Rural Water Resources Management
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Lecture 53
Solving case studies in rural water resource management Part - 3

Hello everyone, welcome to NPTEL course on Rural Water Resource Management. This is week 11 lecture 3, in this week, we have been following rules and regulations and databases to collect data that can help us in understanding the rural water resources. We have actually looked at the key concepts of rural water resource management. And now we are at a stage to collect data to understand further for each and every one specific research area or management area.

For example, if you are located in Shillong or in Kashmir a particular district, you would like to have only that data for rural water management. And that is what we are looking at in these lecture series, how to collect data, we have looked at collecting data from publications, NGO reports, manuals, etcetera. Then we looked at state agencies that collect data. So, state agencies collect multiple datasets we are not going to go into all the datasets. For now, we have understood that there are locations where you can collect data for state.

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In today's lecture, we will focus on the data that needs to be collected from the water balance method that we discussed in class earlier. So, as for the water balance equation, we have a del S

which is the change in storage is equal to the precipitation plus your Q in which is your runoff coming in.

And let us come in here minus Q out is the runoff which is going out the minus your ET which is your evapotranspiration that is caused because of plants transpiring, and also your evaporation from open surfaces then we have G in, which is your groundwater in and G out which is your groundwater out. So, you need to close the water budgets, which means you need to get all these data to close the water budget, estimate each and every part and then you close the water budget so that at the end of the day you can estimate the net storage in the rural village.

Again, the storage could be surface water storage or your groundwater storage. Since we are looking at over water resource management, most of the water is stored at a village level it is mostly stored as a groundwater and there are some surface storage things like check dams, ponds, lakes, recharge ponds, percolation ponds, all these things. We will also look at the major state wise where they could store data for example as rural water database.

So, there are multiple data sets that we saw as per this water equation, one is your precipitation which is rainfall and then you have your evapotranspiration as ET, soil moisture from storage SM and surface water storage as Q in and then the river discharge going out is Q out. You can also have a groundwater in. So, in today's lecture, we will look at one particular centralized database.

So, when I say state and central, there is two things one is that the data all is kept at a state level and it is managed by a state level which means the state agencies pay us for it. In today's lecture, we understand that even though there are state agencies it has to be supported mostly by the central agency, like the Tamil Nadu government, we saw that we have the NVIS website but it is under the Ministry of Forests and Climate Change from the central government.

And then there is data.gov.in websites and all. So, for this aspect, the Indian water resource agencies have created one database where all the data that is collected from the central agencies or the central government agencies are stored. Where for example, a central agencies for rainfall is your IMD, which is the Indian Meteorological Department.

And then the evapotranspiration was also from IMD or it can be from other cultural agency, their soil moisture can also be from either be, the surface water is from CWC, which is the Central Water Commission, the groundwater is from Groundwater Board. So, you could see that the central agencies are always there to collect these data and they could be stored in this centralized database that we will look at.

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So, it is called WRIS, the India Water Resource Information System. So, India WRIS is what it is called. So, it is a multi source and multi data platform for water management, multi source because one source is rainfall, one source is your ground water, etcetera. So, all these sources are mapped in. There is also another meaning for sources where it comes from which is your multi data, it can come from your state agencies, it can come from the local agencies, NGOs, etcetera, some of the data and or your space agencies which is your ISRO and other data boards.

So, you need to be careful in understanding these linkages between the data. It is not only one data source, it can be multi source data and multi data source. So, multi source data means where the data is coming. And multi data means, what is it talking about, is it rainfall, groundwater, etcetera. So, just for groundwater, as I said, you can have data coming from Central Groundwater Board. And you can also have data coming from the State Groundwater Board.

So, if you look at these differences, you can easily capture that there is a lot of data, and you could use it very wisely for River Water Management. Let us look at a few for our water

budgets. I am not going to go through all the data bases, because that itself will be a couple of weeks lectures, but I will just show you some so that you get an understanding on how to use these websites.
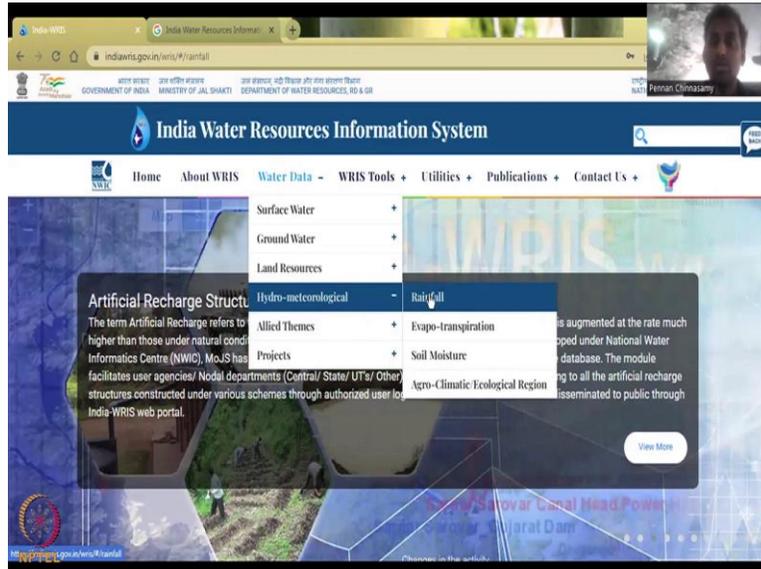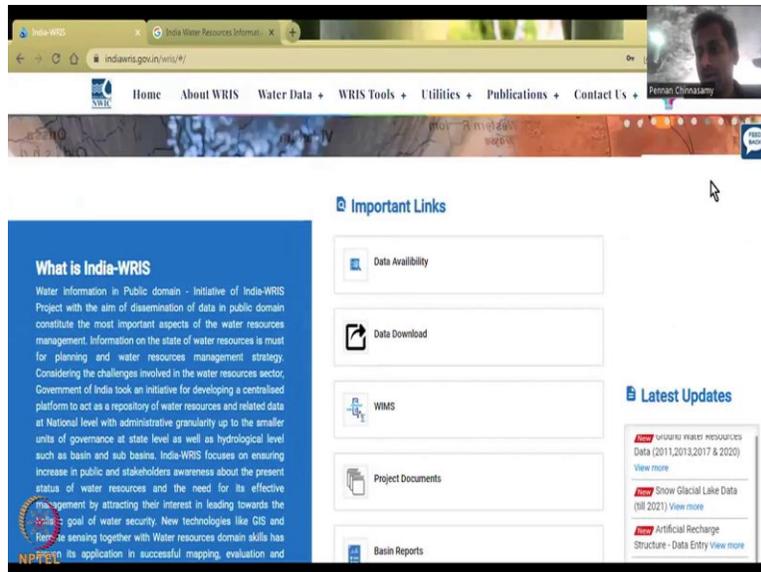
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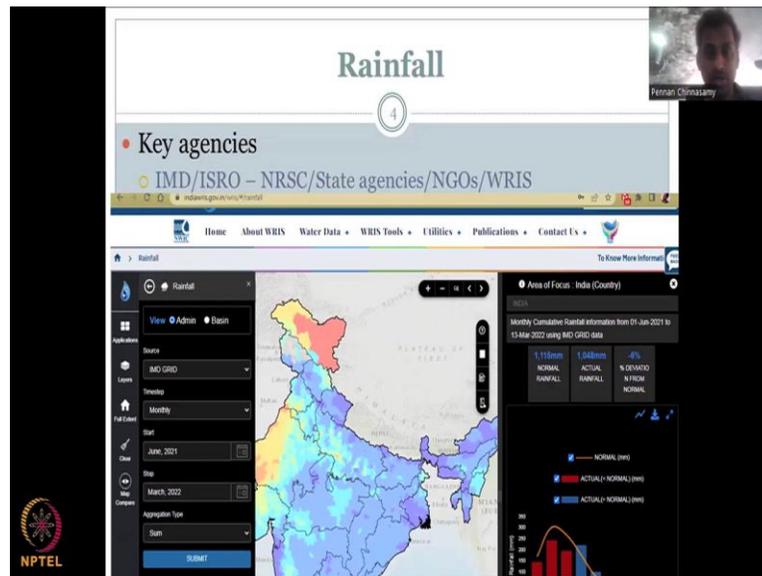
Rainfall, so the first data that we are going to look at is rainfall. The key agencies are IMD, which is the Indian Meteorological Department, and also ISRO, which is the space agency that gives you the data. So, both of these could be clubbed together as one data or they could be separate, IMD can be separate and ISRO can be separate. So, ISRO has an agency called NRSC National Remote Sensing Center and multiple agencies are there under so like SAC Space Application Center, etcetera.

So, these centers collect these raw satellite data and convert it to a satellite product so that you could easily run these analysis for across the country. So, what you could do here is you have your state agencies and NGOs, WRIS, etcetera. You could look at the different sources for rainfall data and you can map them for your village or rural area as per your need.

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So, with this, let me open this website so that we could share what it is in this database. Just because of the internet, I have just put the same thing search here in the Google, India Water Resource Information System, I click search and the first thing that comes up is do India WRIS. If you click it, this opens. If it speed fast then I just started. So, it does take some time, the internet bandwidth and etcetera. So, give it some time.

And you will have this website open, so the India Water Resource Information System. Now, the same as I showed in my slide. And also, there are multiple tabs that work for the database. It is one under the Government of India, Ministry of Jal Shakti and Department of Water Resources, research and development.

So, Ministry of, it is a ministry and then you have a department so, all these come under the Government of India and you could see that multiple, multiple links are given databases are given new data sources are given, I am just coming down to show you what it is. But just to stick on to today's lecture, I will go to Home, which is this web page. And then about WRIS those who want to read about it can read it, but I am going to go to water data, we are looking at mostly water data, and I am going to go to rainfall.

So, rainfall comes under the hydro-meteorological. So, go down four points and then go to the right. So, how you navigate in this website is you have to move your cursor on to water data, do not click, if you move your cursor on top of it, the data populates and then just come down do not click the mouse just come down and then you will see rainfall populating automatically when your mouse is there. Now, you could click rainfall because the arrow mark is shown.

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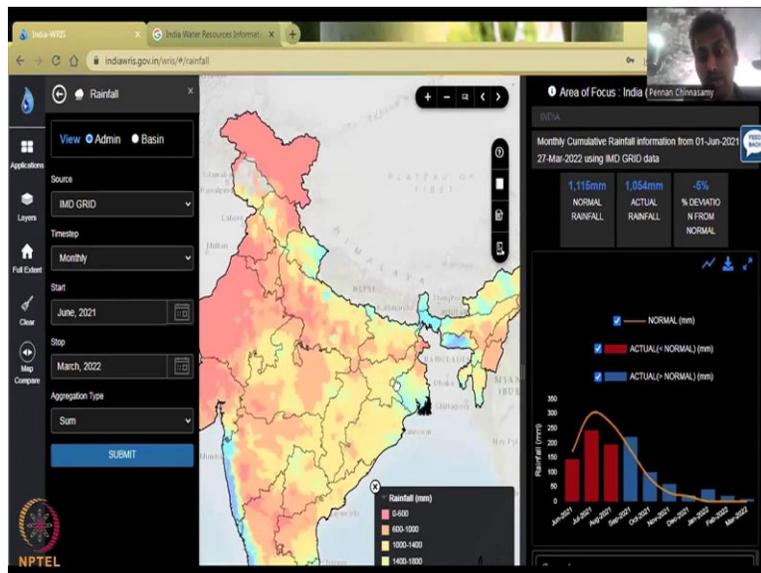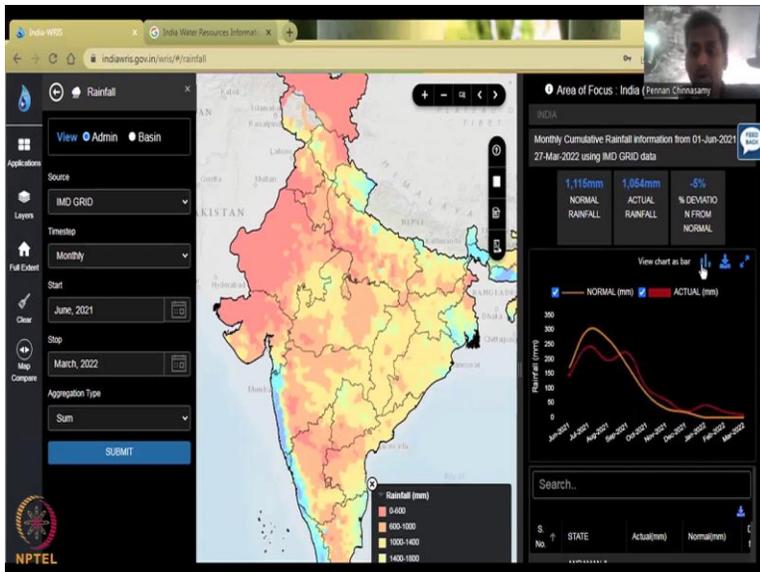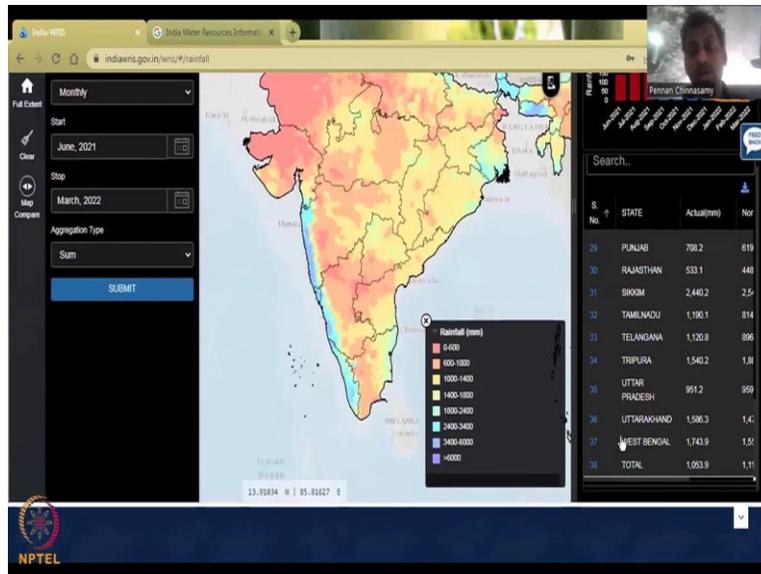
So, what did you see is in hydro-metrological, you saw multiple databases. So, it is not only your rainfall, but also evapotranspiration, soil moisture, and these things, all these we would look into this week's lecture. So, I have opened the WRIS, I have opened the hydro-metrological rainfall. Once you open it, this is the image that comes which is a dynamic image. Dynamic because you can move it, you can zoom in zoom out and also the data can change. So, this is the first point I would like to share with you.

This is an India map with rainfall and the grid coloring of the rainfall pattern is given like this. So, 0 to 600 millimeters per year is red, and wherever it is blue, it is more than 1800 mm rainfall. And as per class you will know where these regions are, mostly it is the Western Ghats along the Ganges plain and regions of West Bengal and Brahmaputra region. But most of central India and northern are still under 0 to 600, 800 mm rainfall, which is kind of scars, all these are in district level heads.

So, if you could zoom in and as a case study I will zoom into Maharashtra. Let me go back a step you have all these districts. So, when you move your cursor, these districts will turn bold, you see the line changing color. And then it turns into a finger when it turns into a finger you can click. So, this is on the side. On your right side, what you see is area of focus, because whole India is shown in this image, it says India.

And the data monthly cumulative rainfall from 01 June 21 to 27 March 2022, which is two days ago using IMD data grid. So, it up to two days ago the rainfall is being calculated and an average

annual rainfall is given here. The normal rainfall for the entire country is around 1115 millimeters of normal rainfall, actual is how much is happening now. So, normal is the average, it could be a 10-year average rainfall and what is the actual is a little bit less, so we are slightly in the negative that is what percentage deviation from normal is 5 percent.

So, you have your actual rainfall data as the line you could see that. The normal is millimeters in a line, the actual is less than normal which is the red color and actual which is greater than normal which is the blue color. You can click and remove those whatever you want to see. And as I said you need the rainfall for both the seasons and this is also coming in the line axis. So, you could download this data, you can look at as a line chart.

Now, I have converted the column graph into a line chart to see where the rainfall goes above the normal. And you could see that what is happening is the rainfall is slightly going up and down two peaks are happening rather than one single peak which used to happen in the normal average period. But here you could see that it is changing slightly. And there is a slight elongation of rainfall, which is like the rainfall is above average during the non-rainy season.

But most importantly during your summer season when the crops are growing and also the monsoon season there is less rainfall recorded as per the normal. Then you could look at on your left you have different applications and layers. Application is rainfall, so do not click on that, if you want to go back and change it, you can click here. I normally would pull this thing up and then go to here and change it if you want to change it.

These are just tools to move your map back and forth, and see where you want to locate the map. And then these are the reports and registrations if it is needed, normally you need to have a login account. But sometimes just the data you can get. The non-sensitive data you can get without login. You can also the page is divided into three small panels, you can also move the panel if you want to see a bigger picture of the area. And then you have all these.

See, you could change it to line graph, you can download the data as a PDF or an Excel file, which is a comma separated value file. It is not the dot Excel it will be dot CSV, but you can change it to Excel and then you can make it big or expand as needed. So, now we have expanded it to see how it is. Just click the X mark it will go back. So, this is how you can look at the data

and then I will show you how to zoom into a particular state and then collect the data you can see here all the states are given, all the regions the union territories everything is given.

So, we have around 37 states and union territories including your Andaman and Nicobar Islands, etcetera. So, I will click Kashmir and went there. Suppose you accidentally click a particular state, you can come back by going on the top and then click India it will come back to India whole scale. So, here is how the data is given.

And the average monthly cumulative rainfall information from this data is given, cumulative. So, monthly cumulative for one year is this much, not monthly we get 1000 month that is too much. So, there is an annual taken at monthly data monthly cumulative, you add every month, and then per year, you get the information. It is kind of an average.

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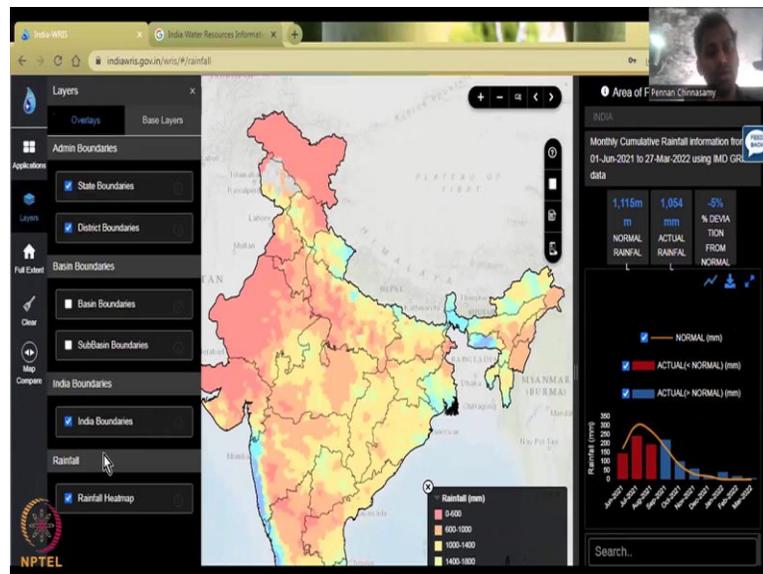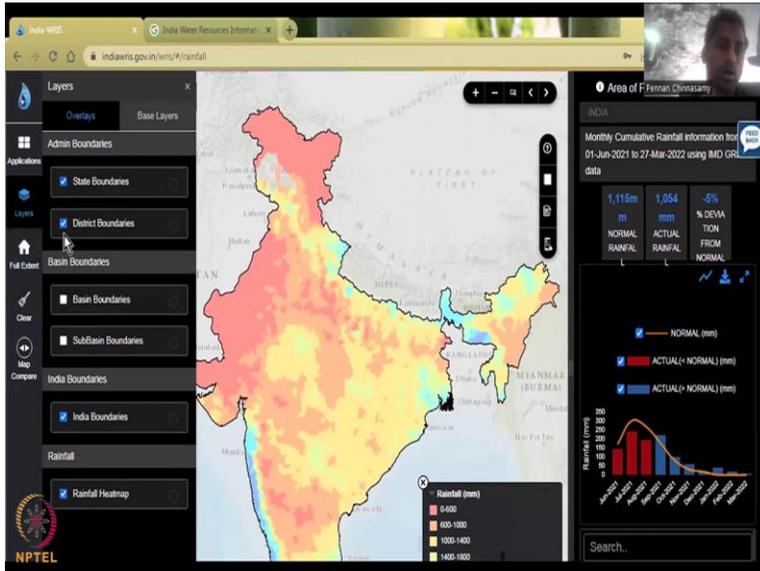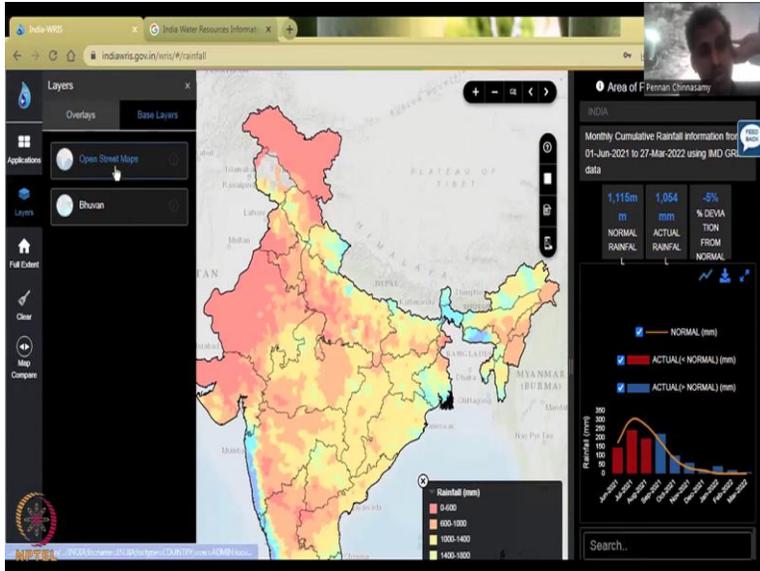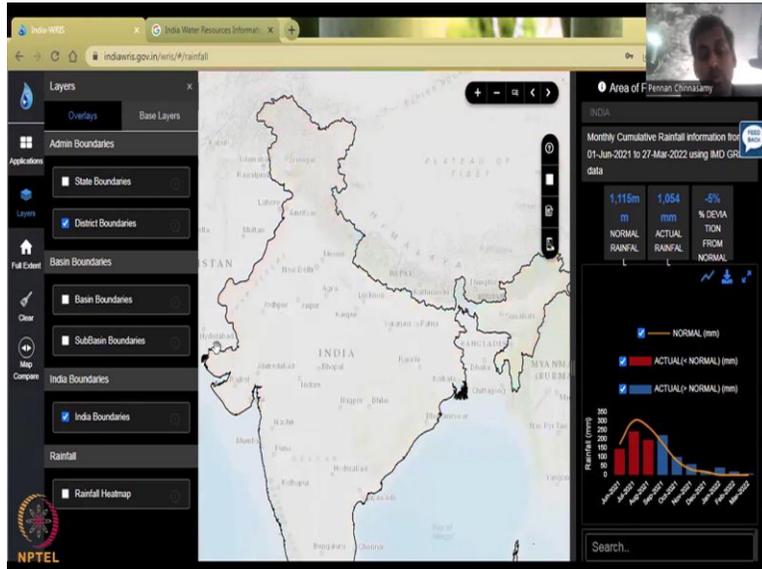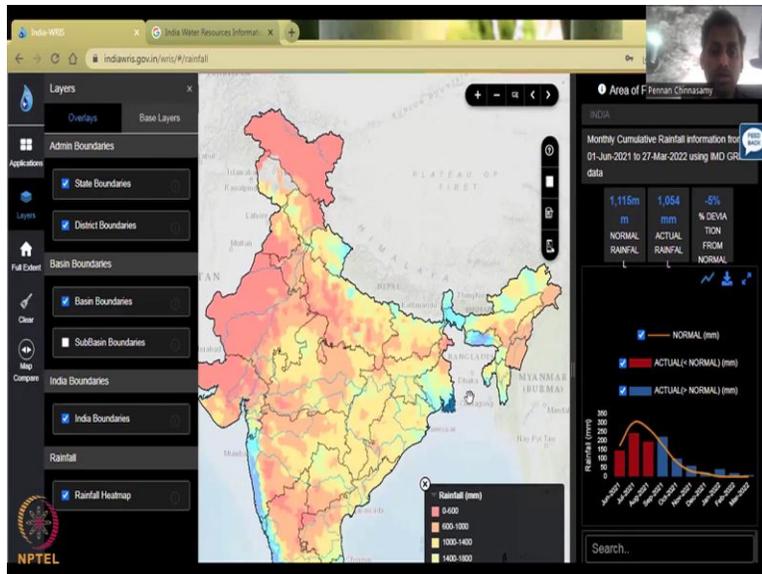
So, now we will see particular state. But before that, let me go to the left side panel, you have different layers. If you click the Layer button, you will get what layers you want. And this boundary, for example, you can have base layers, you can have street Maps or Google Maps depending on your internet speed, just let the default because it will pick the right map for you.

And in the overlays do you want state boundaries if you do not want state boundaries you can do more see now it is gone. Or you can have basin boundaries, which are the major water boundaries now you can see it coming slowly, I can take the state boundary so that you can see the blue line these are the water basin boundaries, you can also add sub basins, depending on the size, if you zoom in, it will slowly populate it takes a lot of internet bandwidth because there are

a lot of sub basins, so I am going to remove it and then the India boundaries India rainfall heat map.

So, this is what is called the base layer. What is behind the data is called the bass. As I said it may consume a lot of power, so do not overdo it, if you add too much on it, then you will, the layers may collapse. Let us say for example, you are having Open Street Map if you want Bhuvan just click Bhuvan, it will slowly populate. Why is this information needed is because when you zoom in to a particular location and you want to see where it is located, it is better to have that zoomed in. So, for example, if I am zooming in to Jaipur, I know where Jaipur is so I can put that data there.

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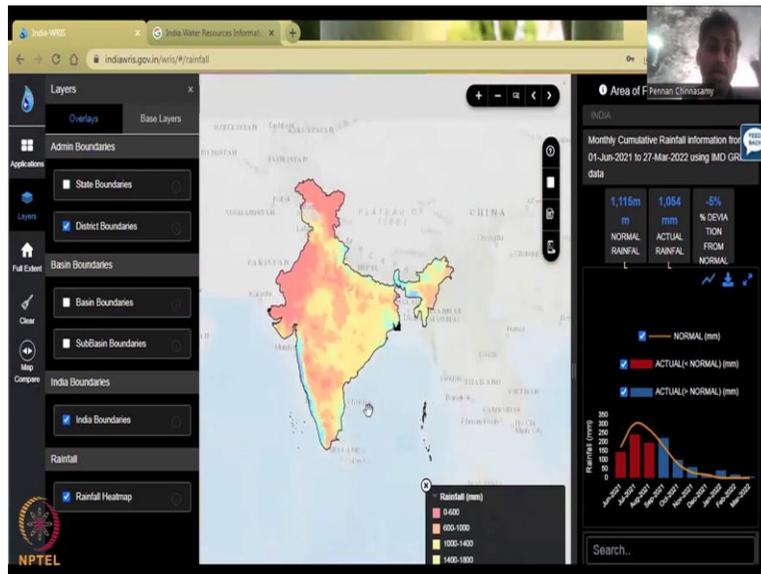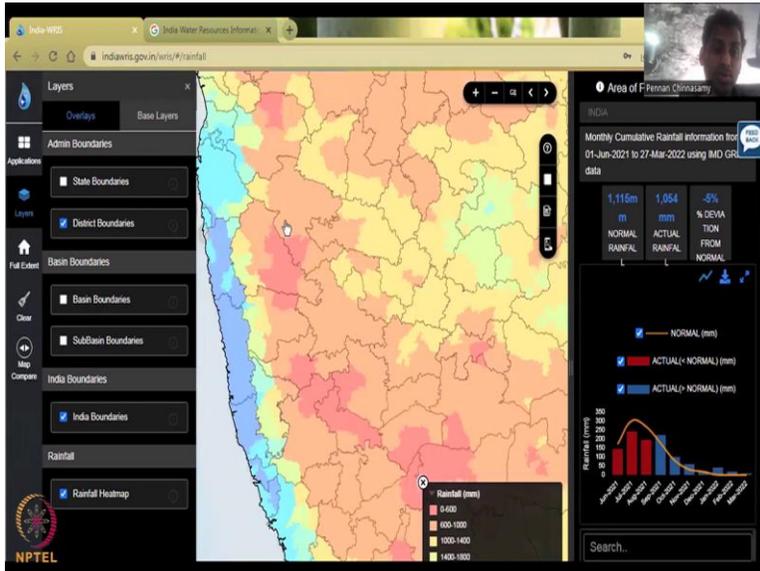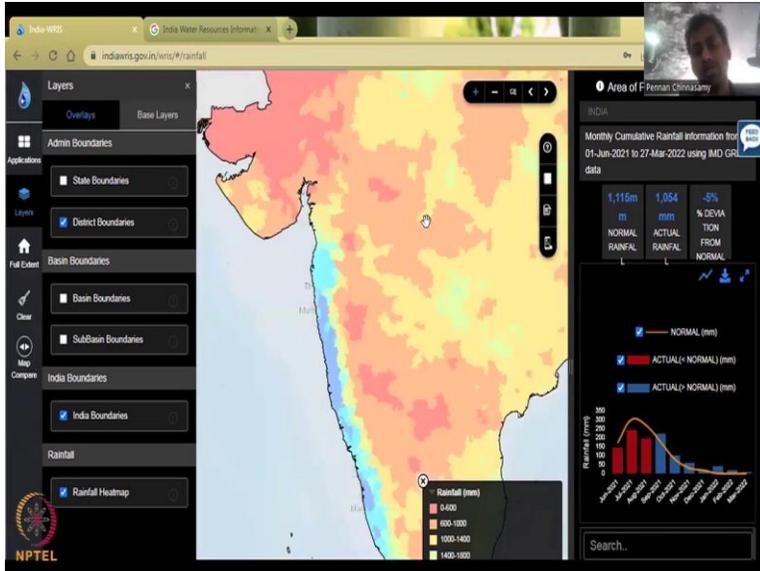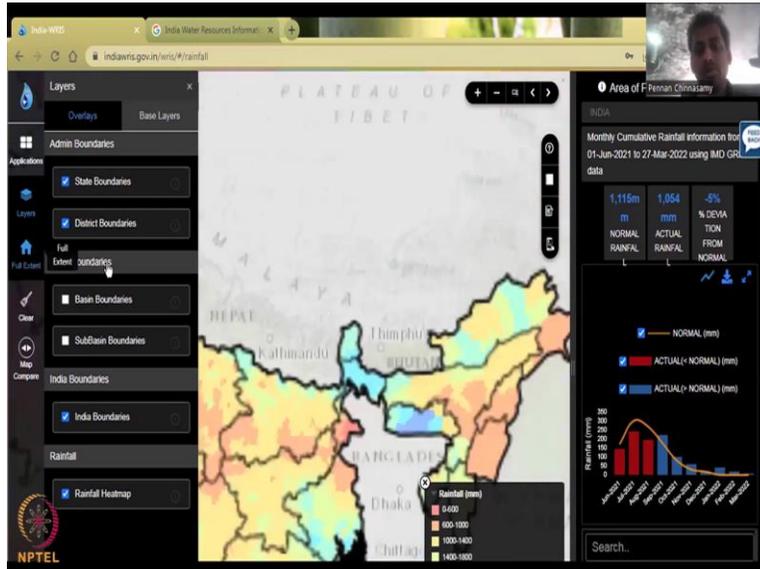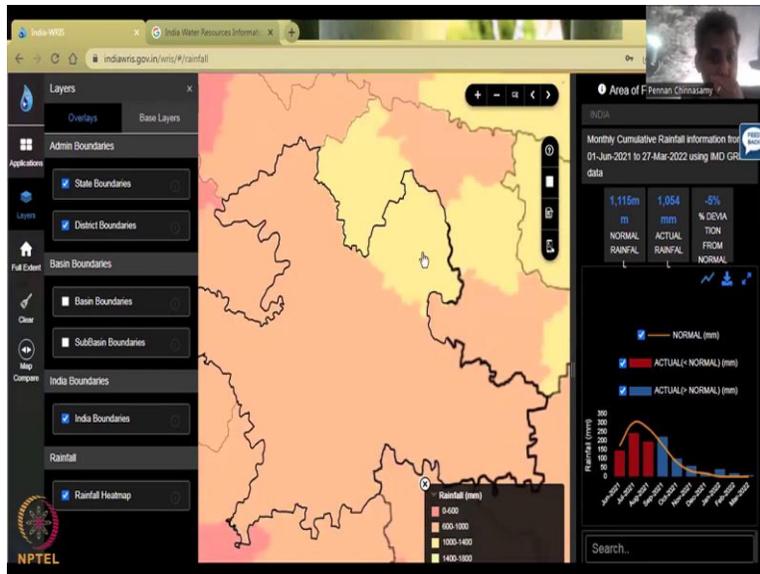
So, let me go back to overlays and then I click the heat map for rainfall only India has given. You could see the full India dataset is there including all the boundaries of India North and other regions. So, it is very important as an Indian citizen you should use the correct rainfall data from the Government of India and the boundaries are also given as per the Government of India.

So, this is, if you want to zoom in you can do use the plus sign you can go in. For example, I am going into the Maharashtra region. You can zoom out by clicking the minus sign. And this is to zoom into an area, when you click this, you can actually draw a box. See I am drawing a box here. And I want to go further. And so now you can see the district boundaries coming up. The state is still there, but slowly the district boundaries are coming up.

If you want to zoom in again, you can do like this, I am just drawing more boxes. And you can see that block level data is also shown. So, this is a block, this is one block, multiple blocks. I will show you how to extract the data once we gave a tour of this website. So, when you give full extend, see sometimes, somewhere you have gone in, and you do not know how to come out, you have to click zoom out, zoom out, zoom out again. But if you want the correct way to see it, you can just click full extent, it will take you to the Indian boundary, then you can clear your map selections, sometimes you have drawn a box, you have clicked on a data particular data, you can clear it.
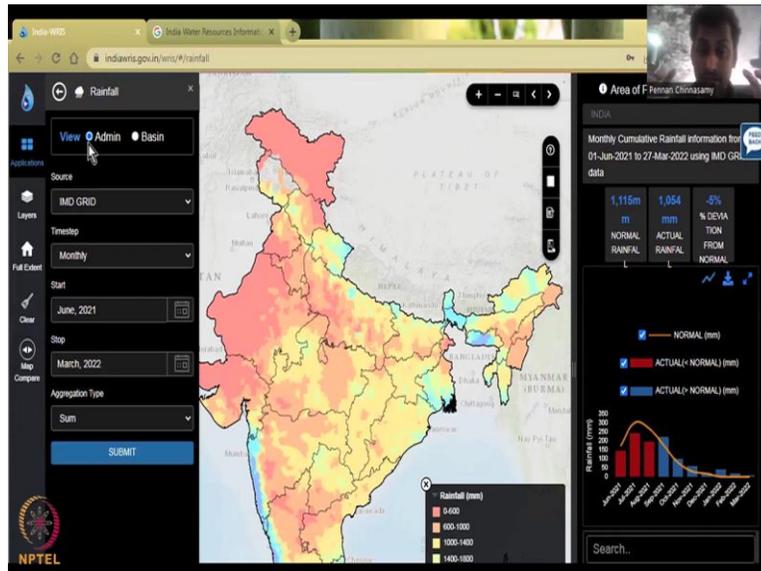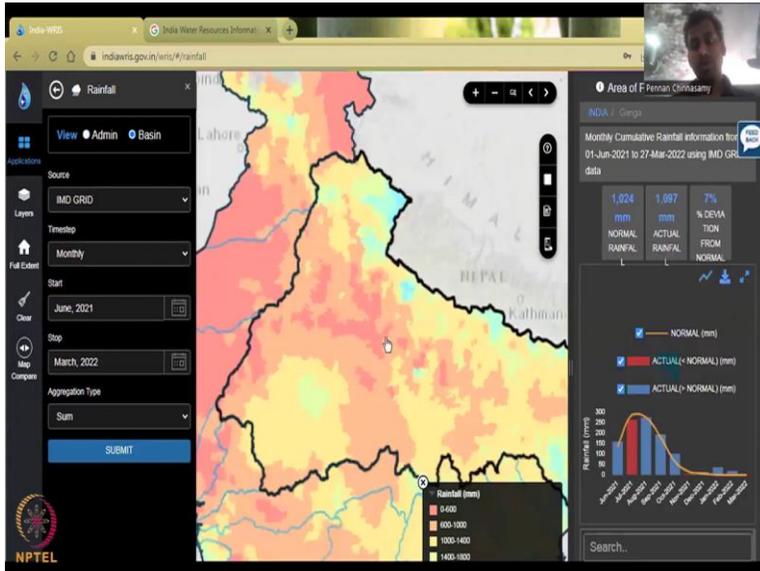
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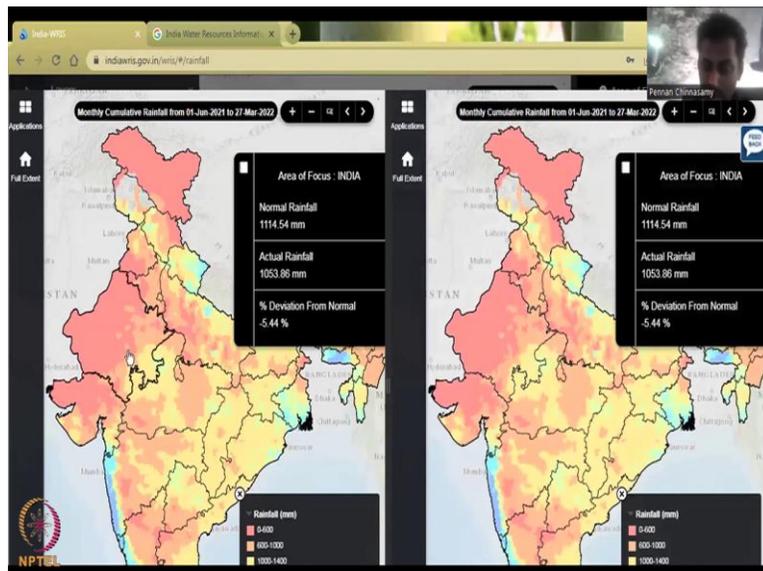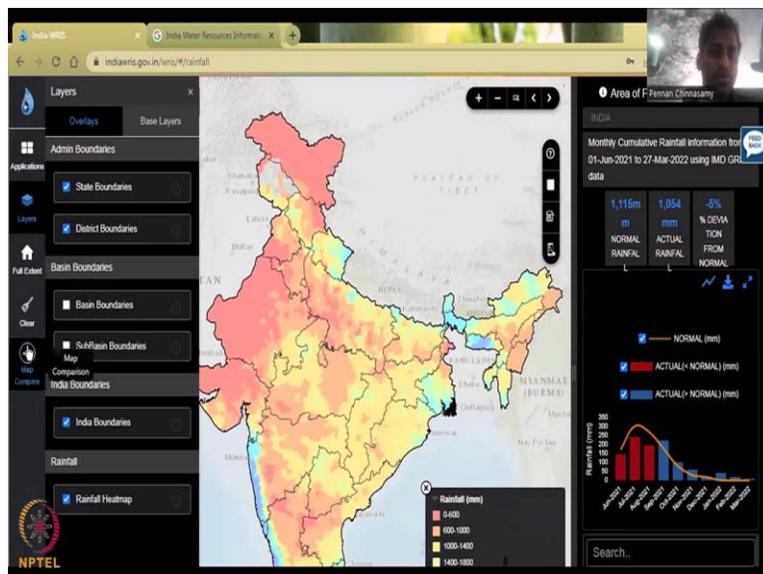
And then you can also do a map comparison between years. So, I will just click and show you for the sake of it. So, I have clicked map comparison and two maps are opening side by side and give it time because the rainfall data is populating, you can see the blue line moving it is the rainfall data populating. So, now what is the difference? It is the same.

You could see this as the same color, this as the same color, the date is the same data is the same. But the idea is you could change this date for a particular season. And you could run this slider to do the comparisons. How was it before how was it after. Normally you should be able to change it, but they are still working on this comparison. So, it does take some time.

Or you can see the full extent in both the images, normally should not be mirrored. So, this is the same as Sentinel and NASA data, how they have two windows on one side you can have 2022 data, on one side you can have 2021 data, and now you could do the comparison. So, these are the buttons that are available.

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And just because you may accidentally click it, I am just going to show you what else is there. You can cry could be application, so to bring back it. So, admin, admin layer is the boundaries, the small lines that you see, if suppose you do not want to see the admin boundary, you want the basin boundary, you can click the basin and admin will go off. And now all this would be at a Basin level. So, I am going to click one particular basin and it will populate.

So, now the India is still focused on India, you can see the rainfall data, but I am going to click on one basin. So, when I moved the finger on the Ganges, you can see that it turns like a pointer finger if you move the mouse and I just clicked on it now the Ganges is highlighted. How do I know it is the Ganges basin? Because here you have the India Ganges name India slash Ganga.

So, now if I zoom in further to the sub basin level, the sub basin name will come. So, now what is the rainfall in the Ganges it is 1025 millimeters. Is it same as the India data or lower? It is lower than the normal average of India, India is 1115 whereas this is 1025 this is the normal. The actual is 1097, so we are having better rainfall for the Ganges basin and there is a plus 7 percent deviation.

So, now the difference between the average and the actual rainfall is positive by 7 percent. And that is what is given here for your information. So, we have seen the Ganges basin and you could see where the data is coming from. So, where is the data coming from? Let me go back to admin boundary so that we have the whole of India and every state boundaries map. So, now the state boundaries are there. You can go back view, like click this button.

See if you, since I clicked this, the box tool is still there. If you want to remove the box to just click the box again. So, for example, I am zooming in I am drawing a box here. I am zooming into that part. It is like same as zooming in your PPTs and your other presentations. You want to go back to the original view, you can go like this or take full extent.

And if you want to bring back that tool out from this map the box tool, you can tick the box again now there is no box. So, now we are back at 1115 millimeters, look at the unit it is millimeters, the units are very important when you do these comparisons and data. So, please be careful about this.

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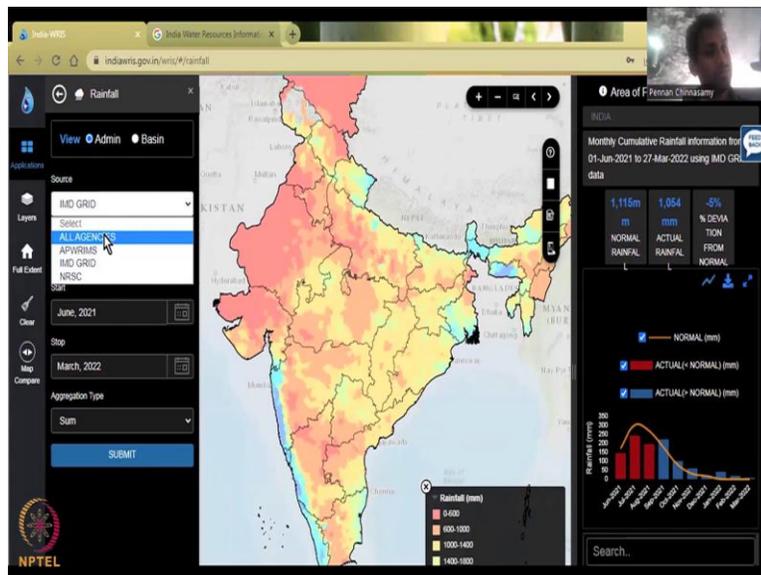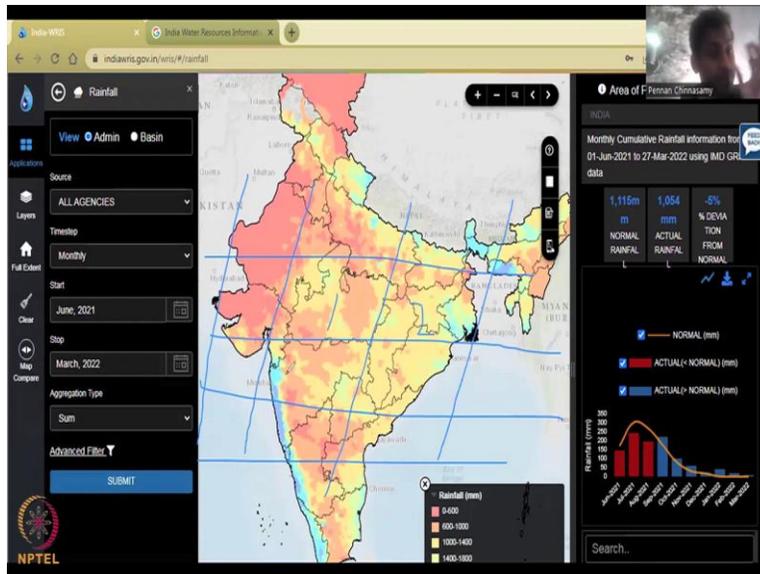
The second thing I would like to showcase today is the source. Do you want all the agencies? Which you can click, all and all the agencies data would be used for this map or you could just say IMD grids or NRSC. So, IMD is your Indian Meteorological Department grid. So, it is divided into grids the Indian region. For example, this is, it will be like horizontal and vertical lines. And then you have grids, equally spaced. So, this will grid 1, 2, it is very small, not this big. But just for drawing I have done it. So, this is what a grid is.

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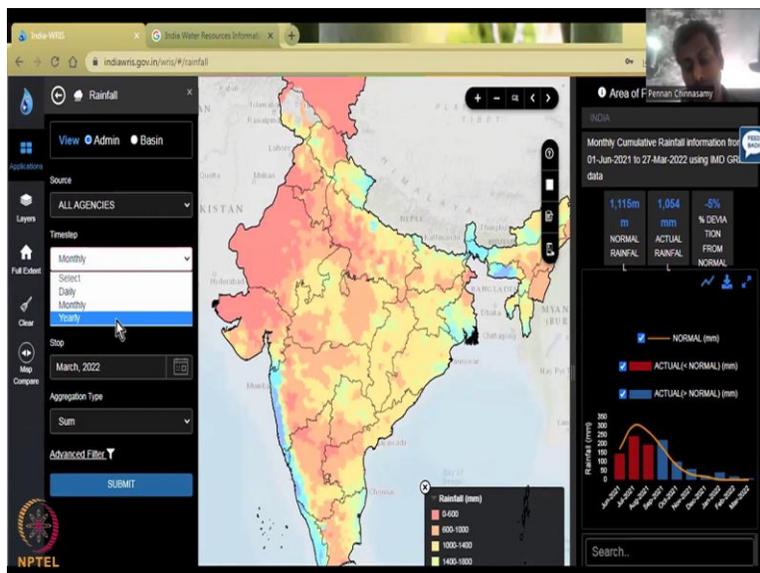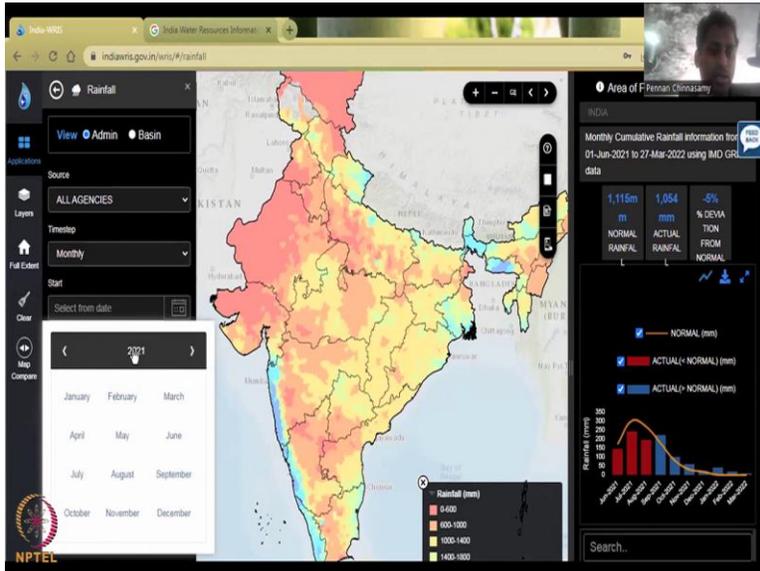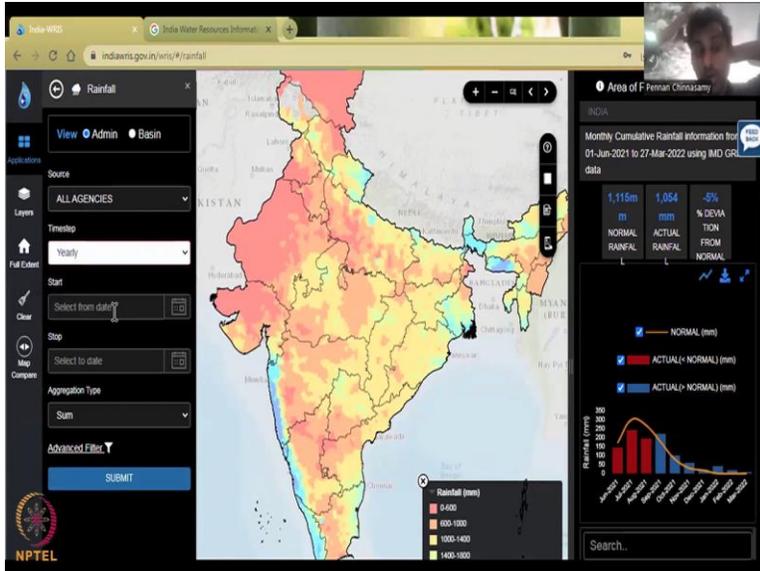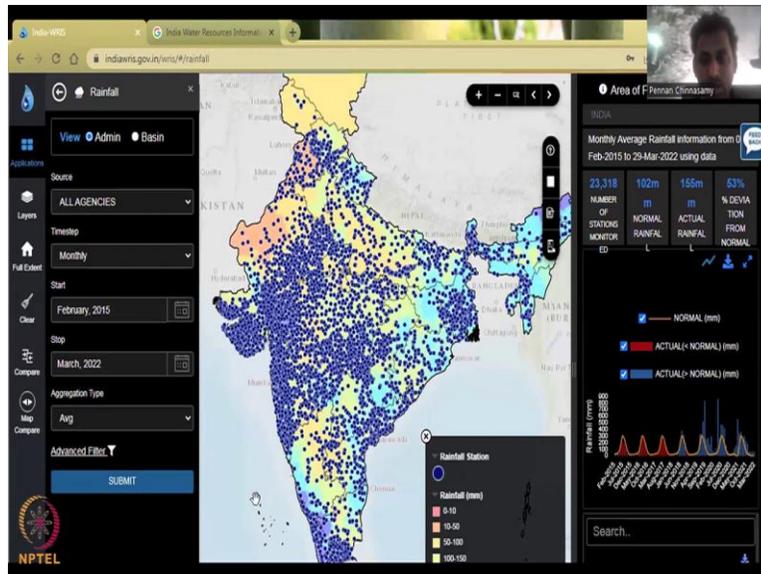
And then you have your timestamps, how often do you want the data, if you click on the timestamp is a daily, monthly or yearly, again you want yearly is just to say that I want to look at data for a particular region, you can swap between the timestamps. In the next class, I will actually show you how to look at data for a particular region. Let us, if you do daily, be careful, you need to have good internet and good space to store the data, because every day you are going to collect data.

So, I put monthly and you can put a selection of when to when that is what happens in the start date, area. And let us click one date. And then if you click it, it is this end date. So, for starting date, end date, and what method do you want, you want the sum, average or min, max, so let us see average. And then I will just pick a month and then click Submit. Now, the data is going to update and then you will see the data from 2015 to 2022.

But again, as I said I will explain each of these in the next class so that we can take one example of the data. If you see here the data has been populated and the rainfall has been given as a monthly data and an average, monthly average. And that is why you see the sinusoidal waves, the average is up down up down because it is a rainy season non-rainy season, alternating, alternating and coming.

And then you have for the whole country, the average monthly rainfall is 102 mm in the normal range. The actual for the last year has been 155 mm and it will be 3 percent positive deviation. So, that is why I said it is always better to do yearly. So, that you remove the noise, the

undulating is what we call noise, you can you can click on the date and the date is you do not see the month anymore, because it is going to be year.

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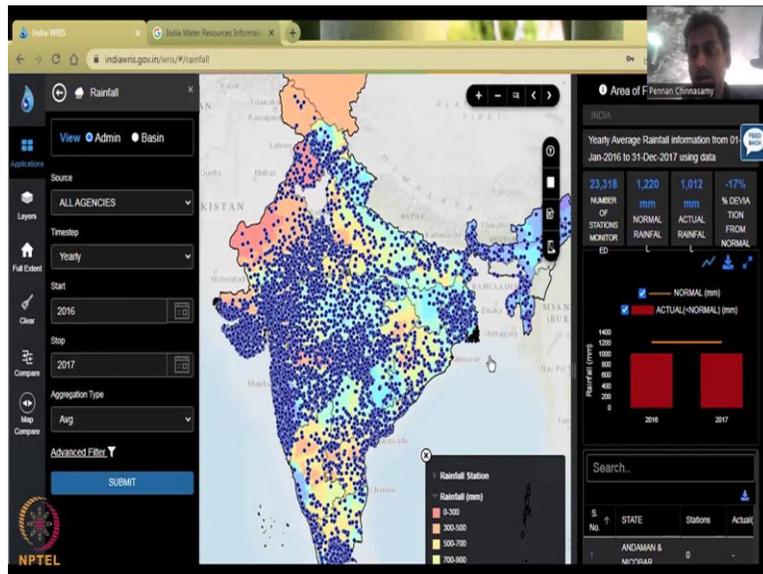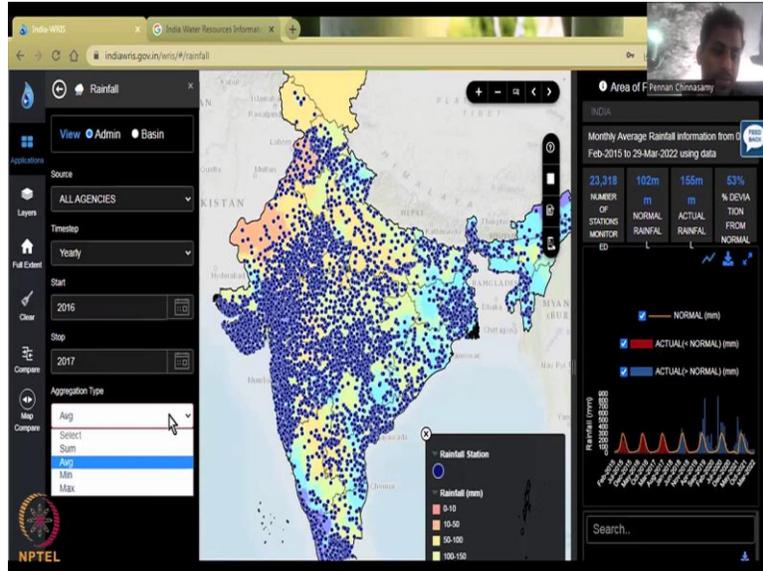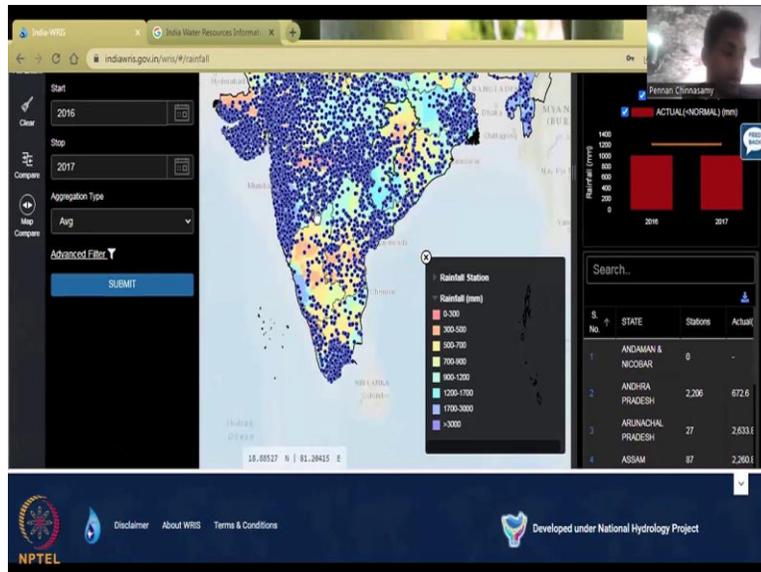
And you can say average or sum, you could say average. So, I am two yours and then you see the data that is populating. You can take off the rainfall data if you want. The stations where the data has been collected. So, all these are coming. And now once you have the data also if you come down you have the states, if you click the state, it goes to district and from District block and till this level. So, I will show this in the next class. Now for now, this class, I have showed you how to go to this website, which is the WRIS website. And also, to zoom in and zoom out use all these tools for your data on your water budget equations. With this I will see you in the next class. Thank you.