Laboratory Practices in Earth Sciences: Landscape Mapping

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Week- 01
Lecture- 03

Hello everyone. So, in this lecture we will give you a demo on the QGIS, how we can do the geo referencing with the help of the QGIS platform. Here we have written some of the steps to do the geo-referencing on the QGIS platform. So, first you have to open the QGIS. So, when you open your QGIS, first you have to add the toposheet. We will show you how we can do the geo-referencing with the help of a toposheet.

So, a toposheet is an image. So, you have to go to the raster format because the image is in raster format. So, you have to browse your image and here we have one toposheet for the Chandigarh region that is the fertile zone of the Himalaya. So, here you can see this is the Chandigarh region and here you will, this image is not geo referenced.

So, you have to first do the geo referencing, you have to zoom up one of the corners of this toposheet. So, here when you zoom in, you can see that here is your longitude and latitude is written over there. So, for this point your longitude is 76 degrees and 45 minutes and the latitude is 31 degrees and 0 minutes. So, to do the geo reference of this image, so on the QGIS there is one plugin. So, you have to go to, you have opened that geo referencing plugin that is called the geo reference and you will get that geo reference over the raster option.

So, you have to go to the raster option and here you can see the geo reference option. So, the sign is written over there. So, you have to just click the geo reference and when you will click the geo reference, you will get such a type of window and you have to because you want to do the geo referencing of the toposheet. So, you have to open your toposheet over there. So, to open the toposheet, you can simply click on this open raster image.

So, you can do the geo referencing only the raster file formats. So, that is why here you can see that you do not you do not have any other file formats such as vector or delimited or the WMS. So, those options are not available here. Here you can see only the raster format option. So, when you click on this raster format option, they will ask you to open your file.

So, I have opened the file here. So, you can simply go to one of the corners of your toposheet. So, I will start from the left top corner of this toposheet. So, to zoom in or zoom

out, you have to simply click on the control button of your keyboard and you have to scroll up with the help of your mouse. So, and to zoom out, you have to similarly scroll down with the help of your mouse.

So, here I have zoomed in to that point. So, here you can see the 76-degree 45 minute and 31-degree 0-minute latitude. So, to do the geo referencing here you can see there are some of the options available. So, here you will also see the add point option and then delete point. So, with this add point, you can simply add points on your map.

So, I will first go to the add point option and then I will go to the point where I want to add the point. These points are basically the GCPs which I explained in the last lecture. So, first I have to add the GCPs. So, I will just go to this point where I know the exact latitude and longitude. So, when I click over there, a window will open and it will ask you to put the latitude or longitude in terms of x and y.

So, you have to give latitude and longitude here. So, now, you have to click over there and when you click over there, a window will open and here they will ask you to enter the latitude or longitude in terms of x and y. So, here you can simply put your values the longitude is 76 and 45 minute and your latitude are 31 and 0 minute and you you you just click ok and here at the bottom down of your screen here you can see your point has been marked and you can see the ID source x y and you're the associated. Now, the error is not showing over here when you will mark all your points then your residual error will show here. So, if suppose this option is not showing on your window.

So, you can enable the GCP table by simply clicking over the panel option and your GCP table. Here you can see this is enabled that is why it is showing over here, but in case if I disable this option now you can see you cannot see your GCP table. So, you can enable your GCP table through the view option. So, I have marked one GCP from the top left corner of this toposheet. Now, I will go to the second corner. You simply zoom out by scrolling your mouse and then again zoom in to the second corner of your toposheet.

Now, here you can see your longitude is 77 degree and 0 minute and your latitude is 31-degree 0 minute. Now, I will choose this point as my second control point. So, I want to mark the second control point on this point. So, simply you have to click and similarly you have to enter the longitude and latitude. So, my longitude is 77 degrees and 0 minutes and my latitude is 31 degrees and 0 minutes.

Now, I have entered the latitude and longitude and marked my second GCP. Now, I will go to the third corner that would be the bottom down corner of the toposheet. So, here you can see that your latitude is 30-degree 45 minutes and your longitude is 76-degree 45

minutes. So, you can add this point as your GCP. So, I will enter the latitude 76 degrees and 45 minutes and the latitude is 30-degree 45 minutes.

Now, click on ok. So, my third GCP has been marked and now I will go to the fourth corner that would be the right bottom corner of the toposheet. Here you can see your latitude is 30-degree 45 minutes and longitude is 77-degree 0 minute. So, I will just enter this value and click on ok. So, my four points have been marked. So, here you can see this point has been marked as the control point.

Now, I can choose my polynomial equations and the re-sampling method by going to the setting option. Here you can see the transformation setting is given. So, by now when you go to the transformation setting, you can see here that you have to select your transformation type. So, which type of transformation I want to use. So, here I would say that you have to shuffle some of the options.

Here you can see the linear helmet polynomial 1, 2, 3, thin plate spline, spline and projective. So, I will start with the linear and nearest neighbor resampling method. So, my target reference system is so, here I would choose the WGS 84, 43, 26 EPSG projection system. So, this is the most commonly used geographic coordinate system. In one of my last lectures, I explained to you what WGS 84 was.

So, this is the bulk geodetic coordinate system and this is considered the earth center as a point, the reference point through which all the latitude and longitude has been calculated. So, I will choose this option or if you want to choose some other projection system or the datum that you can choose by going this option coordinate reference system selector and you can simply search over here which coordinate system or which datum or transformation system you want to use for your map that you can use. For this case, I will choose the WGS 84, 43, 26 projection system. Now, in another option you have to give the output for your image file. Here you can see by default it has been saved on the location where my raw image was saved with a slight modification with the naming of the image.

So, I will you can do the changing if you want to change your output raster name that you can do and the another thing is you have to just click the save GCP point. So, the GCPs or the control point which you have marked that you can save by enabling this option. If you are not saving your GCPs, so in that case the point which you have marked will be deleted once you close your georeferencer window. So, now, I will click on ok.

So, here you can see. So, this red line is basically showing the error. Here you can see now once when I have chosen my polynomial equation and resampling method. So, here at the residual option here you can see these are the associated errors for my pixels. Now, I will

just go to the transformation setting again and now I will change the liner to helmet. Now, I will see what will happen.

So, here you can see your error is very high for this helmet option. So, similarly you can just shuffle these options and you can see which polynomial equations are suitable for you. So, I will keep it with this linear and nearest neighbor and to do the georeferencing you can simply click on the start georeferencing option. So, when you click on the georeferencing option now here you can see the raster was successfully georeferenced. When you will minimize this georeferencer option.

So, when you will minimize this georeferencing option and here you can see these are the points which you have marked. So, this is the true geographic coordinate system. Here you can see the 77 degree and 29 latitude and 77-degree longitude, but you cannot see your georeferencing image over here. So, there is another option in your georeferencer where you can directly load your georeferencing image over the QGIS platform. So, you have to enable the load in QGIS when the georeferencing is done. And if you have not enabled this option, although your image has been georeferenced and it has been saved over here which you have assigned the output raster image path in, on that path your image is already saved.

But if you are enabling this option, this will automatically load your georeference image on the GIS platform. So, now, I will again click on the georeferencing option and now you will see that your image has been already. So, this was your georeference image and this is your georeference one. So, here you can see that your image has been georeferenced and that you can see the true longitude and latitude of your image. You will move your cursor over the image and you will see that your latitude and longitude has been changing.

So, this image has been georeferenced and you can also verify your georeference image by enabling the base map just below this image. So, that you can do by adding the base map. To add the base map yesterday we have to add the base map we showed you in one of the lectures on how you can add the base map on QGIS. For that you have to go to the web option and in quick map service. So, in our last lecture we showed you how you can add the base map by searching over here, but there is another option and through that you will be able to enable the Google satellite images over here.

Now, you can see here you cannot see the other satellite data except NASA and OSM. So, you can add all the images through by clicking on the setting option and in the more service. In more services you have to click the get contributed pack and your other satellite data will also add in your quick map service. So, for that you have to just get the internet access and first make sure that your system has an internet connectivity and then when your system is having the internet connectivity your pack will be automatically downloaded to

the quick map service. To get this all the satellite package first you have to make sure that your PC has an internet connection and once you connect with the internet your PC has the internet connection then you just go to the get contributed pack and you can see the last version of contributed pack was downloaded.

Now, you just close this window and go to the web option. So, once you downloaded your web pack and then you will go to the web and quick map service. Now, here you can see that at first it was only NASA and OSM. Now, here you can see all the satellite data which are provided by different organizations that you will get over here. For example, if you want to use the Google satellite data now here you can see all this data which are provided by Google that you can get from here.

So, now simply we will load the Google satellite. So, you just click on the Google satellite and on the layer panel you can see your Google satellite image has been loaded. You can zoom out your window and you can see all the Google images that have been provided over here. So, you just go to the go to your image for that you can just click on the image right click on the image and you can use this zoom to the layer option. So, when you click on the zoom to the layer option it will direct you to your image.

So, here you can see your image has been geo referenced properly and to you can you can also use the Swipe tool which we have installed in one of our lectures. So, you can use the Swiper tool to swipe your image and see how accurately your image has been geo-referenced. So, you can just drag your Swiper tool. Now, you can see over here the boundary of the hilly terrain or the flat portion you can see and it is it is accurately geo reference you can see over here this portion the mountain where sub Himalaya has been started where the sub Himalaya and the Indo-Gangetic planar meeting you can see this area and with this Swiper tool you can check whether your image has been properly geo reference or not. If suppose your image has not been geo referenced properly or accurately you can again go to the geo reference tool and you can add some more ground control points and that ground control point will help you to geo reference your image accurately.

So, you can use this geo reference tool and you can geo reference any of your maps or images. So, now we will see how we can geo reference a map or image with the help of the base map. So, till now we have understood how we can geo reference a toposheet which has already assigned some coordinate information and now we will look or we will explore the geo referencing option to geo reference such a map which does not have any geographic coordinate information. So, we will geo reference such a map with the help of the base map. So, first you just remove this map to remove this map you just right click on the map and you click on the remove layer option.

So, this will again confirm the remove option and you see here you have removed your map from this software. So, you close this geo reference option. So, to close the geo reference option you just go to the file and you close geo reference. So, now you enable this Google satellite image. So, it will bring your Google satellite map on your screen.

So, now I will load a map which does not have any geographic coordinate information. So, I will geo reference that map with the help of this Google satellite image. So, we will see how we can do that. So, you have to first open that image. So, to open here I have one image of Cartosat band F and you open this image. This image is open in the layer option, but you cannot see it on your screen.

So, to see your image you just right click on the image and click on the zoom to the layer option. Now, here you will see that this image is open on your screen. So, here you can see that image because your Cartosat image has already assigned some geographic information, but it is not accurately correct. So, you can correct this image and assign the geographic information accurately with the help of the geo referencing option. So, if you use this Swiper tool you can see that this image is not accurately correct.

See this river this river is the river on the image is placed somewhere else irrespective of your base image. So, we will do this correction with the help of a geo -referencing tool. So, first you have to go to the raster option and you just open your geo referencing tool and load your data on the geo referencing. So, I have loaded the data here. You can just enable the add control point and with this add control point you can mark the ground control point or GCP on both the images. To mark the GCPs you first have to identify some points which are similar on both the images.

So, you just go to your satellite image and here you know that your image is for this particular area. So, you have to identify some common points or some common control point where those points are similar or you can easily identify both the images. So, you can see you just zoom in a little bit or you can see this is the two rivers and here you can see here this is the road or this is another road and this is the intersection point of the two roads. So, you have to identify this intersection point on your base image also. So, go to your base image or you just zoom in here you can see this is the same area which we have seen in our target image.

So, you can choose this point as your ground control point. So, you go to the geo referencing and you add the point by clicking over here and now this will ask you to put the latitude and longitude. But the geo referencing has one option where you just this will direct you over the base map. So, from this map canvas option when you click over here, this will direct you to the base map. So, you do not need to enter the latitude or longitude

over here. If you know the exact latitude or longitude of this position or this point then you can put it over here as we did for our topographic map, but for this case you can just go to the base map and you can click over here.

So, this way you can see here your longitude and latitude is automatically mentioned once you click over your base map. So, now, you just click ok and here you can see one GCP has been marked. Similarly, you have to again identify another point where you can mark your control point. So, you just go to the base map and you identify another point. So, here you can see this is another river and here this is the road intersection.

So, try to identify those points which are easily identified on both the images. So, that would be better because if you are selecting points which are not easily identifiable in both the images in that case if you are mistakenly selecting points here and there. So, that will ultimately associate some kind of error and that will mean that you will georeference your image, but your image will be getting some error. So, you choose this point and click over here and go to the map and you can see this is the road intersection which we have chosen in our target image. So, you also click on this base map. Once you click you can see this longitude and latitude is mentioned over here for this point and now click ok.

So, we have marked the two points and so and you have to mark another point. So, at least try to mark four to five points to georeference your map and you just try to scatter those four and five points because suppose you are choosing a point in a particular area or your point is clustered for a particular reason. So, that will also associate error in your georeference map. So, here you can see it is a dam.

So, you can just choose one point from here. So, this is your, this is your dam and this is the road. So, you just try to identify this point on your base map. You just scroll and here you can see this is the point and this point you can mark. So, this is the corner of the road. So, I will choose this point as my control point. So, you just click on click on here and you can see this is your latitude longitude.

So, we have marked the three points. So, I have to choose another point. So, you go to another corner and here you can see this is one road and you try to identify this road on your base map. So, this is the river where you can identify your point. So, you have to just see the geomorphic feature of your image. So, for this case I can see that this river is coming from here and this river is passing this road.

So, you can choose this point. So, first you can locate this point on your map. So, this is the point where we can mark the point. So, this is the over bridge. So, I will choose a point on this bridge.

So, here you can click and from the map section you can click over here. So, now, you can see we have marked the four points and you can also mark one another point at the center portion because here we have marked the four points on the four corners of the image and one more point will give us the more accurate georeferencing image. So, here you can see another river. The small river is flowing from here and you can see this is a road. So, you have to just identify this point on your base map. You can see this road you have to identify on your base map where two roads are crossing each other.

So, I will identify this point on the base map. So, you just go to your base map and here you can see this is the point I can mark the control point over here. So, you just mark here and you can see. So, now, we have chosen five points and with the help of these five points with the help of these five points we will do the georeferencing. So, we have completed our GCPs. So, at the GCP table you can see five points have been marked and in the residual error option you cannot see anything.

So, to get the residual errors you have to first choose your polynomial equations and the resampling method. So, to choose the polynomial equation and resampling method you have to go to the setting option and transformation setting you have to choose your polynomial equation. So, I will start with the linear and nearest neighbor and my target coordinate system is WGS 84, 43, 26 because this is the Cartosat image and the Cartosat image has been acquired with this WGS 84 datum system with reference to this WGS 84 reference system. And my output image has been saved on this directory and I have also enabled the save GCP point and load in the QGIS when done. So, just click on ok and here you can see this much is the error associated with your image with this transformation setting.

So, you can just shuffle this transformation setting and you can see what happens. So, for this image you can see that the transformation setting a polynomial one and nearest neighbor is giving me the minimum residual error. Here you can see the residual error. So, you try to shuffle all this option and see which transformation type and resampling method gives you the minimum residual error. So, you choose that option because every image has been associated with some kind of error.

So, you might not know which image has what kind of error. So, for that you have to just simply shuffle all the options and you can go through this option and whichever is giving you the minimum error. So, you try to choose that option. So, for this image I can see that this polynomial one and nearest neighbor resampling method is giving me the minimum error. So, I will go with this option and you just click on the start georeferencing option. So, this will be your image georeferencing and once the georeferencing has been done you

can see one pop-up will come up here and you can read that the raster was successfully georeferenced and because I have enabled the load in QGIS options.

So, your image might have opened in your screen on the QGIS screen. So, here you can see this is your band F modified, this is your georeference image. So, this black patch is basically the portion which does not have any kind of DN values. So, that is why this portion is showing you black. So, you can use your map swipe tool to see how accurately this image has been georeferenced. So, you can see over here you can zoom this image or you can see that this river is perfectly aligned over your base map.

So, this image is accurately georeferenced. So, similarly you can georeference your toposheet or any kind of map which does not have any kind of geographic coordinate information. So, you can use the GIS platform here we have shown you or give a demonstration on the QGIS as well as the ArcGIS. So, with both this GIS platform you can georeference your images. So, in the next lecture we will come with a third lab where we will show you how we can do the merging and mosaic of different images with the help of this QGIS. Thank you.