Remote Sensing: Principles and Applications
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Lecture-61
RS Data, Data Portals and Processing Tools-Part-3

Hello everyone, welcome to the next lecture in the topic remote sensing data, data portals and processing tools. In the last lectures we are discussing about the various remote sensing data sets and saw a few examples of multiple remote sensing satellites that are available and also some of the commonly used data portals from which we can download the data. So, feel free to explore those portals on your own in your free time and try to use to the maximum extent.

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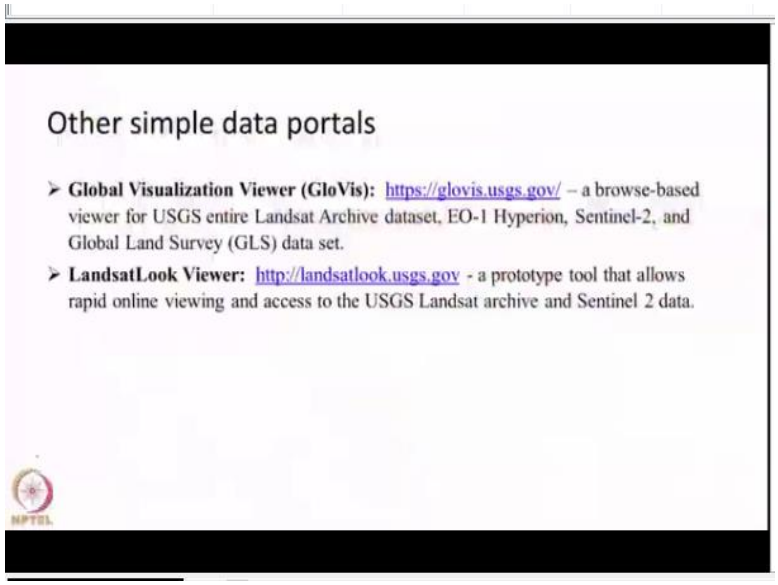

So, we discussed some of the commonly used data products like earth explorer, Bhuvan, MOSDAC. They are all very widely used. There are even other simple data portals which are often not known but again provides some data access to us. So, one is the glovis portal, glovis.usgs.gov, a browse based viewer where we can visualize the software.

Especially Landsat, Hyperion which is a hyperspectral data, Sentinel-2, global land survey are a visualization platform primarily, then also we can have a look at Landsat data using Landsat look.usgs.gov that allows rapid online viewing and access to Landsat archive and sentinel-2 data. So, even before downloading the data we may have to take a look at the data.

If half of my image is covered with cloud I may not interested in downloading it. So, such visualization is also really important when you are searching for data. Without visualization downloading may be waste. After downloading, if you realize the data is fully covered with cloud it is a waste of download and all the data we would have used up.

So, visualization actually helps us even before download. We can check it and these 2 portals are primarily visualization tools which we can use. But within the common data portals itself it is available. So, with this we finish our discussion about the data portals, then we will move on to data analysis tools that are available to us.

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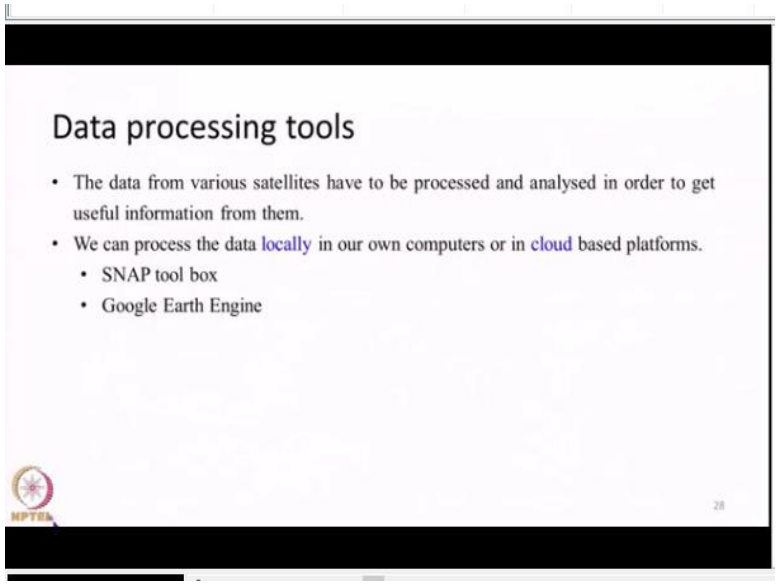

Data processing tools range from freely available open source tools to extremely expensive commercial products. Each tool varies in their capacity or capability to process certain kind of data. Only certain kind of processing and algorithms can be run on softwares. So, we have a very wide spectrum of processing tools and also nowadays with the advent of programming languages where most of the students are interested in doing programming it is always easy to process data on our own. Like GeoTIFF data, HTF data, whatever different formats I told, it is very easy to use some sort of programming language like python or MATLAB to open them, to visualize them, to code them. But even without coding capabilities we can process the data.

But some sort of processing tool is always needed as an interface when we want to use the data. without processing tool the data will be there lying idle and in order to get maximum benefit out of the data definitely we need a tool. So, that is what we are going to see. Lot of commercial

vendors are there, commercially available products are there. Some of the famous commercial products that we can use for remote sensing image analysis are ERDAS imagine, NV, ArcGIS.

So, these are all commercial products, but these products normally will be available in research institutes and academic institutes where the students and researchers will have access to it. We need to purchase a license to them. But normally as an individual cannot purchase licenses to the softwares since they may be expensive. Only for certain projects or for academic reasons we can purchase license.

But as an individual if I am interested in doing some remote sensing analysis there are again plenty of open source tools available starting from just visualization to large scale processing. That is why even in the first lecture of the topic I told you this is a golden era for remote sensing earth observation. Because of the variety of opportunities that lies in front of us. So, among all the tools that are available to us we are going to discuss only 2 of them, one is SNAP toolbox and another one is Google earth engine. So, SNAP toolbox is a software, we can download it, install it in our computers locally, download all the data, process it in our machine, it everything happens locally in our machine.

We have to download everything, whereas Google earth engine, which is becoming famous rapidly in the last few years has gained tremendous popularity and even many global applications are using this particular cloud-based platform. So, Google earth engine is one of the most powerful tool available, in cloud where we need not download anything, it provides us a good interface where we can just see the data, process it in the cloud and get the outputs. So, we will get briefly introduced to these 2 data processing tools.

The first one we are going to see is SNAP, sentinel application platform, developed by European Space Agency as a free and open source platform for remote sensing data processing and analysis. Basically it was developed to process the data from sentinel satellites, sentinel 1, 2, 3, but in addition to sentinel 1, 2, 3 missions, all other commonly used satellites data also can be processed within this tool. So, when you search for SNAP toolbox we will have different options from which we can download the tool only for sentinel-1 which is a SAR mission. We can download only that particular toolbox or sentinel-2 which is optical. Or we can combinely download everything and download the entire SNAP toolbox platform and use it for processing everything.

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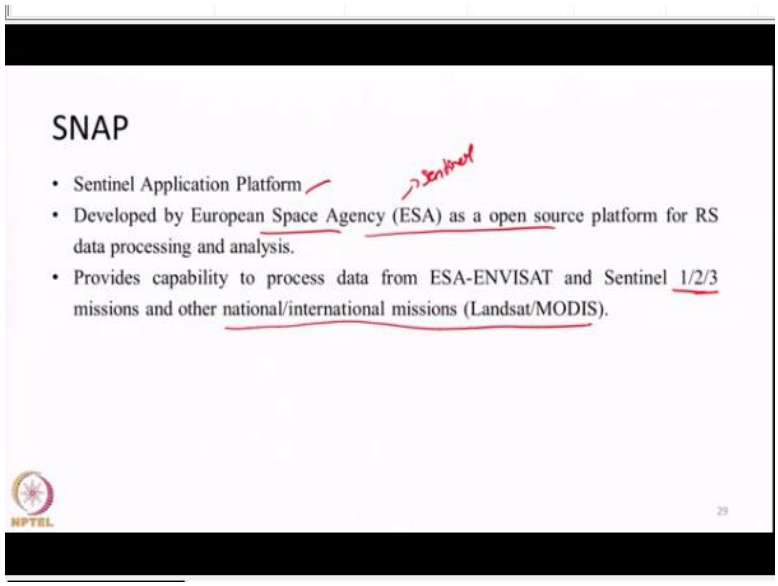

This is a screenshot taken from the SNAP toolbox with the option of processing optical data sets. It is basically sentinel-2 toolbox where we can process optical data.

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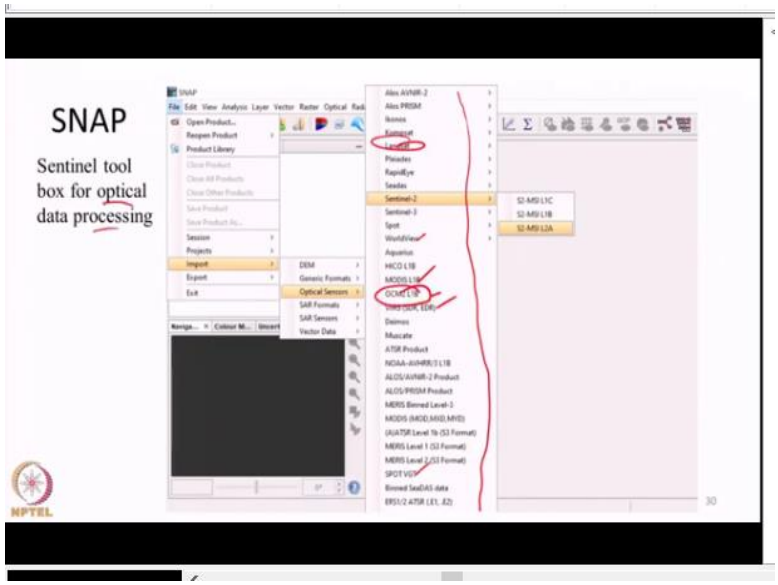

So, in addition to sentinel-2 MODIS we can process, VIIRS we can process and the SPOT, worldview. Worldview is a commercial software, Landsat which is freely available, one of the most widely used platform, OCM2 which is an Indian remote sensing satellite that is available. So, many different data products from different satellites, if they are in optical domain it can be processed within this particular toolbox.

Generally there is a separate course digital image processing which is offered to the students which talks about the various processing that one can do, we can just open the data visualize

it, it is kind of a processing, you can visualize the data. we have seen certain steps how to atmospherically correct the data.

That is again a data processing tool. It will do processing for us or we learnt about different spectral vegetation indices NDVI, EVI and all. So, starting from DN, DN to radiance, radiance to reflectance, reflectance to vegetation indices. It is a processing chain, everything can be done within the tool, you can open the data and do all the processing.

So, step by step the sequential processing can happen within this particular software. So, it is a platform where we can do this processing. So, this is possible within this SNAP tool. So, here is example for optical data sets.

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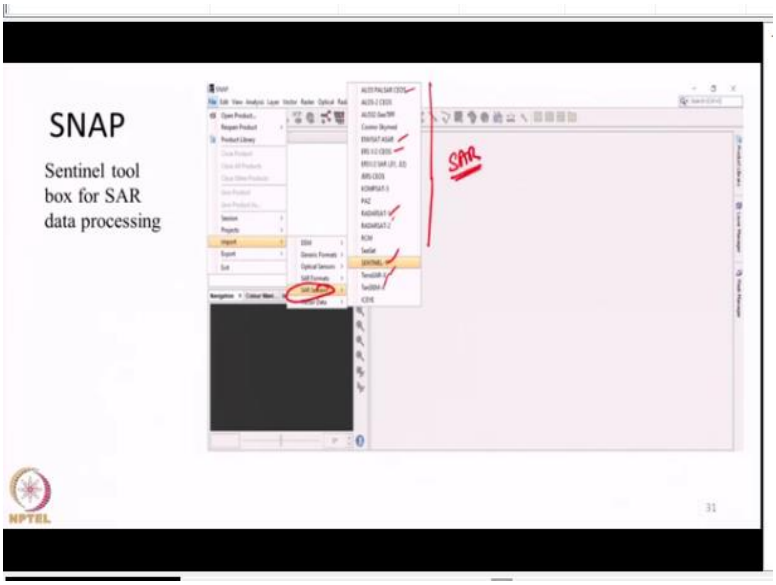

Similarly, this slide tells us the different SAR sensors synthetic aperture radar active remote sensing sensors which we can use. Sentinel-1 is freely available, apart from it RADARSAT, TerraSAR-X, TanDEM-X, ALOS PALSAR, ERS, Envisat. There are many different synthetic aperture radar data that are available, some of them are commercial, some of them are freely available which we can download and use.

Again processing can be done within this tool, we can download the data, convert the data from slant range to ground range. Converting the amplitude information into back scattering coefficient in radar imagery. We will be interested in calculating σ^o back scattering coefficient that is possible. So, all these processing steps we can do, we can do speckle filtering noisy

grainy pattern in the image, pepper and salt pattern, that can be removed using some sort of filters.

All these kinds of processing can be done within the SNAP tool box. So, SNAP toolbox offers us a powerful option to do most of the commonly done analysis with respect to remote sensing images and this is available completely for free, which we can install in our computers and use it. But everything happens locally. So, our machine should be good enough to install the software and run.

If we have older generation computer the software may not run or when you try to open a sentinel-2 data in a normal laptop what we use for online classes, it may not be enough. So, some good quality laptop or a computer may be needed, when we want to process the data. It is good to have a normal desktop computer with a moderate capacity to run this particular thing.

Anyway if you search about the SNAP toolbox you will get information about the basic system requirements and what are other things we need. But installation is extremely simple and just with the click we can install. And even processing is simple with lot of manuals and help files available which we can read on our own, understand and do it.

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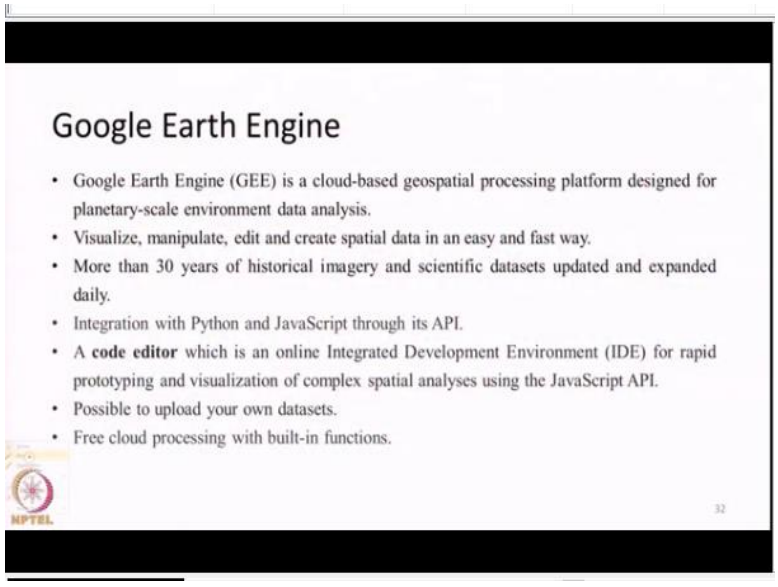

So, the final thing we are going to see in this topic is the Google earth engine. So, Google earth engine is a cloud-based geospatial processing platform which is designed for global scale environment data analysis. So, it is kind of revolutionizing the way we are doing remote sensing data processing. Now most of the large scale projects working in global level have moved to

this earth engine platform. Say I want to analyze data for the entire globe means, I should have a powerful computer which can store all the data and should be capable of processing all the data. So, it needs some capital investment, but if everything happens through cloud means I can just have a normal computer, ask the cloud to work for me that is possible. Because the cloud means the server and the computing power rest somewhere and just using a client we can initialize it.

And analyzing the results sitting in the comfort of our home or offices without the need to do large scale capital investment and developing the infrastructure is the advantage of having Google earth engine. Many different scientific papers are coming out using Google earth engine. Google engine for agricultural applications, Google earth engine for flood mapping, many different things are coming up which is kind of slowly changing the way how we do remote sensing data analysis.

But it is not the one stop solution. It has a very huge capability to do it. So, it allows us to visualize, manipulate, edit or create spatial data in easy and fast way, it has access to more than 30 years of historical imagery and other scientific data sets. If you want Landsat data it is available, MODIS data available, if you want data from some re-analysis product, say some modeled atmospheric outputs available.

So, everything is available within this portal, we need not download them, actually we cannot download the data sets, we can just open them in the cloud, whatever processing we have to do we can do it, get the outputs. May be the final maps, we can store and use it for further analysis. It is not only a data portal which means visualizing and accessing the data but it also acts as a processing tool. It provides powerful APIs application programming interfaces using either javascript language or python programming language. If you are familiar in any one of the language, we will be able to do whatever programming we want to do data analysis. So, the basic framework to do all the things is there.

So, Google earth engine provides us with the code editor. So, the code editor is an online IDE integrated development environment. So, IDE is a place where many different things can be combined and done in one go, you can code, you can analyze, everything. So, this provides like an integrated environment where you can open the data, visualize it, run your codes, see the output.

Everything can be done in one particular place. Also it has capability to upload our own data set. So, I have collected some data from ground, I want to merge it with other satellite data sets which is possible. I can upload the data to my own portal within this cloud platform, analyze on my own, get the results. And for most of the academic and research purposes they provide free access.

We have to first register for this; once we have a Google account we can just go, register for it and request an access. If we are from any academic or research organization they will immediately grant access within a few days. Once we have it, we can access the code editor and do our analysis.

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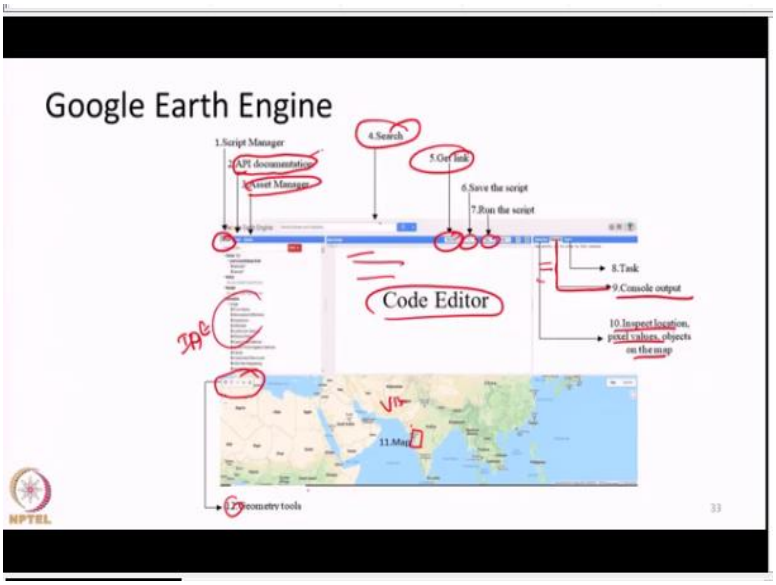

Say, this is how basically a Google earth engine screen may look. So, this portion is actually where we can see the map, if you want to open a satellite image over Mumbai, it will be displayed like this here. So, all the things are possible or if I have some output I can see my output being displayed here. So, that is possible. This is a script manager. So, the script manager tells us what are all the different codes that we have written or what are all the different codes that are available to us. There are plenty of different pre-written codes available, we need not write everything from scratch. Say to calculate NDVI, we can just call a function to do land use land cover classification, we can just call a function everything is possible within this.

It provides us with lot of API documentation which are kind help files. We can read and understand algorithms. Asset manager, basically whatever we create we call it as asset, we can

store them, see them, like I am creating one particular code to analyze all the satellite data set to capture drought prone areas. So, that is one asset. So, now next I am creating another asset to map land use land cover. It has a search bar which we can use to search data sets or places, So, the get link button is used for sharing. Say if I write code in the code editor and want to share the code with someone else, we can use get link button. This one is not publicly available, whatever we write will be available only within our Google account login. If I want to share this with someone else as if we are working as a team I can get the link and share, they will have access to this. So, that get link is a sharing tool and then save button, to save the script, run, to run the script and all. This shows us the console output, tells us whatever output we are asking. Say print something, it will print and all.

We can inspect all the values or objects that are displayed on the map. So, it provides us a complete environment, you can do your coding, you can do your visualization, you can observe or check your variables in this console. So, it is kind of a huge collection of data as well as data processing tools. So, the map geometry tools are available, you can pan the map, you can move, you can zoom in, you can pinpoint a location, that things are available here, label number 12. So, this is very basic introduction to Google earth engine. In addition to this there is a open source GIS software called QGIS which is again freely available open source. We can use it for some sort of data processing, like a GIS software which we can use it for analysis purposes.

So, there are plenty of options available, as an individual user we need not go for a commercial vendor. But commercial software provides lot of flexibilities, many different capabilities that are not there here. But as I told you some of it may be expensive and as an individual we may not have access to them. So, under such circumstances these openly available tools will come to our aid.

So, as a summary in this class we discussed about two of the commonly used data processing tools SNAP engine and Google earth engine. So, all together in the last two to three lectures we discussed about different data sets, data portals and data processing tools. So, it is kind of providing you an introduction to this big field about the different data processing and how to do it. That itself will require separate course. So, the aim of this particular remote sensing course is to provide you introduction, we have dealt with the theoretical concepts, all the physical fundamentals that are required by a remote sensing student has been given to you, the

basics at least. Now we also got introduced to different data sets, the portals from which you can download the data and some processing tools.

So, now we will move on to the applications part. So, where we combine these data sets, downloaded using this data portals, process using these tools, along with our physical concepts that we have learnt. Using those principles what we have already learnt, how to use this data for various applications. So, that is what we are going to see in the last part of this course. So, the application part will be the last part and we will be starting it from the next lecture. With this we end this particular lecture.

Thank you very much.