

Remote Sensing and GIS for Rural Development
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Indian Institute of Technology, Bombay
Week – 10
Lecture – 4
NDVI Data from NASA Platforms

(Refer Slide Time: 00:15)



The slide thumbnail displays the following information:

- Remote Sensing and GIS for rural development**
- Week 10: Lecture 4**
- PENNAN CHINNASAMY**
- FACULTY:**
- CENTRE FOR TECHNOLOGY ALTERNATIVES FOR RURAL AREAS (CTARA)**
- INTERDISCIPLINARY PROGRAM ON CLIMATE STUDIES (IDPCS)**
- CENTRE FOR POLICY STUDIES (CPS)**
- CENTRE FOR MACHINE INTELLIGENCE AND DATA SCIENCE (C-MINDS)**
- INDIAN INSTITUTE OF TECHNOLOGY - BOMBAY**
- NPTEL - REMOTE SENSING AND GIS FOR RURAL DEVELOPMENT**
- NPTEL** logo in the bottom left corner.
- P.Chinnasamy@iitb.ac.in** in the bottom right corner.

Hello everyone. Welcome to today's NPTEL course on Remote Sensing and GIS for Rural Development. This is Week 10, Lecture 4. In this week, we have been looking at online platforms and GIS platforms with remote sensing data that can help us to quickly download NDVI data and other crop vegetation index data.

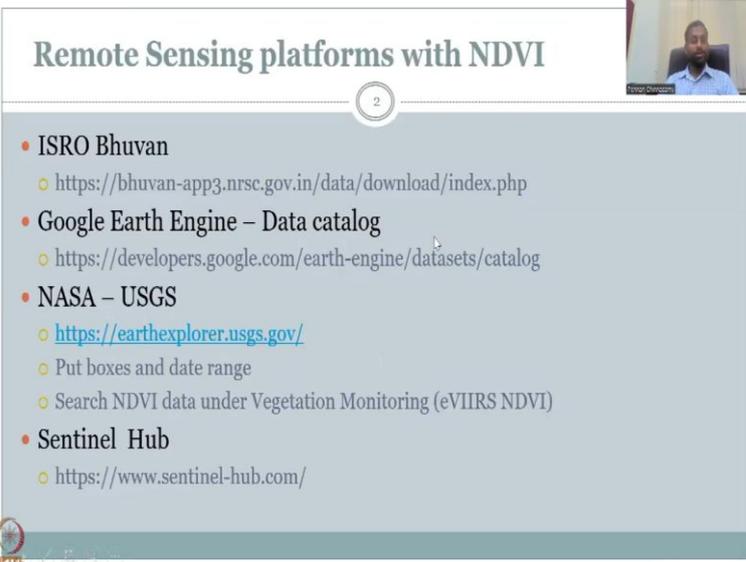
Across the research literature, NDVI ranks number 1 for having a lot of remote sensing based studies for assessing the vegetation, health of vegetation area, acreage etcetera because it is very simple to use, very efficient and open source. We also have vegetation fraction which a lot of these platforms house. And before we get into the other indicators, I wanted to showcase the 4 different platforms that house NDVI the Bhuvan we saw in the previous lectures.

In the last lecture, we looked at Google Earth engine which keeps on updating. And today we will be looking at the NASA's data sets. Why NASA's data sets is it has high benefits on spatial and temporal resolutions when compared to the other data sets that we have discussed initially and because of the high global coverage and spatial and temporal resolutions, there is multiple scientific articles on it.

As students, whenever you want to collect data and form a hypothesis or if you would like to support an idea, the best way to do it is first do a literature review. In the literature review, you find papers, recent papers and look at what methods they have used. And you will find some technologies that everyone can use as example NDBI.

There are other higher indicators with better resolution so called or better analysis, however, they might be expensive. We need to make sure that everyone can map at least in the initial stages and that is what NDVI does for you. It is very simple. It is NIR minus visible red by NIR plus visible red. And almost all open source satellites nowadays have these bands and even the older satellites. So, let us move on.

(Refer Slide Time: 03:08)



The slide is titled "Remote Sensing platforms with NDVI" and is numbered "2". It lists four main categories of remote sensing platforms:

- **ISRO Bhuvan**
 - <https://bhuvan-app3.nrsc.gov.in/data/download/index.php>
- **Google Earth Engine – Data catalog**
 - <https://developers.google.com/earth-engine/datasets/catalog>
- **NASA – USGS**
 - <https://earthexplorer.usgs.gov/>
 - Put boxes and date range
 - Search NDVI data under Vegetation Monitoring (eVIIRS NDVI)
- **Sentinel Hub**
 - <https://www.sentinel-hub.com/>

The slide also features a small video inset in the top right corner showing a person speaking, and an NPTEL logo in the bottom left corner.

And we have actually looked at ISRO, Bhuvan in the previous lectures and then Google Earth engine. I had also indicated that there is some codings that you could do. As I said I will refrain from teaching how to code because that is not a part of the current exercise. Coding, there is a lot of forums that you could go and and find the codes.

You can just Google and say that Google Earth engine making charts and then you will find a lot of videos. What is missing is how does that relate to a particular topic because that is domain expertise. So, in this lecture series, the entire remote sensing and GIS for Rural Development, not only am I giving you the access to remote sensing tools but also making sure that you know where to use it.

Again, remote sensing tool and GIS is taught in civil engineering, earth science engineering, geography, remote sensing as a class by itself, satellite technologies, in our rural development courses I teach it. Now, even policy teaches it, law teaches it. But where we would be different?

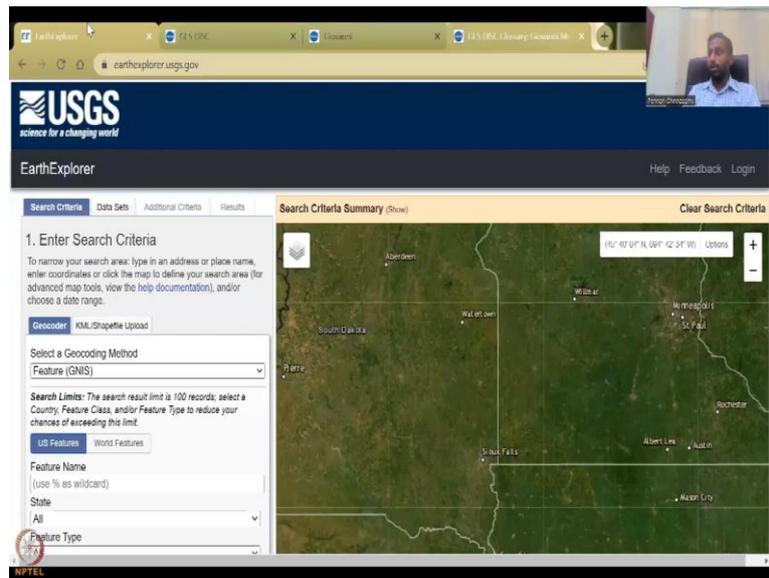
This NPTEL course is very different as we align it to a particular objective which is rural development. And of the rural development, we assess that croppings have a very very high impact because most of the population depends on agriculture, so we had more focus on it. We will slowly look at other options also.

But, please remember that other rural development indicators and indices that we initially started with rural infrastructures, rural droughts, rural schools, rural hospitals, all these have very very less data and remote sensing is one of the best that can help. Still, there is much more to go. Whereas, agriculture, at least you can see the plants, you can see the the croppings, farming, harvest, etcetera.

Suppose, there is a building and it is covered on top with trees, for example, IIT Bombay, if you take a satellite or drone image, you will see a lot of trees. So, you cannot count how many buildings it is. Because the buildings are under the trees. So, the the aerial imagery will not be just enough. So, there is other data that is also needed. As I spoke about synergized data mapping.

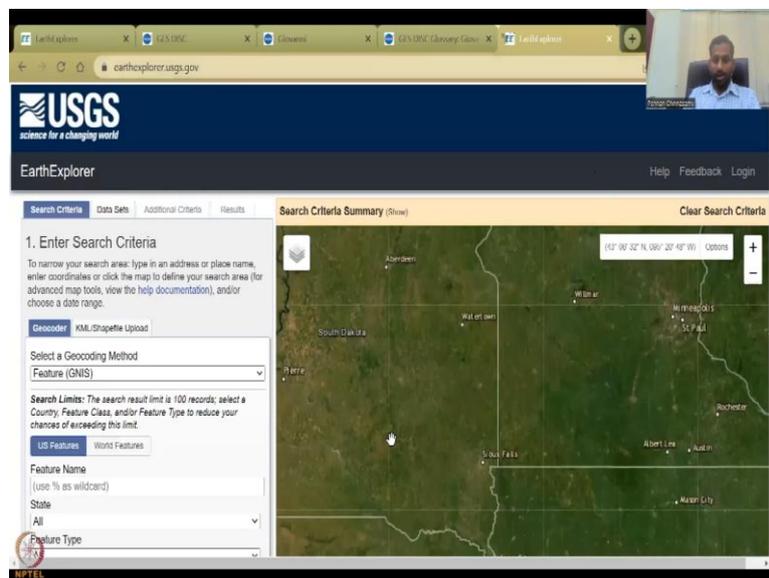
So, after week 10, I hope to again revisit the synergize mapping and showcase some data that has been used widely for rural infrastructure mapping. So, let us start with the NASA data sets. I will explain the Earth Explorer and also go to GES DISC data set that we have already looked at in the previous lectures. Just for the vegetation fraction, we will look at. So, let me share the Earth Explorer website.

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So, this is how the Earth Explorer website looks like and we have already used these in our hands-on exercise. I have not logged in. I will keep it unlogged for now. So, right now, you could see that we have multiple options. So, when you open Earth Explorer, I could open it again for you just in case. Let me open it again.

(Refer Slide Time: 06:45)



1. Enter Search Criteria

To narrow your search area, type in an address or place name, enter coordinates or click the map to define your search area (for advanced map tools, view the help documentation), and/or choose a date range.

Geocoder KML/Shapefile Upload

Select a Geocoding Method
Feature (GNIS)

Search Limits: The search result limit is 100 records; select a Country, Feature Class, and/or Feature Type to reduce your chances of exceeding this limit.

US Features World Features

Feature Name
(use % as wildcard)

State
All

Feature Type
All

Show Clear

Polygon Circle Predefined Area

Degree/Minute/Second Decimal

Lat: 44° 49' 47" N, Lon: 082° 22' 05" W

1. Enter Search Criteria

To narrow your search area, type in an address or place name, enter coordinates or click the map to define your search area (for advanced map tools, view the help documentation), and/or choose a date range.

Geocoder KML/Shapefile Upload

Select a Geocoding Method
Feature (GNIS)

Search Limits: The search result limit is 100 records; select a Country, Feature Class, and/or Feature Type to reduce your chances of exceeding this limit.

US Features World Features

Feature Name
(use % as wildcard)

State
All

Feature Type
All

Show Clear

Polygon Circle Predefined Area

Degree/Minute/Second Decimal

Lat: 44° 49' 47" N, Lon: 082° 22' 05" W

Search Criteria Summary (Show)

1. Enter Search Criteria

To narrow your search area, type in an address or place name, enter coordinates or click the map to define your search area (for advanced map tools, view the help documentation), and/or choose a date range.

Geocoder KML/Shapefile Upload

Select a Geocoding Method
Feature (GNIS)

Search Limits: The search result limit is 100 records; select a Country, Feature Class, and/or Feature Type to reduce your chances of exceeding this limit.

US Features World Features

Feature Name
(use % as wildcard)

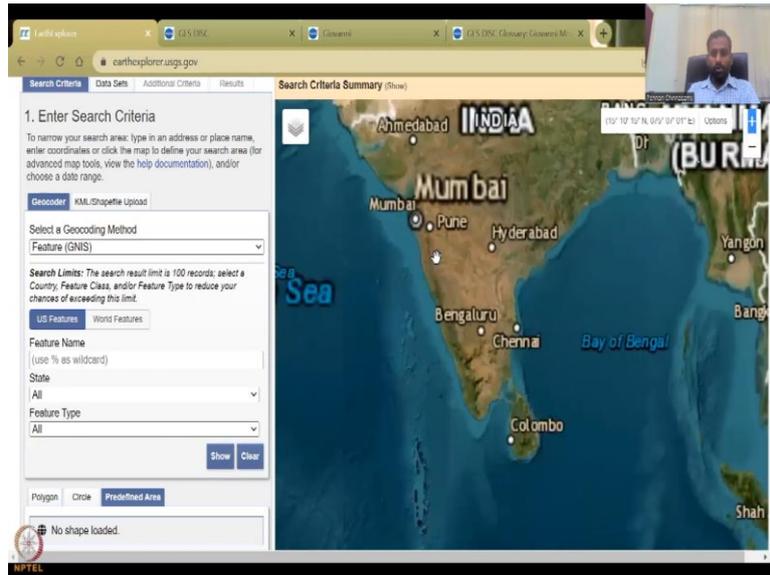
State
All

Feature Type
All

Show Clear

Polygon Circle Predefined Area

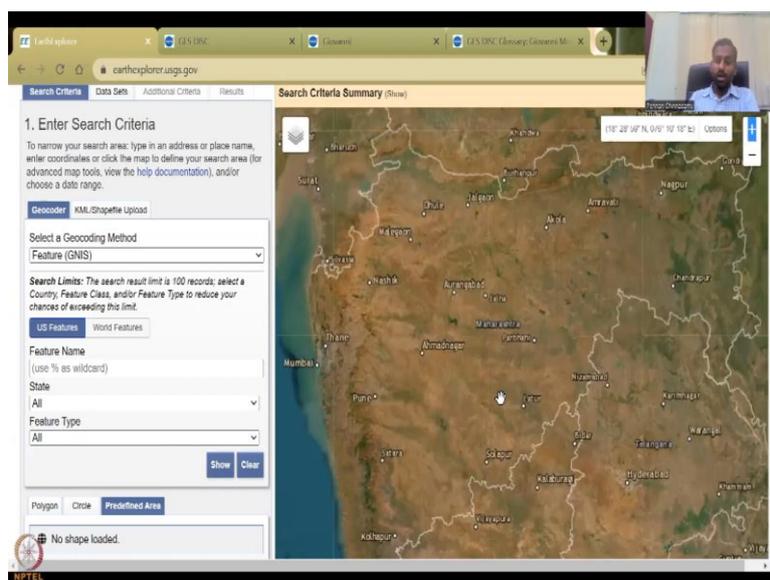
No shape loaded.

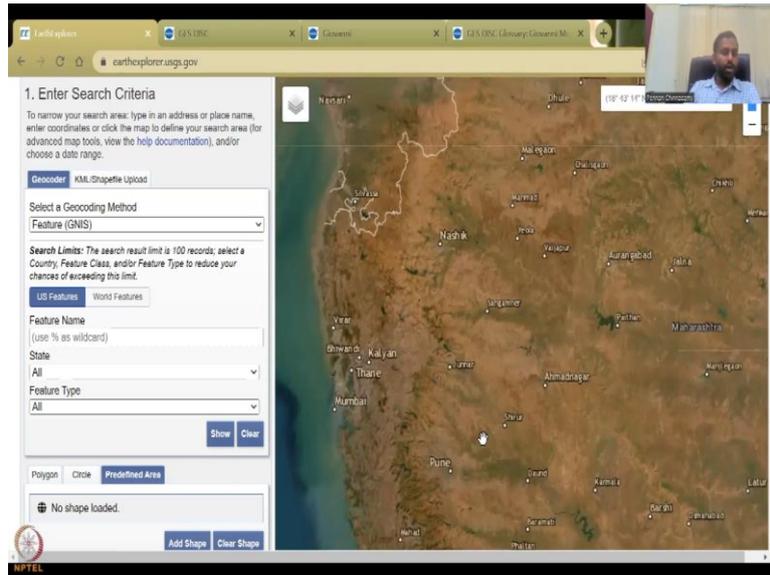


So, if I open the Earth Explorer again, it is the same link that I have shared. You will see that it opens on a particular location and in South Dakota. So, because they want to center it in the US. So, all you can do is if you move your mouse on the frame, you will see a hand. You click it, it will hold it. It is called pinch and then you pinch and then you move.

So, or you can the best way to zoom out to a particular location, zoom out as much as possible and then just drag it. It is easier to go to India like this. So, what happens here is we need to show where we would like to work on. So, here we can zoom in by moving the mouse in front.

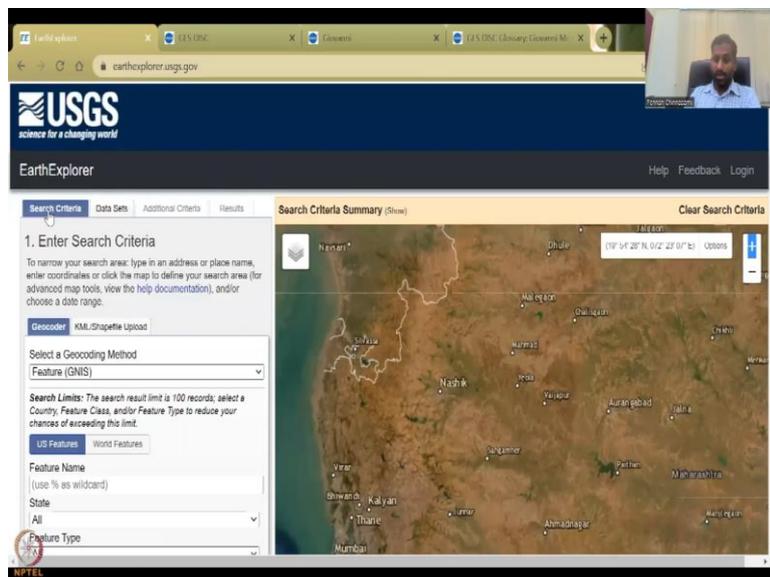
(Refer Slide Time: 07:45)

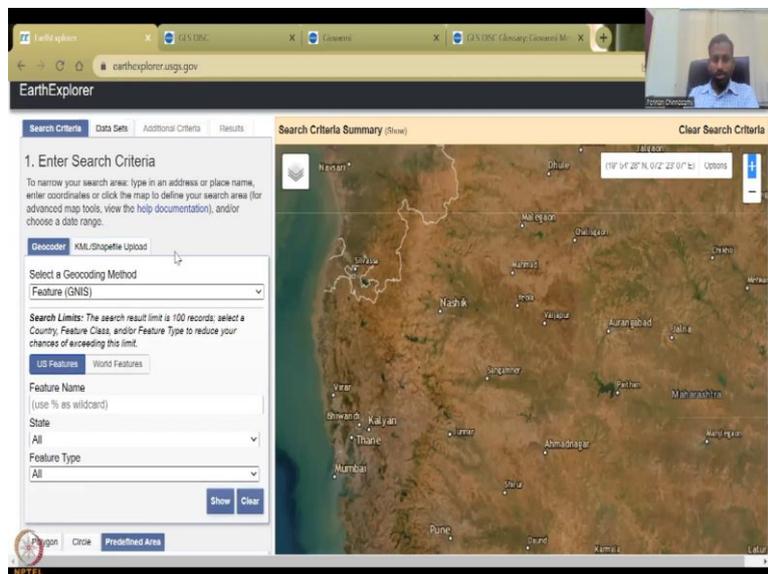
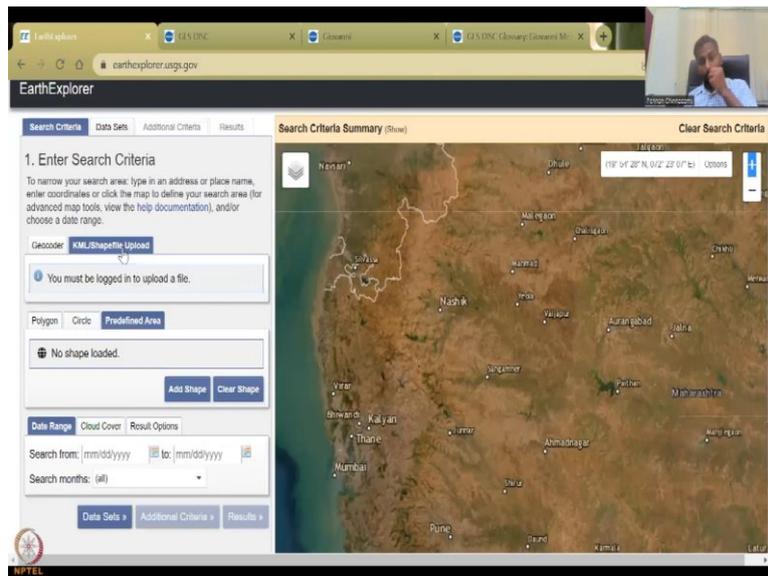




So, let me just put it back on Maharashtra because we have used Maharashtra for the other NDVI indicators. So, you can zoom in more if you need and then, yeah. So, let us keep it at Pune region, Nasik region. So, good. So, we have this Pune, Nasik region and then as I said what we will be doing is there is a lat long that has already been given. We will be using that.

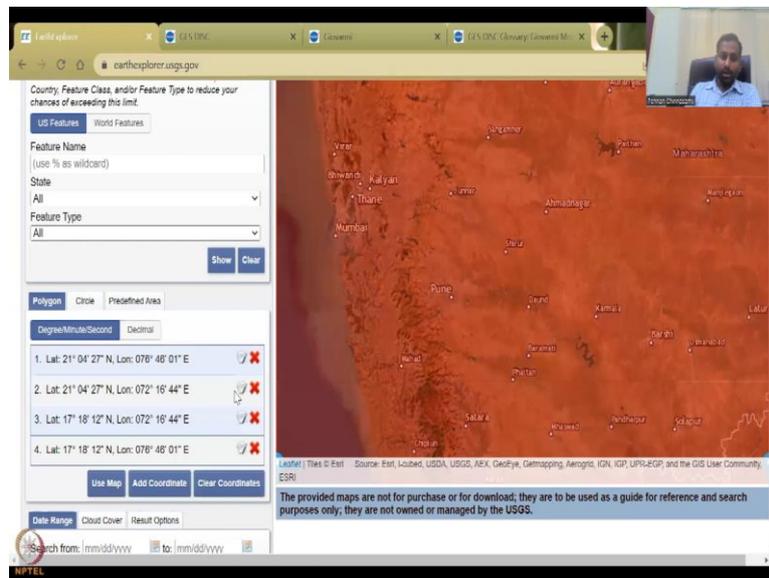
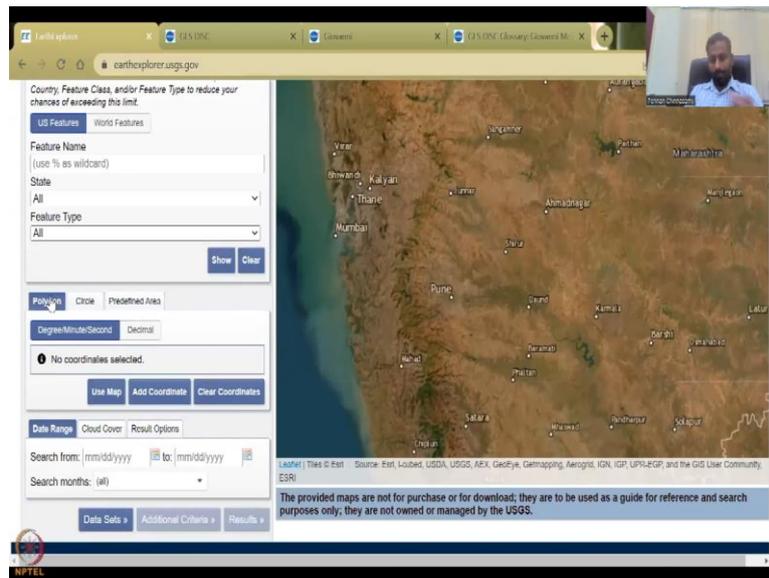
(Refer Slide Time: 08:14)





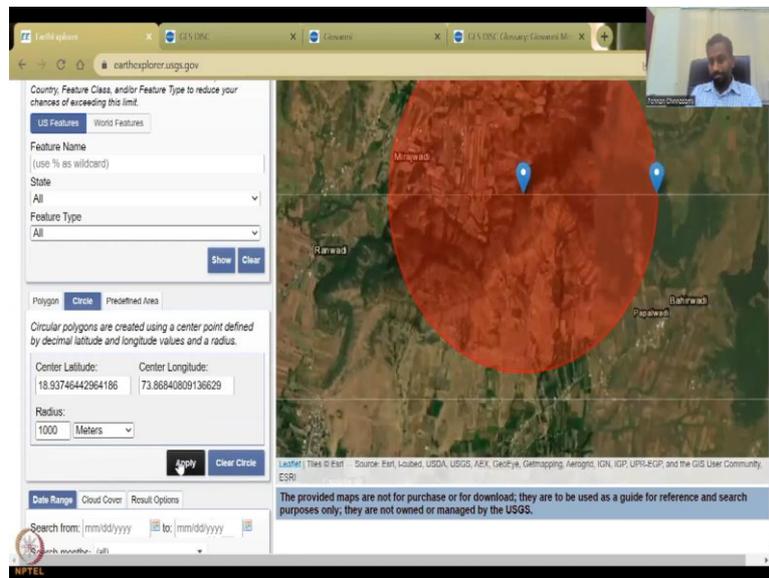
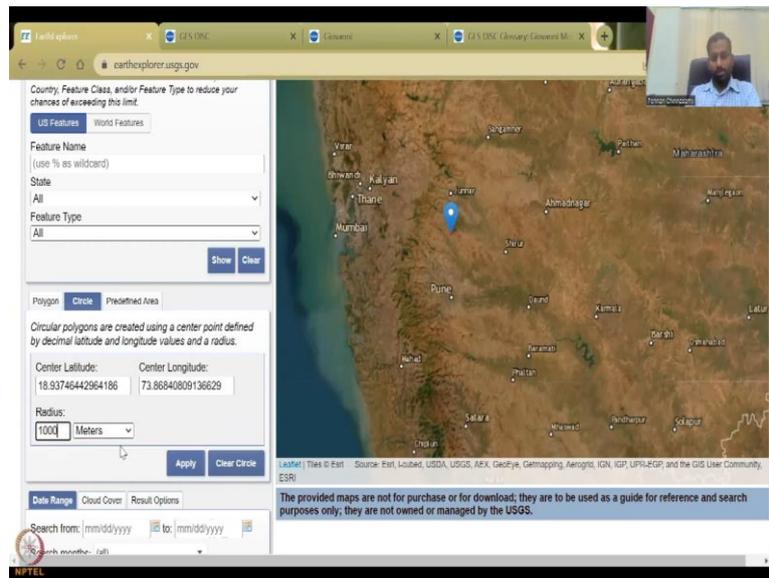
But more importantly, on the top, it is the search criteria. You can use a shape file that you have already used. You can download it and put it on the system and then use it. But also go to geocoder which is kind of a little bit advanced. So, let us skip that part.

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We will go to polygon. So, you will draw the polygon where you want the area to be disclosed. So, when I use this, you can use a map by clicking the previous map that we selected. But again we will use a new coordinates.

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Or you can do a circle, you can click on top and then zoom out and zoom in like for example like this and then you can put a radius and then the circle is created. Let us say 1000 meters that is one kilometer. So, you can see a big circle coming up. Or you can clear the circle and then back. I am going to clear all my polygons coordinates.

(Refer Slide Time: 09:31)

The screenshot shows the Earth Explorer search interface. On the left, there is a search panel with the following sections:

- 1. Enter Search Criteria**: Includes instructions to narrow search areas by address, coordinates, or map click.
- Geocoder**: A text input field containing "KML/Shapefile Upload".
- Select a Geocoding Method**: A dropdown menu set to "Feature (GNIS)".
- Search Limits**: A note stating "The search result limit is 100 records; select a Country, Feature Class, and/or Feature Type to reduce your chances of exceeding this limit."
- US Features / World Features**: Two tabs, with "US Features" selected.
- Feature Name**: A text input field with "(use % as wildcard)" below it.
- State**: A dropdown menu set to "All".
- Feature Type**: A dropdown menu set to "All".
- Show / Clear**: Two buttons.
- Polygon / Circle / Predefined Area**: Three radio buttons, with "Predefined Area" selected.
- Degree/Minute/Second / Decimal**: Two radio buttons, with "Decimal" selected.
- No coordinates selected.**: A message with a red error icon.

The main map area shows a topographic view of the Western United States, including California, Nevada, and Arizona. A small video feed of a presenter is visible in the top right corner.

This screenshot shows the search panel with additional options:

- Date Range**: Includes "Cloud Cover" and "Result Options" tabs.
- Search from**: A date input field with "mm/dd/yyyy" format.
- Search to**: A date input field with "mm/dd/yyyy" format.
- Search months**: A dropdown menu set to "(all)".
- Data Sets / Additional Criteria / Results**: Three buttons at the bottom of the search panel.
- No shape loaded.**: A message with a red error icon.
- Add Shape / Clear Shape**: Two buttons.

The map area remains the same, showing the topographic view of the Western US. A copyright notice is visible at the bottom of the map area: "Landscape | Tiles © Esri | Source: Esri, DeLorme, USDA, USGS, AeroX, GeoEye, IGN, GeoEye, IGN, IGN, Esri, LPS, Esri, and the GIS User Community, ESRI". A disclaimer at the bottom of the interface states: "The provided maps are not for purchase or for download; they are to be used as a guide for reference and search purposes only; they are not owned or managed by the USGS."

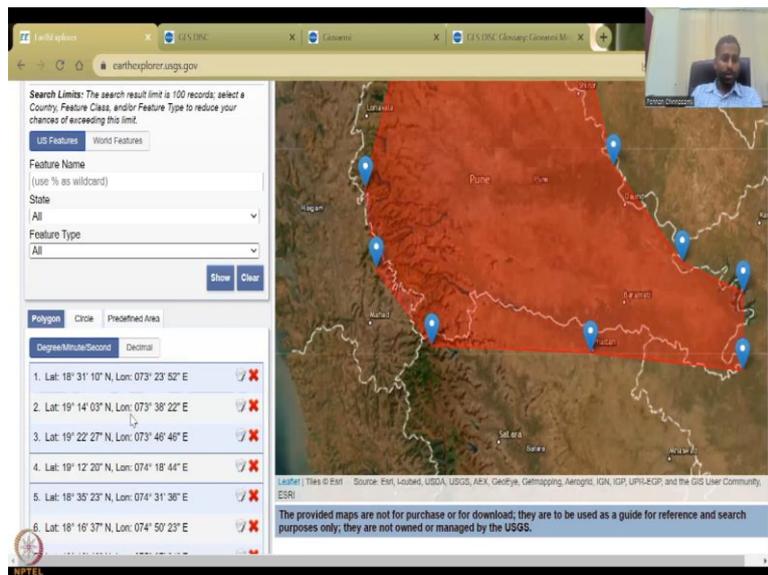
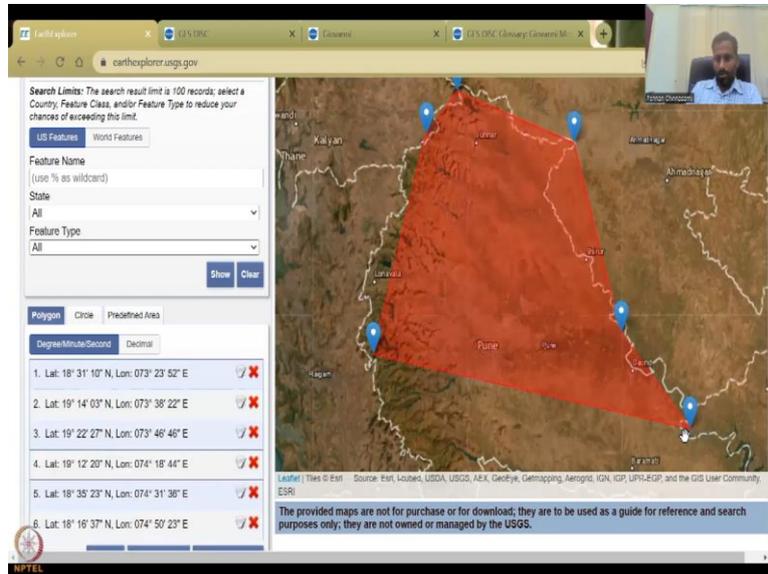
This screenshot shows the search panel with coordinate input options:

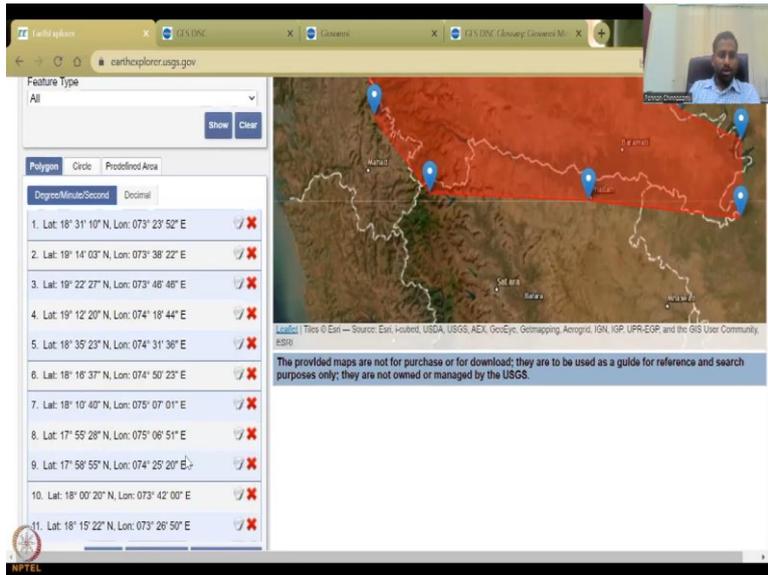
- Use Map / Add Coordinate / Clear Coordinates**: Three buttons.
- No coordinates selected.**: A message with a red error icon.
- Date Range**: Includes "Cloud Cover" and "Result Options" tabs.
- Search from**: A date input field with "mm/dd/yyyy" format.
- Search to**: A date input field with "mm/dd/yyyy" format.
- Search months**: A dropdown menu set to "(all)".
- Data Sets / Additional Criteria / Results**: Three buttons at the bottom of the search panel.

The map area remains the same, showing the topographic view of the Western US. The same copyright notice and disclaimer are present.

Again putting it back to Pune region. And then you can have a circle predefined area, you can add a shape file after you log in but we will use a polygon.

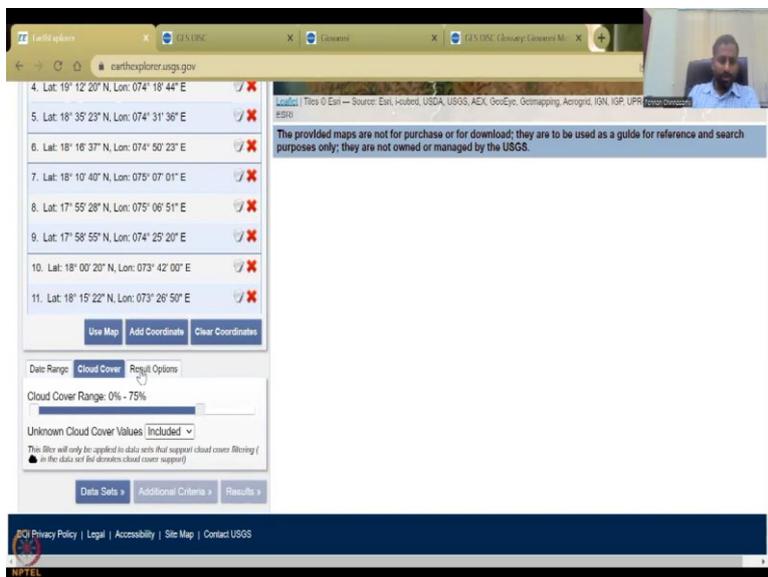
(Refer Slide Time: 09:43)





So, once you click the polygon, you will have to click coordinate. So, this is one coordinate, let us say we can just use Pune. You can also see the grids. So, you can see these lines. These are each tiles of the data and it will be used for searching the data if needed. That will be enough. And then this is the coordinate system we have.

(Refer Slide Time: 10:12)



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4. Lat: 19° 12' 20" N, Lon: 074° 18' 44" E

5. Lat: 18° 35' 23" N, Lon: 074° 31' 36" E

6. Lat: 18° 16' 37" N, Lon: 074° 50' 23" E

7. Lat: 18° 10' 40" N, Lon: 075° 07' 01" E

8. Lat: 17° 55' 28" N, Lon: 075° 06' 51" E

9. Lat: 17° 58' 55" N, Lon: 074° 25' 20" E

10. Lat: 18° 00' 20" N, Lon: 073° 42' 00" E

11. Lat: 18° 15' 22" N, Lon: 073° 26' 50" E

Use Map Add Coordinate Clear Coordinates

Date Range Cloud Cover Result Options

Standard Season

Results per Page: 100 5

Data 25 50 100

Additional Criteria Results

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11. Lat: 18° 15' 22" N, Lon: 073° 26' 50" E

Use Map Add Coordinate Clear Coordinates

Date Range Today Close

Search from: mm/dd/yyyy to: mm/dd/yyyy

Search months: (all)

Data Sets Additional Criteria Results

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11. Lat: 18° 15' 22" N, Lon: 073° 26' 50" E

Use Map Add Coordinate Clear Coordinates

Date Range Cloud Cover Result Options

Search from: 09/01/2022 to: 12/31/2022

Search months: (all)

January February March

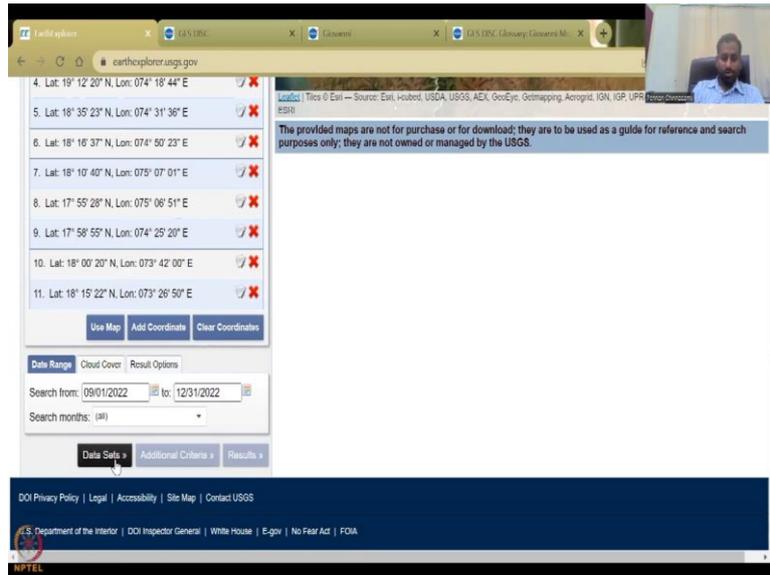
Data Sets Additional Criteria Results

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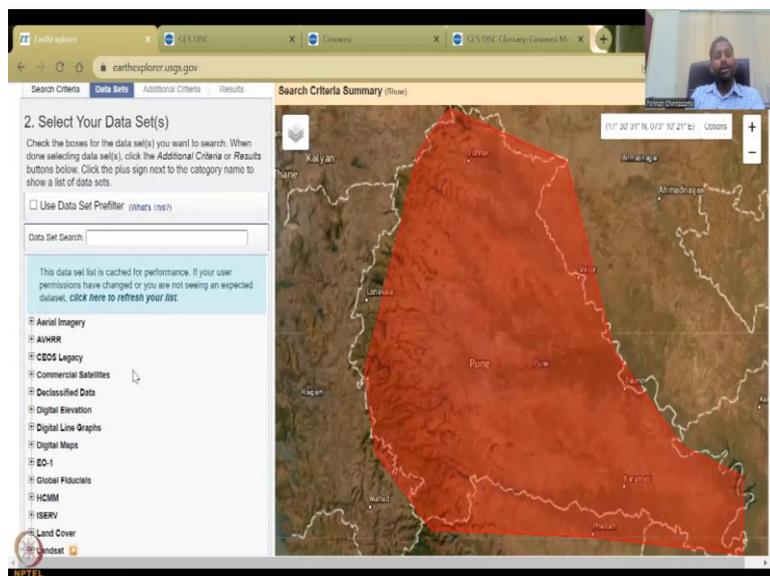
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Then you can come down here to say that what is the cloud cover you are okay with? 100 cloud cover does not make sense. So, let us keep it at 75 percent and then result options you can see how many results you want to see. Let us say 10 is enough. And then the date range is we will go just for this recent year.

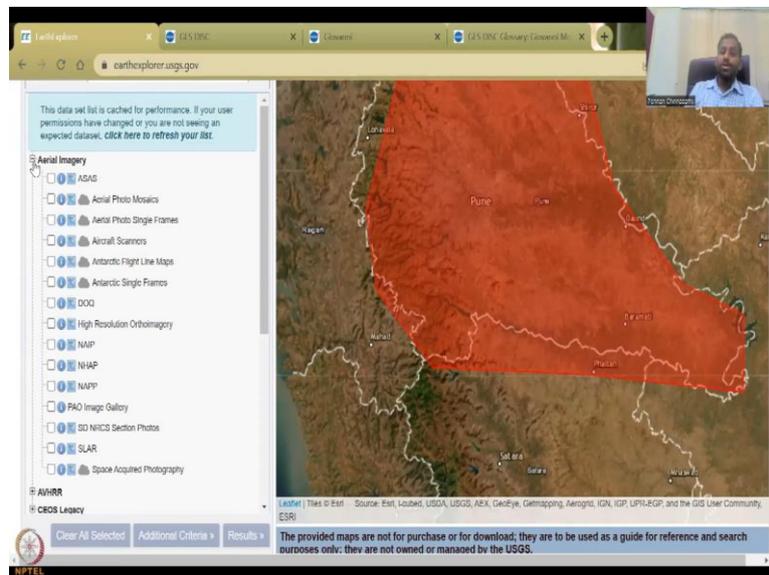
So, or December because we use December 2021 in the Bhuvan but we will use December 2022 and then we will say actually we can go to September also. September 1 to December 2022. End. And then we can say search all months, you can say search all months and then click on the result options. You can click all, if needed and it is also good. This is good. Now we can go to data sets.

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We will just pick what data set you want. So, this is on the top also. And here you will have plethora of satellite remote sensing data that you could use. I will just show you some of it because just for NDVI will come straight to NDVI but I also wanted to explain this slide.

(Refer Slide Time: 11:35)



Aerial imagery is just a photograph picture of the location. For example, you are looking at a post flood analysis and you want to see the impact, the damage of buildings and all, which is not an indicator based approach. So, for that you can use these high resolution images just as aerial images. These are aerial images, not only taken by satellites, most of it is flights. So, you can see here flight imagery, Antarctic flight line maps. And then most most importantly, these are all flights whereas this is space photography from clouds.

(Refer Slide Time: 12:10)

This data set list is cached for performance. If your user permissions have changed or you are not seeing an expected dataset, [click here to refresh your list](#).

- Aerial Imagery
 - AVHRR
 - AVHRR Global 1K
 - AVHRR Composites
 - AVHRR Orbital Segment
- CEOS Legacy
- Commercial Satellites
- Declassified Data
- Digital Elevation
- Digital Line Graphs
- Digital Maps
- EO-1
- Global Fiducials
- HCM
- ISERV
- Land Cover
- Landsat
 - Landsat
- LCMAP
- NASA LPDAAC Collections
- Radar

Clear All Selected Additional Criteria Results

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This data set list is cached for performance. If your user permissions have changed or you are not seeing an expected dataset, [click here to refresh your list](#).

- Aerial Imagery
- AVHRR
- CEOS Legacy
- Commercial Satellites
 - IKONOS-2
 - QuickBird
- SPOT
- Declassified Data
- Digital Elevation
- Digital Line Graphs
- Digital Maps
- EO-1
- Global Fiducials
- HCM
- ISERV
- Land Cover
- Landsat
 - Landsat
- LCMAP
- NASA LPDAAC Collections
- Radar

Clear All Selected Additional Criteria Results

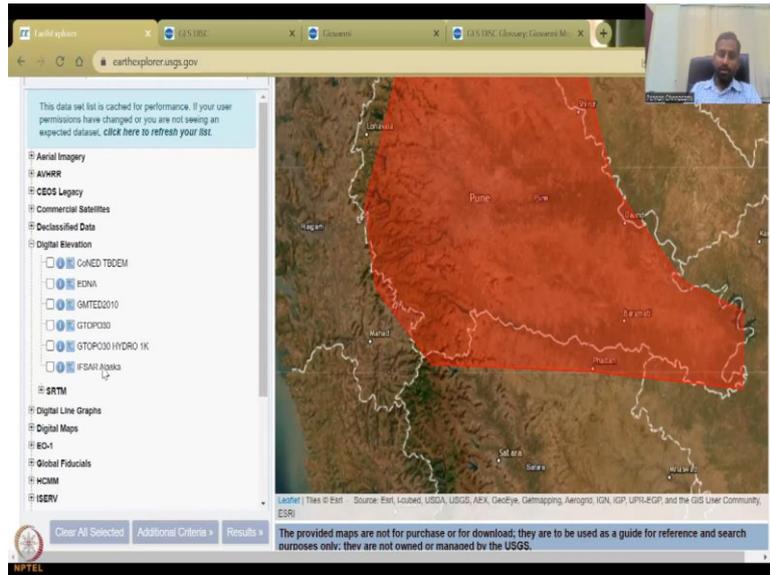
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- Aerial Imagery
- AVHRR
- CEOS Legacy
- Commercial Satellites
- Declassified Data
 - Declass 1 (1996)
 - Declass 2 (2002)
 - Declass 3 (2013)
- Digital Elevation
- Digital Line Graphs
- Digital Maps
- EO-1
- Global Fiducials
- HCM
- ISERV
- Land Cover
- Landsat
 - Landsat
- LCMAP
- NASA LPDAAC Collections
- Radar

Clear All Selected Additional Criteria Results

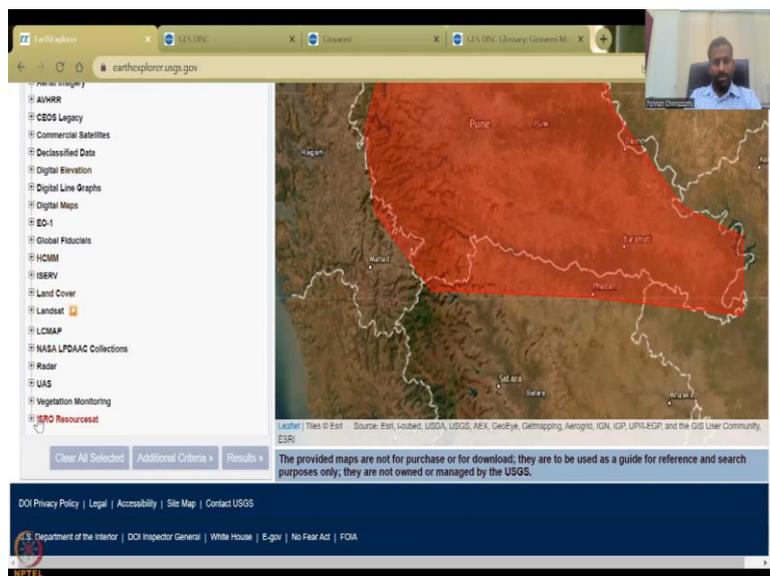
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And then we have AVHRR is also a different sensor placed on satellites CEOs Legacy is there. Legacy means is kind of outdated also commercial satellites. These are two commercial satellites that Earth Explorer has bought for you or have a subscription. It is not the real real high-end satellites. They have now IKONOS and orbital view.

For example, high-end as in, they will not give it for free. So, the freeier versions and other Meta versions or the lower resolution versions. And then there is a declassified data which is something that it was classified once and now it has been declassified some data on the borders and etcetera. These are DEMs. So, we have all these DEMs we do not have the Indian satellites.

(Refer Slide Time: 13:01)



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expected dataset, click here to refresh your list.

- Aerial Imagery
- AVHRR
- CEOS Legacy
- Commercial Satellites
- Declassified Data
- Digital Elevation
- Digital Line Graphs
- Digital Maps
- EO-1
- Global Fiducials
- HCMM
- ISERV
- Land Cover
- Landsat
- LCMAP
- NASA LPDAAC Collections
- Radar
- UAS
- Vegetation Monitoring
- USRO Resourceset
 - IRS AWIFS
 - IRS LIS3A

Clear All Selected Additional Criteria Results

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- Aerial Imagery
- AVHRR
- CEOS Legacy
- Commercial Satellites
- Declassified Data
- Digital Elevation
- Digital Line Graphs
- Digital Maps
- EO-1
- Global Fiducials
- HCMM
- ISERV
- Land Cover
- Landsat
 - GLCC
 - Land Cover Trends Photos
- LCMAP
- NASA LPDAAC Collections
- Radar
- UAS

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- Digital Line Graphs
- Digital Maps
- EO-1
- Global Fiducials
- HCMM
- ISERV
- Land Cover
- Landsat
 - Landsat Collection 2 Level-3 Science Products
 - Landsat C2 U.S. Analysis Ready Data (ARD)
 - Landsat Collection 2 Level-2
 - Landsat Collection 2 Level-1
 - Landsat C2 Atmospheric Auxiliary Data
 - Landsat Legacy

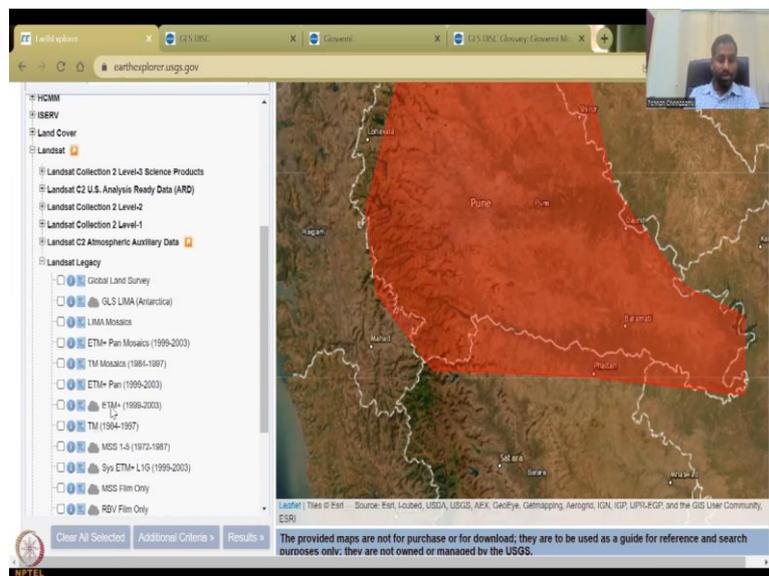
Clear All Selected Additional Criteria Results

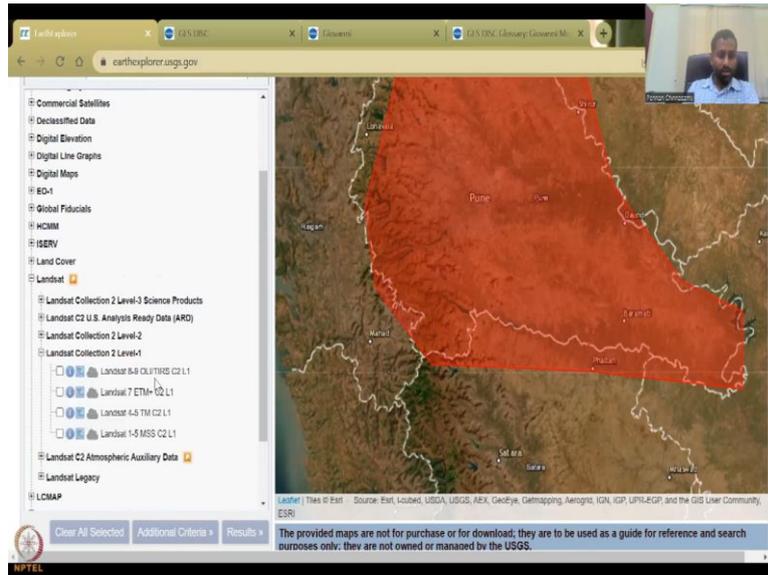
The provided maps are not for purchase or for download; they are to be used as a guide for reference and search purposes only; they are not owned or managed by the USGS.

But if you come down you have ISRO satellite. So, no other big satellite name is there except NASA and the European satellite regions, explicitly here. So, you have resourcesat, both the AWIFS and LISS-3. These are good aerial imagery and a lot of analysis can be done using this.

So, you have digital maps, the national atlas maps and then digital line graphs are there. Earth observation systems and then fiducials, Global fiducials maps, HCM, ISERV, all these are sensors, then the land use land cover. You can have a global land use cover, land cover trends, photos, et cetera. Landsat is the really important one because it has been a legacy, 1960s till date it has been taking images. Now we are at landsat 8 and 9 and you can get all these landsat images.

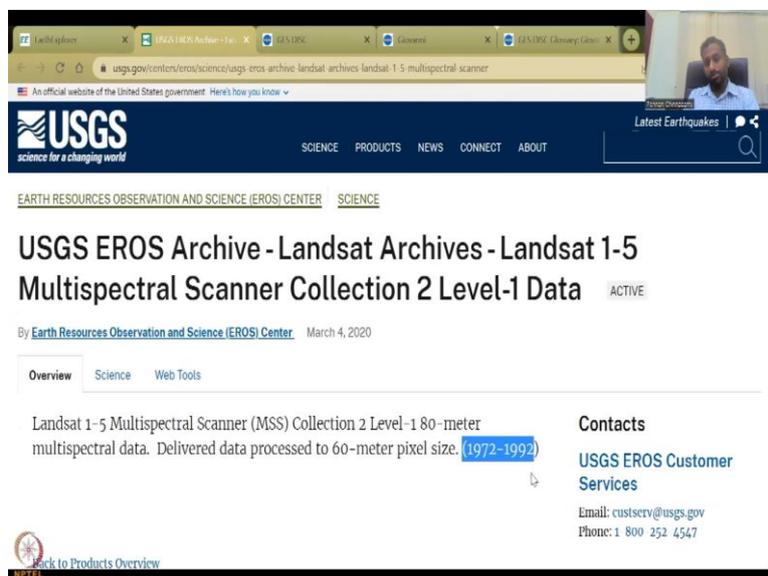
(Refer Slide Time: 13:53)





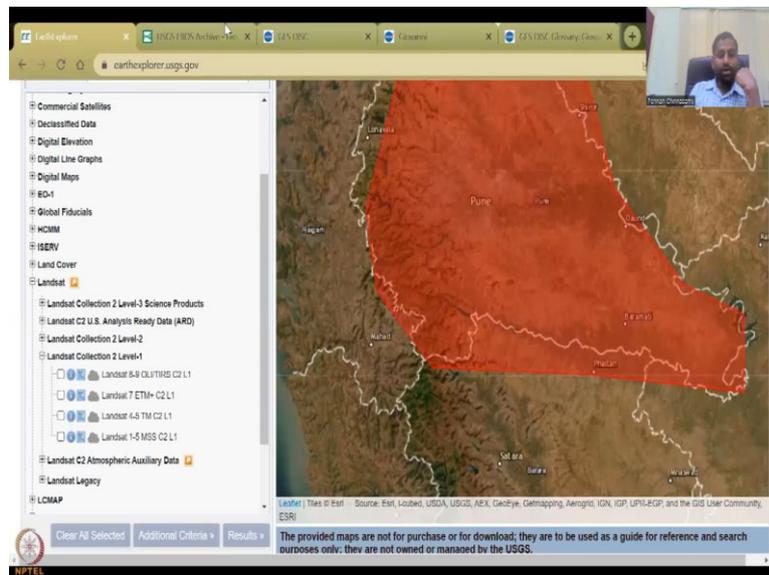
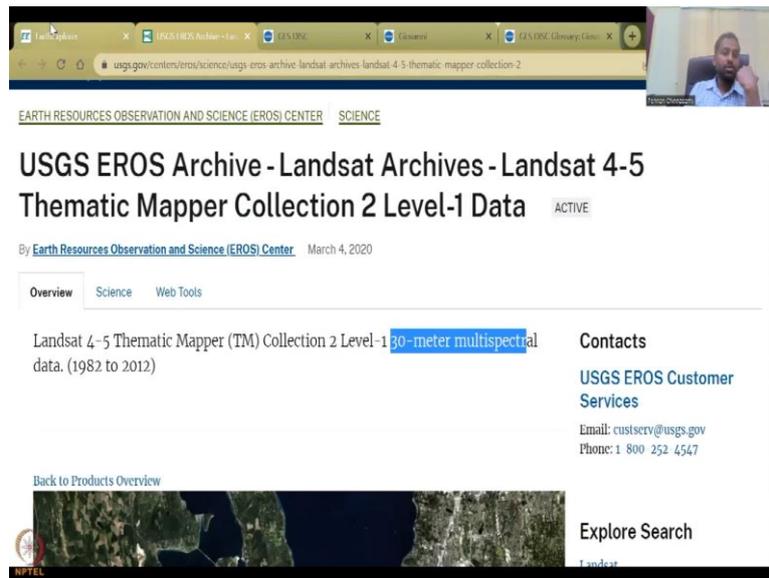
As I said Legacy is the older versions, you can see from 1984, 1960s, 1972s, etcetera, etcetera, you have data. 1960s you will not get much of India but you will get across the other regions. So, there is a collection level 1. You can see that these are the collection level 1s, landsat 1 to 5, 4 to 5, 7, 8, 9. So, the 1 to 5 is the older versions. You can click on this to get the collection info.

(Refer Slide Time: 14:17)



It will open on a different page and tell you what these data landsat 1 includes and it says 1972 to 1992. So, it is 20 years of data at 16 meters resolution. This is the oldest versions, very good versions I would say. And 1960s is kind of reconstructed data it is not actual data but still there. So, that is 1972.

(Refer Slide Time: 14:43)



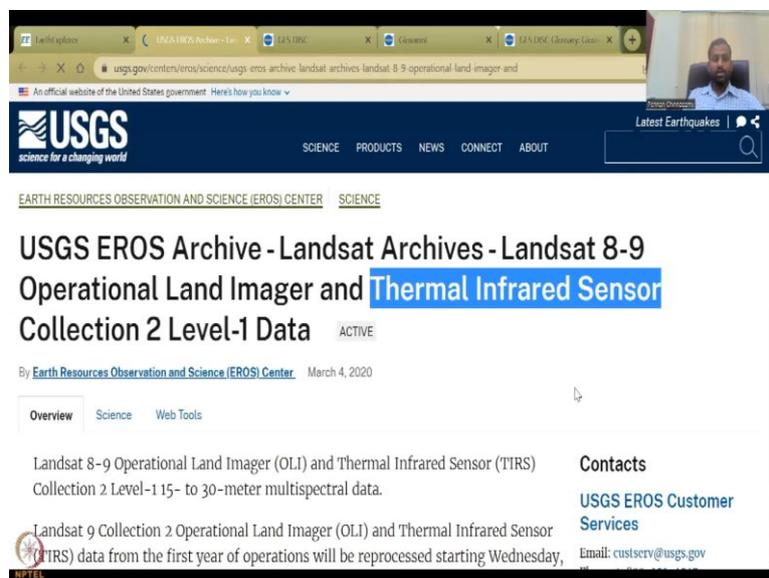
So, just let us look at how a resolution has changed in these Earth Explorer data sets. Now you will see the level collection 2, landsat 4 TO 5. So, the previous one was 1 to 4, 1 to 2. It is asking me to take a survey of life but not now, later I do it. So, then we have the level collection 2 which is landsat 4 to 5 at 30 meter resolutions. So, the previous one was at 16 meter resolutions which was landsat 1 to 5 then the 4 to 5 is at 30 meter resolution. This is the 4 and 5 versions are 30 meter resolutions.

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And then this is also going to be the landsat 7 collection which is really really successful at 30 meter data but it is multi-spectral. So, the previous ones were just normally red, green and blue, whereas the multi-spectral data came into existence much later.

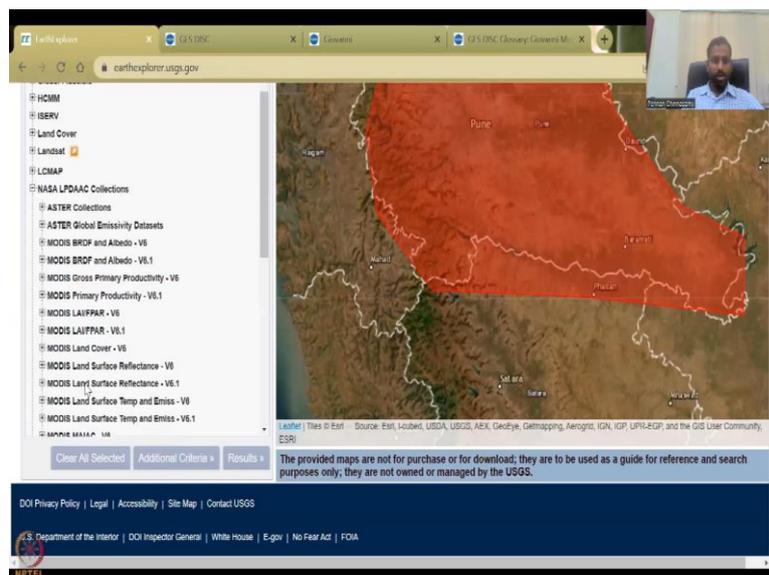
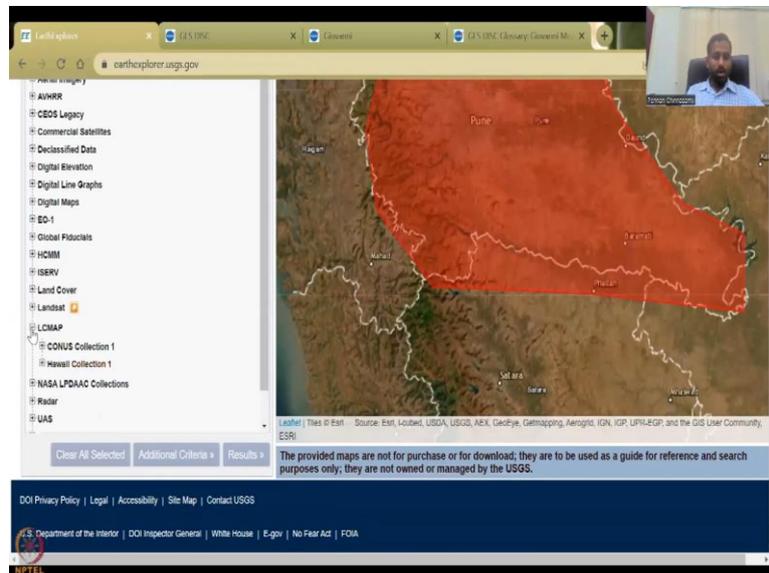
(Refer Slide Time: 15:39)

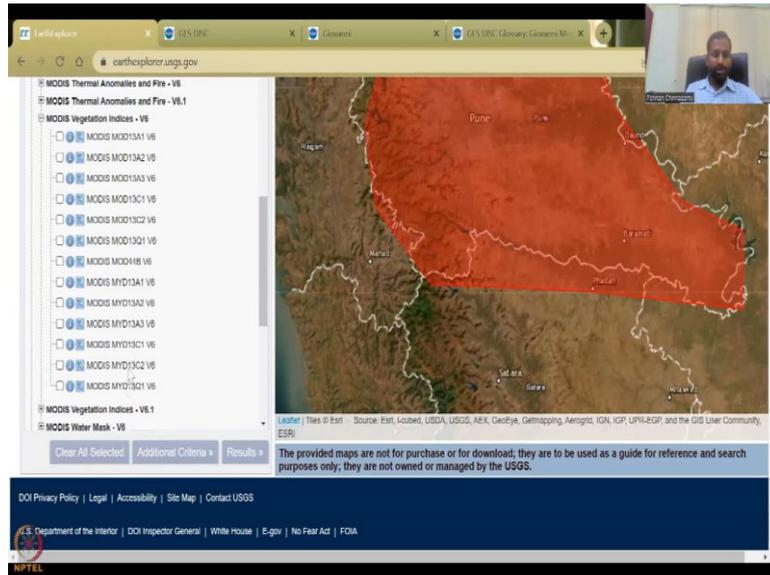


And then we have the 8 and 9, the recent ones. You can see the metadata for it. These are in some locations very very high resolution and it has also the thermal infrared sensors and at 30 meter resolution. So, the landsat goes best for 30 meter resolutions but the sensor has been updated. So, now we have thermal infrared sensors and actually somewhere around bi-weekly

to monthly you get the data. So, again landsat we will not be using for this part because we want products. We want products that are being taken from landsat models whatever it is.

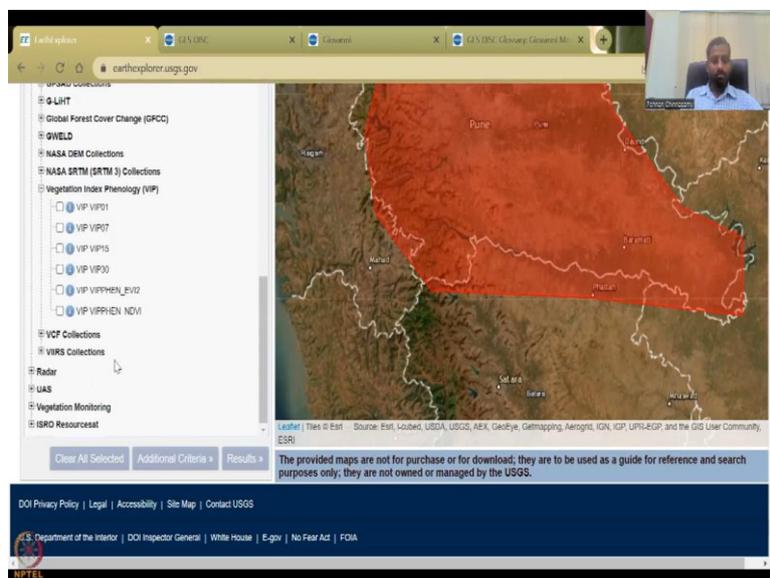
(Refer Slide Time: 16:13)

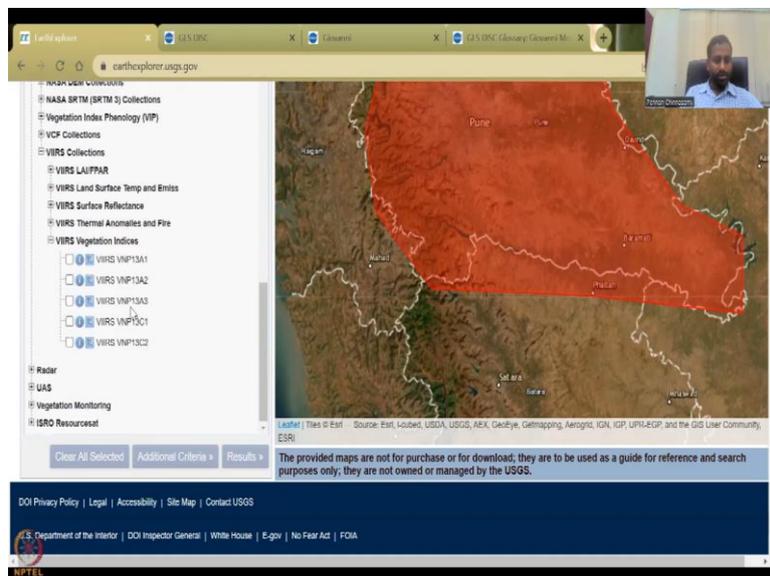
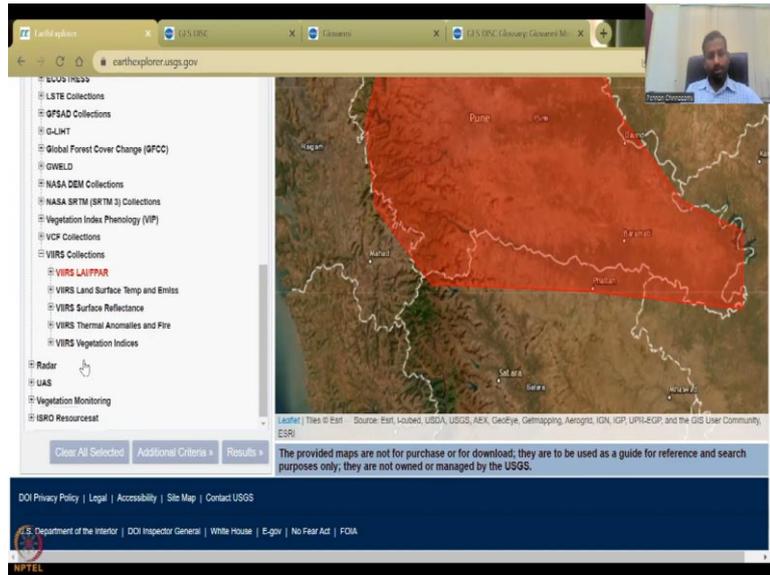




So, we will go to the LCMAP. So, these are 2 specialized maps and the NASA collections of DEM models and then we have vegetation indices. If you will click on the vegetation indices, you have the MODIS derived in the indicators for vegetation and then we have the water, water reservoir area, etcetera, etcetera, ecostress, all these are related to rural entities, NASA DEM vegetation indices phenology.

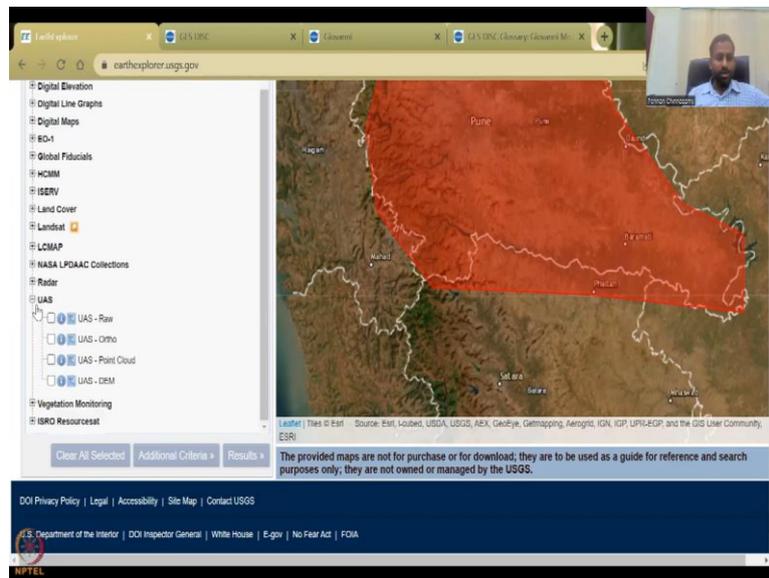
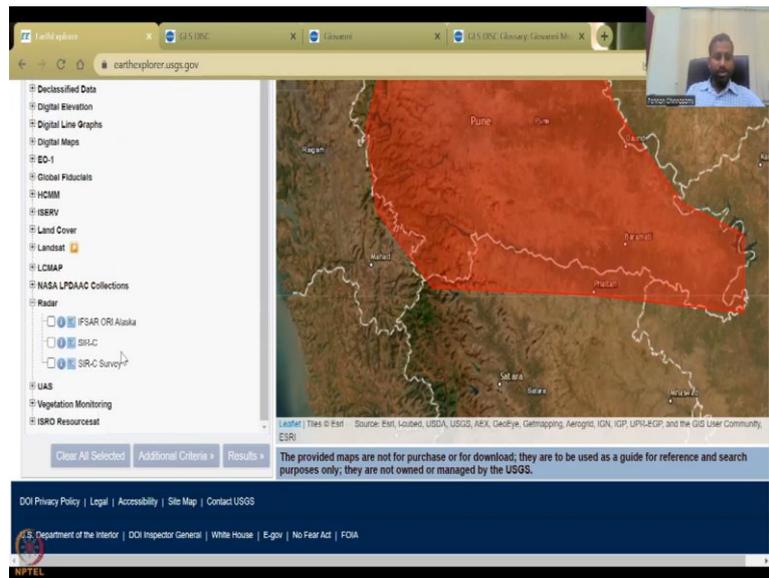
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Phenology is mostly on the plant types and those kind of things. And then we do have the VIIRS collections which also we will be using for our vegetation indexes. So, you can see here these are the vegetation indexes.

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And then the radar is more important for penetrations. So, these have, it penetrates to the ground. So, these mostly will have the soil moisture and land elevation data much much higher resolutions. UAS, unmanned systems are there. DEMs. So, these are drone kind of images and then we can see point cloud, ortho. Let us click this one.

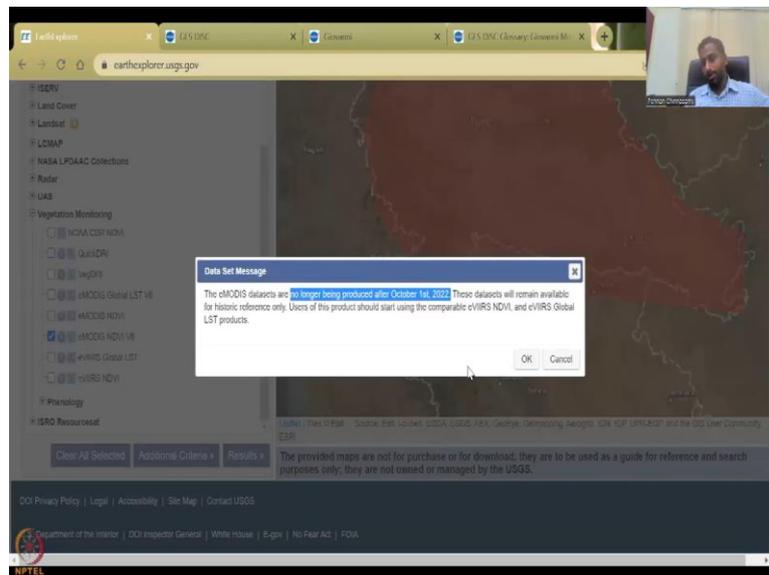
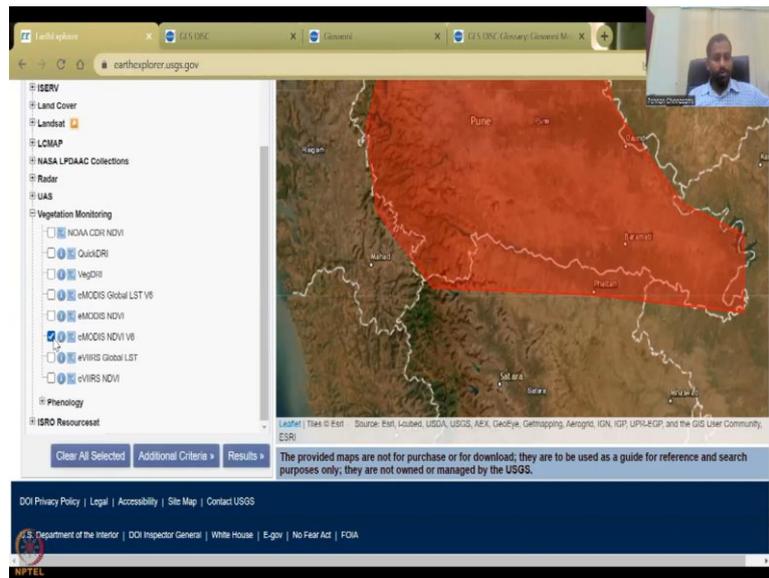
(Refer Slide Time: 17:22)

The screenshot shows the USGS website for the EROS Archive - Unmanned Aircraft Systems (UAS) - Orthoimagery. The page header includes the USGS logo and navigation links for SCIENCE, PRODUCTS, NEWS, CONNECT, and ABOUT. The main heading is "USGS EROS Archive - Unmanned Aircraft Systems (UAS) - Orthoimagery" with a sub-heading "ACTIVE". Below this, it states "By Earth Resources Observation and Science (EROS) Center" and "April 1, 2019". There are tabs for "Overview", "Science", "Publications", and "Web Tools". The main text describes the UAS collection as high-resolution remote sensing data for monitoring landscapes and natural resource conditions over small project areas from 2008 to the present. A "Contacts" section provides information for USGS EROS Customer Services, including an email address (custserv@usgs.gov) and a phone number (1 800 252 4547).

The screenshot shows the USGS website for the UAS Dataset, Orthoimagery, is available through EarthExplorer. The page header includes the USGS logo and navigation links for SCIENCE, PRODUCTS, NEWS, CONNECT, and ABOUT. The main heading is "UAS Dataset, Orthoimagery, is available through EarthExplorer". Below this, it states "The USGS Earth Resources Observation and Science (EROS) Center manages and distributes data for the UAS Project Office, USGS Science Centers and other DOI bureaus. Type of data, format, file size, and resolution will vary by mission. Projects may include multiple missions over a range of dates." There is a section titled "UAS Orthoimagery is created from the raw image files by correcting feature displacement, scale variations, sensor geometry, and camera tilt. The orthorectified images are mosaicked to generate a product that combines the image characteristics of an aerial photograph with the geometric qualities of a map. These Orthoimagery products are in GeoTIFF format." A section titled "The UAS Data Sharing Portal Webform is available to upload UAS data to datasharingportal for inclusion to the USGS EarthExplorer UAS dataset." There is a section titled "Coverage Maps" with a sub-heading "Coverage Maps indicating the availability of UAS Orthoimagery products are available for download." Below this, there are links for "Download shapefile" and "Download kml". There is a section titled "Additional Information" with a sub-heading "UAS Orthoimagery of USGS Midnight Meadow New Mexico Project, September 2018. Imagecenter coordinates 36.767 latitude, -105.352longitude(Public domain)".

You could see that the unmanned systems also will carry drones, unmanned aircraft systems. So, we have these are high high resolution and we have 2008 to present but only small areas. Again, you cannot fly drones across the entire region. So, you can see here, there are some taken in the New Mexico which is, New Mexico is not in Mexico it is the United States. So, you will have some of these data here. And these are the unmanned aerial vehicles we call them or UAS and then we have aircraft vehicles, so systems also they would say. So, the aid differs in how you use it.

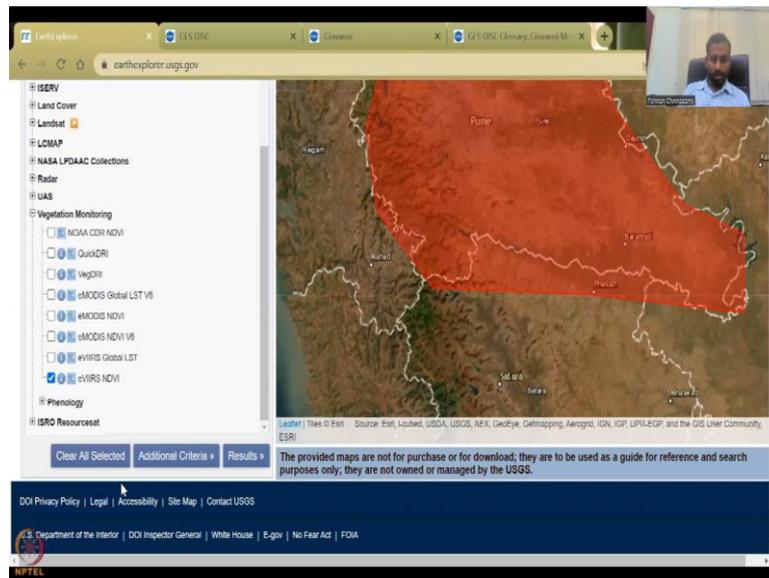
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And then we have the vegetation monitoring which we will be using now. And we will be using the eVIIRS NDVI because we want NDVI. I will just show you what is happening. So, if you click on let us say, yeah, NDVI this one, it will say that it does not get updated or no longer produced after October 2022.

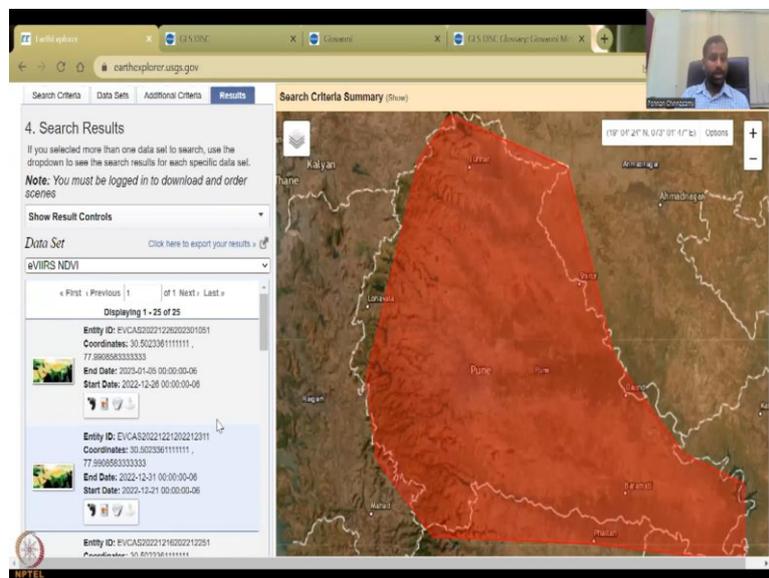
So, until then you can use it. So, if you want to use the recent ones, do not use NDVIs data set, but you can build a legacy of data. For example, from 1972, you can use landsat data and then from 1999s, 2000s models and then from until 2022, you can use a particular models and then jump into landsat again. So, it is okay because the sensor is actually sensing the data. So, we will close this.

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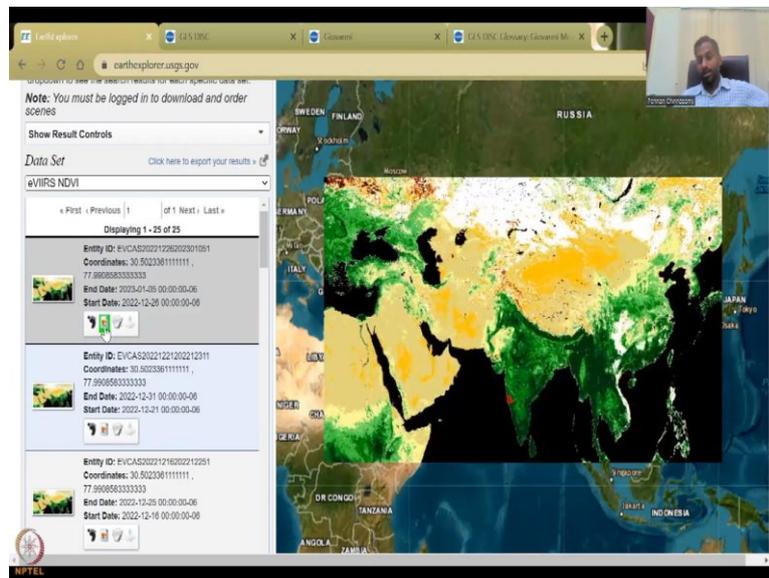
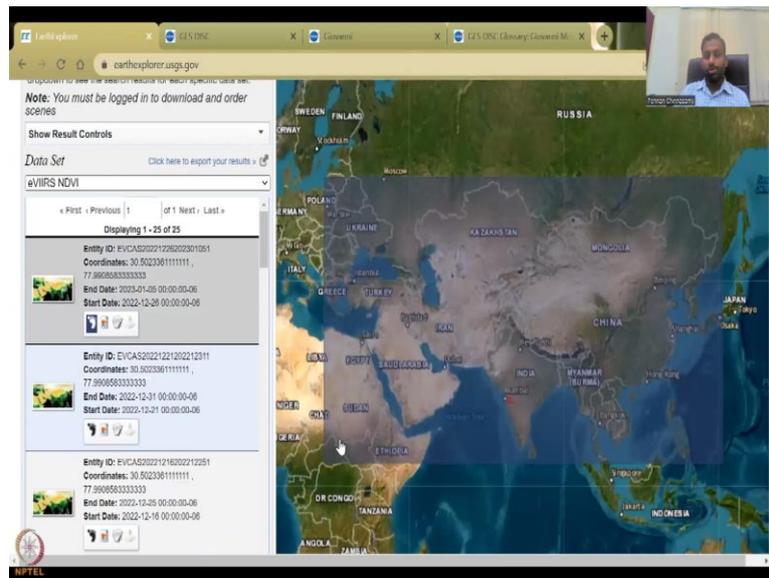
All these are kind of outdated except this one. So, I will just click that one. LSD is land surface temperature which is important to show the stress on plants and land. So, we have this and then I am just going to click result. So, we picked a date. We picked a date range and we also pick the type of satellite that we want.

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And here is what we get. So, we get 25 images for this particular area for one month. I am sorry, September to December. So, it is around 15 15 days a data set. So, what are these is?

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This is a thumbnail to show the footprint of the data. So, if you click it, it will show you that the tile, the tile, entire tile where the data has been collected. You can take it out and then go to this one to show the data set for that region.

(Refer Slide Time: 19:44)

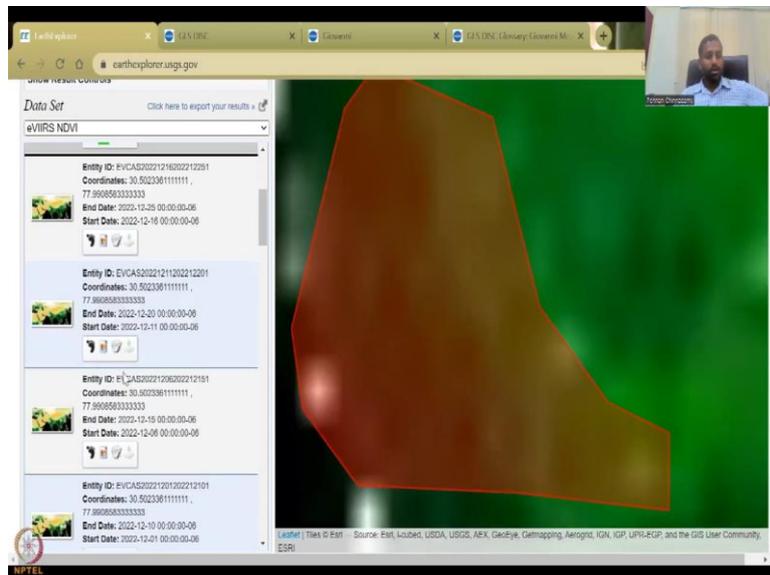
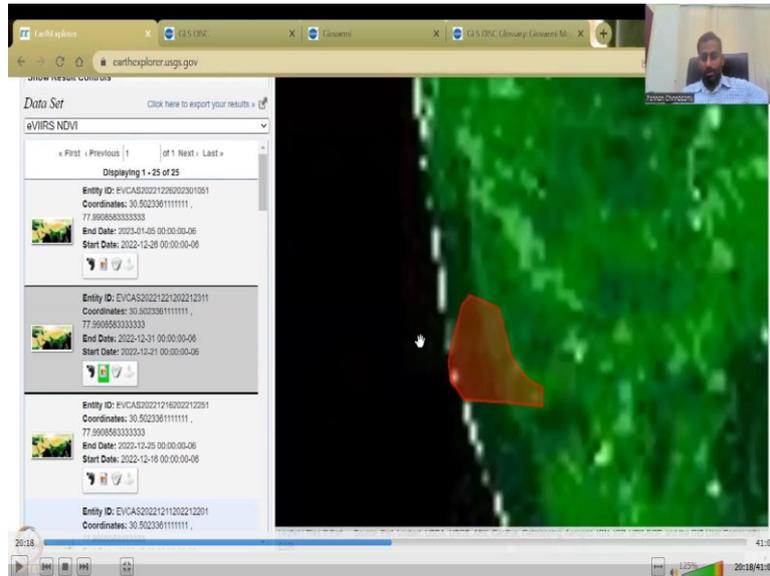
The screenshot shows the Earth Explorer interface with a satellite image of India. A small red polygon is drawn on the southern part of the country. The left sidebar displays the 'Data Set' section for 'eVIIRS NDVI', showing a list of three entities with their respective coordinates and dates. The top navigation bar includes 'earthexplorer.usgs.gov' and a note about logging in.

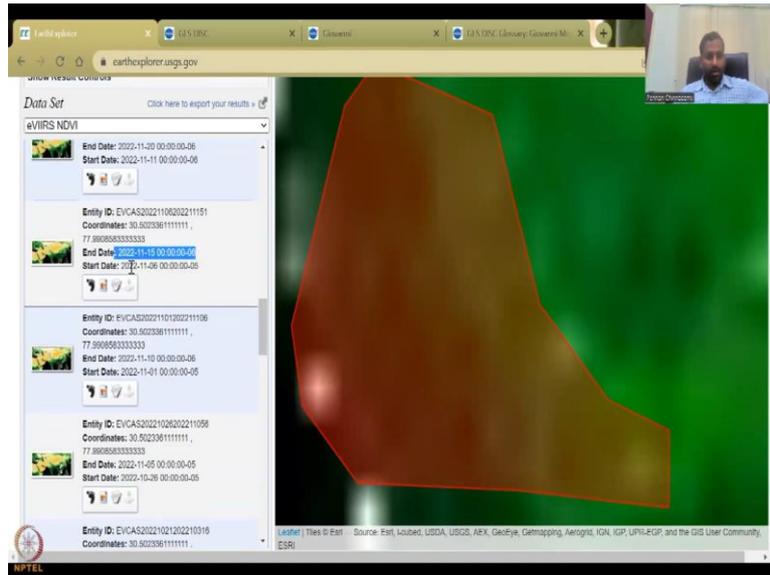
The screenshot shows the Earth Explorer interface with a satellite image of India. A larger red polygon is drawn, covering a significant portion of the southern region. The left sidebar displays the 'Data Set' section for 'eVIIRS NDVI', showing a list of three entities with their respective coordinates and dates. The top navigation bar includes 'earthexplorer.usgs.gov' and a note about logging in.

The screenshot shows the Earth Explorer interface with a satellite image of India. A large red polygon is drawn, covering a substantial area in the southern part of the country. The left sidebar displays the 'Data Set' section for 'eVIIRS NDVI', showing a list of three entities with their respective coordinates and dates. The top navigation bar includes 'earthexplorer.usgs.gov' and a note about logging in.

So, I am going to zoom in. So, this is a previsualization, so that you can look at the data before you download the data to make sure that it does not have errors or it does not have any issues with the resolutions as well, too much cloud cover, for example. It is still downloading. So, that is why you would see the blurry image, yeah.

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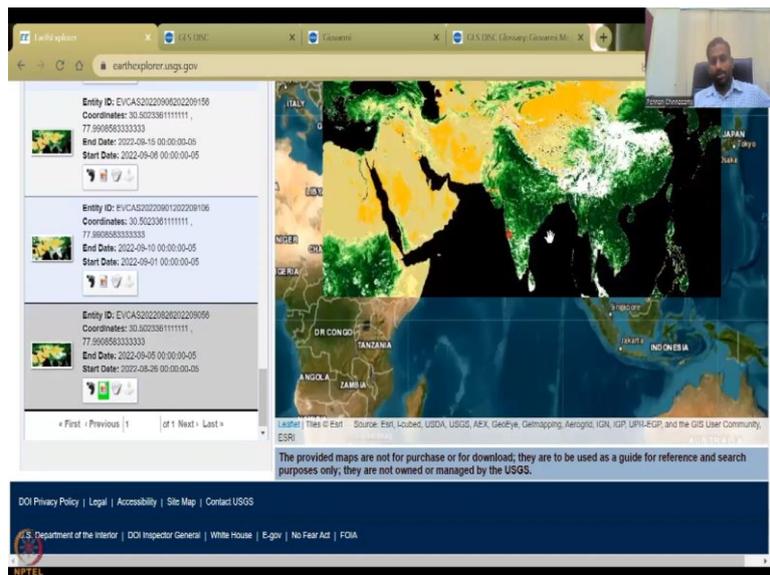




So, this is also good in terms of the satellite data. You can see that a lot of satellite data is there. And all these dates are there. So, the end date, start date is there. So, this is somewhere 6 to 15. So, as I said within every 15 days the data comes in. So, the start date was in September, it was November 6 to November 15.

So, this is the November month of data. So, you can compare between, not readily here, but you can compare in the previous region. So, this is 2023. We did not give 2023 but it also populates it just for our need and then here it is 2022 9, 8 and 9.

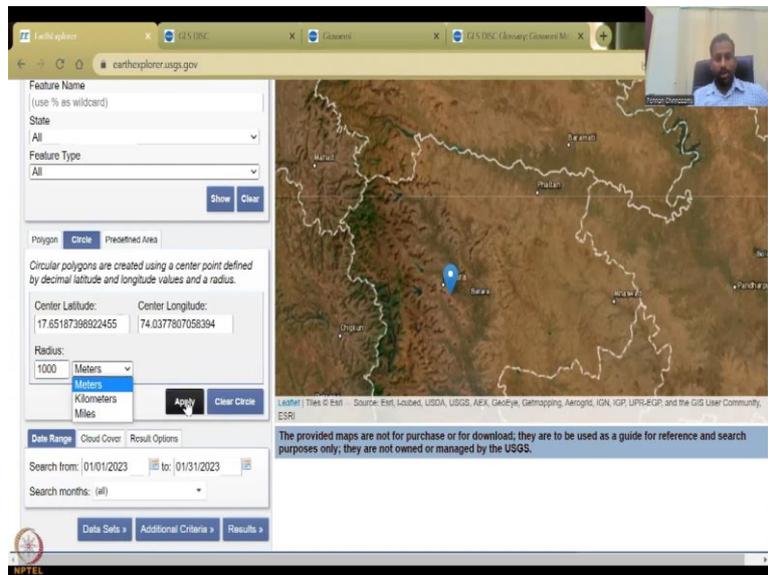
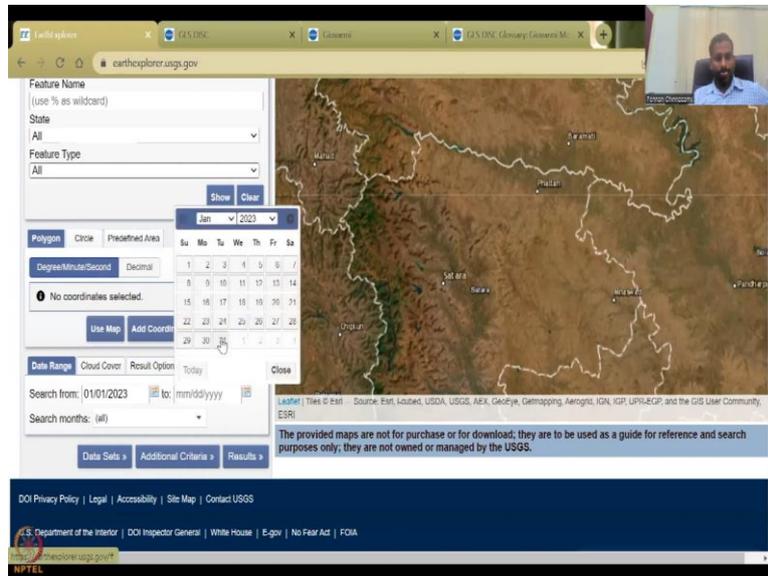
(Refer Slide Time: 20:57)

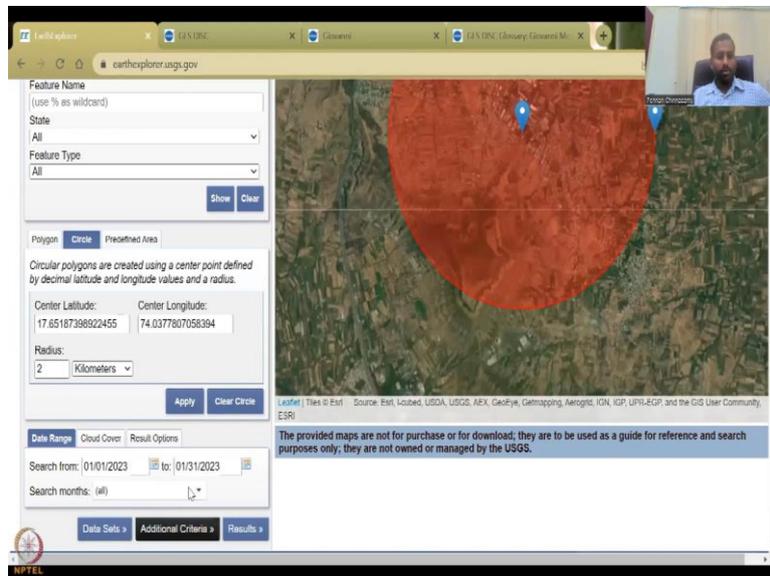
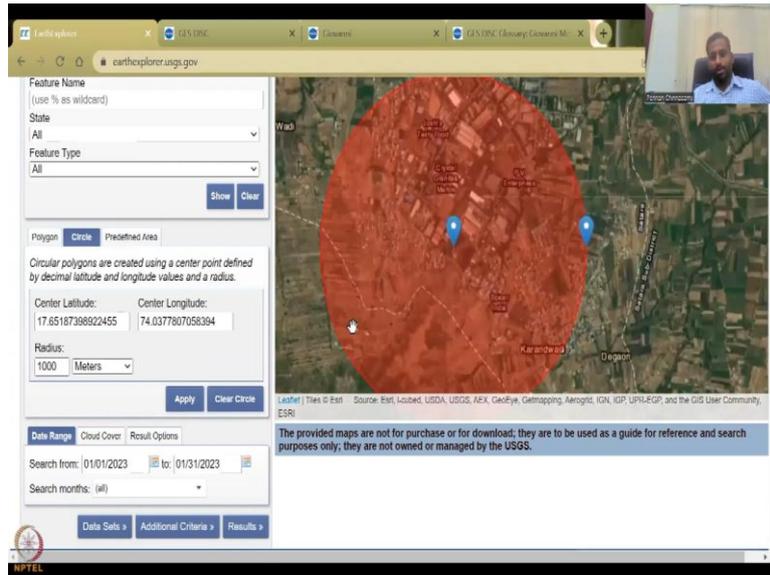


So, this is the last week of the analysis that we wanted to see we have 25 images here. So, the entire map cannot be downloaded that is what this is saying but you can download only the

maps that are available with this link. So, if you want to download you have to login. So, It will ask you to log in and then you can download this data. We have already showed you how to login and download the data.

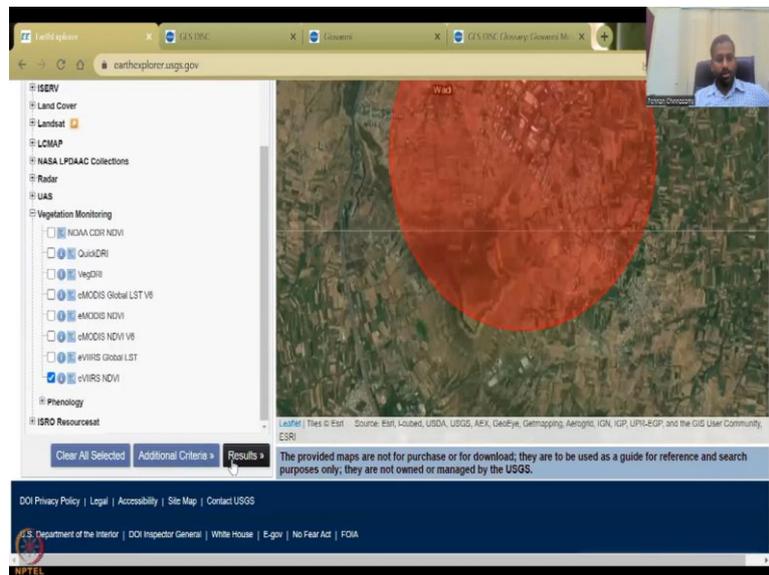
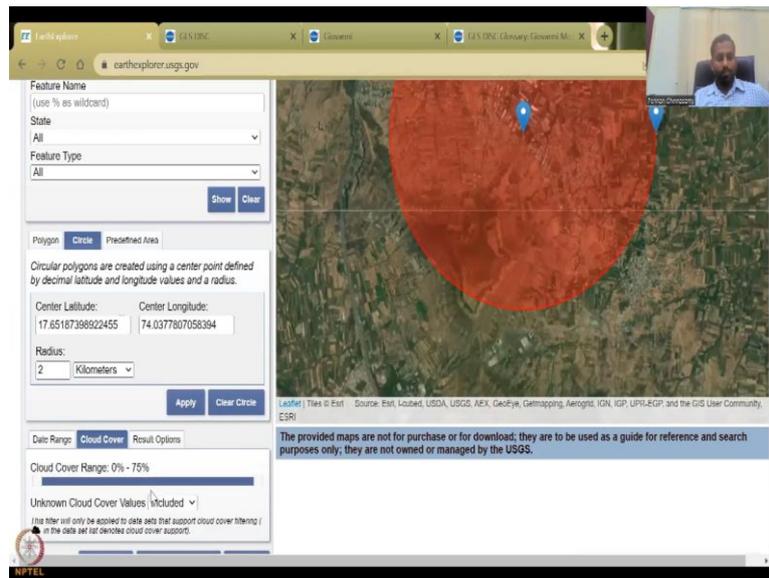
(Refer Slide Time: 21:39)





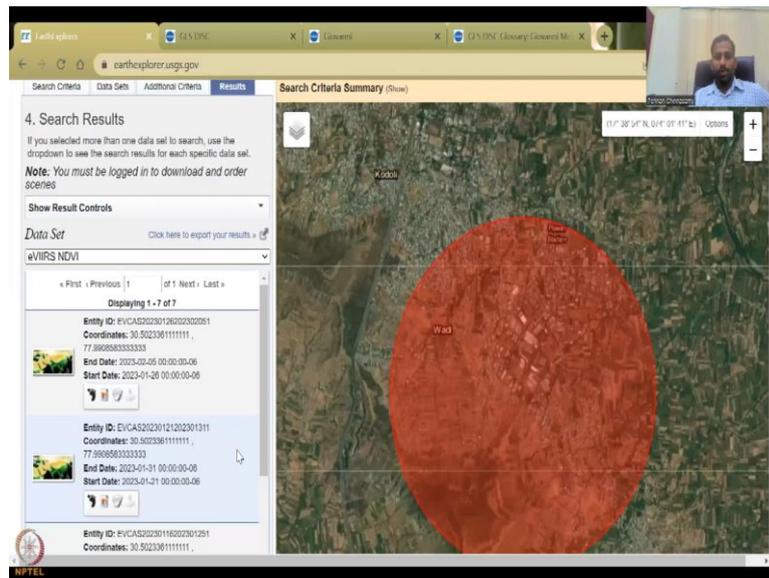
So, while it is getting resolution increased and stuff, let me just pick one month. Let us see if we do have January. So, let us do January to Jan end and then I am just going to do the circle, apply. Let us say 1000 meters or one kilometre. You can change the units here, kilometres, miles etcetera. So, it applies that to the region. Now you see there is a lot of housing there. So, I do not want just the housing. So, let us say 2 kilometers radius and then I apply. So, it gets bigger.

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And then I have this cloud cover is okay for now and then we can go to the results. We have to see the data set of eVIIRS is clicked and then results. Here we go.

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You have all these results and you can actually see them as a full tile. So, you can see how, if you want to quickly look at it, we can look at within the month how it has changed. So, from 1 to 2nd February month we have. So, you see that the entire India is almost green with NDVI high. NDVI in this Basin. And then we can also see the previous results. So, you can download this and if you need you can go back to the clear the results or go to search criteria again.

(Refer Slide Time: 23:05)

Feature Type: All

Polygon: Circle Preset Area

Circular polygons are created using a center point defined by decimal latitude and longitude values and a radius.

Center Latitude: 17.6518736

Radius: 2

Date Range: Search from: Search months: (all)

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NPTL

Feature Type: All

Polygon: Circle Preset Area

Circular polygons are created using a center point defined by decimal latitude and longitude values and a radius.

Center Latitude: 17.65187368922455

Center Longitude: 74.0377807058394

Radius: 2 Kilometers

Date Range: Cloud Cover: Result Options

Search from: 05/01/2022 to: 07/31/2022

Search months: (all)

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Search Criteria: Data Sets: Additional Criteria: Results

Search Criteria Summary (Show)

4. Search Results

If you selected more than one data set to search, use the dropdown to see the search results for each specific data set.

Note: You must be logged in to download and order scenes

Show Result Controls

Data Set: Click here to export your results

eVIRIS NDVI

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	Entity ID: EVI-CAS20220501202208196 Coordinates: 30.50233611111111, 77.89058333333333
	End Date: 2022-05-15 00:00:00-05 Start Date: 2022-05-08 00:00:00-05
	Entity ID: EVI-CAS20220501202208196 Coordinates: 30.50233611111111, 77.89058333333333
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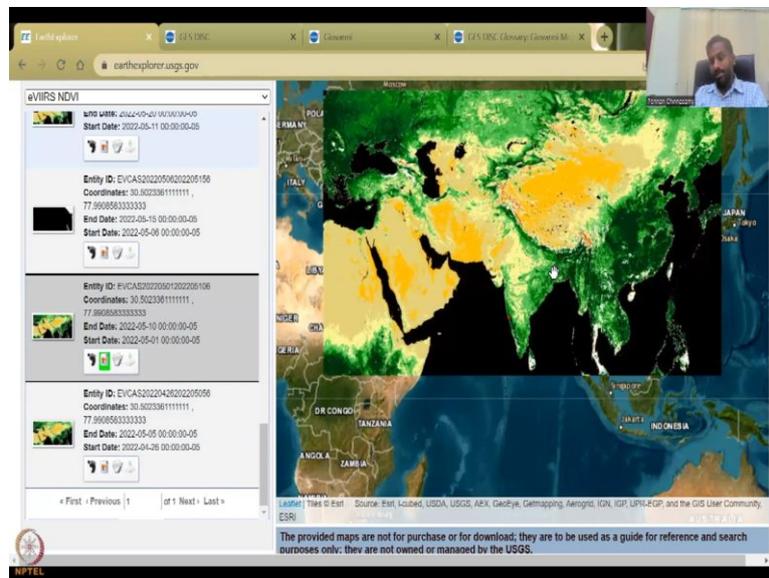
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NPTL

Let us just take the summer month, the previous summer which is May. May 1 to July end and then the data set results. We could see that now we have pushed the date to June, July, August are those those terms. So, if you look at May which is the fifth month, these are the fifth month and then you put the NDVI on. So, like this.

So, this one should have been capturing the image but there is a lot of black space. Which means the data is not good. So, please, look at the data before you download it. So, this one we can remove, saying, I do not want to do it. Because you will spend your memory and taking all the data.

(Refer Slide Time: 24:03)



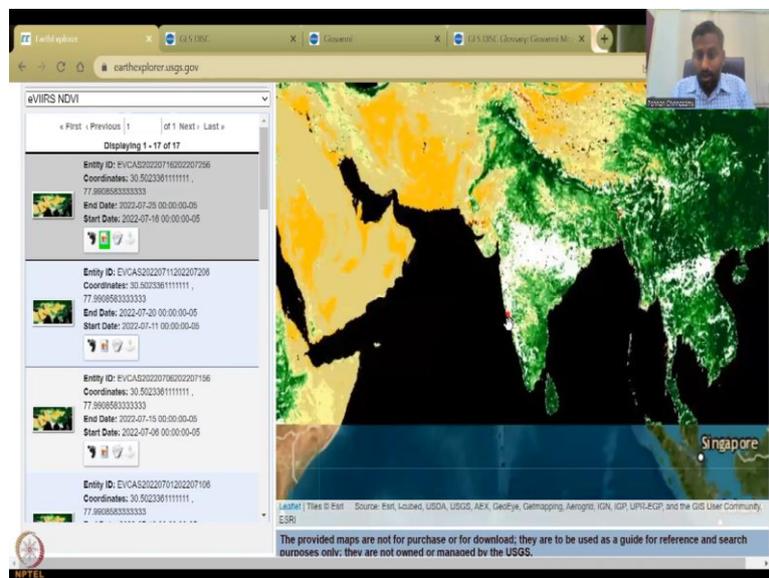
So, now you can see here, all these yellow spots are not growing and the Ganges region is also not growing. So, NDVI is very very less.

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But when we go to the monsoon next months, I am just going to click this one and now you can see all the green. What is the white? It is the cloud. So, the cloud cover if we have increased and said above 50 cloud cover do not show then the data, this tile will not come, because in my region Pune, there is a lot of cloud cover.

(Refer Slide Time: 24:33)



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eVIIRS NDVI

Displaying 1 - 17 of 17

Entity ID: EVCA5202071620207256
Coordinates: 30.502306111111111 , 77.89068333333333
End Date: 2022-07-25 00:00:00-05
Start Date: 2022-07-16 00:00:00-05

Entity ID: EVCA5202071202207206
Coordinates: 30.502306111111111 , 77.89068333333333
End Date: 2022-07-20 00:00:00-05
Start Date: 2022-07-11 00:00:00-05

Entity ID: EVCA5202070620207156
Coordinates: 30.502306111111111 , 77.89068333333333
End Date: 2022-07-15 00:00:00-05
Start Date: 2022-07-06 00:00:00-05

Entity ID: EVCA52020701202207106
Coordinates: 30.502306111111111 , 77.89068333333333

Source: Esri, DeLorme, USGS, AIRX, GeoEye, AeroGRID, IGN, IGP, LPS/ECP, and the GIS User Community, ESRI

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eVIIRS NDVI

Displaying 1 - 17 of 17

Entity ID: EVCA5202071620207256
Coordinates: 30.502306111111111 , 77.89068333333333
End Date: 2022-07-25 00:00:00-05
Start Date: 2022-07-16 00:00:00-05

Entity ID: EVCA5202071202207206
Coordinates: 30.502306111111111 , 77.89068333333333
End Date: 2022-07-20 00:00:00-05
Start Date: 2022-07-11 00:00:00-05

Entity ID: EVCA5202070620207156
Coordinates: 30.502306111111111 , 77.89068333333333
End Date: 2022-07-15 00:00:00-05
Start Date: 2022-07-06 00:00:00-05

Entity ID: EVCA52020701202207106
Coordinates: 30.502306111111111 , 77.89068333333333

Source: Esri, DeLorme, USGS, AIRX, GeoEye, AeroGRID, IGN, IGP, LPS/ECP, and the GIS User Community, ESRI

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eVIIRS NDVI

Displaying 1 - 17 of 17

Entity ID: EVCA5202071620207256
Coordinates: 30.502306111111111 , 77.89068333333333
End Date: 2022-07-25 00:00:00-05
Start Date: 2022-07-16 00:00:00-05

Entity ID: EVCA5202071202207206
Coordinates: 30.502306111111111 , 77.89068333333333
End Date: 2022-07-20 00:00:00-05
Start Date: 2022-07-11 00:00:00-05

Entity ID: EVCA5202070620207156
Coordinates: 30.502306111111111 , 77.89068333333333
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Start Date: 2022-07-06 00:00:00-05

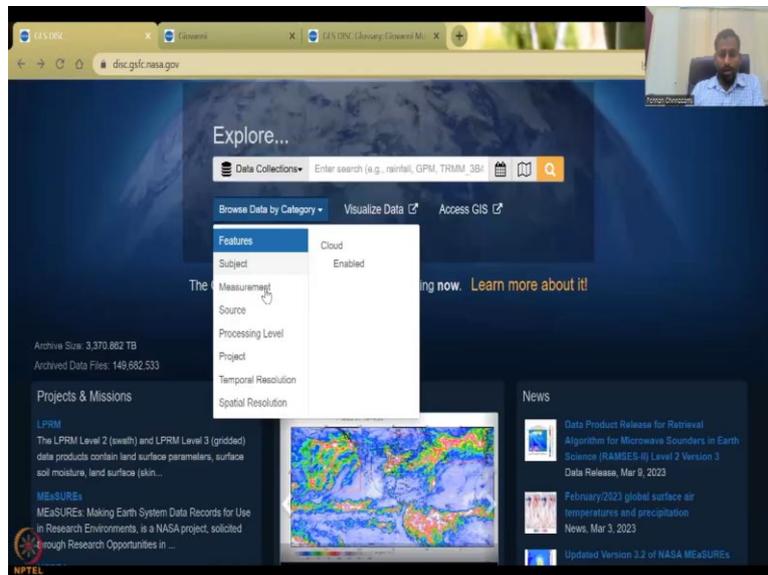
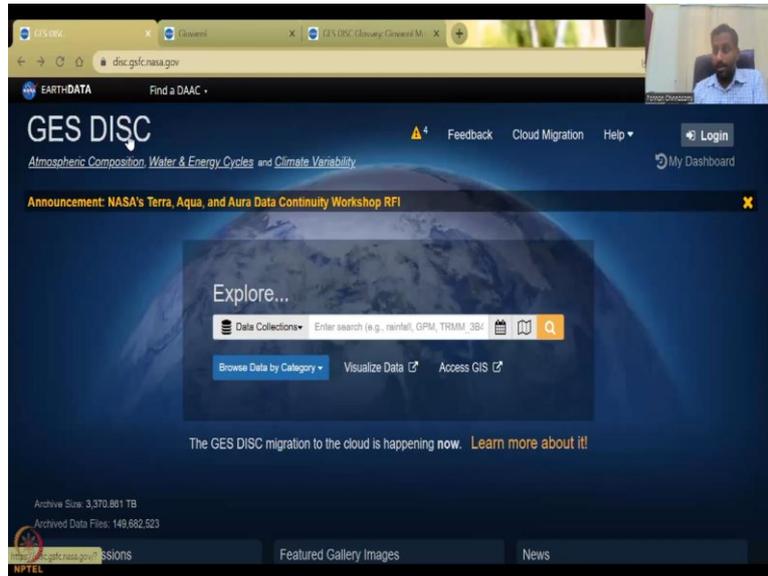
Entity ID: EVCA52020701202207106
Coordinates: 30.502306111111111 , 77.89068333333333

Source: Esri, DeLorme, USGS, AIRX, GeoEye, AeroGRID, IGN, IGP, LPS/ECP, and the GIS User Community, ESRI

The provided maps are not for purchase or for download; they are to be used as a guide for reference and search purposes only; they are not owned or managed by the USGS.

You can see here. If I zoom in and if it is full of cloud cover, it will not take this image. So, this particular image will not be showcased here. So, you do not have to download this image and then work on it. So, this is the above the Earth Explorer and NDVI, readymade NDVI products.

(Refer Slide Time: 24:54)



I also wanted to show you the other NASA product which is GES DISC. So, GES DISC is also used for a lot of other data sets as we have seen in the rainfall, grace data can be taken from here etcetera. But you can do the same as browse by catalog. So, you can say browse by catalog and say what data you want to use, measurement, temporal resolution. You will just see how big this database is.

(Refer Slide Time: 25:22)

The screenshot shows the NASA Earth Data Explorer website. The main heading is "Explore...". Below it is a search bar with the text "Data Collections" and a search icon. A dropdown menu is open, showing a grid of categories. The "Measurement" category is highlighted. The categories listed are:

Absorption	Evaporation	Reflective Band Radiance
Aerosols	Evapotranspiration	Rivers/Streams
Aerosol Backscatter	Extreme Drought	Root Zone Soil Moisture
Aerosol Extinction	Extreme Precipitation	Runoff
Aerosol Optical Depth/Thickness	Fire Occurrence	Satellite Soil Moisture Index
Aerosol Particle Properties	Floods	Scattering
Aerosol Radiance	Formaldehyde	Sea Ice Concentration
Air Mass/Density	Formic Acid	Sea Level Pressure
Air Temperature	Geopotential Height	Sea Salt
Airglow	Glacier Runoff	Sea Surface Height
Albedo	Ground Ice	Sea Surface Skin Temperature
Alkalinity	Heat Flux	Sea Surface Temperature
Ammonia	Heat/Cold Wave	Sensible Heat Flux
Angstrom Exponent	Frequency/Intensity	Sensor Counts
Antenna Temperature	Humidity	Shortwave Radiation
Atmospheric Carbon Dioxide	Hydrochlorofluorocarbons	Sigma Naught
Atmospheric Carbon Monoxide	Hydrogen Chloride	Skin Temperature
Atmospheric Emitted Radiation	Hydrogen Cyanide	Smog

The screenshot shows the NASA Earth Data Explorer website. The main heading is "Explore...". Below it is a search bar with the text "Data Collections" and a search icon. A dropdown menu is open, showing a grid of categories. The "Large Use Land Cover Classification" category is highlighted. The categories listed are:

Atmospheric Heating	Hydrogen Fluoride	Snow
Atmospheric Nitric Acid	Hydrogen Peroxide	Snow Cover
Atmospheric Ozone	Hydrogen-Deuterium Oxide	Snow Depth
Atmospheric Pressure	Hydroperoxy	Snow Melt
Measurements	Hydroxyl	Snow Water Equivalent
Altitude Characteristics	Hypochlorous Acid	Snow/ice Temperature
Barometric Altitude	Ice Fraction	Soil Heat Budget
Biogeochemical Cycles	Ice Temperature	Soil Infiltration
Black Carbon	Incoming Solar Radiation	Soil Moisture
Boundary Layer Temperature	Infrared Flux	Soil Moisture/Water Content
Boundary Layer Winds	Infrared Imagery	Soil Porosity
Brightness Temperature	Infrared Radiation	Soil Temperature
Bromine Monoxide	Land Surface Temperature	Solar Induced Fluorescence
Canopy Characteristics	Land Use Classes	Solar Irradiance
Carbon	Large Use Land Cover Classification	Solar Radiation
Carbon Dioxide	Landslides	Sublimation
Carbon Monoxide	Latent Heat Flux	Subsurface Flow
Carbon Tetrachloride	Layered Precipitable Water	Sulfate
Carbon Tetrafluoride	Leaf Area Index (Lai)	Sulfate Particles
Carbon and Hydrocarbon Compounds	Leaf Characteristics	Sulfur Dioxide
Carbonaceous Aerosols	Liquid Precipitation	Sulfur Hexafluoride
Carbonyl Fluoride	Liquid Water Equivalent	Sulfur Oxides
Carbonyl Sulfide	Longwave Radiation	Surface Pressure
Chemical Composition	Magnetic Fields/Magnetic Currents	Surface Roughness
Chlorine Dioxide	Maximum/Minimum Temperature	Surface Soil Moisture
Chlorine Monoxide	Methane	Surface Temperature
	Methanol	Surface Winds

The screenshot shows the NASA Earth Data Explorer website. The main heading is "Explore...". Below it is a search bar with the text "Data Collections" and a search icon. A dropdown menu is open, showing a grid of categories. The "Large Use Land Cover Classification" category is highlighted. A date range selection dialog is visible, showing the date range from 1920-01-01 to 2023-03-19. The dialog also includes a "Default Range" button and a "Learn more about" link.



So, let us see measurement and see how many variables are coming. So, all these can be taken from this database. You can take carbon monoxide landside, land use land cover classifications. It just goes on and on. It is really really big extensive data set. But if you already know what you want, you can click NDVI and then you can pick a date range. So, you can pick a date or just leave it and you can pick a bounding box. Why is this important? So that you have an area of interest rather than downloading for the entire world.

(Refer Slide Time: 25:55)



So, I am just going to click on the pencil and then draw a box. So, I am going to draw a box along India and then there it is the bounding box for India has been kept and then you just click it back and then say search.

(Refer Slide Time: 26:08)

Dataset	Source	Version	Time Res.	Spatial Res.	Level	Begin Date	End Date
MODIS/Terra Monthly Vegetation Indices Global 1x1 degree V005 (MODVI 005)	Terra MODIS	005	1 month	1° x 1°	3	2000-02-01	2016-01-01
MODIS/Aqua Monthly Vegetation Indices Global 1x1 degree V005 (MYDVI 005)	Aqua MODIS	005	1 month	1° x 1°	3	2002-07-01	2016-01-01

So, when you do search, it will search and give you for your bounded region which is India, the box I clicked, and then I drew a box. You just have to click on the pointer and then draw the box and then you will get these values. So, here what you could see is 2 data sets are there.

In this data collection, there is only 2 data sets for NDVI as marked as NDVI. It is the NASA's modest images and you could see the resolution is monthly and spatial is one by one degree. So, which is around 100 kilometers resolution. It is not that great but it has a long long time series from 2000 to date. And a lot of people have been using these indicators.

(Refer Slide Time: 26:53)

Back to search results

NASA NESPI Data and Service Center

MODIS/Terra Monthly Vegetation Indices Global 1x1 degree V005 (MODVI)

The global monthly gridded MODIS vegetation indices product is derived from the standard 0.05 CMG MODIS Terra Vegetation Indices Monthly product MOD13C2 (Huete et al., 2002) collection-5. The product is generated for Northern Eurasia Earth Science Partnership Initiative (NEESPI) program in supporting researches on the surface processes and climate modeling. The vegetation indices product is generated at 1x1 degree spatial resolution starting from 2000.

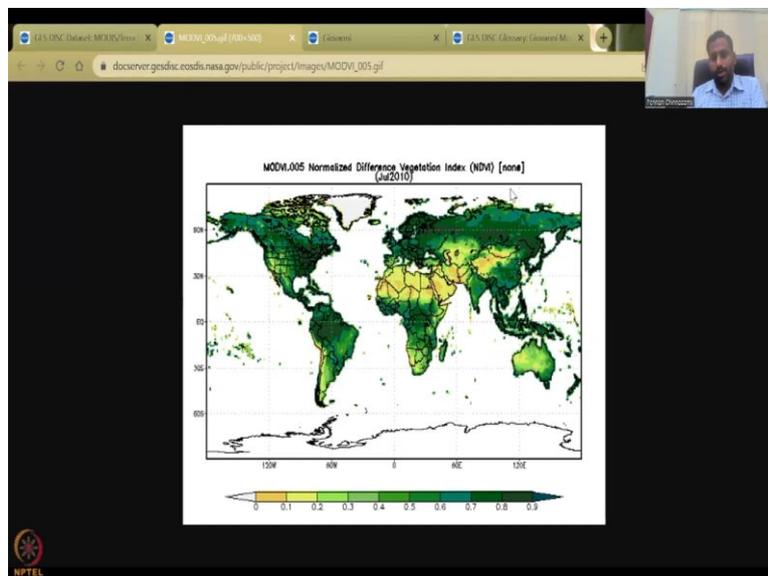
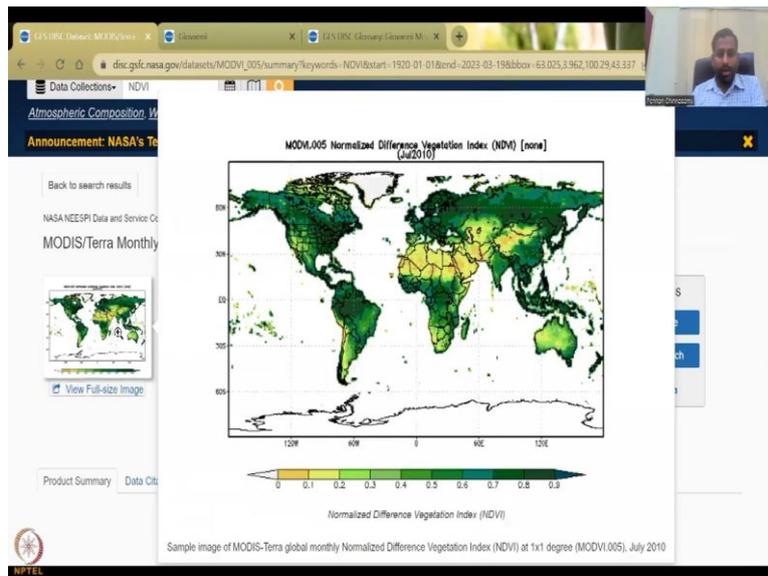
[View Full-size Image](#)

Data Access

- [Online Archive](#)
- [Earthdata Search](#)
- [Get Data](#)

Product Summary | [Data Citation](#) | [Documentation](#) | [References](#) | [Data Calendar](#)

Shortname: MODVI
Longname: MODIS/Terra Monthly Vegetation Indices Global 1x1 degree V005
DOI: 10.5067/C44M4E9NOL2



So, you can see here that the image you can just click on this to see the full image just for for a verification process. It gives you the date time you can also download this image, save this image for your reports, if you want, if you are working on a preliminary report quickly. Just took what, 2 seconds to download this image. So, from here you just said I want to see this image and take it for this particular month also July 2010. So, these can be used as a proposal writing those kind of images.

(Refer Slide Time: 27:28)

The screenshot shows the GES DISC website interface. At the top, there's a navigation bar with 'EARTH-DATA' and 'Find a DAAC'. Below that, the 'GES DISC' logo is prominent, followed by sub-topics: 'Atmospheric Composition', 'Water & Energy Cycles', and 'Climate Variability'. A search bar is visible. A sidebar menu is open on the left, listing various navigation options like Alerts, Data in Action, Data Release, FAQs, Glossary, How-Tos, Image Gallery, Mission Guides, News, Publications, Service Releases, and Tools. The main content area features a heading for 'Monthly Vegetation Indices Global 1x1 degree V005 (MODVI)'. Below this, there's a descriptive paragraph: 'The global monthly gridded MODIS vegetation indices product is derived from the standard 0.05 CMG MODIS Terra Vegetation Indices Monthly product MOD13C2 (Huete et al., 2002) collection-5. The product is generated for Northern Eurasia Earth Science Partnership Initiative (NEESPI) program in supporting researches on the surface processes and climate modeling. The vegetation indices product is generated at 1x1 degree spatial resolution starting from 2000.' To the right, there's a 'Data Access' section with buttons for 'Online Archive', 'Earthdata Search', and 'Get Data'.

This screenshot shows the 'Explore...' section of the GES DISC website. The background features a globe. At the top, there's a search bar with the text 'Data Collections' and a search icon. Below the search bar, there are three main buttons: 'Browse Data by Category', 'Visualize Data', and 'Access GIS'. A tooltip is visible over the 'Access GIS' button, containing the text: 'Explore geophysical parameters with our Geographic Information Service'. Below the buttons, there's a line of text: 'The GES DISC migration to the cloud is happening now. Learn more about it!'. At the bottom left, there are statistics: 'Archive Size: 3,370,868 TB' and 'Archived Data Files: 149,682,623'. At the bottom right, there are links for 'Featured Gallery Images' and 'News'.

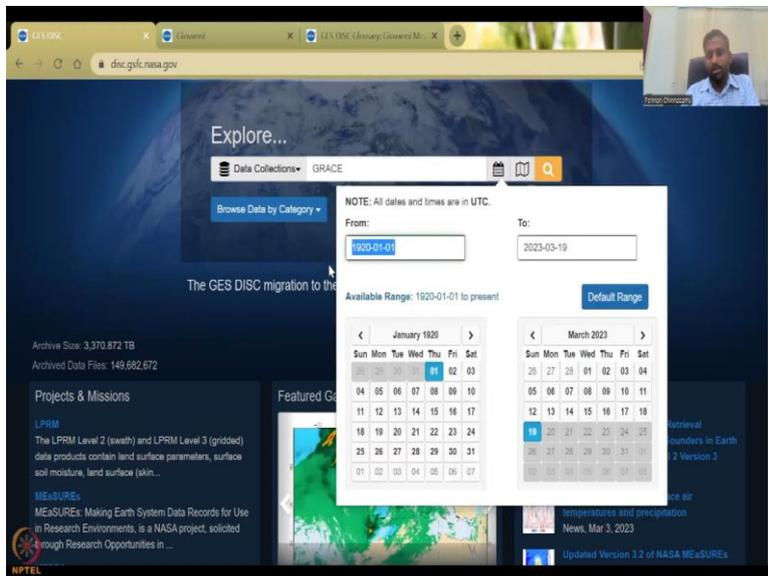
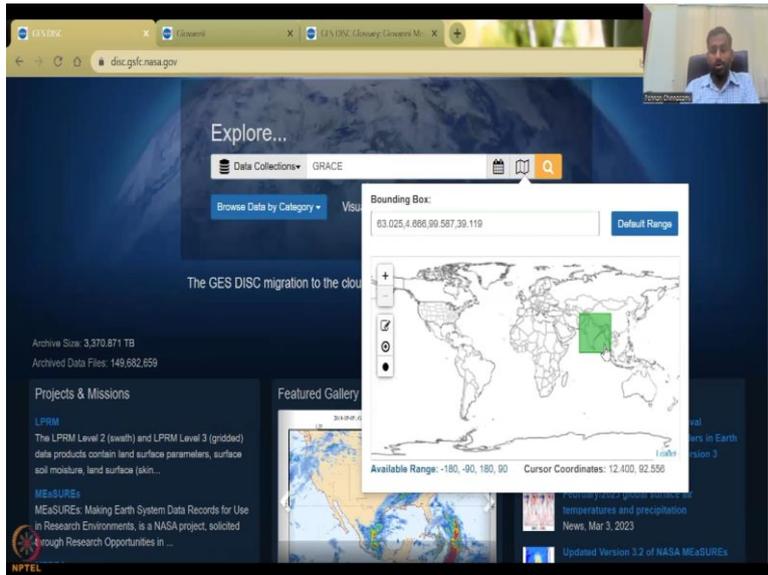
This screenshot shows the 'Explore...' section of the GES DISC website, similar to the previous one. The background features a globe. At the top, there's a search bar with the text 'Data Collections' and a search icon. Below the search bar, there are three main buttons: 'Browse Data by Category', 'Visualize Data', and 'Access GIS'. A tooltip is visible over the 'Visualize Data' button, containing the text: 'Visualize geophysical parameters (aka variables) using Giovanni, GES DISC's on-demand visualization application'. Below the buttons, there's a line of text: 'The GES DISC migration to the cloud is happening now. Learn more about it!'. At the bottom left, there are statistics: 'Archive Size: 3,370,868 TB' and 'Archived Data Files: 149,682,623'. At the bottom right, there are links for 'Featured Gallery Images' and 'News'.



So, if you go back to data collections and then see what data is available, let us go back to GES DISC, the full website. These 2 also I will give access GIS is mostly to use it with a proprietary software, visualized data will go to Giovanni. Giovanni is another dashboard within the Earth data explorer that is only used for visualizing the data and then making real time analysis. So, we will get into that pretty soon. And then we will have browse data at different spatial, temporal resolutions, project, et cetera.

(Refer Slide Time: 28:09)





So, if you also wanted to, as I said, I also in order to say grace. So, you have the grace data, you have different versions of grace. Let us see if the bounding box is the same. The bounding box has gone. You can actually type in the values here or you can draw the box again. So, click on the box symbol and then say like this. It can only be as box, you cannot put a India boundary and take it out.

So, it is normally 63 4 5 87 and 40. So, it is 100 actually. Normally I use 63 500 and then 40 and then you can just say this one and then grace data is available. So, you can see here, the earliest data available on this is 1920. It is reconstructed data but it is still good and then you can see grace data available.

(Refer Slide Time: 28:58)

The screenshot shows the NASA Data Collections search results page. The search criteria are: GRACE, date range 1920-01-01 to 2023-03-19, intersecting 63,025, 4,666, 99,587, 39,119. The results table lists three datasets:

Dataset	Source	Version	Time Res.	Spatial Res.	Level	Begin Date	End Date
Groundwater and Soil Moisture Conditions from GRACE and GRACE-FO Data Assimilation L4 7-days 0.25 x 0.25 degree Global V3.0 (GRACEDADM_CLSM025GL_7D 3.0)	Models Catchment-LSM	3.0	7 days	0.25° x 0.25°	4	2003-02-03	2022-11-01
GLDAS Catchment Land Surface Model L4 daily 0.25 x 0.25 degree GRACE-DA1 V2.2 (GLDAS_CLSM025_DA1_D 2.2)	Models Catchment-LSM	2.2	1 day	0.25° x 0.25°	4	2003-02-01	2022-11-01
GLDAS Catchment Land Surface Model L4 daily 0.25 x 0.25 degree GRACE-DA1 Early Product V2.2 (GLDAS_CLSM025_DA1_D_EP 2.2)	Models Catchment-LSM	2.2	1 day	0.25° x 0.25°	4	2022-11-01	2023-02-10

So, ground water and soil moisture conditions from grace is available. Time reservation 7 days from 2003 to 2022, November. And there is a lag, basically, it is a model data and then you also have per day GLDAS estimates and Grace estimates of data.

(Refer Slide Time: 29:29)

The screenshot shows the summary page for the dataset: Groundwater and Soil Moisture Conditions from GRACE and GRACE-FO Data Assimilation L4 7-days 0.25 x 0.25 degree Global V3.0 (GRACEDADM_CLSM025GL_7D). The page includes a description of the data, a map of the globe, and a 'Data Access' sidebar with buttons for 'Online Archive', 'Earthdata Search', 'Giovanni', 'Web Services', and 'Subset / Get Data'. A timer in the top right corner shows 29:29 / 41:02.

Back to search results

Gravity Recovery and Climate Experiment Data Assimilation for Drought Monitoring

Groundwater and Soil Moisture Conditions from GRACE and GRACE-FO Data Assimilation L4 7-days 0.25 x 0.25 degree Global V3.0 (GRACEDADM_CLSM025GL_7D)

Scientists at NASA Goddard Space Flight Center generate groundwater and soil moisture drought indicators each week. They are based on terrestrial water storage observations derived from GRACE-FO satellite data and integrated with other observations, using a sophisticated numerical model of land surface water and aquifer recharge.

Cloud Enabled Dataset

S3 Resource: s3://gesdisc-cumulus-prod-protected/GRACEDADM/GRACEDADM_CLSM025GL_7D_3.0

FAQ: Cloud Migration FAQs

How To Use: Example of in-region access using S3 resource

CMR Concept ID: C2283200566-GES_DISC

[View Full-size Image](#)

[Global V3.0 drought ind...more](#)

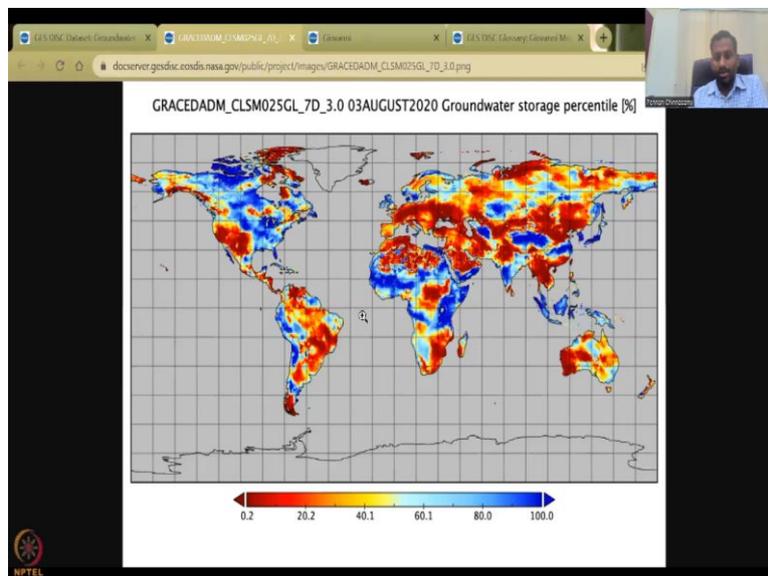
Data Access

- [Online Archive](#)
- [Earthdata Search](#)
- [Govern](#)
- [Web Services](#)
- [Subset / Get Data](#)

Product Summary | Data Citation | Documentation | References | Data Calendar

Shortname: GRACEDADM_CLSM025GL_7D

Longname: Groundwater and Soil Moisture Conditions from GRACE and GRACE-FO Data Assimilation L4 7-days 0.25 x 0.25 degree Global V3.0



So, I can also click and showcase one of this data set and then show you how to access it. So, or since, we we started with NDVI also will do but since we have this. So, the cloud enabled is where the data is stored. You can also have an online storage for your images and then you have this Grace data set, just a thumbnail to see how the data, the grids are present. And then groundwater storage percentile for August. So, you have 100 percentile or 0.2, based on the average values.

(Refer Slide Time: 30:02)

Back to search results

Gravity Recovery and Climate Experiment Data Assimilation for Drought Monitoring

Groundwater and Soil Moisture Conditions from GRACE and GRACE-FO Data Assimilation L4 7-days 0.25 x 0.25 degree Global V3.0 (GRACEDADM_CLSM025GL_7D)

Scientists at NASA Goddard Space Flight Center generate groundwater and soil moisture drought indicators each week. They are based on terrestrial water storage observations derived from GRACE-FO satellite data and integrated with other observations, using a sophisticated numerical model of land surface water and energy processes.

This data product is GRACE Data Assimilation for Drought Monitoring (GRACE-DA-DM) Global Version 3.0 from a global GRACE and GRACE-FO data assimilation and drought indicator product generation (Li et al., 2019). It varies from the other GRACE-DA-DM products which are from the U.S. GRACE-based drought indicator product generation (Houborg et al., 2012).

The GRACE-DA-DM Global V3.0 is similar to the GRACE-DA-DM U.S. V4.0 product. Both products are based on the Catchment Land Surface Model (CLSM) Fortuna 2.5 version simulation that was created within the Land Information System data assimilation framework (Kumar et al., 2016). GRACE-DA-DM Global V3.0 drought indicator maps are derived from the GLDAS_CLSM025_DA1_D product, at 0.25 degree resolution, forced by ECMWF meteorological data, and assimilated RLO6 GRACE and GRACE-FO data from the University of Texas at Austin (Save et al., 2016; Save, 2020). The GRACE-DA-DM U.S. V4.0 is at 0.125 degree, which is based on a model simulation (not published at GES DISC) forced by NLDAS-2 meteorological data and assimilated with RLO6 GRACE/GRACE-FO data. More information on GRACE-DA-DM U.S. V4.0 and previous versions of the data can be found in the README.

The GRACE-DA-DM Global V3.0 data product contains three drought indicators: Groundwater Percentile, Root Zone Soil Moisture Percentile, and Surface Soil Moisture Percentile. These drought indicators express wet or dry conditions as a percentile, indicating the probability of occurrence within the period of

Cloud Enabled

[View Full-size Image](#)

Data Access

- [Online Archive](#)
- [Earthdata Search](#)
- [Giovanni](#)
- [Web Services](#)
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available...loss

Product Summary | [Data Citation](#) | [Documentation](#) | [References](#) | [Data Calendar](#)

Shortname: GRACEDADM_CLSM025GL_7D

Longname: Groundwater and Soil Moisture Conditions from GRACE and GRACE-FO Data Assimilation L4 7-days 0.25 x 0.25 degree Global V3.0

DOI: 10.5067/SZYMDFZTJ4H

Version: 3.0

Format: netCDF

Spatial Coverage: -180.0,-60.0,180.0,90.0

Temporal Coverage: 2003-02-03 to 2022-11-07

File Size: 2 MB per file

Data Resolution

- Spatial:** 0.25° x 0.25°
- Temporal:** 7 days

Science Focus Areas

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- [Water & Energy Cycles](#)
- [Climate Variability](#)

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- [GIS](#)
- [Data Tools for Hydrology](#)
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So, you can see more on the metadata here and then documentation data citations, etcetera.

So, this grace, we did not see all these, but I will be showing now for the NDVI.

(Refer Slide Time: 30:23)

The screenshot shows the NASA Earth Data GES DISC search results page. The search criteria are NDVI for the date range 1920-01-01 to 2023-03-19, intersecting 63,025, 4,666, 99,587, 38,119. Two datasets are listed:

Dataset	Source	Version	Time Res.	Spatial Res.	Level	Begin Date	End Date
MODIS/Terra Monthly Vegetation Indices Global 1x1 Degree V005 (MODV1 005)	Terra MODIS	005	1 month	1° x 1°	3	2000-02-01	2016-01-01
MODIS/Aqua Monthly Vegetation Indices Global 1x1 Degree V005 (MYDVI 005)	Aqua MODIS	005	1 month	1° x 1°	3	2002-07-01	2016-01-01

So, we are going to do the NDVI again for the same box range. Date is fine, whatever date is fine. So, we will say okay, do you want one of these. I will say Terra Modis I will be using.

(Refer Slide Time: 30:30)

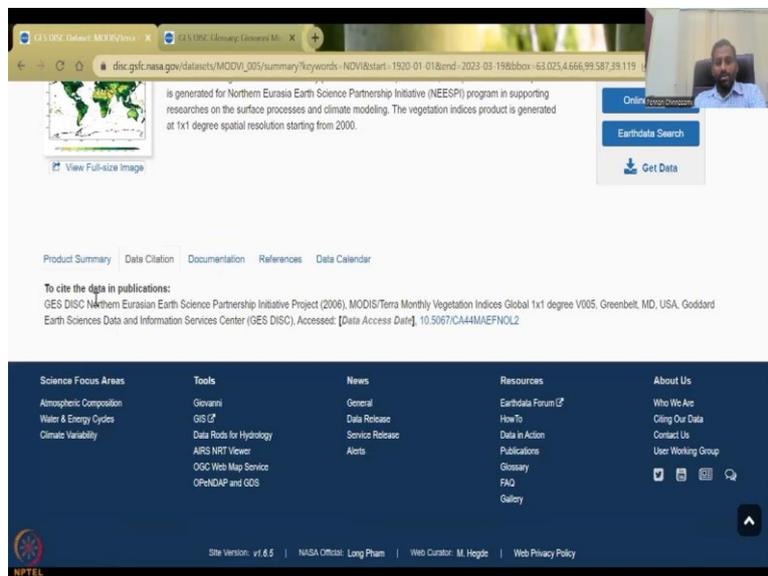
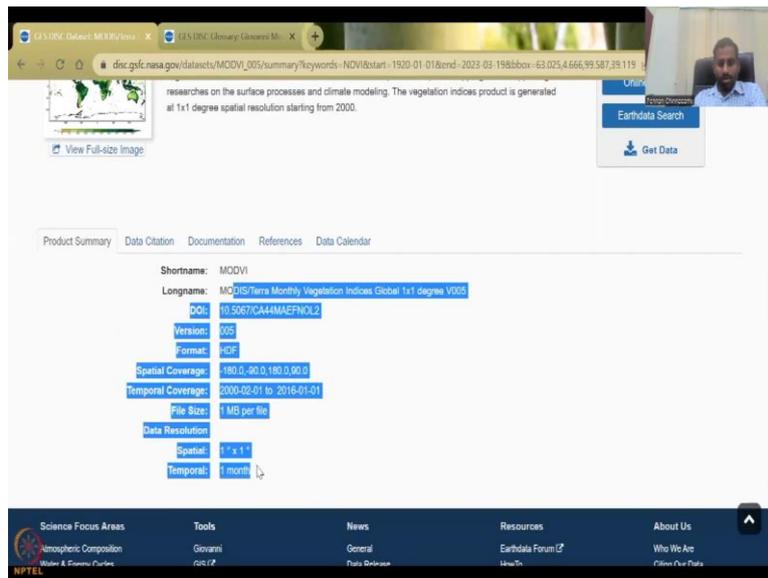
The screenshot shows the NASA Earth Data GES DISC product page for MODIS/Terra Monthly Vegetation Indices Global 1x1 degree V005 (MODV1). The page includes a description of the product and a 'Data Access' section with buttons for 'Online Archive', 'Earthdata Search', and 'Get Data'.

MODIS/Terra Monthly Vegetation Indices Global 1x1 degree V005 (MODV1)

The global monthly gridded MODIS vegetation indices product is derived from the standard 0.05 CMG MODIS Terra Vegetation Indices Monthly product MOD13C2 (Huete et al., 2002) collection-5. The product is generated for Northern Eurasia Earth Science Partnership Initiative (NEESPI) program in supporting researchers on the surface processes and climate modeling. The vegetation indices product is generated at 1x1 degree spatial resolution starting from 2000.

Data Access

- Online Archive
- Earthdata Search
- Get Data



So, here we have the global monthly gridded data for models, a vegetation devices using these products. And then there is a resolution given here, monthly, temporal is monthly, spatial is one degree by one degree which is good. And then we have data citations, who you have the cite, if you use the data. There is no pay. Most of people do not even cite these in the publications. It is good to cite it or at least cite the NASA team because they have processed this data; put this up and they are running it.

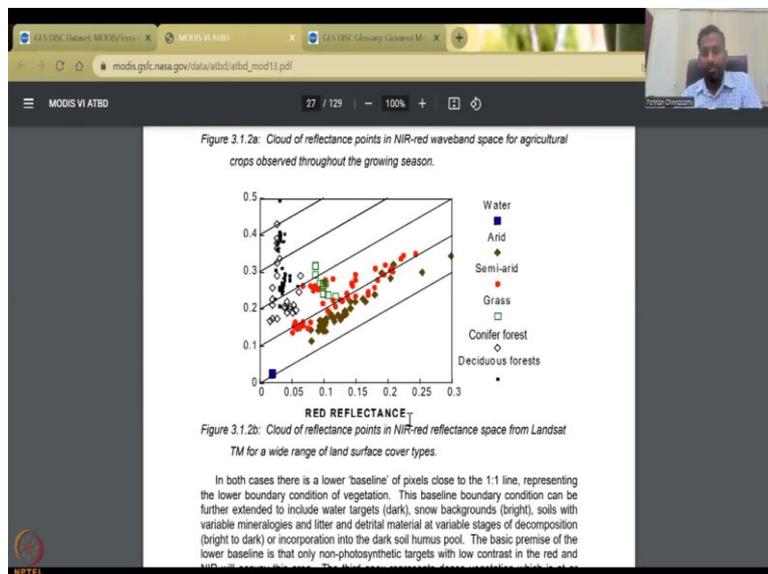
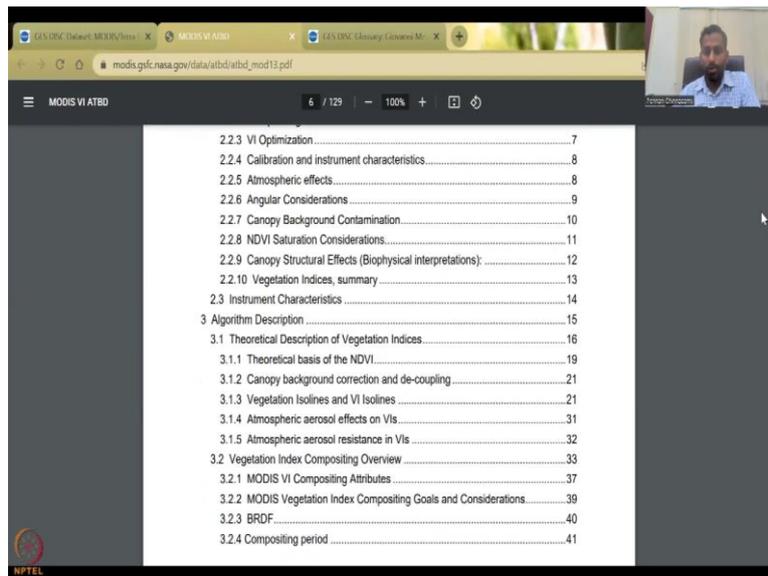
So, at the end of the day they are not asking for money for using it but if people use it then the publications, they can show that so many people are using it, so that this program can continue. The government looks at how many people are using it and the only proof they can show is publications. So, if I can write a letter saying that I use it but I do not publish it then what is the use. So, please, cite it in your work, your citations. You can hear you have it here.

(Refer Slide Time: 31:33)

The screenshot shows the NASA Earthdata website for the MODIS Vegetation Index (MOD13). The browser address bar shows the URL: disc.gsfc.nasa.gov/datasets/MOD13_005/summary?keywords=NDVI&start=1920-01-01&end=2023-03-15&bbox=-63.025,4.666,99.587,35.119. The page features a world map, a "View Full-size Image" button, and a "Get Data" button. Below the map, there is a "Product Summary" section with links for "Data Citation", "Documentation", "References", and "Data Calendar". A "README" section is visible, including a "README Document" link and an "ALGORITHM THEORETICAL BASIS DOCUMENT" link. A footer section contains navigation links for "Science Focus Areas", "Tools", "News", "Resources", and "About Us".

The screenshot displays the title page of the "MODIS VEGETATION INDEX (MOD 13) ALGORITHM THEORETICAL BASIS DOCUMENT, Version 3". The authors listed are Alfredo Huete¹, Chris Justice² (Team Members), and Wim van Leeuwen¹ (Associate Team Member). The page is viewed in a PDF viewer, showing the page number "1 / 129" and a zoom level of "100%".

The screenshot shows the introductory text of the document. The first paragraph states: "study the role of terrestrial vegetation in large-scale global processes with the goal of understanding how the Earth functions as a system. This requires an understanding of the global distribution of vegetation types as well as their biophysical and structural properties and spatial/temporal variations. Vegetation Indices (VI) are robust, empirical measures of vegetation activity at the land surface. They are designed to enhance the vegetation signal from measured spectral responses by combining two (or more) different wavebands, often in the red (0.6-0.7 μm) and NIR wavelengths (0.7-1.1 μm)." The second paragraph discusses the purpose of the MODIS VI products: "The MODIS vegetation index (VI) products will provide consistent, spatial and temporal comparisons of global vegetation conditions which will be used to monitor the Earth's terrestrial photosynthetic vegetation activity in support of phenologic, change detection, and biophysical interpretations. Gridded vegetation index maps depicting spatial and temporal variations in vegetation activity are derived at 16-day and monthly intervals for precise seasonal and interannual monitoring of the Earth's vegetation." The third paragraph describes the improvements of the MODIS VI products: "The MODIS VI products are made globally robust and improves upon currently available indices with enhanced vegetation sensitivity and minimal variations associated with external influences (atmosphere, view and sun angles, clouds) and inherent, non-vegetation influences (canopy background, litter), in order to more effectively serve as a 'precise' measure of spatial and temporal vegetation 'change'." The final paragraph outlines the data sources: "Two vegetation index (VI) algorithms are to be produced globally for land, at launch. One is the standard normalized difference vegetation index (NDVI), which is referred to as the 'continuity index' to the existing NOAA-AVHRR derived NDVI. At the time of launch, there will be nearly a 20-year NDVI global data set (1981 - 1999) from the NOAA-AVHRR series, which could be extended by MODIS data to provide a long term data record for use in operational monitoring studies. The other is an 'enhanced' vegetation index (EVI) with improved sensitivity into high biomass regions and improved vegetation monitoring through a de-coupling of the canopy background signal and a reduction in atmosphere influences. The two VIs compliment each other in global



So, some documentation of this indicators same like ISRO we did. You click it, there is a PDF which opens up, about the satellite, about how it is being used, etcetera. There you go. So, we have all the resolutions and then a big report on how this data was taken, the reflectance of red, percentage of reflectance and what it means.

So, if it is water, how much reflectance it is and then grass, how much reflectance it is. So, you have cloud reflectance points in an IR spectrum from landsat and different land use land cover types. So, you have different reflectances based on the land use land cover types. So, a lot of lot of these are done.

(Refer Slide Time: 32:27)

topographic equal amounts of a particular vegetation parameter. This may be observed by the term "vegetation isoline" and may be derived via canopy radiative transfer models and/or observational data sets. Vegetation index isolines, on the other hand, represent all combinations of red and NIR reflectance responses resulting in the same VI value. These are the model parameters which dissect the pixel data structure into various levels of vegetation amounts. They create the "gray levels" of the vegetation index from low to high. The concept of isolines essentially connect radiative transfer theory with vegetation indices and provide a basis for decoupling atmosphere and background signals from the vegetation signal.

3.1.1 Theoretical basis of the NDVI

The NDVI is a "normalized" transform of the NIR to red reflectance ratio, ρ_{NIR}/ρ_{red} , designed to standardize VI values to between -1 and +1;

$$NDVI = \frac{\left[\frac{\rho_{NIR}}{\rho_{red}} - 1 \right]}{\left[\frac{\rho_{NIR}}{\rho_{red}} + 1 \right]} \quad (4)$$

It is functionally equivalent to the NIR to red ratio and is more commonly expressed as:

$$NDVI = \frac{X_{NIR} - X_{red}}{X_{NIR} + X_{red}} \quad (5)$$

19

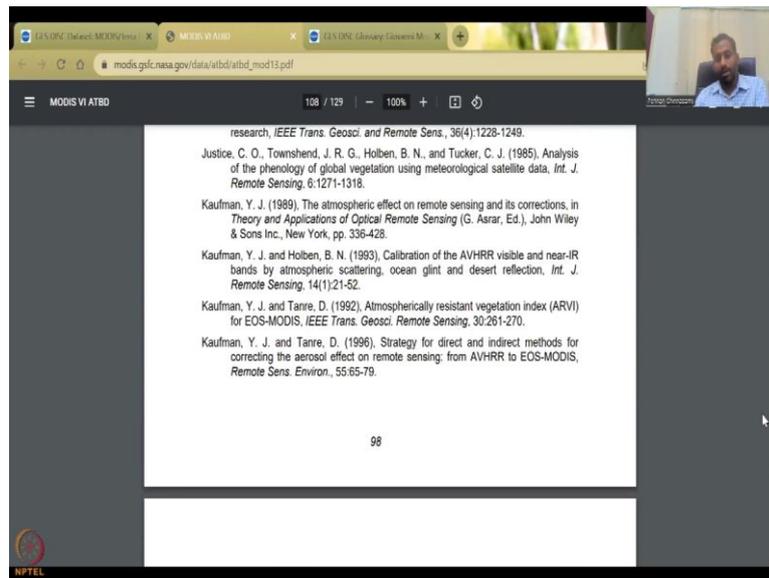
Vegetation isoline equation in red-NIR reflectance space

Yoshioka et al. (1999) presented a technique to derive vegetation isoline equations in red-NIR reflectance space for homogeneous canopies. They utilized a canopy radiative transfer model, known as the Cooper-Smith-Pitts model (or the adding method applied to the canopy reflectance modeling), which takes into account multiple interactions of photons between the canopy and its background surface. The higher order interaction terms between the two layers are truncated to derive a linear relationship of the red and NIR band reflectance. The technique consists of two model simulations, one with a perfect absorber as canopy background and the other with an arbitrary background to estimate the canopy optical properties necessary for the determination of the isoline parameters. These cases were independent of the canopy background optical properties for any specific site, hence, the results can be used for any type or series of background conditions to construct the vegetation isoline equation. The isoline equation and derivation were found to be useful for further study of two-band VIs and their variation with canopy background (Yoshioka, 1999).

We first define the red and NIR band reflectances from the coupled canopy-soil system of layers as ρ_r and ρ_n , respectively. We also define the pure canopy transmittance and reflectance of the two bands. For the radiation coming into the canopy layer from the upper surface, the downward transmittance and upward reflectance are represented as $T_{\lambda,0}$ and $\rho_{\lambda,0}$, where λ represents the band indices N and R . For the radiation coming into the same canopy layer from the bottom surface

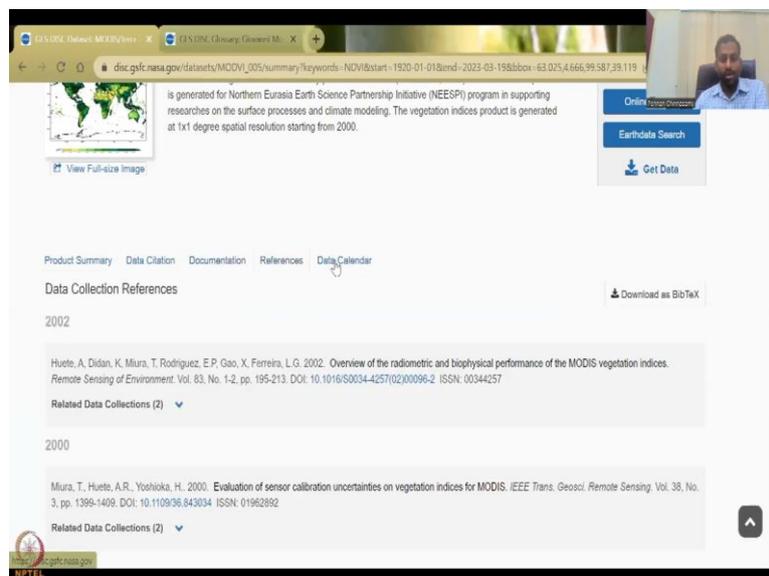
And NDVI has been taken as this one, same thing NIR minus red by NIR plus red, basically, from the following equations. So, if you want to theoretical knowledge about NDVI, you can look at this also.

(Refer Slide Time: 32:39)



Then when you do it, please, cite it. There is a lot of information that has been used about the satellites where it has been placed, data calculations, estimations, those kind of things.

(Refer Slide Time: 32:52)



disc.gsfc.nasa.gov/datasets/MODV_005/summary/keywords=NDVI&start=1920-01-01&end=2023-03-19&bbox=-63.025,4.666,99.587,35.119

Huete, A, Didan, K, Miura, T, Rodriguez, E.P, Gao, X, Ferreira, L.G. 2002. Overview of the radiometric and biophysical performance of the MODIS vegetation indices. *Remote Sensing of Environment*. Vol. 83, No. 1-2, pp. 195-213. DOI: 10.1016/S0034-4257(02)00986-2 ISSN: 00344257

Related Data Collections (2)

2000

Miura, T, Huete, A.R, Yoshioka, H. 2000. Evaluation of sensor calibration uncertainties on vegetation indices for MODIS. *IEEE Trans. Geosci. Remote Sensing*. Vol. 38, No. 3, pp. 1399-1409. DOI: 10.1109/36.843034 ISSN: 01942892

Related Data Collections (2)

Related Publications

Disclaimer: The majority of publications using GES DISC data do NOT include the data version id. As such, publications below may not use the most recent processing version of the data.

2022

Sun, Yuanheng, Knayzakhin, Yuri, She, Xiaojun, Ni, Xiangnan, Chen, Chi, Ren, Huazhong, Mynani, Ranga B. 2022. Seasonal and long-term variations in leaf area of Congolese rainforest. *Remote Sensing of Environment*. Vol. 268, pp. 112762. DOI: 10.1016/j.rse.2021.112762 ISSN: 00344257

Related Data Collections (1)

2016

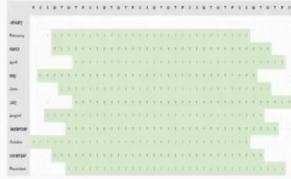
Inohara, Charles, Ellison, Luke T, Wilcox, K, Flansburg, Matthew, Toshihisa, David, Amin, K, Galata, Charles K, Wang, Jun, Wilcox, Eric M, Lee, Jaesun, Atencio, Jimmy



disc.gsfc.nasa.gov/datasets/MODV_005/summary/keywords=NDVI&start=1920-01-01&end=2023-03-19&bbox=-63.025,4.666,99.587,35.119

Product Summary Data Citation Documentation References Data Calendar

First 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 ... Last




disc.gsfc.nasa.gov/datasets/MODV_005/summary/keywords=NDVI&start=1920-01-01&end=2023-03-19&bbox=-63.025,4.666,99.587,35.119

Product Summary Data Citation Documentation References Data Calendar

First 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 ... Last

F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S

January

February

March

April

May

June

July

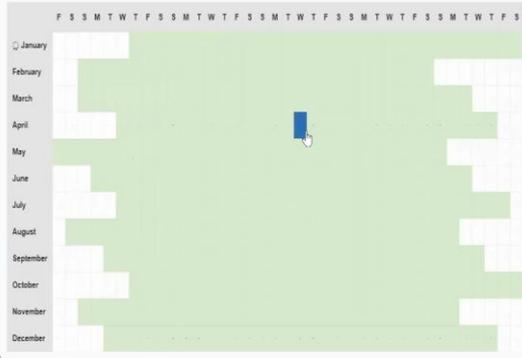
August

September

October

November

December




References, again you will have multiple references for this data set and then data calendar. So, the data calendar gives you on which month, which date the the mission was taking data and then it also shows you that there are, if there is any data gap because of instrumentation etcetera, they will show you that in the data gaps, if needed. So, how do you access this data that is another question people need to ask.

(Refer Slide Time: 33:21)

The screenshot shows the NASA EarthData website interface. At the top, there's a search bar with 'MODV1' entered. Below the search bar, the results for 'MODIS/Terra Monthly Vegetation Indices Global 1x1 degree V005 (MODV1)' are displayed. A world map icon is visible next to the product name. To the right of the map, there's a 'Data Access' section with buttons for 'Online Archive', 'Earthdata Search', and 'Get Data'. Below the map, there's a 'View Full-size Image' link. At the bottom of the page, there are links for 'References' and 'Data Calendar'.

The screenshot shows the NASA website with a disclaimer and a directory listing. The disclaimer text reads: "By accessing and using this information system, you acknowledge and consent to the following: You are accessing a U.S. Government information system, which includes: (1) this computer; (2) this computer network; (3) all computers connected to this network including end user systems; (4) all devices and storage media attached to this network; or to any computer on this network; and (5) cloud and remote information services. This information system is provided for U.S. Government-authorized use only. You have no reasonable expectation of privacy regarding any communication transmitted through or data stored on this information system. At any time, and for any lawful purpose, the U.S. Government may monitor, intercept, search, and seize any communication or data transmitted, stored on, or traveling to or from this information system. You are NOT authorized to process classified information on this information system. Unauthorized or improper use of this system may result in suspension or loss of access privileges, disciplinary action, and civil and/or criminal penalties." Below the disclaimer, there's a section for 'Access to GES DISC data' and a 'GES DISC Users' section. At the bottom, there's a directory listing table.

Name	Last modified	Size
Parent Directory	-	-
2000	2016-05-25 15:33	-
2001	2016-05-25 15:33	-
2002	2016-05-25 15:33	-
2003	2016-05-25 15:33	-
2004	2016-05-25 15:33	-

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Access to GES DISC data requires all users to be registered with the Earthdata Login system. Data continue to be free of charge and accessible via HTTPS. Access to data via anonymous FTP is no longer available. Detailed instructions on how to register and receive authorization to access GES DISC data are provided [here](#).

GES DISC Users who deploy scripting methods to list and download data in bulk via anonymous FTP are advised to review the [How to Download Data Files from HTTPS Service with wget](#) recipe that provides examples of GNU wget commands for listing and downloading data via HTTPS.

Once registered, you can [click here](#) to authorize 'NASA GESDISC DATA ARCHIVE' application.

Name	Last modified	Size
Parent Directory		-
2000	2016-05-25 15:33	-
2001	2016-05-25 15:33	-
2002	2016-05-25 15:33	-
2003	2016-05-25 15:33	-
2004	2016-05-25 15:33	-
2005	2016-05-25 15:33	-
2006	2016-05-25 15:33	-
2007	2016-05-25 15:33	-

researches on the surface processes and climate modeling. The vegetation indices product is generated at 1x1 degree spatial resolution starting from 2000.

[View Full-size Image](#)

[Earthdata Search](#)

[Get Data](#)

Product Summary | Data Citation | Documentation | References | Data Calendar

Shortname: MODVI
 Longname: MODIS/Terra Monthly Vegetation Indices Global 1x1 degree V005
 DOI: 10.5067/C444MAEFNOL2
 Version: 005
 Format: HDF
 Spatial Coverage: -180.0,-90.0,180.0,90.0
 Temporal Coverage: [2000-02-01 to 2016-01-01](#)
 File Size: 1 MB per file
 Data Resolution
 Spatial: 1° x 1°
 Temporal: 1 month

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 Atmospheric Composition | Giovanni | Earthdata Forum | Who We Are
 Water & Ecosystem Services | Data Access | Publications | Links To Us

So, there are 2 types given in this particular data set. Not all data set have 2, some may have 4 or 1, depending on the storage. You can click on first open archive data. This is a folder kind of data, which means you will go here and just click, click and then take the images out.

Instead of downloading it from the drawing, the box and then taking it out, you can just go to the data set. So, for example here, we know that this data is from 2000 to 2016. So, when you did online archive, this comes up. And it is open source. It is secure system, anyone can download it. How to download files from this https service, you can read and understand. I will just show you a quick demo.

(Refer Slide Time: 34:09)

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Name	Last modified	Size
Parent Directory	-	-
2000/	2016-05-25 15:33	-
2001/	2016-05-25 15:33	-
2002/	2016-05-25 15:33	-
2003/	2016-05-25 15:33	-
2004/	2016-05-25 15:33	-
2005/	2016-05-25 15:33	-
2006/	2016-05-25 15:33	-
2007/	2016-05-25 15:33	-
2008/	2016-05-25 15:33	-
2009/	2016-05-25 15:33	-
2010/	2016-05-25 15:33	-
2011/	2016-05-25 15:33	-
2012/	2016-05-25 15:33	-
2013/	2016-05-25 15:33	-
2014/	2016-05-25 15:33	-
2015/	2016-05-25 15:33	-
MODVI.xml	2022-08-16 18:35	1.9K
MODVI_005_ah.xml	2022-08-16 18:35	12K

reason.gesdisc.cosdis.nasa.gov

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GEOS DISC Users who deploy scripting methods to list and download data in bulk via anonymous FTP are advised to review the [How to Download Data Files from HTTPS Service with wget](#) recipe that provides examples of GNU¹ wget commands for listing and downloading data via HTTPS.

Once registered, you can [click here](#) to authorize 'NASA GEOSDIS DATA ARCHIVE' application.

Name	Last modified	Size
Parent Directory	-	-
README-MODIS_VI_1deg.005.pdf	2022-08-22 18:32	17K

[NASA Web Privacy Policy and Important Notices](#)

If you have reached this page for error, feel free to contact the [GEOS DISC Help Desk](#) by clicking this link

Gridded MODIS land cover product

Gridded MODIS vegetation indices product for northern Eurasia

The gridded MODIS vegetation indices product presents gridded statistical summaries of standard 0.05 CMG MODIS Terra Vegetation Indices Monthly product MOD13C2 (Huete et al, 2002) collection 5. The product is intended for use in Giovanni system focused on regional (NEESPI) analysis of surface processes and climate modeling. The vegetation indices product is generated at 1 degree spatial resolution yearly starting from 2000. The product is generated from the 0.05 degree Climate Modeling Grid global coverage product.

File naming convention

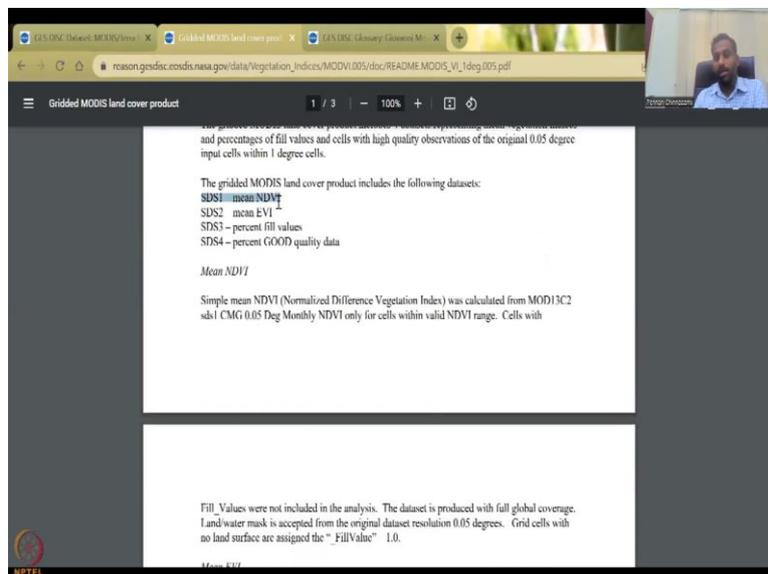
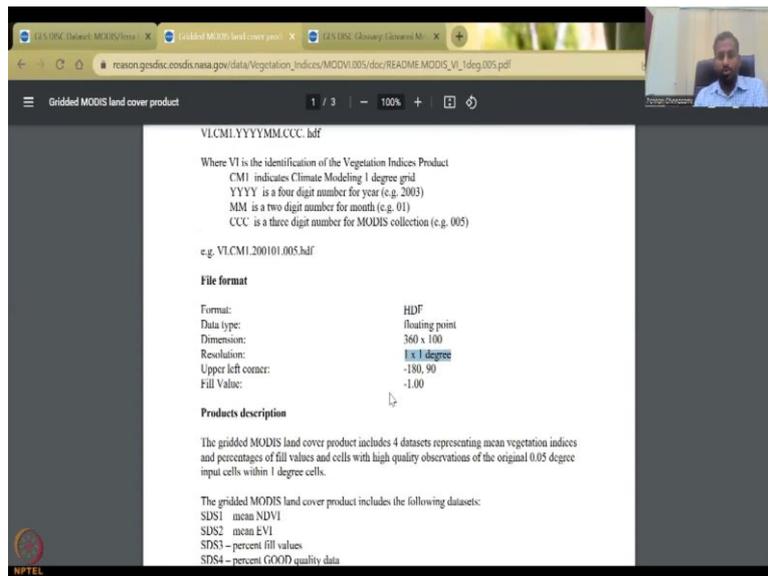
VLCMI.YYYYMM.CCC.hdf

Where VI is the identification of the Vegetation Indices Product
CMI indicates Climate Modeling 1 degree grid
YYYY is a four digit number for year (e.g. 2003)
MM is a two digit number for month (e.g. 01)
CCC is a three digit number for MODIS collection (e.g. 005)

e.g. VLCMI.200101.005.hdf

File format

Format: HDF
Data type: floating point

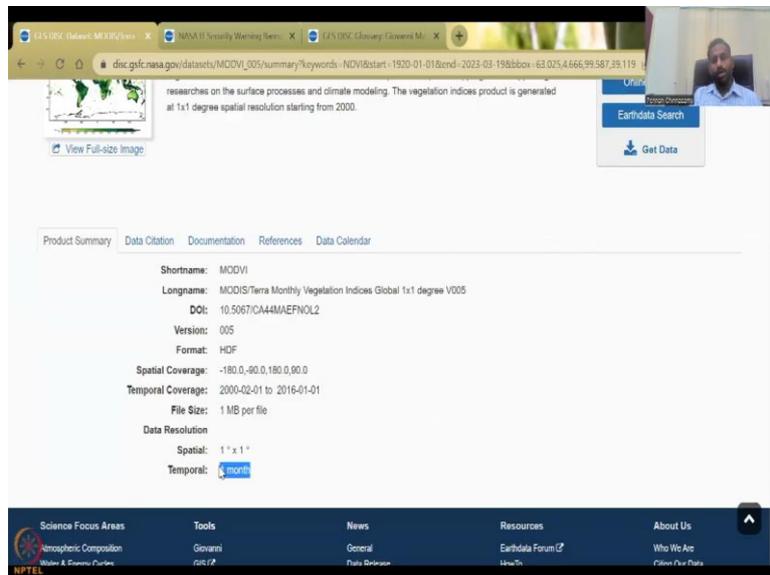
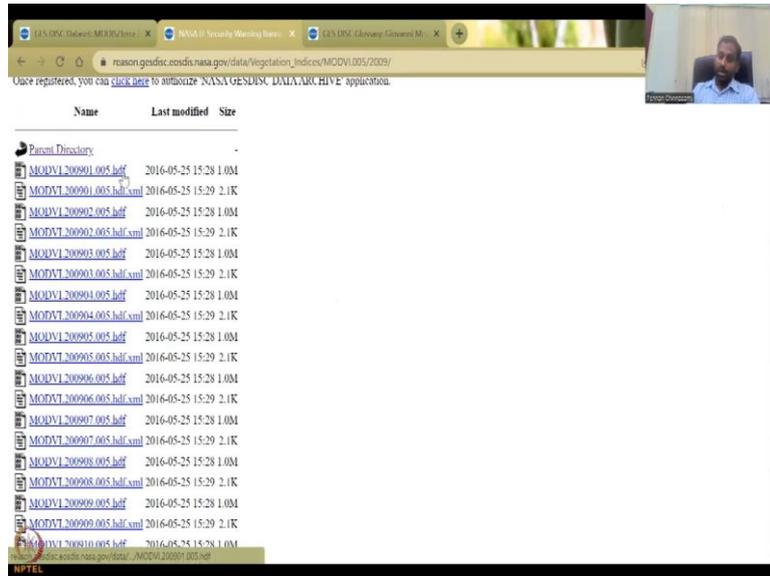


Here, there is no login needed much, you can see. So, from 2000 to 2015, 2016, there is folders. So, folders are kept for the data and you just click on a particular year. So, let us say, I am going to go 2009 and when you click 2009, what happens is there is a readme file. Before I will just show you, there is a readme file, these things, to show what this data is about.

Read me. So, readme means it is a metadata about the data. So, you can just click on this. It will open the Modis, what these products are, file format, resolution, everything is given which is like the metadata for you. And then it says sds1 means NDVI. So, the product, if you want to download.

So, when you download this data all of it will come out but you want to only use the NDVI. So, for which you say I just want SDS1. So, all these are included. So, if you go back. I accidentally closed entire thing but I will open it. Open online data archive and then you can see all the folders.

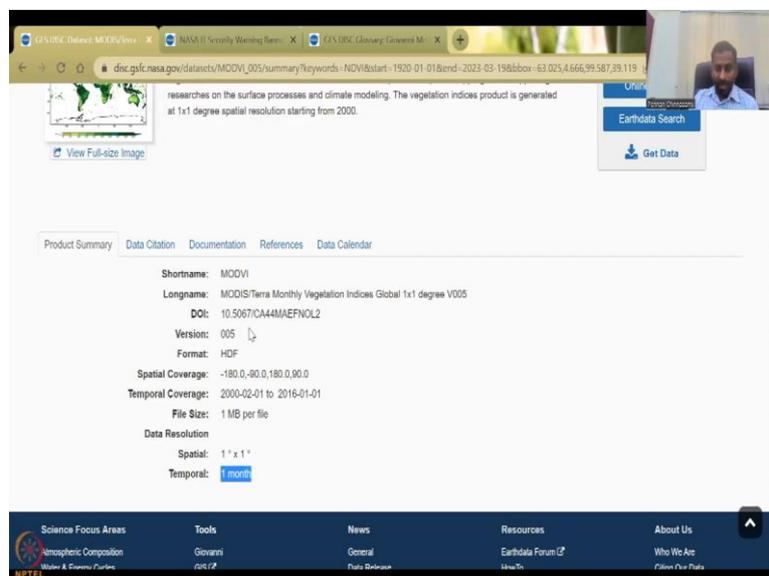
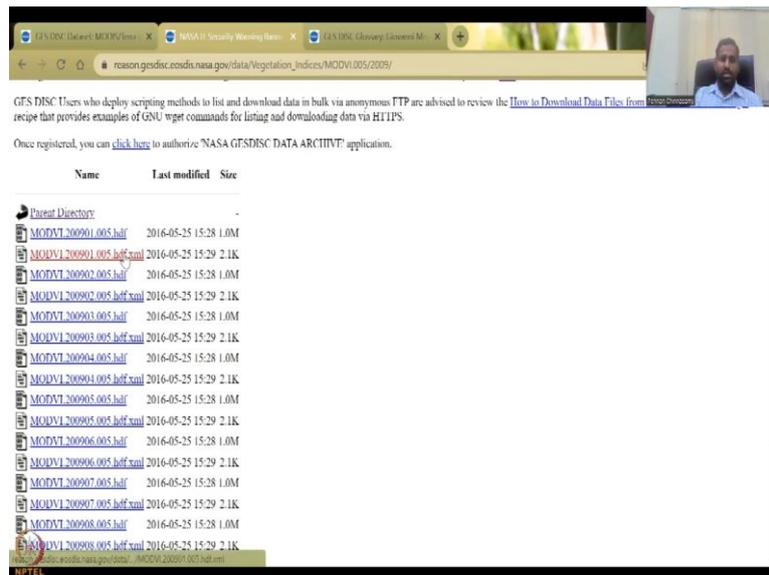
(Refer Slide Time: 35:16)



I have clicked on 2009 and you can do the hdf. So, that is the format, file format, grided format which is available. You can just download all of it if you want, but I will just show you the convention how it is given MODVI is the name MOD VI. And in the MOD VI, we have a 2009 01 00 01 is the month. So, you have the month given as January and then 005 is the level of the version, the version of the data.

So, maybe they would have added multiple criteria to clean the data, new algorithms, improvement. Because they do not stop with version 1. So, they make it better every year. So, we have version 5. So, all you could see is they go year, month and date. Since, Modis is a monthly data, as we could see here, it is at monthly resolution, there is no point of putting a date. So, they do not put a date.

(Refer Slide Time: 36:13)



So, this is just the XML file. It will just populate here the XML file if you need it, but if you want this, just click on it. It will ask you to download. First you have to sign, in login and then you download. So, and then you can just put it on your GIS database platform and then you can model it. So, this is the raw data that comes out and in the raw data, they have also made these documentation for NDVI data.

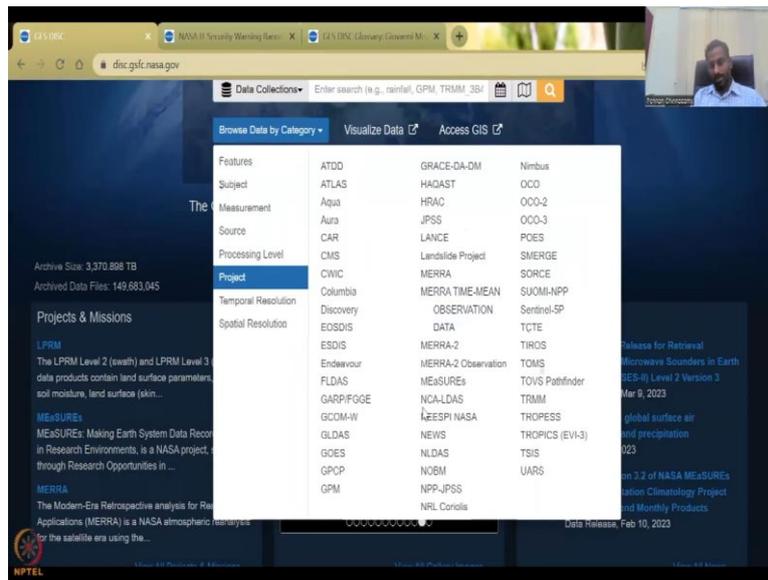
(Refer Slide Time: 36:54)



In the next lecture, I will start with the visualization of GES DISC. So, I will just keep it here ready for you. You can also play with these 2 links. But we will start with the visualize data and then we will also clarify on Sentinel Hub which is also a good beautiful data set platform that we can use but mostly for European satellites. They do have NASA satellites but they want to promote the COPERNICUS system. The COPERNICUS is a database for European satellites.

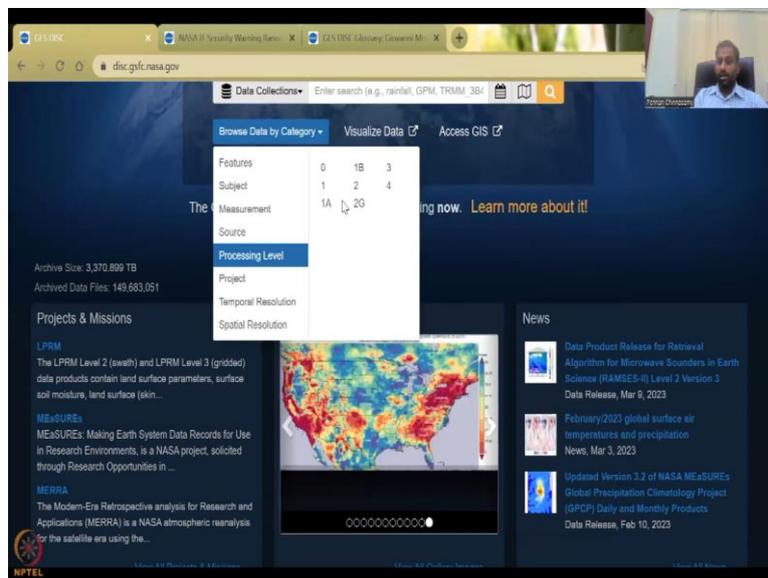
So, with this I will see you in the next lecture but feel free to go and look at these different data collection, how to do it, image gallery and then Mission guidelines. Mission is the satellites and then see the recent news on how these data sets have been used widely, globally, etcetera.

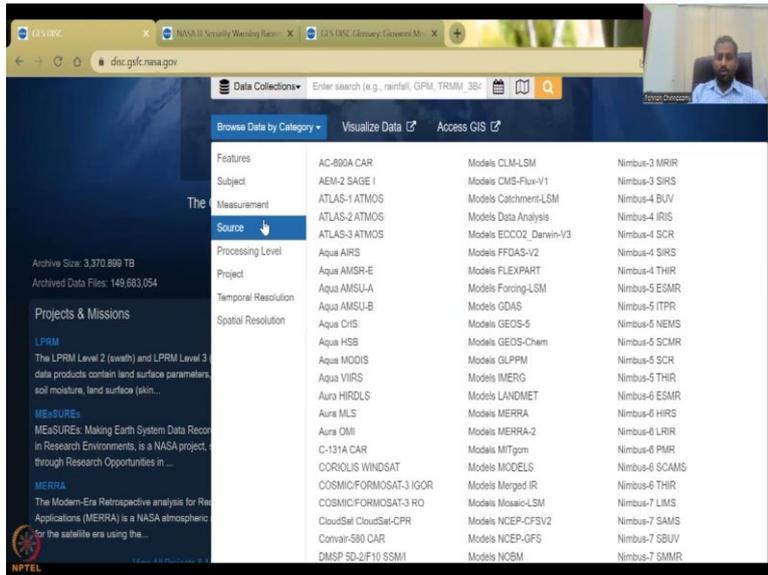
(Refer Slide Time: 38:38)



So, you also have the project which satellite you want to use. You can pick from satellite missions that are there landsat, aqua, Discovery Satellite Systems, etcetera, GLDAS. These are projects.

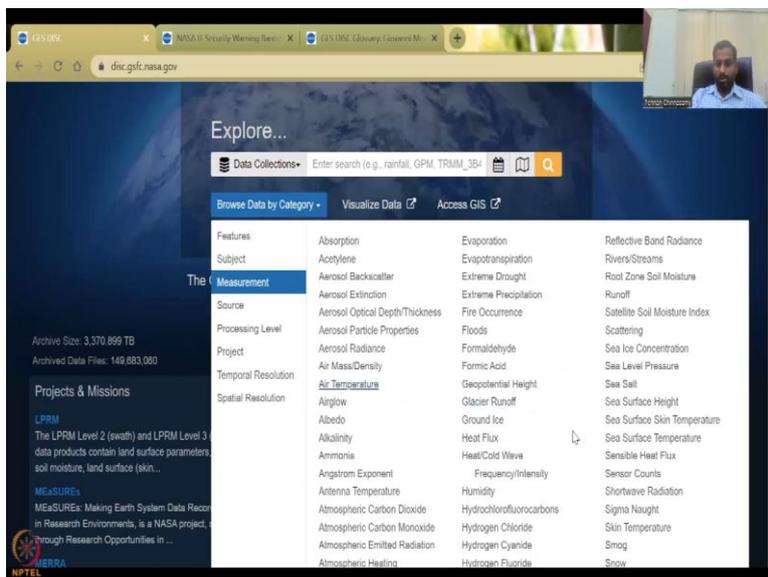
(Refer Slide Time: 38:51)





And then the processing level. As I said there are multiple versions and levels. The source of the data. These are the satellites themselves. So, you have NASA drove, NASA and then resourcesat would not be here but it was not the other NASA webpage.

(Refer Slide Time: 39:10)



And then we have the measurement. As I said, you can take the measurements, what you want to measure. Soil, infiltration is also part of your soils that we use or subjects.

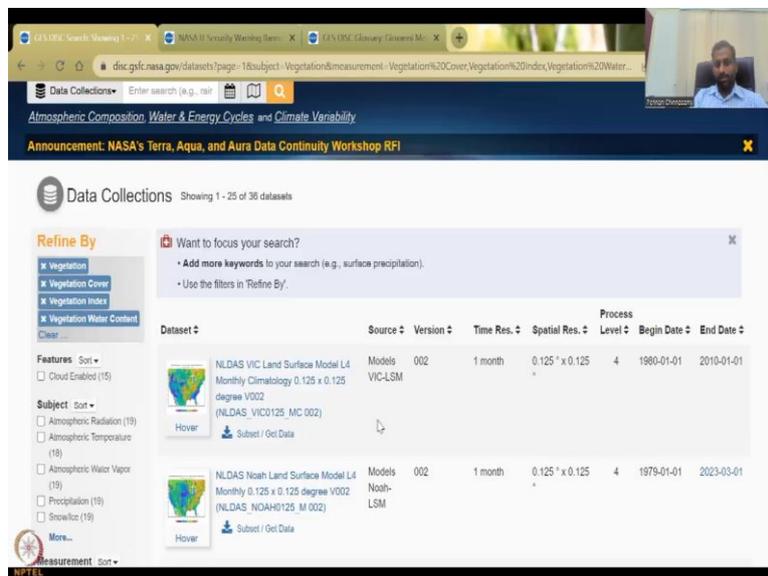
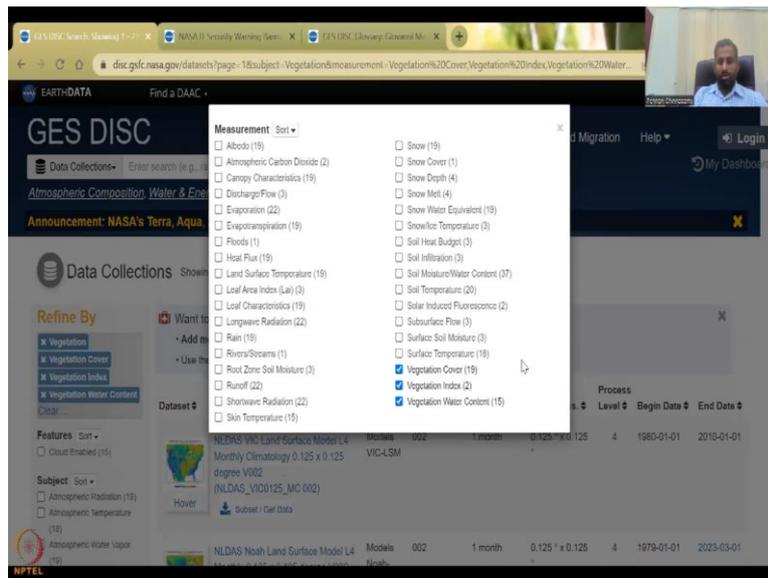
(Refer Slide Time: 39:18)

The screenshot shows the NASA Earth Data Explorer website. The main heading is "Explore...". Below it is a search bar with the text "Data Collections" and "Enter search (e.g., rainfall, GPM, TRMM, 3B)". There are three tabs: "Browse Data by Category", "Visualize Data", and "Access GIS". A dropdown menu is open under "Browse Data by Category", showing a list of categories. The "Subject" category is selected and highlighted. The list includes: Aerosols, Air Quality, Altitude, Atmospheric Chemistry, Atmospheric Pressure, Atmospheric Temperature, Atmospheric Water Vapor, Atmospheric Winds, Atmospheric/Ocean Indicators, Clouds, Ecological Dynamics, Ecosystems, Frozen Ground, Glaciers/Ice Sheets, Ground Water, Infrared Wavelengths, Ionosphere/Magnetosphere Dynamics, Land Surface/Agriculture Indicators, Land Use/Land Cover, Microwave, Natural Hazards, Ocean Chemistry, Ocean Heat Budget, Ocean Optics, Ocean Pressure, Ocean Temperature, Ocean Winds, Paleoclimatic Indicators, Platform Characteristics, Precipitation, Probes, Public Health, Radar, Sea Ice, Sea Surface Topography, Sensor Characteristics, Snow/Ice, Soils, Solar Activity, Solar Energetic Particle Flux, Solar Energetic Particle Properties, Sun-Earth Interactions, Surface Radiative Properties, Surface Thermal Properties, Surface Water, Tectonics, Topography, Ultraviolet Wavelengths, Vegetation, and Visible Wavelengths. On the left side, there is a sidebar with "Archive Size: 3,370,900 TB" and "Archived Data Files: 149,683,068". Below that, there are sections for "Projects & Missions" including "LPRM" and "MEASUREs".

The screenshot shows the NASA Earth Data Explorer website with the "Vegetation" subject selected. The page displays a list of datasets with columns for Dataset, Source, Version, Time Res., Spatial Res., Level, Begin Date, and End Date. The datasets listed are:

Dataset	Source	Version	Time Res.	Spatial Res.	Level	Begin Date	End Date
Hourly Time-Averaged Single-Level Assimilation Land Surface Diagnostics V5.12.4 (M2T1NKLND 5.12.4)	MERRA-2						
NLDAS VIC Land Surface Model L4 Monthly Climatology 0.125 x 0.125 degree V002 (NLDAS_VIC0125_MC 002)	Models VIC-LSM	002	1 month	0.125° x 0.125°	4	1980-01-01	2010-01-01
NLDAS Noah Land Surface Model L4 Monthly 0.125 x 0.125 degree V002 (NLDAS_NOAH0125_M 002)	Models Noah-LSM	002	1 month	0.125° x 0.125°	4	1979-01-01	2023-03-01
NLDAS Mosaic Land Surface Model L4 Monthly Climatology 0.125 x 0.125 degree V002 (NLDAS_MOS0125_MC 002)	Models Mosaic-LSM	002	1 month	0.125° x 0.125°	4	1980-01-01	2010-01-01

The screenshot shows the NASA Earth Data Explorer website with the "Vegetation" subject selected. The page displays a list of datasets, similar to the previous screenshot. A dropdown menu is open for the "Measurement" category, showing options: "By measurement: ascending", "By measurement: descending", "By count: ascending", and "By count: descending". The "By measurement: ascending" option is selected.



Subjects. If you click vegetation, you see what vegetations they have and in the vegetation index you will have here. So, what measurements they have also here. All these are vegetation. And then you can see, you can find find, sort them here by for example, let us say, you can click on more, all the measurements come up.

So, I will say vegetation cover, vegetation index, vegetation water content is what I need and then I close this. Then now only these are filtered. Initially, there was 36 more interesting data sets. Now it is reduced. Let me reduce it further by saying that resolution.

(Refer Slide Time: 39:56)

The screenshot shows the NASA Earth Data website interface. On the left, there are filters for 'Project' (listing Aqua, GCOM-W, NCEP/NOAA, and NLDAS) and 'Temporal Resolution' (listing 1 hour, 1 day, and 1 month). The '1 month' option is selected. The main area displays a table of datasets with columns for Dataset, Source, Version, Time Res., Spatial Res., Level, Begin Date, and End Date. Three datasets are visible:

Dataset	Source	Version	Time Res.	Spatial Res.	Level	Begin Date	End Date
NLDAS Noah Land Surface Model L4 Monthly Climatology 0.125 x 0.125 degree V002 (NLDAS_NOAH0125_MC 002)	Models Noah-LSM	002	1 month	0.125° x 0.125°	4	1980-01-01	2010-01-01
NCDAS Noah-3.3 Land Surface Model L4 Daily 0.125 x 0.125 degree V2.0 (NCDAS_NOAH0125_D 2.0)	Models Noah-LSM	2.0	1 day	0.125° x 0.125°	4	1979-01-02	2017-01-01
NLDAS Mosaic Land Surface Model L4 Monthly 0.125 x 0.125 degree V002 (NLDAS_MOS0125_M 002)	Models Mosaic-LSM	002	1 month	0.125° x 0.125°	4	1979-01-01	2023-03-01

The screenshot shows the NASA Earth Data website with a refined search. The 'Data Collections' section is active, and the search results are filtered to show 14 datasets. The 'Refine By' section shows '1 month' selected under 'Temporal Resolution'. The 'Dataset' table is updated with the following entries:

Dataset	Source	Version	Time Res.	Spatial Res.	Level	Begin Date	End Date
NLDAS VIC Land Surface Model L4 Monthly Climatology 0.125 x 0.125 degree V002 (NLDAS_VIC0125_MC 002)	Models VIC-LSM	002	1 month	0.125° x 0.125°	4	1980-01-01	2010-01-01
NLDAS Noah Land Surface Model L4 Monthly Climatology 0.125 x 0.125 degree V002 (NLDAS_NOAH0125_MC 002)	Models Noah-LSM	002	1 month	0.125° x 0.125°	4	1979-01-01	2023-03-01

Come down, here you have resolution. And I want only monthly. So, if I click monthly, only 14 datasets will come. So, this is how you could reduce the number of data sets you want and then filter it and use it for your analysis. So, this I will stop here I have given you an introduction of this website and how it could be used what type of data, I will see you in the next class. Thank you.