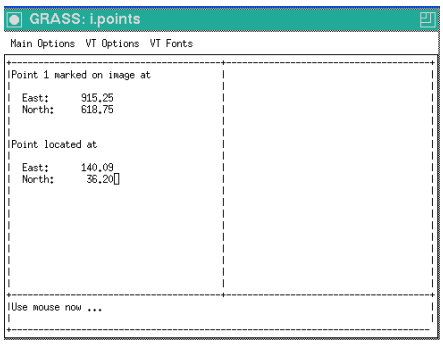
Then, type in the longitude and latitude (longitude first!) and hit 'Enter'.

For this example,
140.095 36.205

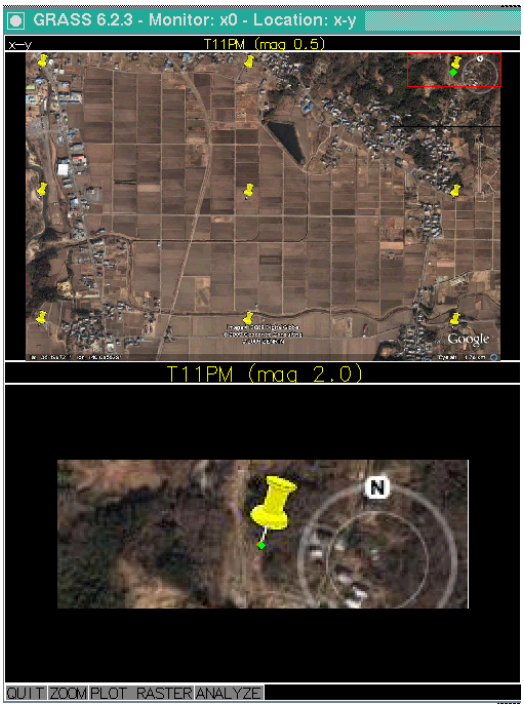
Delimiter must be a space.



The typed in values are displayed. Check them and type 'y' if it's OK. If not, type 'n' and you can re-type in the values.



The message 'Use mouse now…' appears. Show 'Monitor X0' display by clicking its top bar.

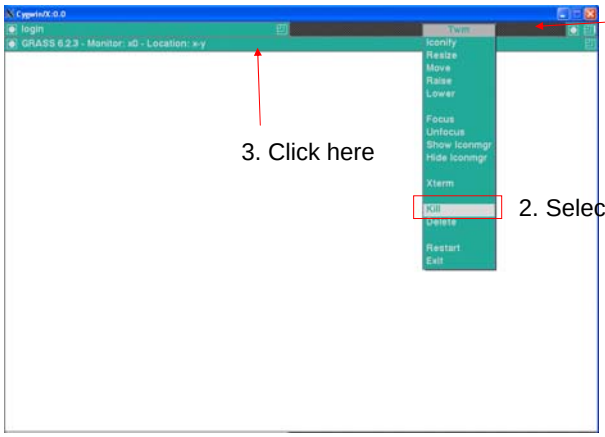


Repeat the above steps to give the coordinates for all displayed PlaceMarks.

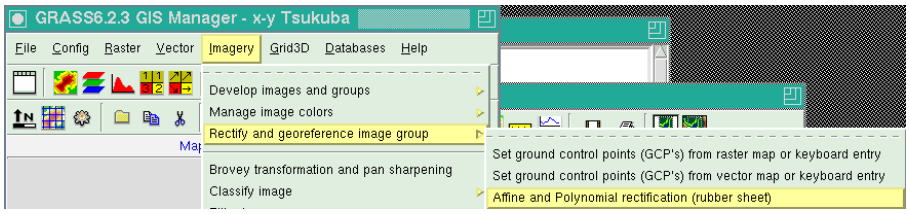
Finally, click on QUIT

And 'Yes'. really quit? NO YES

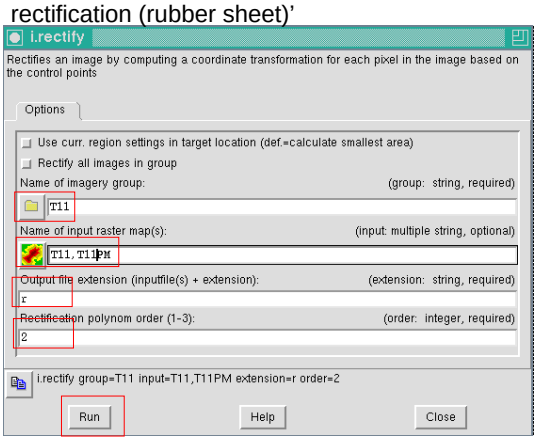
'i.points' display disappears but 'Monitor X0' display remains.



Click on the back ground of X-window once and 'Twm' pull down menu appears.
Then, select 'kill'.
The cursor changes to a skull mark.
Click on the top bar of 'Monitor X0' display to erase it.

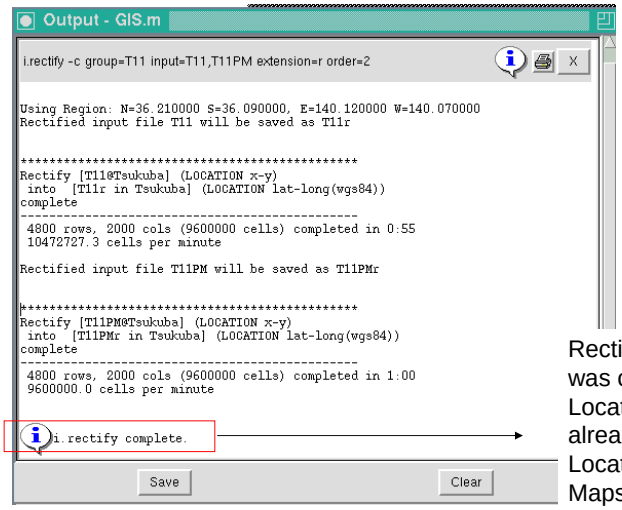


'Imagery', 'Rectify and georeference image group' and 'Affine and Polynomial rectification (rubber sheet)'



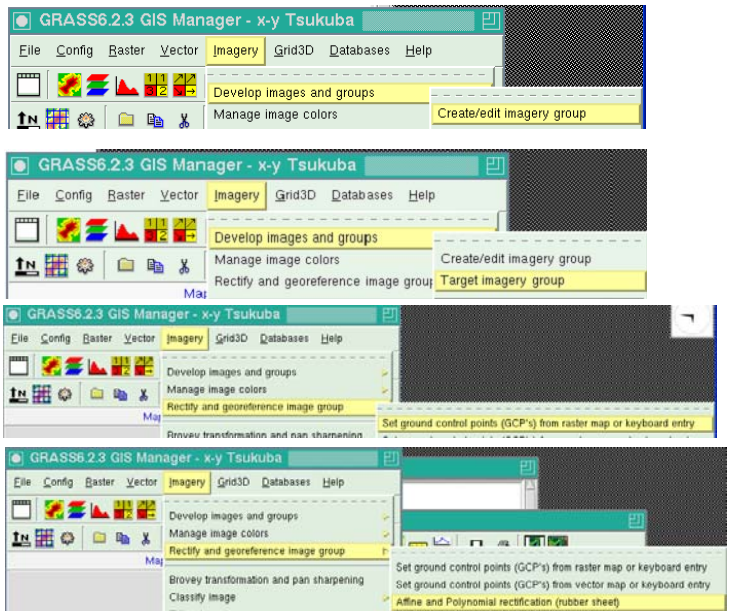
'i,retify' dialog appears.
Type in the imagery group name to be projected (for this example 'T11'. Select input raster maps ('T11', 'T11PM'). Type in 'Output file extensions' (for this example 'r', but arbitrary). Type in 'Rectification polynom order' (if more than 15 PlaceMarks are used '3' can be selected. If not type in '2'. It means that the second order polynomial is used for rectification).
Then, click 'Run'.

Result of 'Run' is shown in 'Output-GIS.m' dialog.

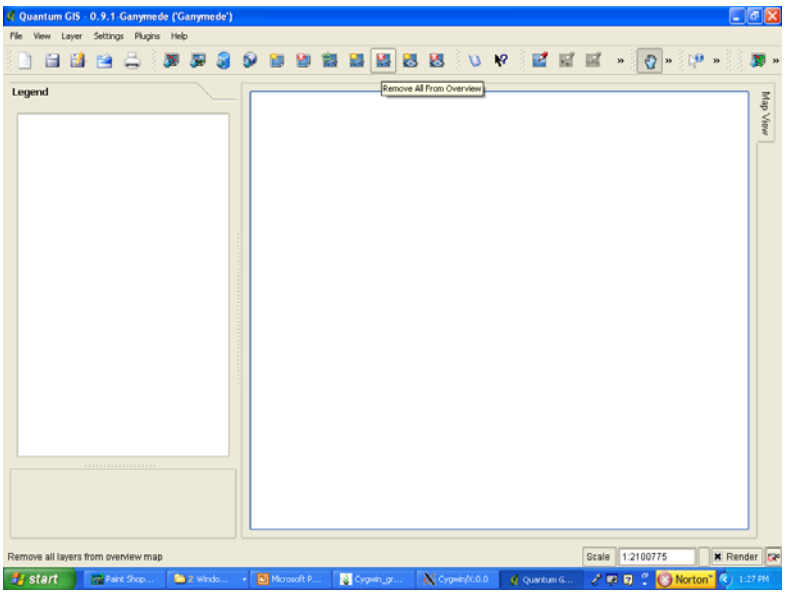


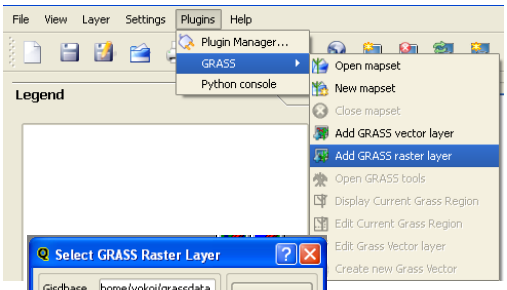
Rectification is completed. T11r was created in the target Location-Mapset selected already (for this example, Location='lat-long(wgs84)', Mapset='Tsukuba'.

Repeat: ‘Create imagery group’, ‘target imagery group’, ‘set ground control points’ and ‘Affine and Polynomial Rectification’ for all other remained color maps.

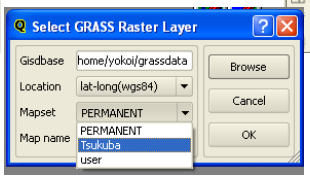


Start QGIS.

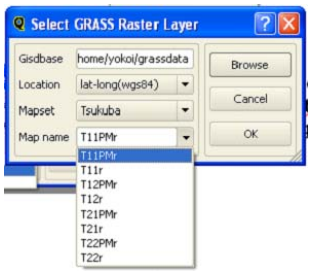




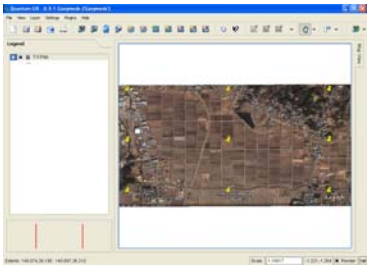
'Plugins', 'GRASS' and 'Add GRASS raster layer'.



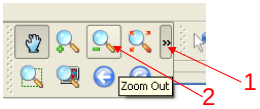
'Select GRASS Raster Layer' dialog. Select Location and Mapset. For this example, Location=lat-long(wgs84), Mapset='Tsukuba'.



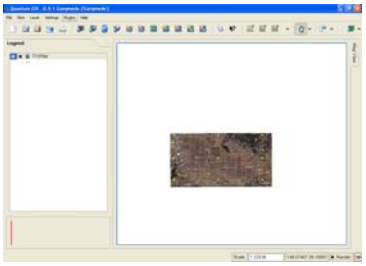
Select Map. Then, click 'OK'.

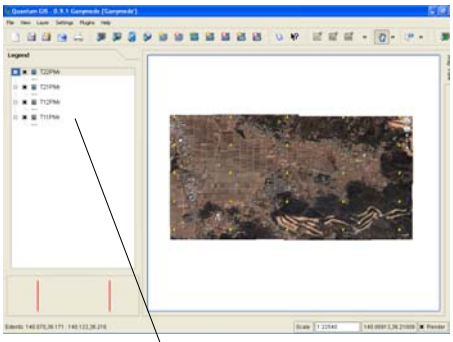


Selected raster layer is displayed.

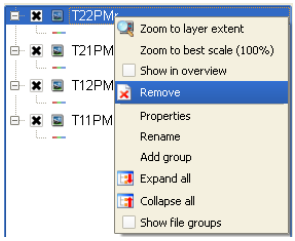


Zoom Out.

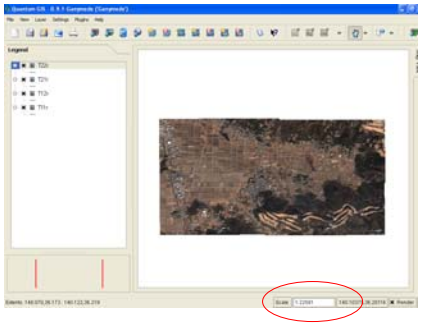




Load all layers with PlaceMarks. Check whether they are projected appropriately or not.



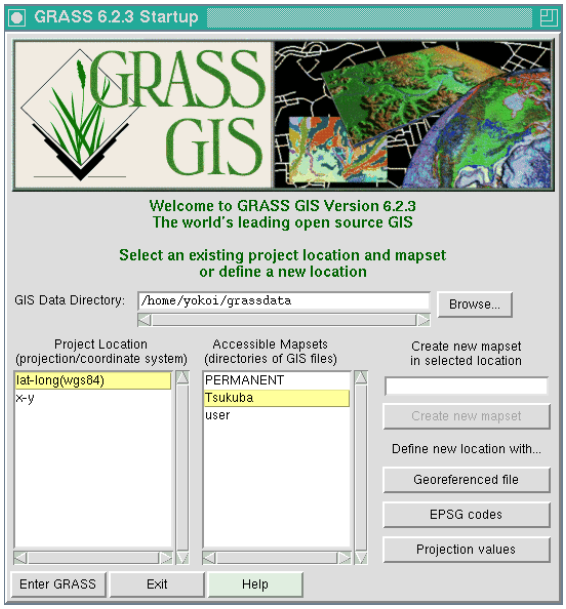
Remove them. Click the right button on the layer, select ‘Remove’.



Load all layers without PlaceMarks. Check whether they are projected appropriately or not.

Type in Scale 1:10000

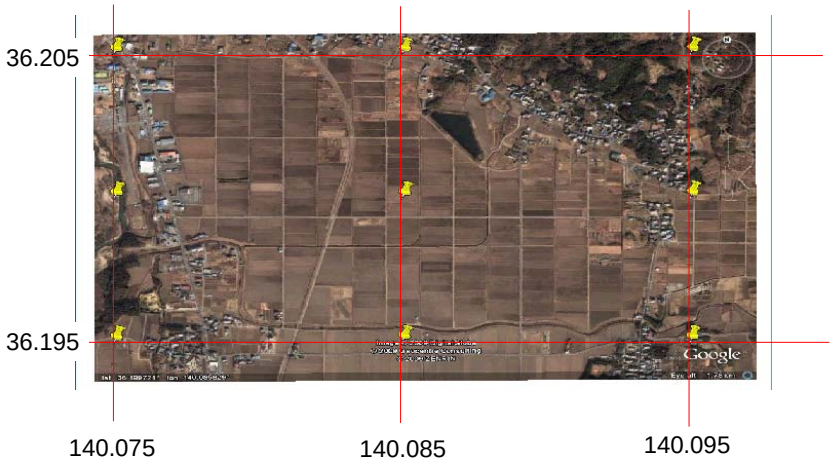
Quit from QGIS without save anything.

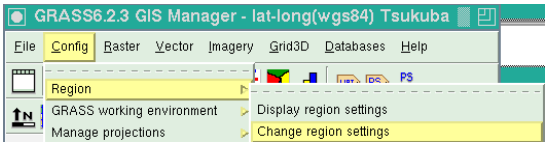


Re-enter GRASS to Location='lat-long(wgs84), Mapset='Tsukuba'.

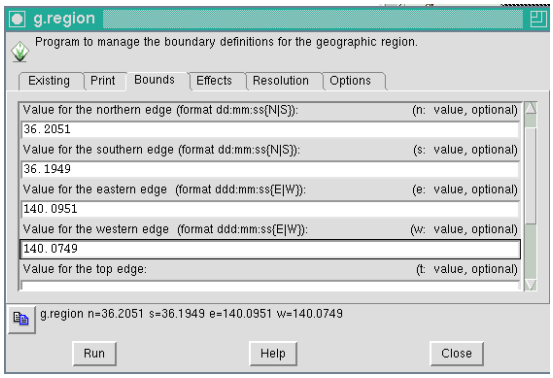
The projected raster maps are going to be trimmed and merged.

Trimming: the peripheral part of the projected images, especially outside of the area surrounded by PlaceMarks, can not have good accuracy, because of the extrapolation of the projection rule defined using PlaceMarks.
For the example shown below, the part of the latitude from 36.195-e to 36.205+e and the longitude 140.075-e to 140.095+e is going to be extracted, where e is a small value.





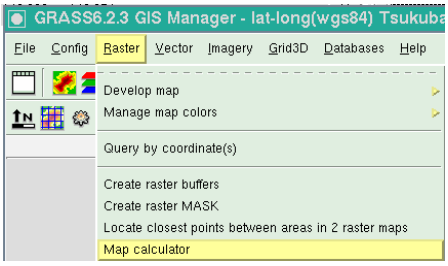
'Config', 'Change region Setting'.

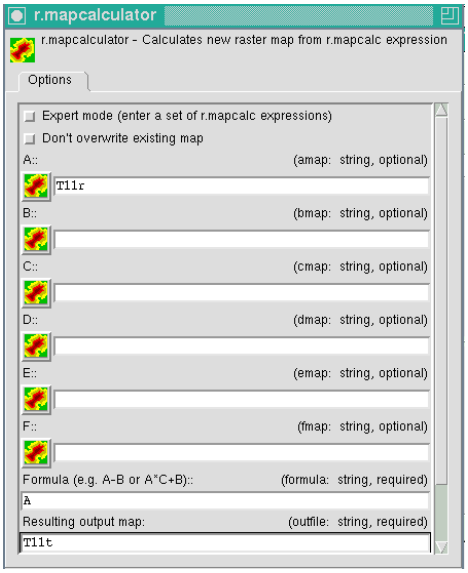


'g.region' dialog.
Type in new edges of region slightly wider than the area surrounded by PlaceMarks.

Then, click 'Run'.

'Raster' and 'Mapcalculator'.





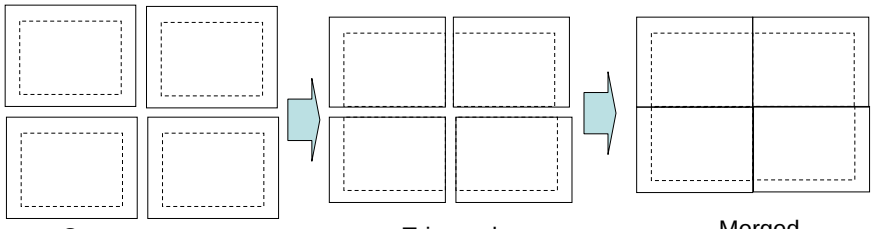
'r.mapcalculator' dialog.
Type in A the raster layer name to be trimmed.

Type in 'A' in Formula.

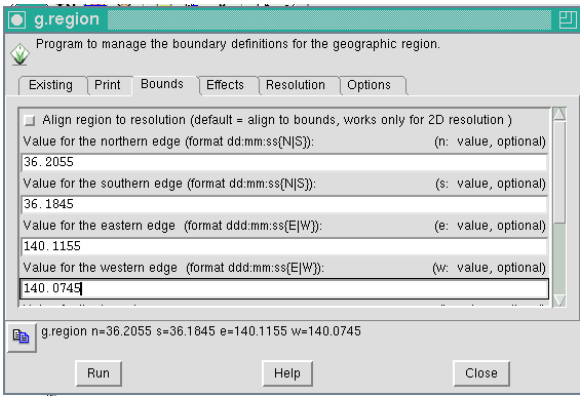
Type in a new name for 'Resulting output map.

Then, click on 'Run'.

Repeat this trimming process for all images without PlaceMarks. Then, close 'r.mapcalculator' dialog

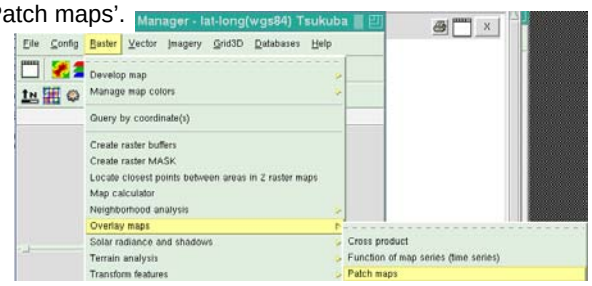


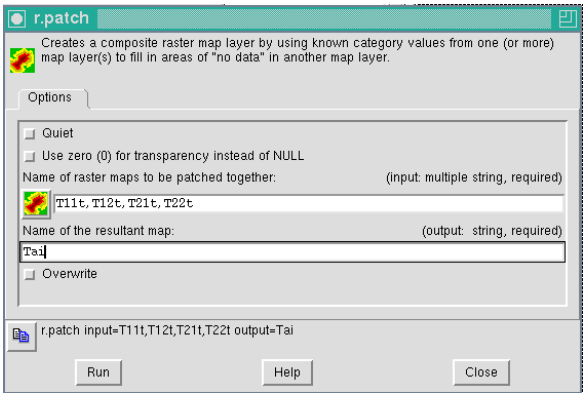
Component maps　　Trimmed　　Merged



Set region to cover all the trimmed images.
'Run' and 'close'.

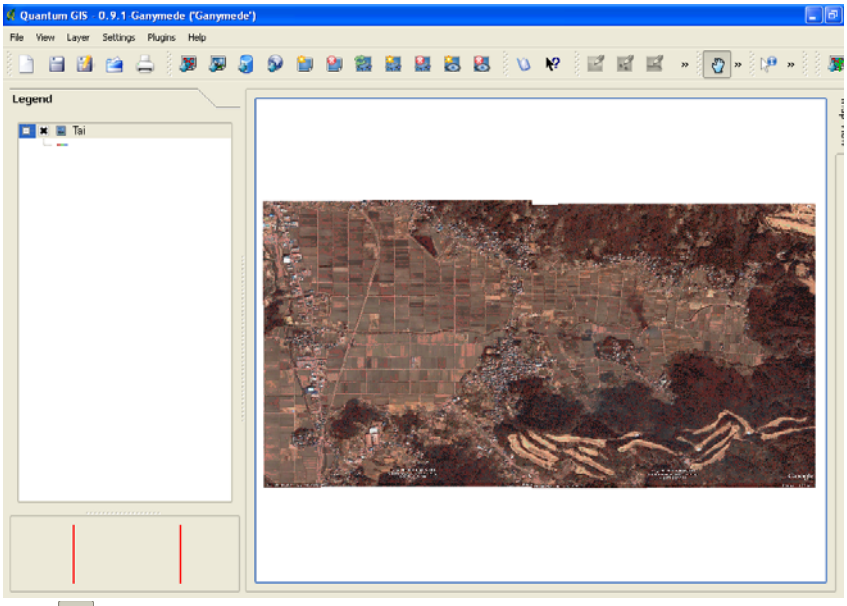
'Raster', 'Overlay maps' and 'Patch maps'.



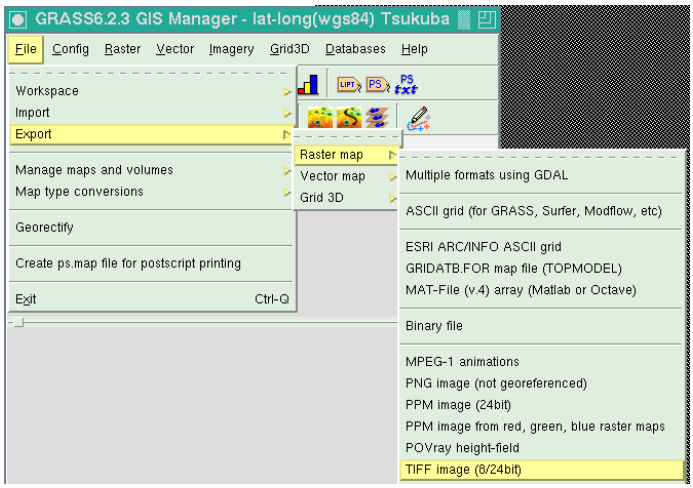


Close all dialog.

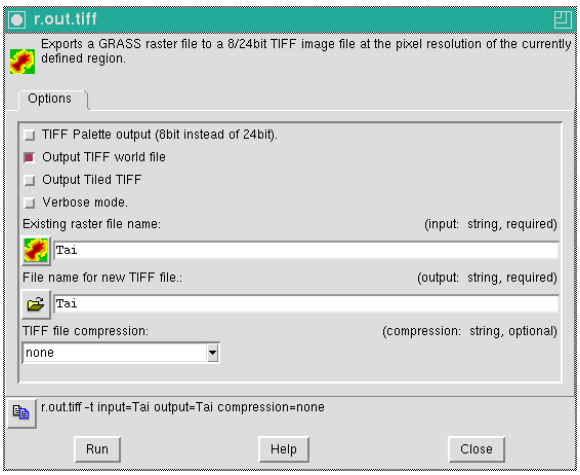
Browse the merged map using QGIS (‘plugins’, ‘GRASS’ and ‘Add GRASS raster…’)



Click on  and the image can be panned. Quit from QGIS.



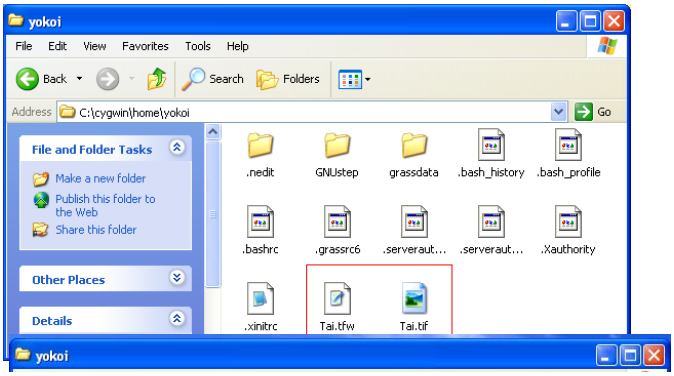
‘File’, ‘Export’, ‘RasterMap’ and ‘TIFF image’. The merged map is going to be exported in TIFF format.



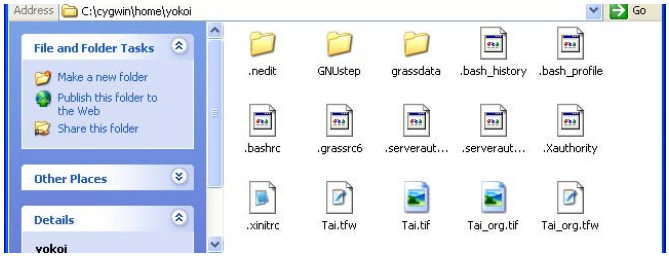
'r.out.tiff' dialog. Select 'Output TIFF world file that has the georeference information.
Select the merged map for 'Existing raster file name' and type in file name for new TIFF file.
Then, 'Run'.
Exit from GRASS after the completion of the exporting task.

The exported geotiff files, namely 'Tai.tif' and 'Tai.tfw', have the image in latitude-longitude system (wgs84).
This can be converted to other projection system using GRASS, for example, to Universal Transverse Mercator projection. The procedure is as follows.

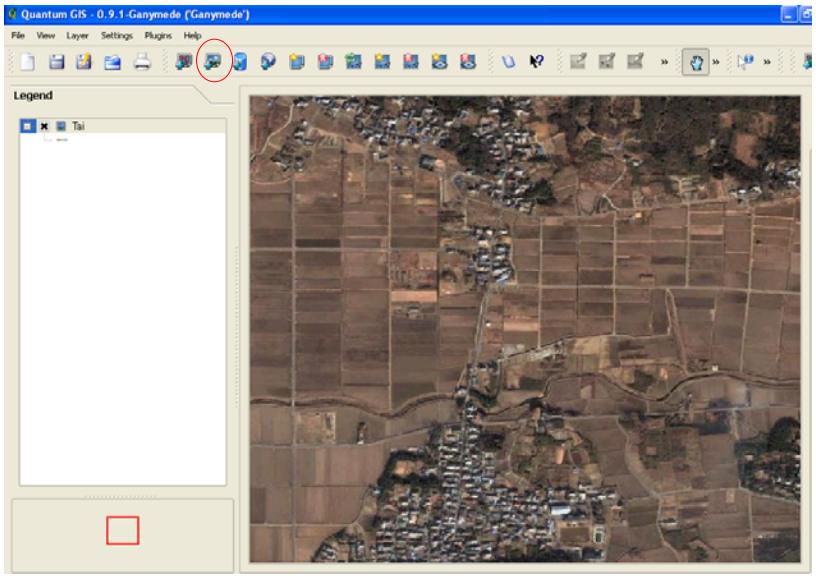
i: Create a new location for the selected projection.
'Define New Location with..', 'EPSG code' or 'Projection Value'.
Ii: Re-project raster layer from the original location-mapset.
'Raster', 'Develop Map' and 'Reproject raster from other location'.



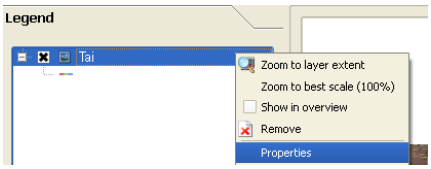
Tiff file (Tai.tif) and its world file (Tai.tfw) are created in the working directory of user ‘yokoi’. Make copy of them for back up. The next step breaks them.



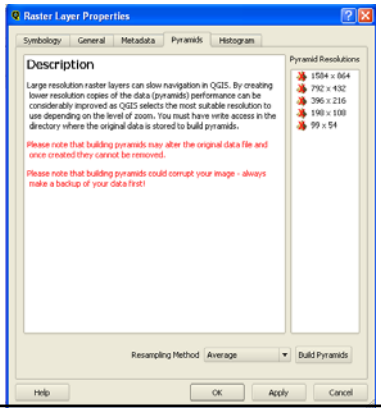
Display the exported tiff file on QGIS.



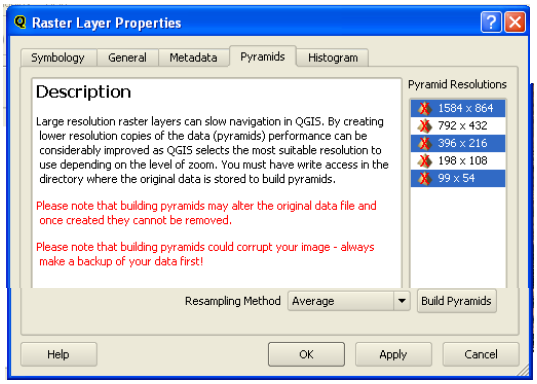
The following slides show the stepes to build “Pyramid” structure of BaseMap especially for Quantum GIS.
It’s advantage is speeding up panning and zooming.



Click on the right button on the layer name and select ‘Properties’.



‘Raster Layer Properties’ dialog. Select ‘Pyramid’ tag.



Select Resolutions.
Resampling Method=Average.

Then, click ‘Build Pyramid’.

After completion, click ‘OK’.

The inner structure of ‘Tai.tif’ and ‘Tai.tfw’ is changed. They can not open by usual image browsers .

The long process to make BaseMap from Google Earth images is completed.