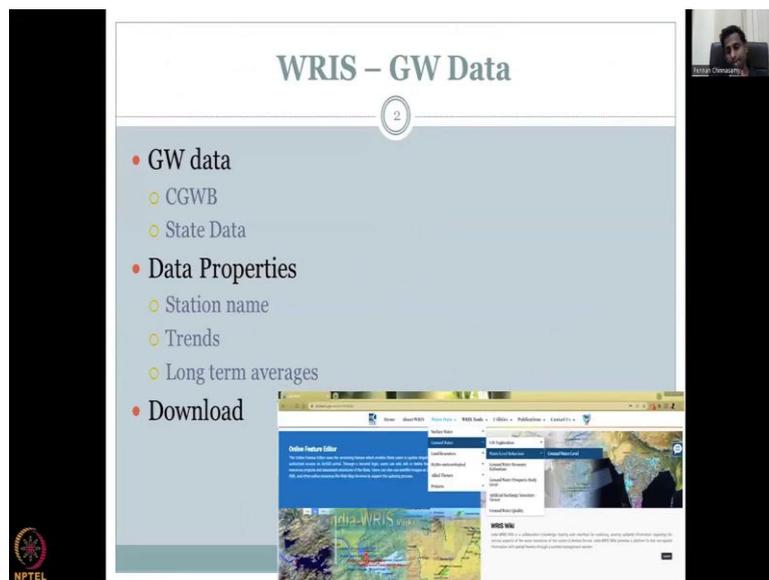


Groundwater Hydrology and Management
Professor Pennan Chinnasamy
Centre for Technology Alternatives for Rural Areas
Indian Institute of Technology Bombay
Week 10
Lecture 02
Groundwater data - Water level data

Hello everyone, welcome to NPTEL course on Groundwater Hydrology and Management. This is week 10 lecture 2, in the past weeks, we have been looking at the importance of groundwater and the important properties that help us to understand groundwater. We are coming to a close of this lecture, wherein we are looking at the resources to collect data and map data for your study areas. Since this course is focused on India, I will only be showing the data sources for India regions. I will also show 1 remote sensing data which is across the world you could use, but for now we are going to look at the observation data. In the past classes we looked at the little logs and the aquifer depth aquifer type data.

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Now, in today's lecture, I would like to take you to the groundwater data. This is one of the most important data for groundwater hydrology, water management resources etc. And it is one of the most dynamic data because the aquifer type, the width thickness, all these parameters lithology does not change the water storing in and pumping changes.

That is captured by this groundwater data. In India while there are some private players that could monitor data for their benefits, like for example, industry or a housing agency that wants to monitor most of the data is only monitored by the government agencies.

There are 2 government agencies 1 is the CGWB which we have extensively looked at in this lecture series CGWB stands for Central ground water board and they collect a lot of data almost 18,000 wells across India. We will look at that data in detail. Then we have the state data which is in different names.

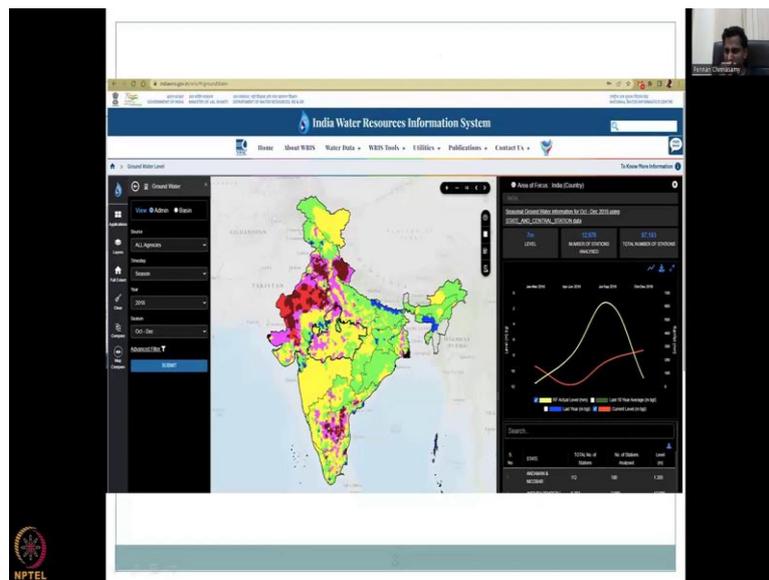
So, for example in Tamil Nadu is the PWD, Public Water Department of Public Works Department in West Bengal, it is SWID State Water Information Director or there are other ground water boards. We will look at some of them in data and why is it different from Central groundwater board etc. Most important details while looking at this data, please take note is station name.

Every single data point has a name and a location attached to it. So, the station name captures all this along with it. The station Lat-Long is given in the text, I will show you how to extract that image. Then quickly we can do a trend analysis, you do not have to download the data. Just looking at the data you can get some analysis, especially qualitatively, is it coming down? Is it going up? Is it stabilizing? How? There are long term averages given by the WRIS website to help you understand these trends.

For example, if I just have data, groundwater data, and it is coming down, is that good enough to understand for that state, the water level is coming down. No, if you have long term data, let us say 100years or 50years or 30years right now we have almost 30years data. You could see that how does your observation the lowering trend compared to the 30years if for example your lowering trend is still about the average of the 30years, then your, you have good groundwater and that is what we are going to see in some case studies today.

And then finally, I will show you how to download the data. And then keep it for working further using Excel, or other tabulated form. You can also use GIS and other tables, maps to look at the data.

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So, this is how it looks like, it has on one side, you have your layers and different options for the layers. You can also import your own data, which is kind of advanced and we do not want to spoil that right now, we will just look at most of the grounds, government data and the entire focus you can look at a nation, state, a district or a particular well.

So, you see how you can look at the entire groundwater for the whole country as 1 value you can zoom into a particular state, you can zoom into a particular district which has a lot of villages, and you can also zoom into block or the exact location of the well and look at these trends.

So, what you see here is this is the actual seasonal groundwater information for October 2018 using state and central ground water stations for India, area focuses India, so, you could see the area focuses India and it says for October 2018 using both the state and the groundwater board data, central groundwater board data, you could see that the RF actual level. So, actual level is above or below, so this is your current level, the orange is your current level, whereas your long term average level is given here. So, RF is your long term ground water average.

So, on a long term average it has been high, but for your actual current level, it is low and then you have the last 10years last year, you can also look at the last 10years of data or the last year data, so for example 2018, last 10 years would be 20 to 08. Or you could also look at the last year data which is 2017 data. So, let me take you to the website where you can also show how to download the data.

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India-WRIS

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Sabki
Sapka VIK
Sabka Vishwas
Sabka Prayas

Artificial Recharge Structure - Viewer

Ground Water Quality

Ground Water Prospects Study (2011)

Ground Water Resource Estimation

Water Level Behaviour

Ground Water Level

GW Exploration

75 Azadi Ka Amrit Mahotsav

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Live Telemetry

The stations established by the Centre measure important hydrological and meteorological data for water resources management and planning.

Water Level Behaviour

Ground Water Level

Ground Water Resource Estimation

Ground Water Prospects Study (2011)

Artificial Recharge Structure - Viewer

Ground Water Quality

View More

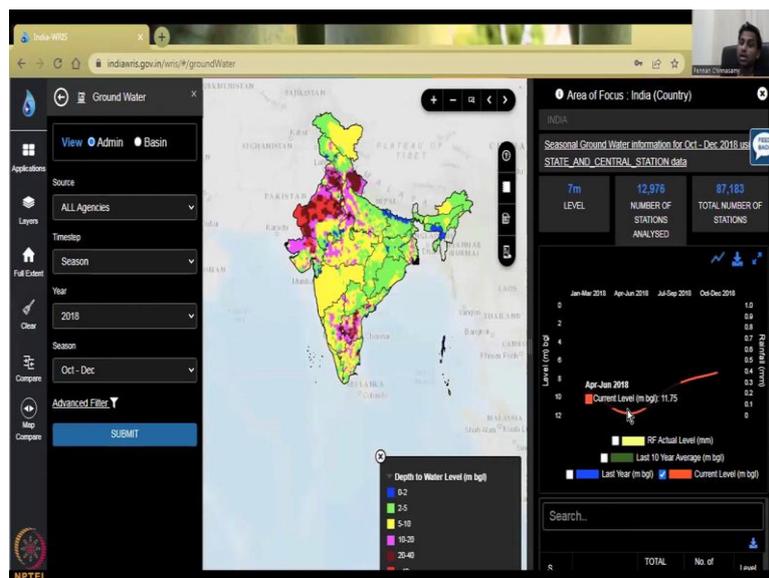
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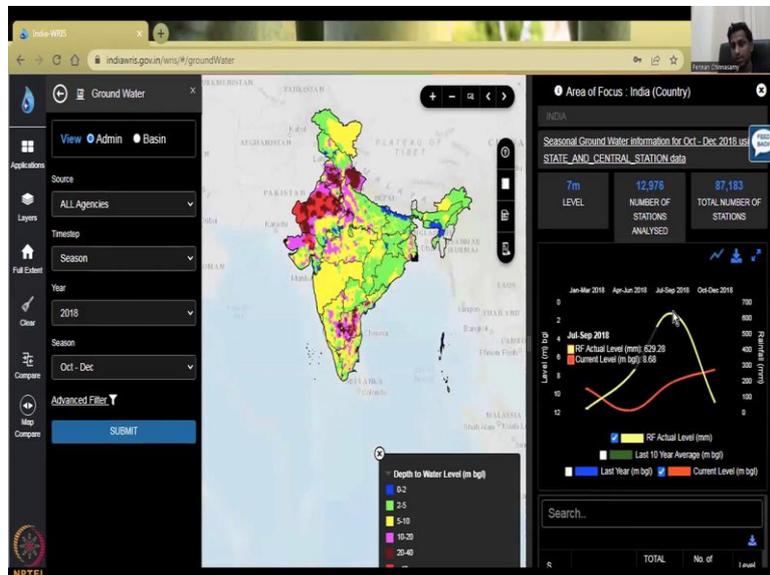
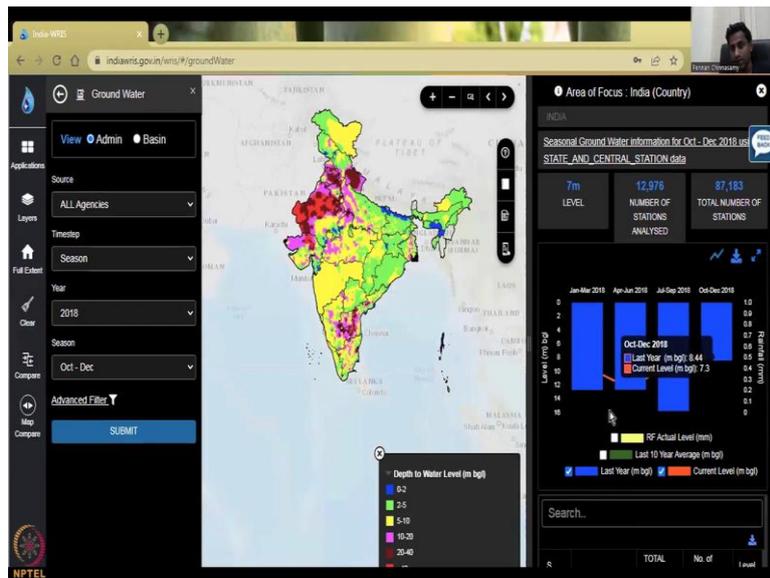
I am going to show you the website from the home screen, this screen the share, that screen. So, that is opening the website. Yeah, so I hope you could see the website which is showing the India WRIS. What you could see here is, some, where I am going to show you the access to the groundwater data.

So, go to the water data, come down and then go right in your mouse come down water level behavior. I have taken a screenshot of this and put it in the PowerPoint, please use it then go to groundwater level. Do not click anywhere. If you click it might take you stop somewhere or go back, you lose it.

So, just slowly come down. Just then move it to the right. Move it to the bottom to water level moving to the, see I lost, see. So, you have to go very slowly, just on that water level and ground water. I clicked groundwater, and then this page comes up.

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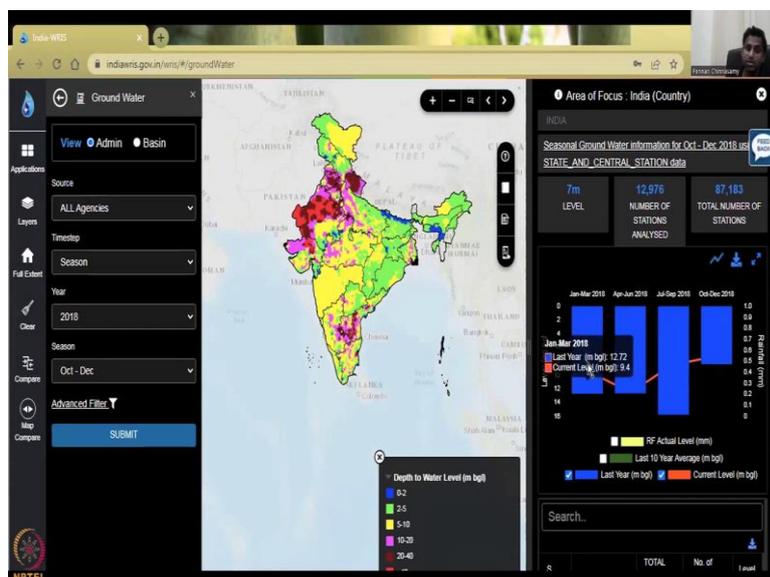
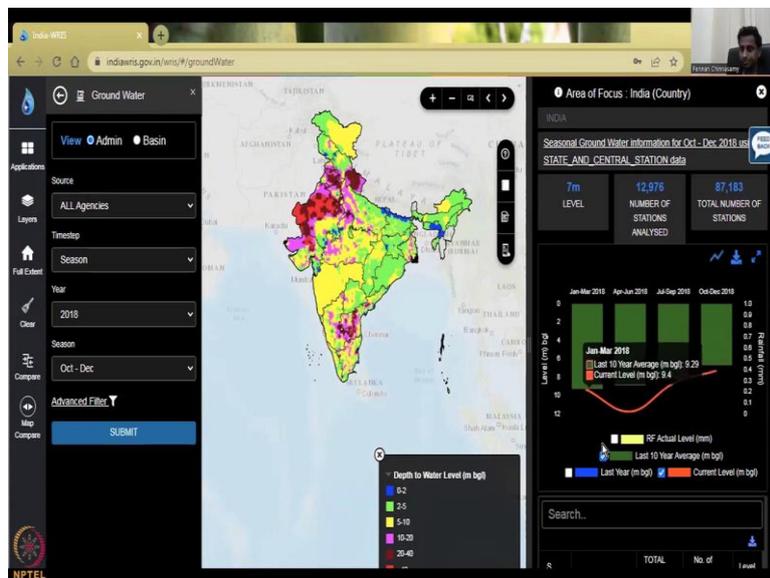
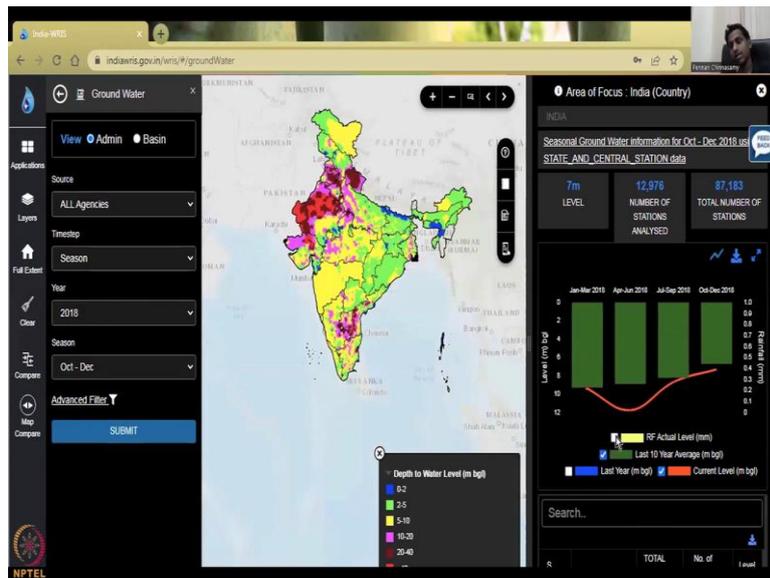




You have to wait for a couple of seconds I am showing it live so that, you do not worry that oh, wait sir showed, I see the India map but why is it not coming from me. See now the India map has come, it does take time. So, all these lags are going to be captured in the video for the lecture. Because I want you to understand that it does take time.

So, do not worry about, it is the internet and connectivity issues are also there, so when it comes straight this image comes where you have the focus areas as India and you have I will just go through each and every step for you. So, the whole of India is there and you have the let us take this out and then say the current level the current level is 11.75 and the last 10 years is, this is the last 10years rainfall, so the RF is your rainfall level so you have good rainfall coming in July-September, but we are just going to look at the last 10years of groundwater.

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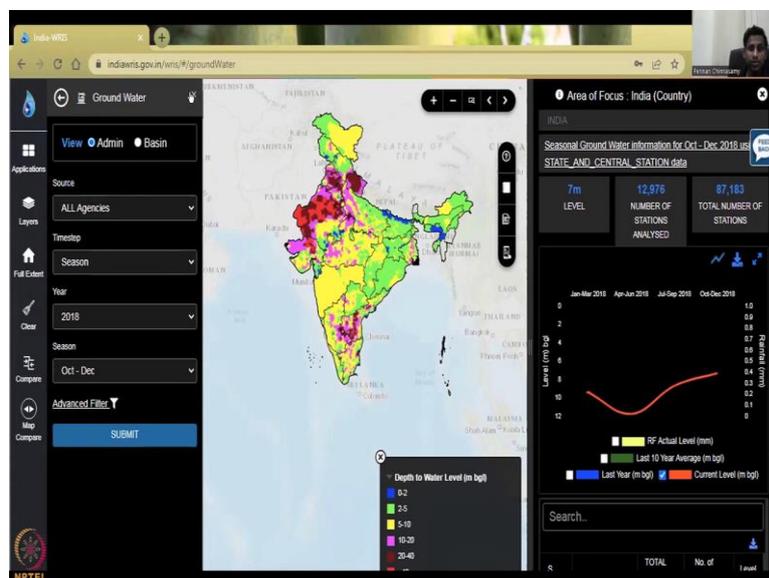


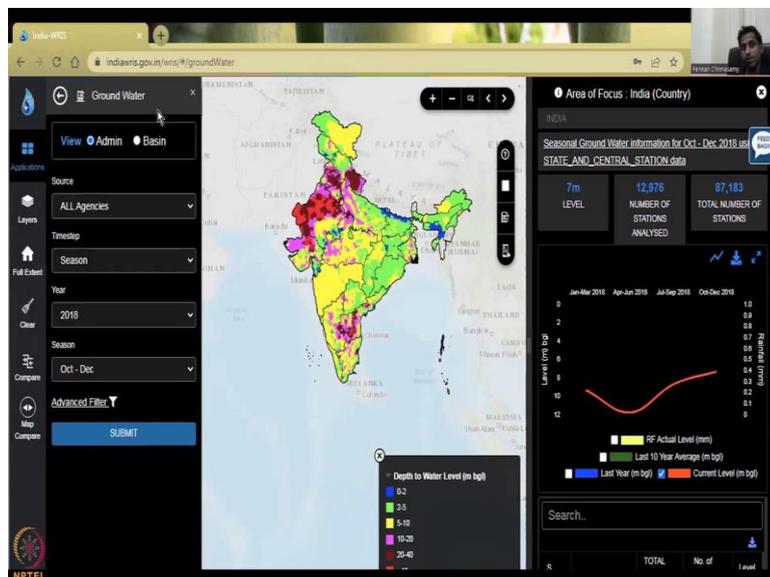
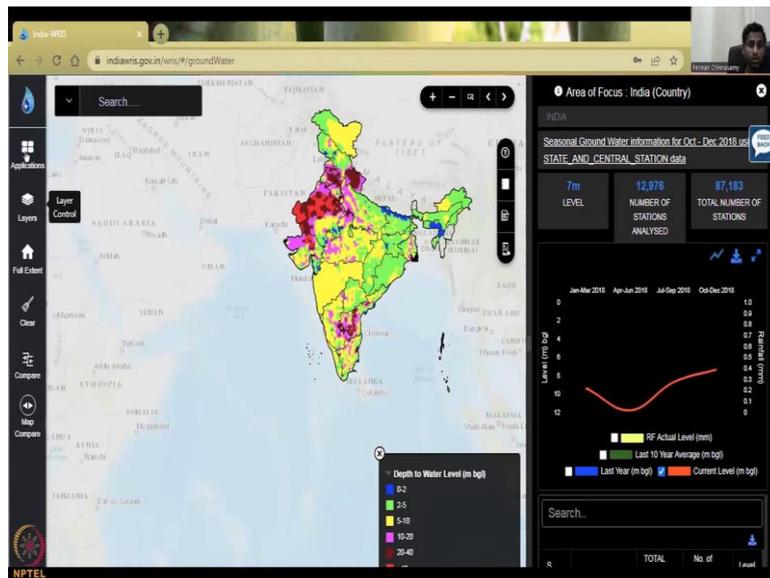
So, you could see that, somewhere it still there 2018 is okay, because it is touching these lines and but still somewhere it is going below. So, this is going below groundwater level, overall it is below the groundwater level. So, 2018 was a rough year for groundwater we can say because it has gone below the green line, the green line is the 10year average let me take it out and then show you this and this is last year just 2017, even 2017 the groundwater level was even lower.

So, you can see it is coming down below the current level. So, 2018 is not as bad as 2017 but over the 10years, it is bad. So, maybe 2017 was bad and it has pulled down the water level or something like that. So, this is the trend of groundwater level going from the ground, how much deep you have to go, to get the water level then you could see that it is on average for whole of India, 9 meters etc.

Is this a good number to think about? No, because what is the point of taking whole India 1 level, it is just for informative purpose, but when you want to conserve water, work on water, you need to go to every particular location.

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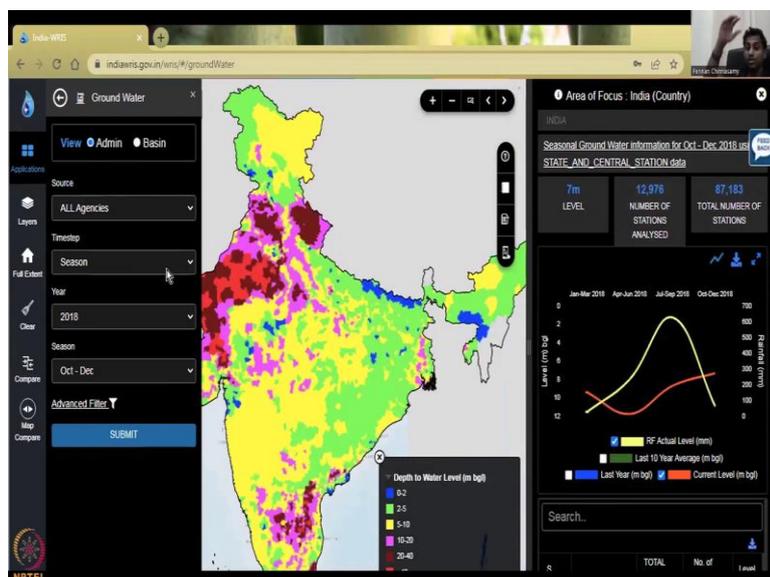
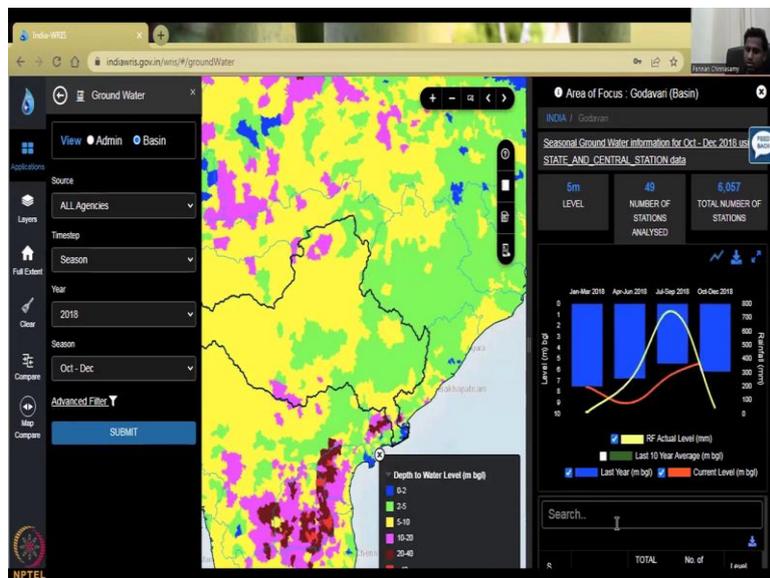
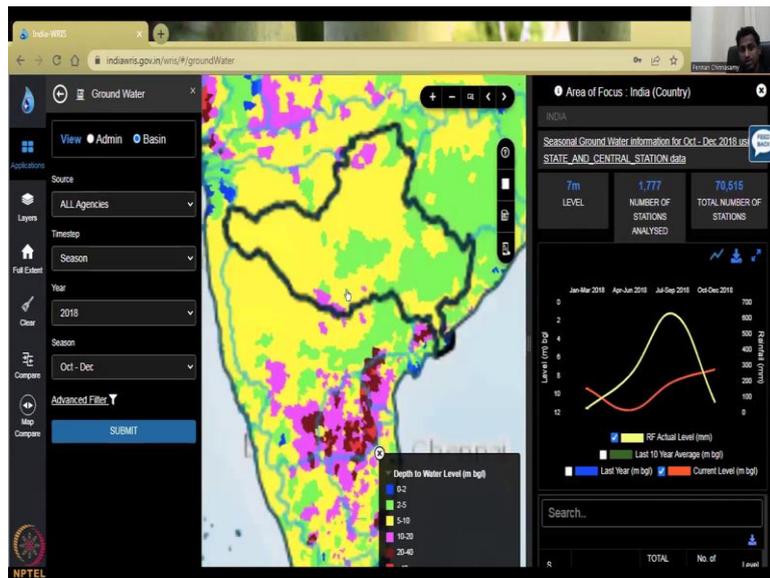




So, let us start when you come here sometimes if this does not show or it is not coming, do not worry, for example, I am going to close it, see oh, I do not know what where it went, do not worry go to applications.

It will come up even if you close this arrow mark because you did not know what to press all these other things would come rainfall, reservoirs, river points, evapotranspiration, all these we saw as part of your water budget, but we want our ground water. So, we just keep groundwater. Let groundwater come, Yeah.

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The first bifurcation of this data is, do you want it as admin boundary which is administrative boundary or basin boundary, administrative boundary means your states or districts those kinds of things, where administration is occurring or basin is a watershed basin, do you want it as a for example, the Ganges, the Brahmaputra, the Indus, the Kaveri basin like that.

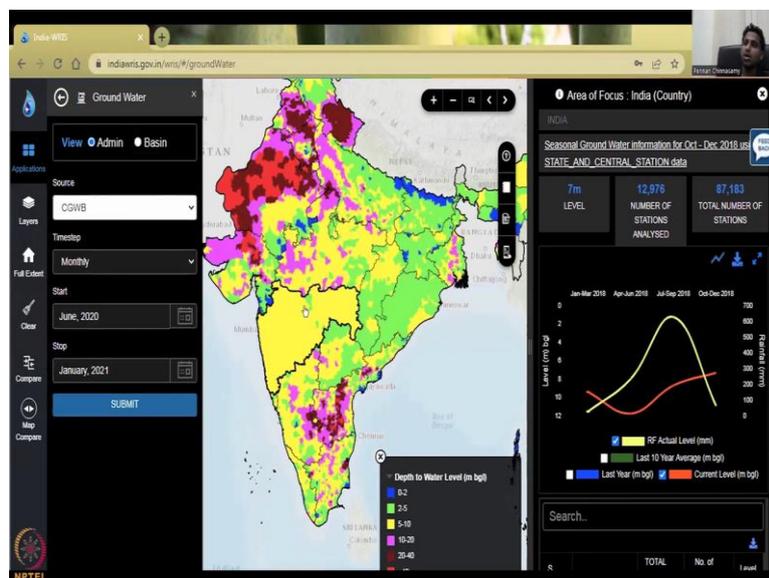
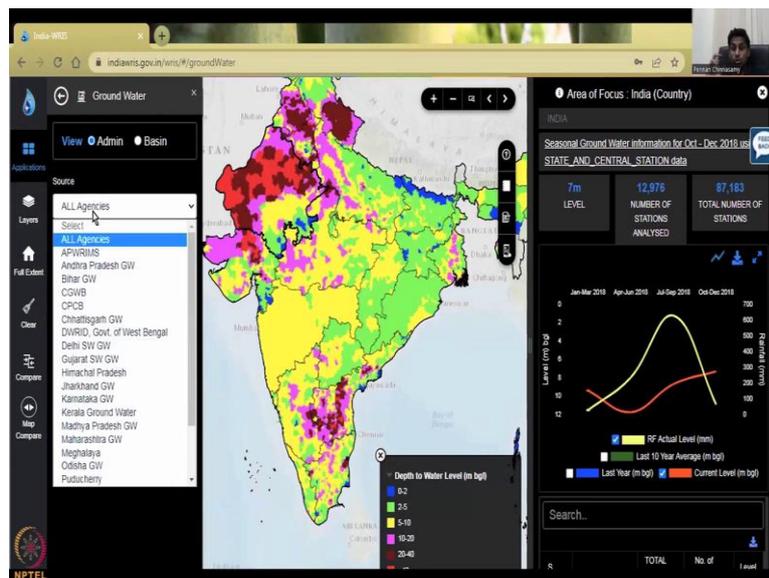
So, if you see slowly the black lines will come. And that is your blue lines is your boundaries. And the black line is when you select 1 boundary you have to be slowly working on this because of the internet speed and the data transfer from the server. It will be taking some time. So, you will see this I have clicked I am going to click on this and suddenly this will change to Godavari, because Godavari is the basin I selected just randomly and you have the same 10year average and everything change now look at the numbers it has changed.

So, for the last 10 years, still your groundwater level is okay. And then you can see all the other data, let us not get into the full data now, let us first look at the left hand side how do you communicate between. So, I am going to go back to the admin, there is a reason why I go back to the admin because you have the different central and state agencies and that comes at a level.

The other thing I wanted to show you is the coloring, what does the coloring indicate, if it is 0 to 2 meters below the ground, the access of water is there it is good, it is blue color. But if it is continually decreasing, like 2.5, 2 to 5 meters, 5 to 10, then the color change to red, the color is picked very smartly, because red means danger.

So, right now, you know, where the dangerous locations are for groundwater, it is along these regions where excessive pumping happens for agriculture purposes. And some domestic use industrial use is also there. But mostly it is the agriculture because agriculture uses lot of groundwater.

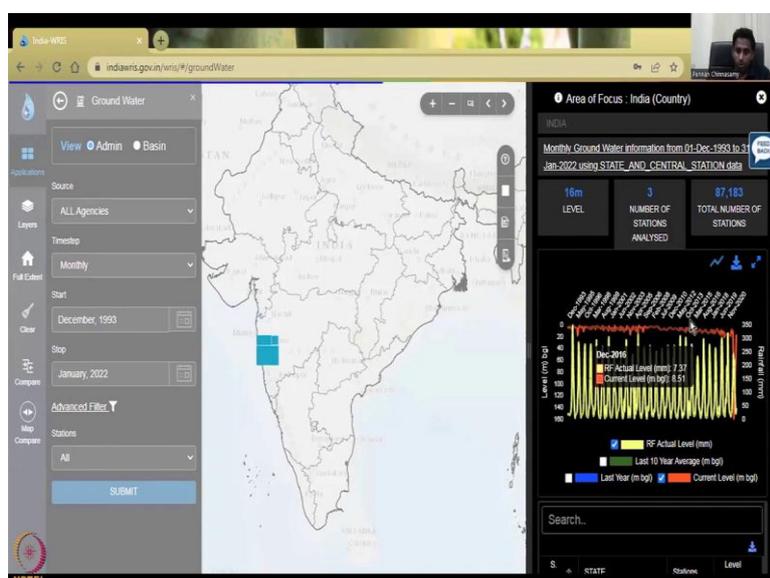
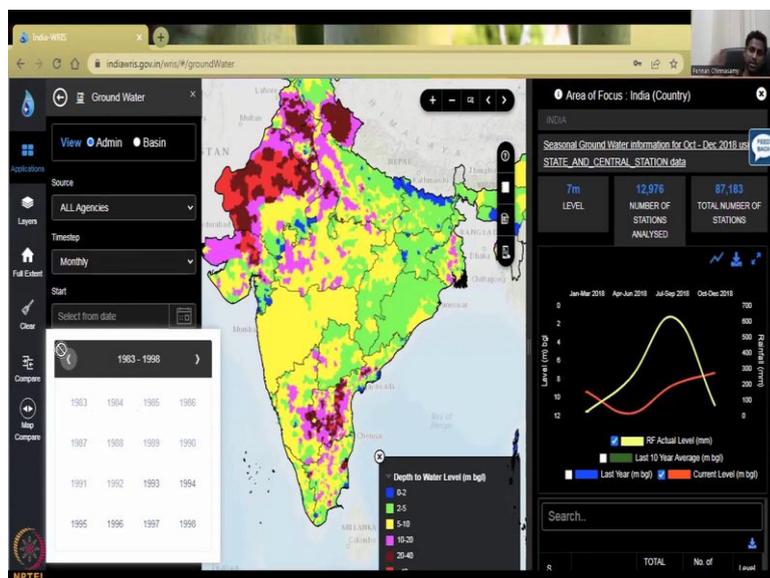
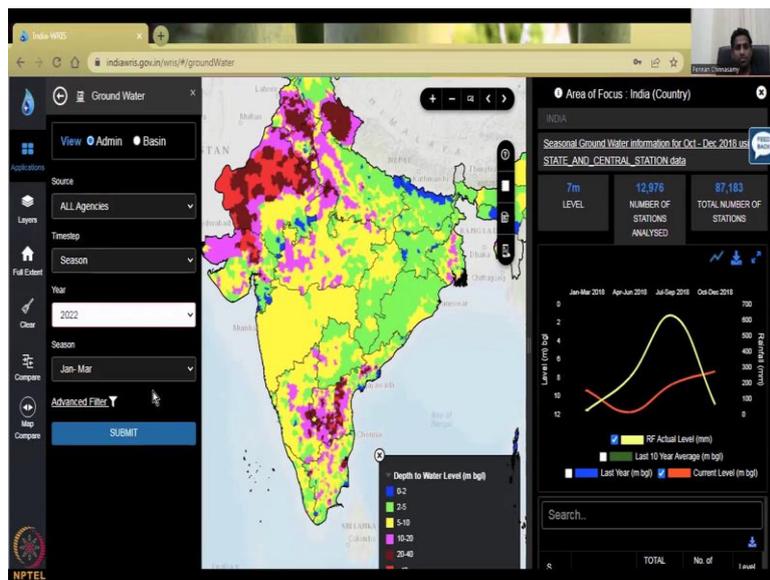
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Then you have agencies the source of data. As I said, each 1 state government will have its own names a DWRID, that rate of water resources, inventory direct, something like that. They will have different different names in different different states, I am for sure now Tamil Nadu will be PWD. And surface water groundwater is also their agency, Delhi, surface water, groundwater, all these agencies are there.

Then you have your CGWB, CGWB is across India, whereas these are only at particular state levels. So, if you say all agencies, all the data will come. So, let us say CGWB. So, now slightly, the color changes. But again, as I said, for the whole of India, CGWB has the most amount of data. So, the good data will be coming. Then, I am just going to put it back to all agencies.

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So, all data will be there, then do you want it at what different level, timestamp, time step timestamp or temporal resolution? So, we say monthly? Do we have monthly data? Do we have daily, yearly or season, mostly we have seasonal data, we do not have for groundwater. daily data, it is too expensive. Even monthly is not collected, CGWB collects 4 times a year. So, it is mostly seasonal.

So, you can say seasonal, and which year you want, you can give a year. So, let us say monthly, if you see monthly, then there will be gaps. But still, you can pick a date, only say monthly, you can pick a date. And let us say you click this calendar, you can see this calendar start date, click the calendar, click the year, then the different years will come then click again this arrow, let us see how far we can go.

And see there is a stop sign comes, which means it tells do not go you cannot go further. This is the last. So, 1993 is the first data point. If you go here, there is no data it does not, so turn into a finger. So, here it turns into a finger which means 1993 the data started. And which month did it start, December.

So, December, I am going to click and stop. I will say let us say 2022 Jan, they have data for March, April, they do not let us say Jan, December 1993 to Jan 2022, I have put in the request and I am going to see advanced filter all stations or not. Yes, all stations or CGWB will be asking manual, telemetry etc. So, what is the difference manual is when people put in the meter and take the data.

The telemetry is a automated system where it collects data by itself and release the data to the government agencies, it is a kind of telemetry or through remote sensing, it sends the data to the end user, which is the government agency.

There is a modem or a Sim card, which is transmitting this data to the central server. I am going to say all, submit. So, hit submit, you will find this block going up and down, up and down, up and down. Basically the coloring takes time but your data has already populated you can see all the data has already populated.

The rainfall also comes in but you can remove the rainfall because right now, I am just going to see the ground water. See the coloring has finished. And there are some errors. This is a clear error which goes down very fast. It cannot jump from 0 to minus 160. So, 160 meters down, it cannot go. So, that is an error. So, those who, in class, I have taught that what are the groundwater data errors that you can get? This is 1 clear error.

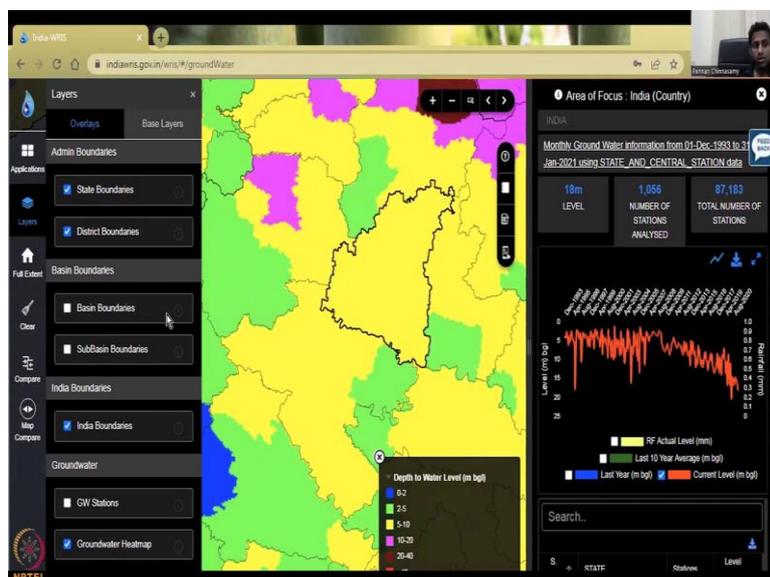
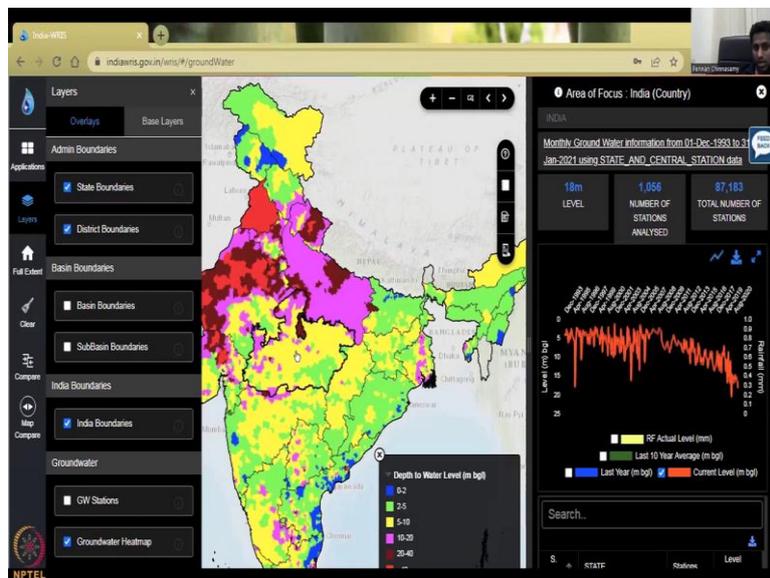
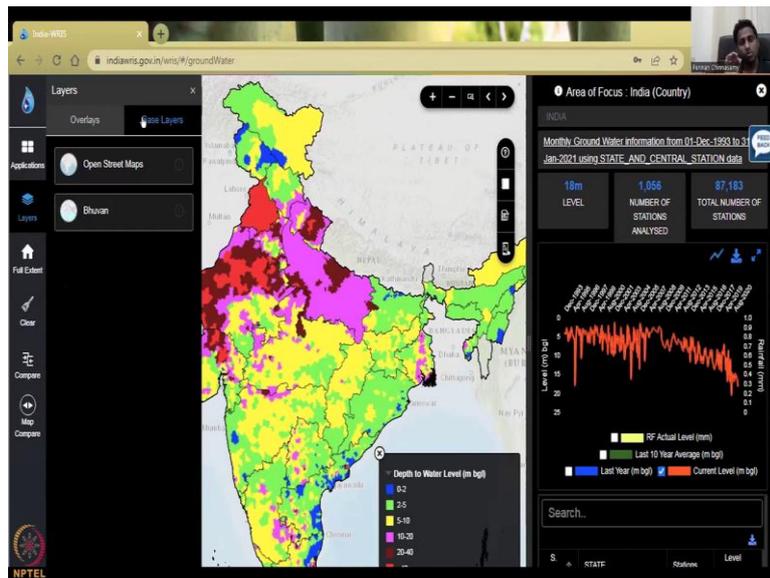
Maybe I am showing, but let us say, I want to see which month it is, it is August 2021. So, let us remove that. Which means I have to go before August 2021. I am going to go Jan 2021. Submit. Now you could see a better resolution thing, you can see how beautifully the groundwater level is declining, right? It goes up and down, up and down, up and down, and then goes down. Why does it go up and down, because in the summer, you pump, So, groundwater goes down, and then after summer, you have rainfall, the motor goes up, down, up, down.

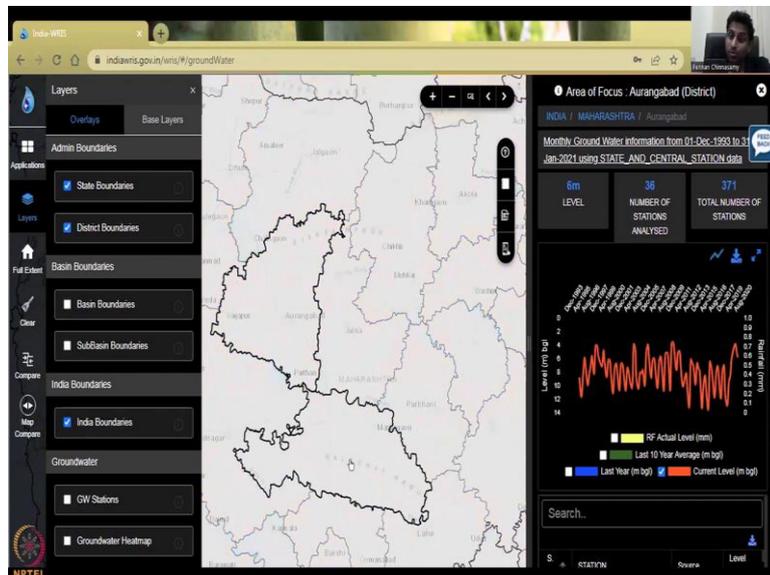
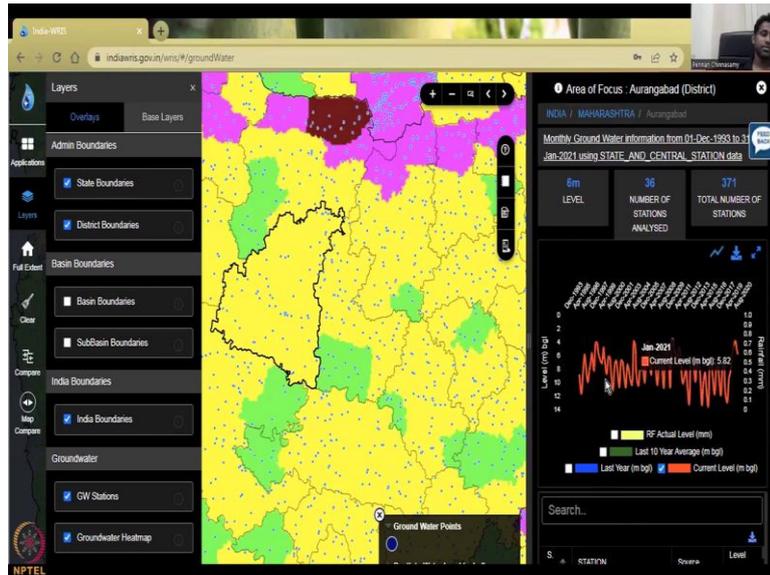
So, this up down motion, if it is just up down motion, you see in groundwater, if it is coming in the same average, then it is fine, but if the average is coming like this, then you are facing groundwater depletion, for example, up, down, up, down, so the average was around here, which is okay, but after 2007, you could see that it is going down, this is the concern for groundwater, because you are actually using more than the water which is recharging.

So, I would, I showed you how to pick all agencies, whole of India, we are looking at, for all of India this is the trend. And I have told you how to select the timestamp which is monthly. And also where to start, how to start the timestamp, which month etc. Do not do daily, daily there is no data, then you have to pick a date, which is actually extra work.

But if you do monthly at least you will capture some seasonal because seasonal means for example August is the June, July, August is your peak month of rainfall, they want to collect data August month, but suddenly, August, if they did not collect data, because too much flood they collected in September, then what happens is you miss the data point. So, that is why I am saying use monthly, monthly is fine you can collect all the data.

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Similarly, to the previous lecture, I am going to show you the different layers that exist, when you click the layers, the base layers will come, there is 2 base layers, the Bhuvan or the Open Street Maps. Depending on your internet, the slowest and the most stable one would have already been selected.

So, here, it is already selected Open Street Maps and I am fine with it. If you zoom in, for example, I do not know this area, if you zoom in, sometimes you will see the background telling the name the label, that for that you can use it, then you want the boundaries which boundaries you want, do you want the let us go to Maharashtra their state and district boundaries. If you unclick this, then your district boundaries are coming.

If you click this, then the state boundaries are also there. You want the basin, sub basin boundaries is you can put it in or take it out the India boundary for sure. And the groundwater

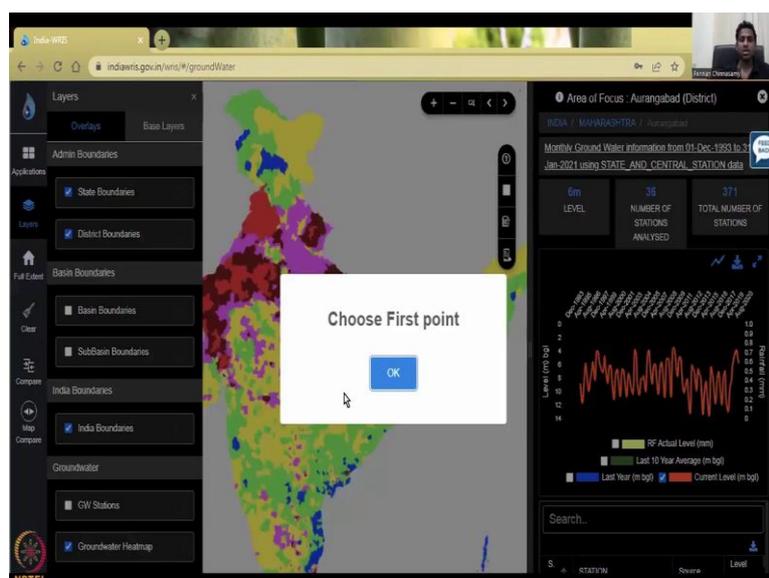
stations. So, if you click this, the location of the groundwater station comes. So, beautifully you could see like for example, this, if you click it this name will come here it is Aurangabad in Maharashtra.

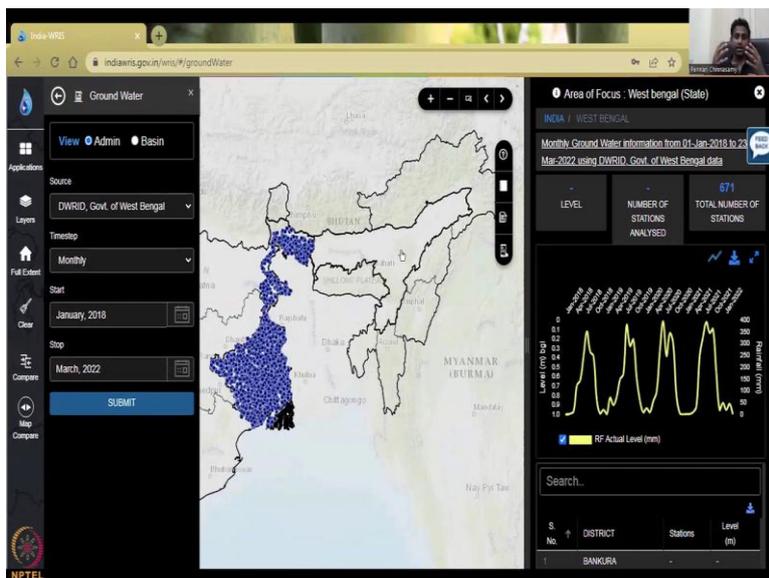
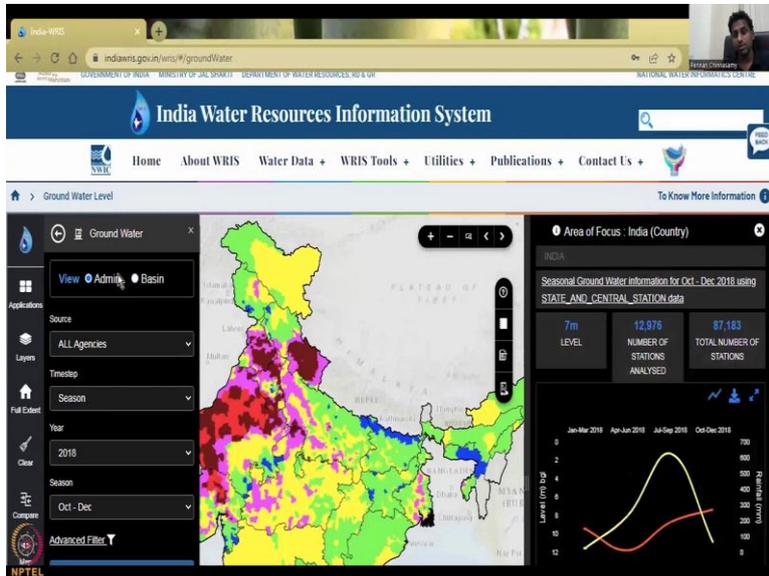
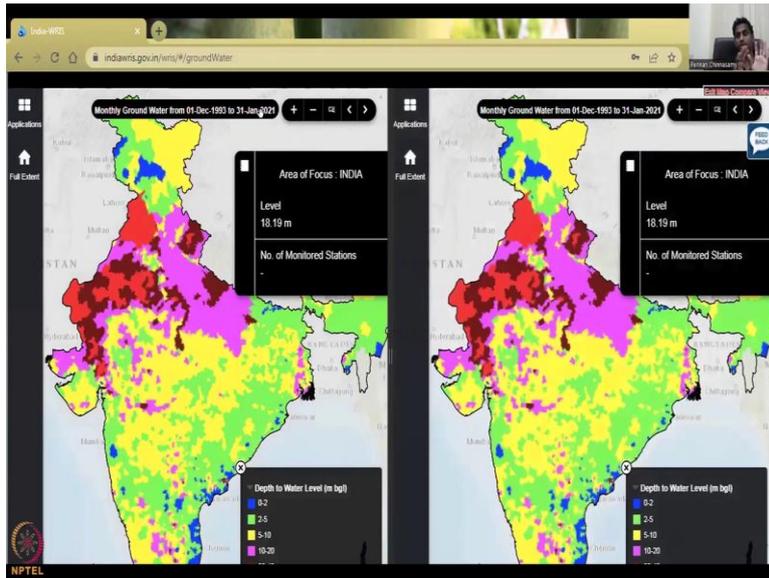
And you could see the table also populates. Again, I am going to take up the rainfall RF, and you can see the drought is stable, this is more stable, it fluctuates up and down. But the net average is almost the same, slight decrease, but that is fine, but again, if you add all these layers into your visualization of the map, depending on your computer speed and your computer internet, you will find lag so, I am going to take it out.

And this is the groundwater heat map which is the color which is coming. So, if I remove the color, you could see that the names of the different districts are coming Aurangabad, Jalgaon, etc. So, we do need the groundwater heat map let us keep it but that is the one which takes a lot of time.

You can even if your computer is very slow, you could go to your layers come down, take out the groundwater heat map and this data will still be very quick this data is very quick because it is just a number you give from to, it will populate the data and give it to you. Then you have the full extent if you want a full India coming and one button you can click it clear compare etc.

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So, the compare is just between two data points if you want to compare the stations, you have to select 1 station 2 station and then do. So, right now, we are not going to do that because all these tools you could play and take a comparison. I want to show this map comparison where you can pick two different years, it does take time, depending on your internet, but I am going to just show you for India, this is 1993 to 2021, all the 20years data is coming.

So, what is this used for? This is the information that comes on your groundwater books, what does it show, it shows you 2 distinct time periods, 1993, 2001, 2021, something like that. And you will find the differences just by visualization here, right now, it will be the same because both the time periods are the same, you could actually change the month here, or you could change the data. And then you could use this as a slider to show which one you want to compare between the time periods.

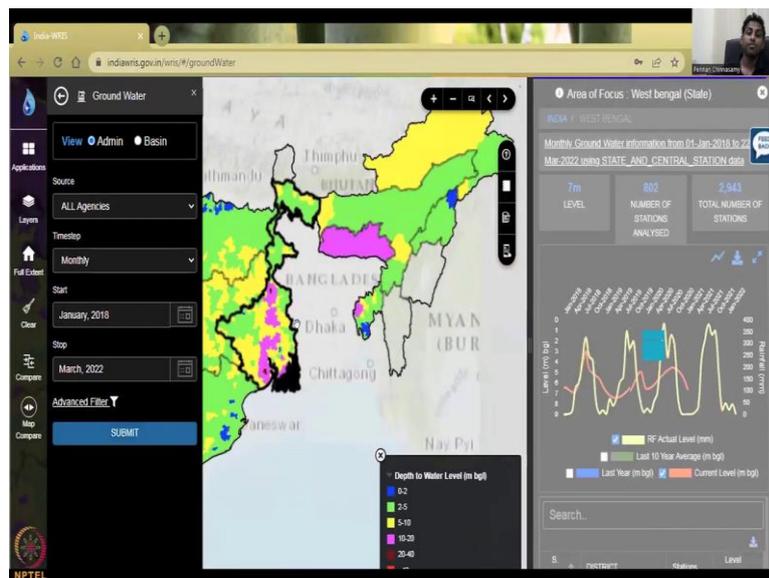
So, I want to go to the full extent again, just 1 extent back. And I would like to show you one state that I am going to take. Sometimes if it does not let you do it just go back groundwater. It is not letting me go to the previous view, it is fine, I am just going to click the groundwater, it will take me to initial water level data. So, because of so much data in this website, it might get, you know, sometimes struck.

So, you are and do not worry, your work is not stuck inside. Anyway, you need to download the data. That is why they let you visualize the data. And from the visualization, you can take the data. So, here it is. I have refreshed it, it has gone, the full data page has come. Now, I am just going to select 1 agency.

So, PC CPCB is the central pollution control board that is also monitoring groundwater to understand the pollution, not the quantity alone, but the pollution. So, that is why you see your CPCB here. So, now let us say that I want to see the West Bengal. So, automatically, it should focus on West Bengal, but it does not, you could still use these date ranges.

So, I am going to say let us say 5years data. So, now when I say submit it brings it so these are their stations by DWRID, so DWRID stations have populated and the trend for the full West Bengal has populated, in the next class I will show you how to pinpoint one data and download the data understand the data and also most importantly get the important location specific information from the data. I will see you in the next class.

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But just one more information I would like to give you is read about these agencies. So, this small short forms are given it might be different what I have said also because it depends on where the agency is kept, but all agency is better for let us say all agency and then I am going to select all the agency is here and you will see all the data combined for India and I am going to just do West Bengal. So, West Bengal state you can see this map if it is getting slow remove the heat map only take the graph data which is enough. I had to move my video because to show the readings, So, do not worry about it. You can also close this legend etc.

So, next week when next class, when we come, we will go back to this West Bengal location and we will pick some stations and look at how to understand the data, what are the key statistics are given in the data and we will look at it for now, we will just say the average is 7 meters 800 stations are monitored 2943 total number of stations are there, for this data 800 are monitored and analyzed, but total is around 3000 stations. So, there is some gap some issues, we will come back and understanding about this in the next class. Thank you