Laboratory Practices in Earth Sciences: Landscape Mapping

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Hello everyone. So, in our last lecture we learned to generate the Enacrylve with the help of Cartosat-1 stereo paired data and the DEM on the N V software. Today we will use that Enacrylve on the GIS platform and we will learn that how we can extract information with the help of this 3D image that is Enacrylve and we can map different kind of geomorphological features and we can digitize that those geomorphological features and we can prepare a tectonal geomorphological map. So, here you can see I have imported the Enacrylve on the GIS platform and first thing when you are importing your map. So, here on the layer panel you can see that this map right now is not geographically corrected or it is not geo referenced. So, you can right click or you can go to the properties and when you will check your information here you can see the CRS that is the coordinate reference system that is empty.

So, this map right now does not know the exact location on the globe. So, first thing you have to georeference your Enacrylve and in one of our labs we have explained how you can georeference different kinds of satellite images. So, today we first have to georeference your Enacrylve. So, to georeference your map you have to go to the raster panel and there you will see the georeferencer and with the help of the georeferencer you would be able to georeference your Enacrylve.

So, to georeference your Enacrylve first you have to identify some GCPs that are the ground control point and with the help of the base map on the WMS plug in. So, you would be able to georeference your map. So, you have to identify the GCPs. So, to identify or extract information or the geomorphological features you have to use the 3D glasses. So, this is a 3D glasses.

So, you can see this glass is of two colors. First is the red and another is the cyan color. So, as I explained during the Enacrylve generation lab, when you are generating the 3D maps with the help of stereo pair image. So, your RGB bands have been converted into two bands that are your red and cyan. So, your red color is assigned a single red band and another your blue and green band has been assigned a single band that is the cyan color. So, to extract information you would be required to the red and cyan color.

So, you can see over here that this glass is of two colors: first is red and another is cyan.

So, with the help of this glass you can extract information or you can view your Enacrylve in the 3D domain. So, first you have to wear this glass and with the help of this glass you can see the 3D features on your Enacrylve. So, here you have to first import your map. So, here you can see that here I have imported the map that is the Enacrylve and with the help of this 3D glass you can see your map in three dimensions.

If you have to, you can easily buy this type of glasses from any kind of online retail platform. So, you will get this glass at a very cheap cost around 100 to 200 rupees. So, you can buy these glasses from there and you can use this glass to extract the or view your map in three dimensions. So, if you have the glass or you have this 3D glass. So, you can see over here you can pause your video or you can see with the using this glass.

So, you would see this Enacrylve in three dimensions. So, here these are all hilly trains. So, these are the Shivalik hills of the Himalayan foothill zone. Here you can see this is the river area and this area is the foothill of the Himalaya that is the Indo-Gangetic plain. So, this area you can see that this is the flat area, this is the alluvial cover of the Himalayan foothills and this sediment has been brought here by the Himalayan rivers.

For example, for this reason this sediment has been deposited by this river. So, you would be able to see your structures or your geomorphological features in the three dimensions with the help of this glass. So, first we will georeference this map to assign the coordinate reference system and then we will map the different kinds of geomorphological features with the help of this Enacrylve. So, to georeference you have to first identify some common features that you would easily identify on your Enacrylve as well as your base map. So, first you have to open the base map on your QGIS.

To open your base map you have to just go to the quick map service and you can choose any of the Google service maps or any other maps here you can see different maps are available. So, I would choose the Google satellite image and you simply click on the zoom to the layer where you would be seeing that your map is opened. So, first you have to identify your area for example, this map is from the for example, this map is from the Haldwani region. So, first you have to identify this region on your base map and so, this is your Haldwani region or you can simply use your Google train images that will enable all the labeling part for this Google satellite image you cannot see the the labeling part, but I know that this map is from this this region only. So, you have to first identify some common points that you can use as your GCPs.

So, first you have to at least identify 4 to 5 GCPs to georeference your map. So, to mark the GCP you enable the add point and you click over here and a window will pop up and from the map canvas view you simply go to that location which you have chosen for your

ground control point. So, here you can see the first point has been marked and the another point I would mark from somewhere here you have to keep in mind that the point which you are marking on your to georeference the anacolip or any kind of satellite images. So, you have to distribute the points all over your image. So, that your georeferencing would be correctly generated if you are clustering your point at a particular place or particular location.

So, that would ultimately create some kind of error with your georeference map. So, the best way is the best way is that you can choose 4 points from 4 4 corners of your map and if you add some more points you can choose points from the center portion of your map. So, now, I will mark my third point. So, from the bottom right corner of the map. So, here I am able to identify some houses.

So, I would first identify this place on the base map. So, here you can see a bridge. So, I would mark my third GCP over this bridge. So, you can choose this point as your GCP. So, these are all points I have already discussed in earlier labs.

So, how you can choose your GCPs or what kind of features you should choose while selecting your GCPs. These are all things I have already explained in our georeferencing lab. So, you can follow that lab or you can use those instructions while choosing your GCPs. So, here you can see I have marked 4 points, but I would mark another point. So, the number of points if you are marking that will ultimately enhance your georeferencing or that will give more accuracy to your georeference map.

So, I have marked the 5 points, but I can mark another point somewhere in this location because this area is left out. I have not marked any points in this area. So, I would mark another point here. So, first you have to identify the location where you can mark your GCP. To choose your GCP, first you have to identify the location.

To identify the location, the simple way is that you can simply trace the roads or any kind of natural features that would be your river or your forest area that kind of things you can trace or that would help you to locate your area where you want to add the GCP. So, here you can see that I have scored 6 points. So, all those points you can see over the GCP table. So, this table you can enable from the view setting or here you would be able to see all the information regarding your ground control point. The residual that is your error associated with the individual ground control point.

So, that you would see over here on the residual panel. Once you have selected the triangulation or resampling technique, then you would be able to see your residual errors for all the individual points as well as the cumulative error that is associated throughout

your image. So, these errors are basically the errors which are associated with the GCP. So, try to select the point which you can easily identify both on your target image that in this case is the anaglyph and the on your base image. So, if you are not selecting the point very accurately, that would include the error in terms of your pixel values or that you can see over on the residual panels.

So, now I will select the transformation method or the resampling method. So, I will start from the linear or the resampling method. The nearest nearest neighbor and the target coordinate reference system would be your WGS 84 because this Cartosat-1 image is acquired data on the WGS 84 reference system. So, here you can see by default your output file has been given, you click on the save GCP table and you also enable the load in QGIS when done. So, you select this here you can see the error associated with your individual pixel point. So, you can see the error is quite high.

So, I would change the transformation type or the sampling method you have to shuffle. Now, you can see with this transformation method Helmer and the resampling method nearest neighbor. So, you can see your associated error is minimum. So, I will choose this transformation and resampling method. So, what is this? What is the transformation method and what type of method we have to use and what are the resampling methods? These are all things I have explained in our georeferencing lab.

So, you can follow that lab or you can understand about all this transformation method or resampling method and how it works. So, once you select your resampling or transformation method you simply play the georeferencing tab and now your georeferencing is started. So, once you start it is completed you would see that one information you can see over here and because we have enabled the load in the georeferencing tab. So, here you can see your map has been georeferenced. So, you can see now on the layer panel one another map is added you can see this is the name with the modified.

So, this is your georeference map and the earlier image was then this one and here you can see there is one question mark symbol you can see over here. That means that this layer is not georeferenced, but the map which is named as the modified here you can see this map is georeferenced and once you put your cursor over this layer you can see here your you can see the information regarding the reference system that is the EPSG 4326. So, this is the georeferencing code if you want to understand about this coordinate reference system or the different kinds of codes which are used all over the world. So, if you want, if you are interested, I will also give one lecture about the different kinds of geodetic or the local datum system or the UTM about the transfer marketer projection system. So, different kinds of projections or the local datums are used throughout the world based on their own

interest.

So, that I can explain in one or in a separate lab. So, here once you have georeferenced your map so you can check whether your georeferenced map is perfectly georeferenced or not or whether it is associated with some kind of error. So, you can simply use your cipher tool. So, this cipher tool will simply drag your map over the base map. So, here you can trace any of the features for example if I am tracing this river so that you can see over here this river is perfectly placed over the base map.

So, this I can say that it is associated with a slight error but for now if you want to accurate this map more precisely you have to add more GCPs point with the help of your your georeferencer here you can add more GCPs point and that will ultimately that would ultimately enhance your map and that would place your map perfectly over this base map. So, that you can do and once your map is perfectly georeferenced so now you can use this map and you can identify different geomorphological features that you would be able to see in three dimensions. So, for that you have to use the 3D glass and with the help of this 3D glass and with this high resolution anaglyph that is ultimately a DSM digital surface model. So, you would be able to identify the different geomorphological features and you have to first thing is that you have to spend some time on this anaglyph and once you have identified the different kind of geomorphological features based on your interest what kind of features you want to add or trace so that first you have to identify and then you after you identified all those features then you start your digitization that is your mapping part. So, now I would explain how you can map all the georeferencing all the geomorphological features.

So, first use your 3D glass and you analyze the your anaglyph so you just you can disable this base map and now you can see so here few things are that you can rotate your map if you are not able to visualize your map in three dimension so you can simply rotate this map in 90 degree so you can just simply type 90 and you click on enter so here you can see now your map is now in this rotation you would be able to see the different landform in three dimension. So, now it would be easier for you to identify the different geomorphological features. So, here you can simply identify the broader geomorphological feature that is your river system you can easily identify over here the mountains you would be able to identify simply. So, now the the geomorphological part that is your river terraces, alluvial fan surfaces or different kind of structural feature that could be your fault scarp that generated due to the faultings or the nick point or the or the sand bars and the different kind of geomorphological features or tectonic feature that is associated with your different kind of faulting environment if you see the deep-slip environment you would see the fault scarp or you would see the your barping or pressure range so this type of structure you would see that is basically associated with deep-slip environment and if you see the

strike-slip environment you would see the offset of these streams or somewhere where oblique displacement you oblique displacement associated with the deep-slip and the strike-slip you would be able to see the sac mounds or your pressure range or this type of structure you would be you would be identified with the help of this high-resolution Cartosat and the the anacolip which you have prepared from the Cartosat data so that you can easily identify with the help of this this kind of satellite data so you based on your research interest or you can identify the those features or you can trace so here if you use your 3d glass and you you would see that here some kind of barping you can see over here in this place so this here you can be where my cursor is this this area is at the downside and the this this this portion is at little bit up so you can see this is some kind of this type of height perception you can see over over this area so this these are basically the fault is curve so this type of structures are basically forming due to the faulting when when your hanging block is overriding the on the on your football so you would be see such type of structure so these these are basically associated with the faulting so this you can trace on your map or you can identify you can identify or you can trace this type of tectonic or geomorphological features and the another kind of features you can see over here so here you can see the level of steps on on on both side of the your river so this is your river and here you can see this is a one level and then another steps is here little bit high and then another step is over here so here you can see three level of steps so these steps are basically your river terraces so river terraces are basically when your river is changing its base level it could be due to the tectonic or it could associated with the climatic impact also but whenever this is happening the river is changing its base level so that time the river surface is abundant and it is form a abundant surface and that abundant surface is called your river terraces so these are basically the river terraces so this type of this this terraces you can map so this terraces are basically giving you the idea about the different phase of climatic impact over this area or it can it can also relate to the different phase of tectonic events so whenever there would be any great tectonic event that could be a great or large magnitude earthquake so that time your river will change your the base level and it will form such type of steps or it will form the terraces so you can map this terraces or to interpret the different phase of climatic or tectonic events so you can you can also see the river deflection so here in this area you can see that the one river was flowing from like this so this is the your channel path so earlier this river was flowing like this so this river was flowing straight and then this this area this area got uplifted and due to this afflictment this river was not able to incise or erode this this uplifted portion so it changed its course so now you can see this river is flowing from this area so this this due to this deflection of the river so this area is now abundant and this portion is called the your bend gap so bend gaps are those areas which are basically earlier it was it was path of the river channel but now it's abundant and the river is not flowing in this area so this is called the bend gap so such this is also a tectonic feature so you can map this type of tectonic feature here you can see this is a basin type structure you can see over here and this is a this is called the

sac pond this is also associated with the strike sleeve faulting event or strike sleeve faulting so this this all the tectonic as well as the geomorphological features you can identify with the help of this this high resolution anaglyph and once you identify all these features then you have to start the digitization part so today we will stop here and in our next next lecture we will we will explain you that how we can start the digitization and how we can map the different tectonic geomorphological feature with the help of this QGIS and this anaglyph so thank you you