Laboratory Practices in Earth Sciences: Landscape Mapping

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Week- 07
Lecture- 30

Hello everyone. So, today we will start with a new lab. So, that is the real time kinematics. So, it is a technique we can use to precise our locations. So, today we will show you a field demonstration of how we can use the real time kinematics and we can mark our positions on this globe with a very high precision with an accuracy of centimeter level. So, what is RTK? So, RTK is yours, including the two GPS stations: one is your base station and the other is your rover station.

So, in real time kinematics, as I was discussing, you will have two GPS stations: one is your base station and the other is your rover station. So, how does it work? So, basically you will be having one base station. So, suppose this is your base station and you will be having another station that would be your rover station. So, this base station is static. You have to fix this station at one place and then your rover station, this rover station, you have to move this rover station to collect the data.

So, all your data will be stored in your rover station. So, how does it work or how does it acquire the accuracy of centimeter level? So, this is a GPS receiver. So, it receives signals from the satellites. So, suppose these are your satellites. So, different satellites have been launched by different GNS agencies.

For example, the most famous you might know is the GPS, the global positioning system that satellites have been launched by NASA. Similarly, there are other GNS satellites available. For example, the Chinese space agency has launched the Baidu and then Goulonas and then your Galileo and obviously the Indian satellite is Navic. So, the most famous satellite system which people are using worldwide is the GPS. So, this GNS receiver can receive signals from GPS Galileo, Goulonas and as and Baidu as well.

So, today we will give a demonstration on how we can use the GNS 14 receiver that we have in our lab. So, with these GNS 14 receivers, you can achieve an accuracy of centimeter level. So, this receiver, the base station, receives signals from the satellite. So, these are all your GNS satellites. So, it receives signals from your satellite and this actually calculates this signal as in case of RTK this signal has been transferred to this receiver by the carrier method.

So, this carrier method is a high accuracy technique and with this using this carrier technique can achieve an accuracy of up to centimeter level. So, another method is your DGPS that is the DGNS, NSS differential global navigation satellite system and this DGNS is basically using your code base technique and this RTK is using your carrier base technique. So, these are two different techniques and these are basically your method of the signal transferring from your satellite to your receiver stations. So, in the RTK case this signal is receiving this base station or your rober station in the carrier format. So, this the signal it basically calculate the range between the your satellite GNSS satellite and the receiver through this carrier base by the by multiplying the number of carrier and the and the the phase or the time or range is has been calculated by the the the number of signal or the carrier received and multiplied by the wavelength.

So, this technique actually gives you the distance between your or it calculates the positions of this receiver on the globe. So, by this carrier technique your one can achieve an accuracy of centimeter level. So, how this technique actually works or how the centimeter level accuracy has been done. So, first step is that this base station you have to set up at a at a at a place and then this base station will receive signal from the GNS satellite and this signals will this base station or the base receiver will calculate it position on the on the globe and it will also estimate the the error associated with this with the position of this base base station and this error has been transferred to in a real time to the to the river station. And simultaneously this rober is also receiving signals from the satellite or GNS satellite.

So, it is this rober receiver that has been able to calculate its position on the globe with an accuracy of centimeter level. So, in a normal scenario the receiver which you are using in your mobile phones or in any kind of satellite receiver that is actually associated with an error of up to 10 meters. So, that error range you can minimize with the using of this RTK technique. So, as we were discussing how you can achieve the centimeter level accuracy by using the real time kinematics GPS receiver. So, through this method you would be able to get the position of any area or any point on this globe.

So, this kind of data with with the high accuracy data you can use to generate a high resolution DEM that is the digital elevation model or you can you can you can generate the high resolution terrain profile that that you will ultimately you can use those those point data or those elevation data to generate the DEM and as well as the the contour line or this this type of information you can use your in in in a in a in a train evolution model. So, now we will see how you can acquire data in the field with the use of the base and rover station. So, this is your tripod. On this tripod we will mount our base station. So, that base station should be static and we will not move this base station. So, the concept is that here we have to mount our base station and this base station will pinpoint exactly this position.

So, this position the latitude longitude and the elevation with the help of this base receiver it will measure the point latitude longitude and elevation. So, the first step is that you have to label this base station because your tripod is not labeled. So, it will ultimately associate some error in your point data. So, to label your base station you have to put a label on your tripod. So, first you have to fix your tripod and then you put a label on your tripod.

So, this is your labeler here you can see one bubble at the corner of this labeler and three of these bills are you can use these bills to adjust the or fix the labeler on your tripod. And these are this one key holder that has been given on this labeler and with this locking system you can put a stand on your labeler and that stand on this on that stand you have to mount your base station. So, here you can see the three the three holes have been given and, on this hole, you have to put your mount where you will ultimately fix your base station. So, you have to first place this labeler on your tripod and you have to put this circle at the center to fix at a precise label. So, first you have to mount this with this holder and you have to fix this labeler on the tripod.

Once you have fixed this on your tripod then you have to see whether your bubble is at the center or not. If your bubble is not at the center you have to, you can simply keep bringing this bubble at the center by adjusting the two legs of your tripod. So, the simple method is to keep the label at the center. You have to see the simple way to fix your labeler if you have to adjust the two legs of your tripod. And you have to see your labeler and then you can simply adjust this one or this one or you can also choose this one or this one or accordingly you have to the the the third leg you have to keep it a a stand and the other two strand or two leg of the tripod you have to you have to adjust to fix the bubble at the center. Once you have fixed your bubble and your bubble is at the center then you can mount your tripod on the base of the tripod.

So, this is the stand you have to use and this is where you can see some screw has been given on this pole and here you have to mount your base station that would be your base receiver. And here you can see three fixers have been given and this fixer you have to put on the hole provided on your labeler. So, with this key you have to fix your stand and once you have fixed your stand now you have to place the base station over you on this stand. So, this is your GNS global navigation satellite system receiver and it is the model of the GNSS of is GNSS 14. Here you can see the information regarding this receiver has been given over this panel here this receiver is GNSS 14 and another thing is your serial number of this receiver.

This serial number you have to use while you will connect your base station and your rover station with the blue tooth. So, I will tell you in the coming few minutes. So, here a few

things are given to you on your receiver. So, first thing is here you can see this is the radio antenna fixer and with this fixer you can mount your radio antenna and with this radio antenna you can you would be able to receive the signal from the satellites. And this is another point that has been given and with this point you can directly connect your receiver with your PC.

So, you have to connect some cable on this on this given position and with this with those cables you would be able to connect this receiver with your PC. Here the other you can see where you have to mount the battery. So, this receiver will operate or get the energy from this battery. So, here you can see that this is a lithium ion battery and this battery is also provided by the Leica. Leica is the providing agency. Another thing here is that you can see the sim card and the slot for the micro SD.

So, all the data which is received by these receivers has been accumulated on these receivers or this SD card. So, you have to put the battery in and then. So, here once you place your battery you have to lock this. You have to lock this button you have to press or you have to keep it up and then you can lock and fix your battery. And this is the mountain holder and with this holder you can simply mount your receiver on the tripod. Signal panel can be seen over here.

So, this is your signal panel and with the signal panel you would be able to receive or you would be getting the idea about all the information regarding the GPS receiver. So, this one is your switch panel. This one is your function panel. Here you can see the battery signal. So, it will show you how much battery is left out in your battery and this one is when you will connect your receiver with the system. So, that signal you will you can show over here this is the Bluetooth signal and this one is the micro SD card signal whether your micro SD card is placed in in your receiver or not this this this symbol is showing the the positions of the of your satellite whether the your receiver is receiving satellite or not or what is the condition of the satellite that all information you would be able to see with this symbol and this one is your or the base and rover signal this arrow are basically showing whether this base is transporting transforming information to the rover or or it is receiving information from the base. So, these two arrows are basically showing the base or rover information.

So, you first mount your GPS on the receiver on the tripod. So, after mounting your receiver on the tripod you have to fix this radio signal antenna on your GPS receiver. So, you first mount this antenna on this antenna connector and then on this port you have to simply place your radio antenna on with the GPS receiver once you place this radio antenna now this GPS station will receive signal from the satellite. So, to on this receiver here you can see this power button you can use this power button and you simply press this power

button for two seconds and once you press this now here you can see your receiver is on and this all the signals you would be able to see once this receiver is able to receive signals from the satellite. So here you can see that this green light is showing the battery positions and this is the bluetooth symbol when you connect this receiver with the field remote or field controller.

So, then you would be able to see a blue light over your bluetooth function and this one is your micro SD card position here you can see your micro SD card is also placed. So, that is why it is showing the green color and this is the yellow light. So, this yellow light is basically showing that this receiver is receiving a signal from the satellite. So, when your yellow light is blinking, that means that your receiver is receiving minimum four satellites and if receiving signals from minimum four satellites and when this is a constant light. So, that means it is receiving signals more than four satellites or or the signal is enough to precisely locate its position on the globe and this this blink this means that now it is working as a base station that means this a receiver is transporting signal to the rover station and if this one is blinking that means that this is working as a rover station.

This you will understand when we will show you how your rover station is receiving signals from your base stations. So, now we will connect this GPS receiver with our field controller. So, a field controller is basically an operator or a a with this. With this field controller you would be able to give all the information or you can see all the information because this field controller is associated with a software or that is a kind of mini computer. So, you can use that field controller to operate or or to connect the base station with your rover station. So, first you have to set up this base station to do the set up you have to use your field controller.

So, now we will connect this base station with the field controller. So, we saw how we mounted our base and before aa marked the position or set up the base we mounted our rover station. Similarly, as we did for our base mounting we mounted the base on the a the mounted the rover on the pole. So, this is your pole and this GPS receiver we will use this one as a rover station. So, first we have one GPS receiver we have used as a base station and this one we will use as a rover station.

So, both are the GPS receivers you can use one of your GPS receivers as your base station and another one you're as a rover station. So, here you can see a radio signal antenna we have mounted and this is the GPS receiver that we have placed on the pole. So, the height of this pole you can adjust from here. So, currently it is at a 1.

8 meters. So, you can by pressing on this a on this lever you can adjust the height of the pole. So, and now you can simply the best part of mounting this receiver on the pole is that

you can mount you and your controller field controller on the pole itself. And with the help of your field controller from the pole itself you would be able to connect your field receiver first with the base station and once you set up your base station then you can shuffle your field controller from base station to your rover station. So, now we will show you how by using this lever you can mount a field controller on a pole. So, this is a base platform where you can mount your controller on the pole.

So, here you can see one lever and this lever you can connect here. So, this is the screw and you can lose or tighten this screw by rotating anti clockwise or clockwise. So, once you lose this screw and you can place a screw over it. So, this you can place and you rotate it clockwise and according to your suitability. So, according to your suitability you can adjust this a base platform and once you adjust or you tighten this a lever then you can place your field controller over your base a base of the field a field controller.

So, this is your field controller and so this field controller you would be able to mount on the base of this platform. So, here you can see two levers have been given and these two levers you can place over these two levers on the base platform. So, here you have to simply place this two-whole lever on your base platform and once you place it, you just simply press this a little bit. So, here you can see this is your base platform and you can see that this lever has been fixed with your remote controller and once this is fixed you can lock this remote controller with your base platform using this lever. So, this red lever one you press on in this direction.

So, it is now locked. To remove this you have to simply press from the other side and now you can remove this remote controller from the base platform. So, now this one is fixed. So, you would be able to use your remote controller while mounting on the pole of a rover station. So, this is your field controller as I told you that this works as a mini computer. So, here you can see one software has been given that is the SMARC work Viva LT.

So, this controller has been provided by the Leica geo system and they have also provided this Viva software. So, with this software you would be able to connect your base station with the rover station and you would be able to acquire data from the field. So, you have to simply open this software. So, once your software is opened. So, here on the screen you can see it will ask you to create a new job or whether you want to continue with your last job.

So, we will create a new job from this a new job option and one you once you will click on the next. So, here you have to give some information regarding your new job. So, that means creating a new job that means all the data which you are going to acquire through this RTK method that would store in a job which you are going to create. So, here you

have to give a name for your job that would be the RTK. So, here you can see I have given a name that is the L is the lab RTK.

So, once you have assigned the name for your job then you have to see that you have to choose the coordinate system in which coordinate reference system you want to acquire your data. So, based on your locality you can use the geodetic coordinate system that is the WGS 84 or you can also use the local datum system. So, for this area this is the UTM 44. So, I will choose UTM 44. If you want to change your coordinate system you can simply go from the drag down menu you click the edit option and from here you can choose the coordinate system for your respective area. So, for this reason we have chosen the UTM 44 and once you have chosen the coordinate system for your work or your locality you simply store the information.

Once you have created the job. So, then a new window will open and, on your screen, you can see some information. So, one by one I will explain you that all these information's are means what the means of this all these informations in here you can see the satellite symbol this is basically showing that how much satellite is been connected with you with your GPS receiver. Right now this is this receiver is not connected with the with your base or or rover receiver that is why it is showing the 0 because because on this receiver on this controller the the controller is not connected with the your GPS receiver and the other is this this symbol is basically showing that whether this receiver the controller is receiving signal from your receiver and this one is the Bluetooth symbol here you can see with this symbols you can connect your controller with the your receiver with the Bluetooth and the this is the camera option. So, this camera action option will enable or you can use the camera which is inbuilt on this field controller and this is the battery symbol and this is on the main screen of your window these are all the functions which you can use to connect your controller with the GPS receiver or you can do the survey with the help of go to the work option that we will explore in few minutes and the another option is the the CQ that is your coordinate quality. So, the coordinate quality when you will see that there are three CQ has been mentioned on your screen, one is one DCQ that means that your one dimension coordinate quality.

So, that means the GPS location which the receiver is receiving that is only in the vertical line of the camera direction and two DCQ that means in the horizontal direction and the three DCQ that is your accurate or precise location in vertical as well as horizontal direction. So, to acquire a high precision or to acquire a precise location on the globe these three DCQ should be minimum. So, now we will show you how you can connect your field controller with the GPS receivers. So, to connect your field controller you have to go to the instrument . Here you can see one GPS setting, another is the connections and the instrument status. First we will connect this and then we will explore some of the options

of this GPS controller. So, here you can see once you go to the connections option here you can see one is a GS connection wizard internet wizard and the other connection from all other connections you can connect your GPS field controller with the GPS receiver.

So, here you can see one option is the CS internet another is the GPS rover. So, on this GPS rover currently you can see this is connected with the Bluetooth GS 14. So, you can simply go to the edit option and here the audit option because this sensor is GS 14. So, this is the model number for your Leica GPS receiver and the connection using whether you want to connect your field controller with the cable or the Bluetooth.

So, two options are available here. So, you can directly connect your field controller with the cable that I initially told you I show you one port on the GPS receiver and that port you can connect to and that cable you can also connect with this field controller. So, with this cable option you can connect your field controller with the receiver and another option is Bluetooth. So, today we will connect them with the Bluetooth option once you have chosen the Bluetooth option here you can see the last used rover. So, by default it is showing which GPS receiver is connected when you last used this field controller.

So, it is showing the code. So, this code is mentioned on the GPS receiver. So, this is the 995. So, this 995 is for the receiver which we are using as a rover. So, we have to change or we have to connect this controller with our base station so that you can simply click on the search option and once you click on the search option it will search the available Bluetooth.

So, because the Bluetooth for the base station is enabled. So, it will search the Bluetooth for here you can see all the available Bluetooth it is showing. So, on the GS2870 959 this is the Bluetooth ID for our base station. So, we will click on this ID and we will click and you click and. So, here now on this portion you would be able to see that when your Bluetooth is connected your rover field controller is connected with the base station.

So, here this connection will be. So, here now you can see that your field controller is now connected with your base station and once your field controller is connected with the satellite receiver GPS receiver here you can see this is the number of satellites. Now, it is currently your base station receiver that is receiving a signal from the 16 satellites, but the 14 or 15 satellites are currently available to give the precise location and the remaining satellite is basically associated with some kind of error. So, that is why this receiver is not receiving signals from those 2-3 satellites. So, that you can see over on this sigma or g option this is basically meaning that you mean that you're the available satellite which is providing the location for your receiver. So, once this has been connected here you can see the battery status for both your field controller and another is the GS that is the GPS

sensor or that GPS receiver.

So, once this part has been done your field controller has been connected with the GPS receiver. So, you simply go to the work option and from the go to the work option here you can see a few options you can see over your screen one is your over known point over last set up over any point or go to the river menu. So, the simple meaning is that you have to first assign or you want to acquire the point where you have placed the base receiver on the globe. So, if you know the position of your base station you can simply go to choose this option and you can put the latitude longitude for your known position.

You can use the second option that is your last set up. So, this option you can use when you have work in the same location and you want to again set up your system over the same point. So, for that case you can use this option and for you can use the third option you can use over any point. So, this over any point we will use and that will ultimately give you the latitude longitude or try to identify the location of the receiver on this globe. So, here you have to give a certain location certain information that is your antenna height.

So, first you have to give the antenna height. So, this is your field controller as I told you that this works as a mini computer. So, here you can see one software has been given that is the SMARC work Viva LT. So, this controller has been provided by the Leica Geo system and they have also provided this Viva software. So, with this software you can connect your base station and the rover station and you would be ultimately able to acquire data from the height of your base station. So, up to this height up to this height you can directly measure from this measuring tape and this much height has been that is your 3.

6 centimeters. So, that is the constant height and that instrument is automatically measured from the software. So, I will show you how this 3.6 meter is given on your software. So, another thing is here you can see once this receiver is connected with your field controller. So, this blue light you can see over here earlier was a green light flashing and now it is the blue light.

So, the height of your base station is 1.22. So, you simply use your screen and you can put your 1.22 meter. So, that is your 122 centimeters here you can see the vertical offset which I was talking about is 3.6 centimeters.

So, this vertical offset is automatically calculated. So, once you on this screen here you can see the 3-d c q is 3.6 meters. So, that means the position which your base receiver is receiving is associated with an error of 3.6 meter. So, this error you have to minimize by establishing the r t k once your base station has been connected with your rover station.

So, this error would be minimal. So, once you have given the information. So, then you click on next. So, here you have to give the point id for your base station. So, that would be your 0 1 you can give any id. So, here once you have assigned the id click ok. Now here you can see one information will pop up and that is written the base setup is completed press rover to return to the rover survey menu.

So, now, your base setup is done and now you have to go to the rover option. So, for that you have to use your rover antenna. So, you press your power button and now you can see your rover is on. So, your base setup has been completed now we will move to the rover option on your rover receiver and then we will see how we can connect or we can establish r t k or we can connect the base station with the rover station. So, we will stop here and in the next lecture we will see how we can connect the base station with the rover station. Thank you.