Geographic Information Systems
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Module No. #03
Lecture No. #14
Representing the Real World in Surface Models (continued)

Hello namaste I am back here with the lecture for where we would be understanding how do we represent a real word in terms of surface model, I was speaking about different surface model that are exist and will look at what are different types of surface model and how will we are actually define this. So, there are various ways, various definitions of the surface model we look at each of the surface model in this particular lecture

Why this is extremely important is that, for example, if you are trying to model any land surfaces the first thing that you have to generate as a surface model, so that is how you understand how you what is a kind of earth surface you have, okay. So, any kind of analysis, any kind of gas analysis the first thing you generate this surface model. So, let us look at different surface model.

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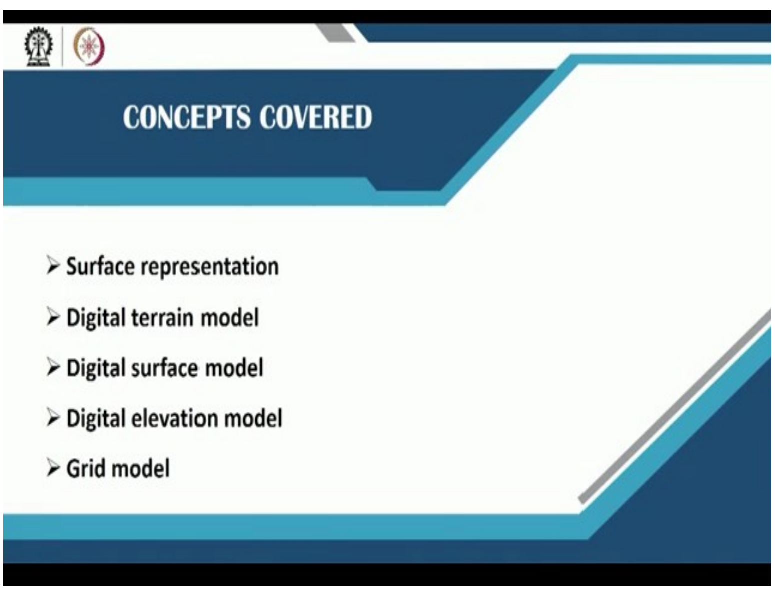

And in this in today's class, I would be ah defining what you mean by surface representation then we would look at digital terrain, what is the digital surface model and a digital elevation model. How do you actually generate this, then you have a grid model. So we look at all of these things in this particular class so let us go into every one of these understand, different ways of representation.

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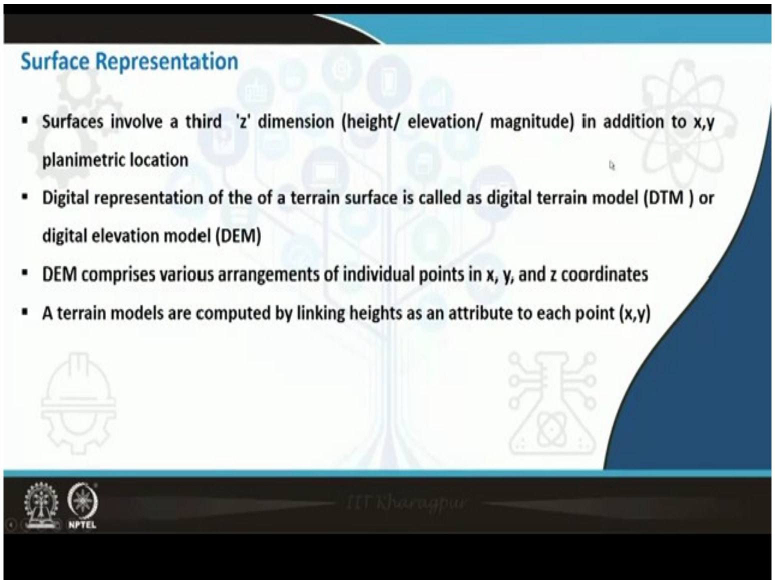

The first thing a surface representation, when I say surface, surface is not represented only by an x and y dimension, okay. Why because when you have x and y dimension to just a planimetric location, but surface should always involve a z location which means a z dimension, which actually giving a high elevation and magnitude, say in addition to the x y coordinates. So, if you have only x y, then it becomes planimetric and extremely difficult to represent the surface, okay

So when you are looking at a digital representation of any terrain surface it is called a digital terrain model, okay, or very frequently called as DTMs or digital elevation model okay. So digital elevation model comprises various arrangements of individual points. So please understand this, digital elevation model comprises various arrangements of individual points in x, y and z coordinates. So, if it is only x y, then it is planimetric.

Whereas, if you have z coordinate then it becomes a surface okay because it is giving high elevation or a magnitude, then a terrain models are computed by linking heights as an attribute to each points okay. Always remember this, this is extremely important when people are trying to represent the surface. So they do not understand that we have x1, x, y, and z we normally what students do is that you take of image you just a try to represent A DEM and say this is the DEM.

So you do not understand what you mean by x y and how you represent the z, so you have different tools to just develop it. But always remember it always has a third dimension and representing a dimension is extremely important when you are doing any surface analysis okay.

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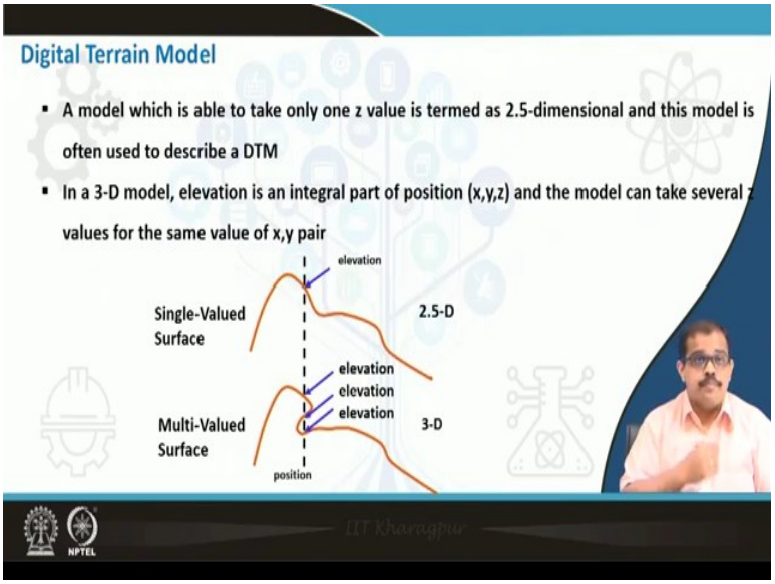

So when you say additional terrain modelled okay the model, which is able to take only one z value, so you can have number of z values at a point of time, but there is if it can only one z value it is termed as a 2.5 dimensional model and is often the called a digital terrain model okay, please understand a model which is able to take only one z value. That is that is what is the crux, one z value its call at 2.5 d model okay

See for example you have x y and 1 z then it is called a 2.5 D 1 here when you look at this, this is one surface, it is like this okay when you are representing this particular region, you have x and y along with it, you know what is a geographical location of this place and then you have a z value, that is the height of this place okay, you have only one value at that point, then it is called a 2.5 D model okay.

Now if there is elevation, elevation that is an integral part of any model see you have 1 elevation, you have second elevation, you have elevation in the same region, so number of values of z z1 z2 z3. So this is along with the x y pair is called a 3D model okay, normally referred to as digital elevation model. If this if you have a 2.5 D model, then it is a digital terrain model whereas you have a 3 D model it is normally referred to as an digital elevation model.

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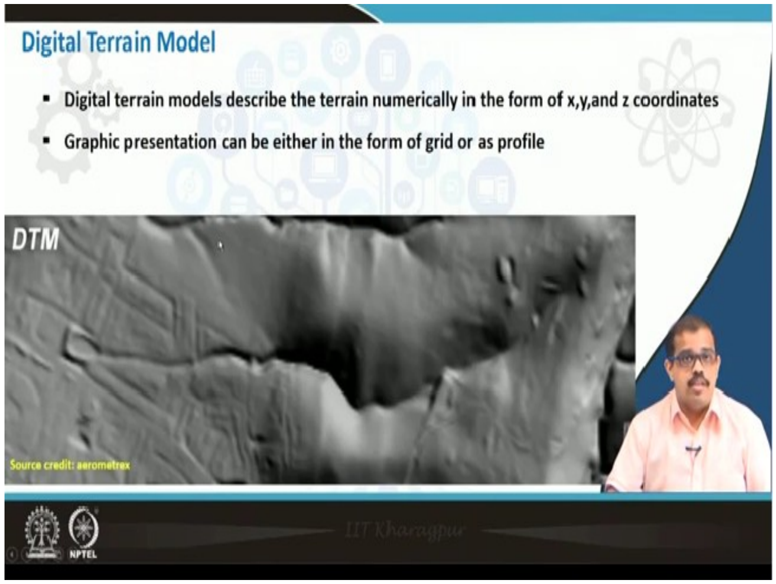

When to give an example of digital terrain models, digital terrain models described the terrain numerically in the form of x y and z coordinates and you have only one z coordinate if it is a graphic representation can be either in the form of grid or even a profile okay that is how a digital terrain modernists are represented. This is an image that the source from acrometrics. So this is digital terrain model of the earth's surface, you can see the terrain how the terrain is divided, you can see where there is actually slope and where there is an high terrain in this particular image.

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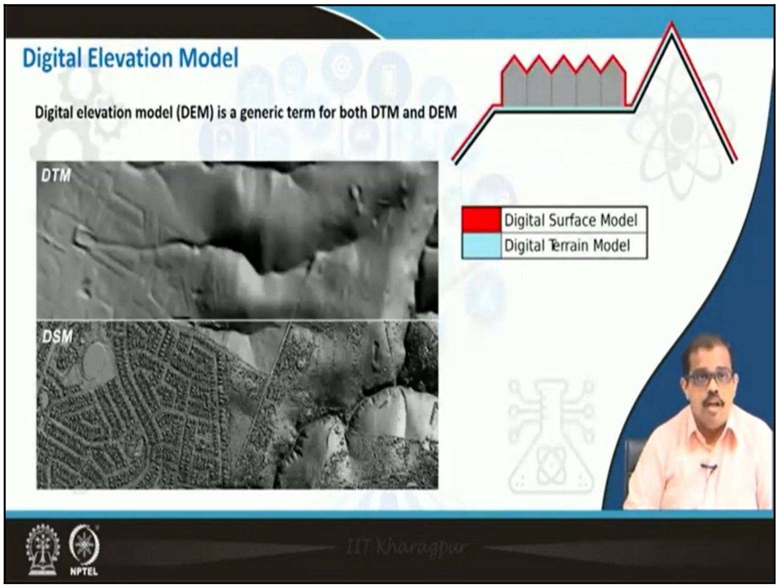

And there is another notion called as surface, digital surface model, so it is basically it has nothing different from a terrain model but it is actually giving you the describes a terrain surface including the above ground object. So for example let us say someone wants to understand what is the height of a building. So the first thing you develop is a detail, you define a digital terrain model okay.

Then add surface information to, so yeah which means that you will give numerically the above ground objects into the x y z coordinates okay. So that becomes a surface terrain or surface model digital surface model or digital surface terrain model okay which means you can see here there is a terrain in the same image there is a terrain information also here okay, whereas a surface information of buildings, roads, etc. right.

So that is what is called a digital surface model, now I hope everyone understands what is a difference between a surface model and a terrain model okay. Now if to give you more precise information, this is what is nothing but a distal surface and this is nothing but the digital sorry digital terrain and this is nothing but digital surface. So, if you look at an exclusive representation of the that, this is a surface.

If this is there is just as the surface of the earth, so it is called a terrain okay, if you add information about building road etc. then this value comes here on the terrain then it is called a digital surface model okay. So normally a digital elevation model is a generic term with for both DTM and DEM okay. Only thing is that distal terrain model has a single z value whereas digital elevation model at every point can have more than 1 z values okay.

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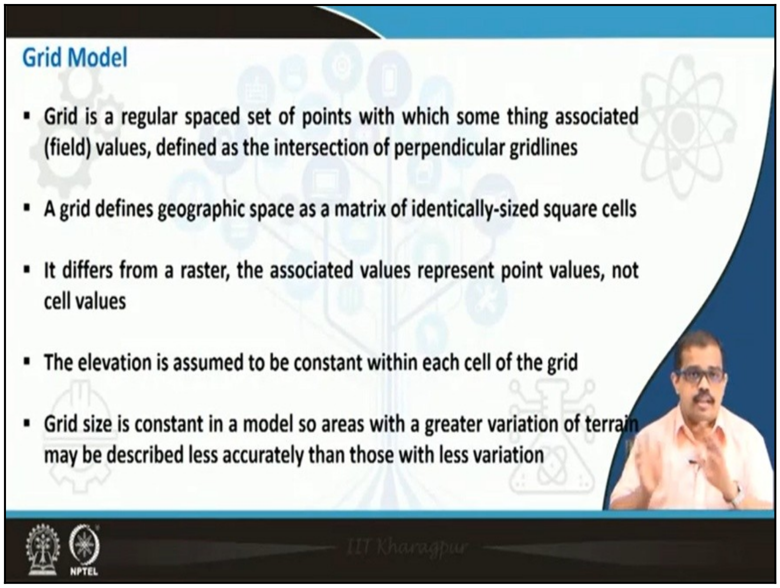

That you should remember that is a basic difference between a DTM and DEM. But in general, both are referring to the same kind of representation. So the next thing as a grid model, grid is a regular space set of points which with which something associated. For example, you have a field values defined as intersection of perpendicular grid lines.

If for example, in this particular image if you add grid lines you have a perpendicular nodes okay which has certain specific values okay. This intersection notes have certain specific values. This, this is called as a grid model. A grid defines a geographic space as a matrix of identically size, square, cells. So whenever you are looking at the grid these are large number of identically sized squares cells.

Any it can be any number of cells, but these are identically sized, so that we should keep in mind grids cannot have different values but these are identically spaced, it differs from a raster associated values represent a point values not the cell value. So grid model is not a raster one okay. Grid model it has a data as a point data about what you are representing from the real world.

Elevation is assumed to be constant within each cell of the grid always. That is how the grid is built, so once you build a grid that particular z value will remain constant, grid size is constant in a model so areas with greater variations of terrain may be described in a less accurate way. Otherwise you will not be able to exactly say what kind of differentiation is this. So in a way that you are approximating anything that is falling into the grid into a particular z value. That is why it is less accurate in terms of representation of any terrain information.

Always grid model is avoided in terms of representing any terrain values, any z values if you are trying to represent any different quantities, but the main concern here is to understand how a terrain model can be used, how a surface model can be used. So let me go back to my terrain modell and the surface model here if because when I normally speak to students they assume that the terrain model and a surface model, they have understood.

But please understand it is not so easy to really get into a terrain model or a surface model, you have the generation of terrain model and surface model is extremely difficult in terms of extraction of the z values. So I would suggest if anyone who is learning this particular subject if you want to a generated DEM or a DTM and also the surface model known just go into the software and put in your data and generate whatever the output is there and say I already have a DEM or DSM.

But please understand you need to have a values from the ground, which accurately measures, not whatever the DEM you generated from the satellite data have accuracy measures also. So, you should look at what is a kind of accuracy and what kind of measurements are trying to do, otherwise it is giving you imprecise measurements on your earth's surface. So if you then measurements made on your planimetric data and your digitally elevated data you may not match in terms of the real word quantities.

So keep in mind that you have to look at what is error associated with generating the DEM or DSM and then verify it on the ground to correct it how you can I mean corrected to the real world scenario, without which it is going to fail in the larger context okay. So that is about a digital elevation model and a distal of surface model, but as I grid model is least used because it is least accurate in term and has and has extremely less variation in terms of what it has to be.

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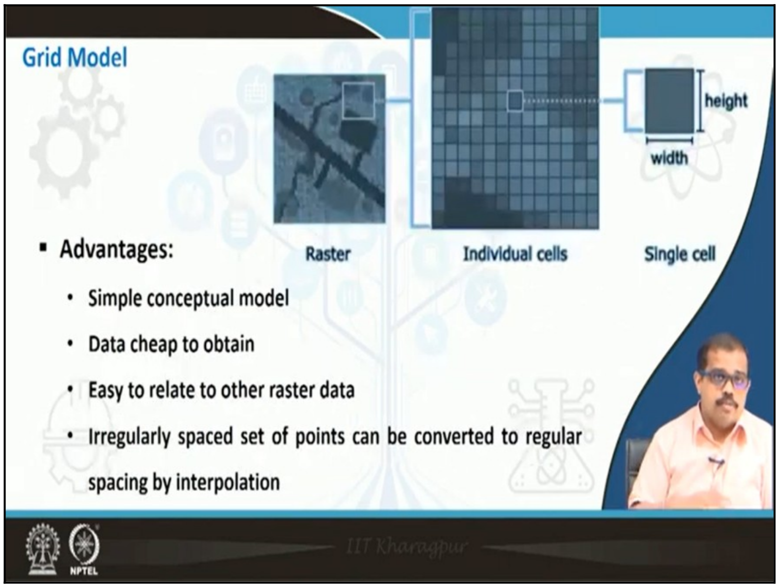

But you have certain advantages that are associated with it, let me give you certain before I get into advantages. Let me give an example of a grid model. For example, you have a raster here okay, this is a raster data, so now raster data has various values, this is an water body, this is a city etc. okay. Now if I zoom into this particular region okay, there is an individual cell here okay. This when I see here is a collection of may be a number of points or number of values.

So it is giving only one value at that particular entire location. If let us say this entire cell is representing 1 kilometre 1 by 1 kilometre grid or 1 kilometre by 1 kilometre location on the ground, which means it is representing a single elevation value across 1 kilometre by 1 kilometre, that is why grid model is normally avoided in terms of using a in terms of representation of any of the surfaces.

But there are certain advantages when you are looking at the grid model, it is simple conceptual model, very simple yeah just converting those points on the map to grids and each grids has a value and representation of that value is extremely easy, because you have a different values associated with different grids just give a range of values, a particular colour. So representation is extremely easy.

The thematic representation extremely easy. So data is cheap to obtain yeah this the kind of data that you need is extremely cheap to obtain and cheap to generate easy to generate okay, easy to relate to other raster data. So once you have a grid, it is easier to relate any raster data with can be easily associated with it. Then irregularly spaced set of points can be easily converted to regular spaces just by interpolation using an interpolation technique.

Any kind of interpolation technique you can convert into the equally regular spaced or regular space values. So that is what about the grid model okay.

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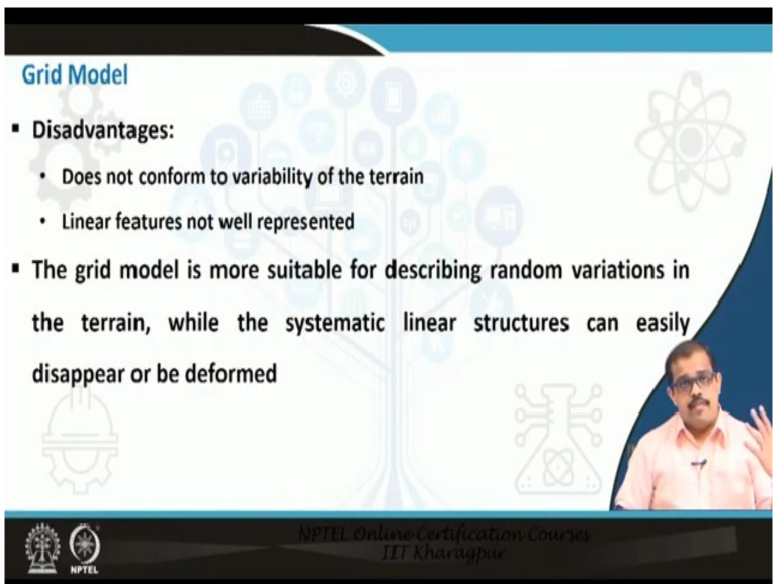

So, but when we look at disadvantages, this does not conform to variability on terrain, I have explained how are the variability of terrain cannot be captured using a grid model, then linear features is not represent not well represented, or it is hardly represented in a grid model. The grid model is more suitable for describing random variations in the terrain while the systematic linear structures can be easily disappear or be deformed.

So, I have shown you how do you convert vector to a raster and when the road is represented in a raster it is quite deformed in terms of representation, you do not understand what kind of representation it is. So that is why you the grid model is extremely disadvantages in terms of usage.

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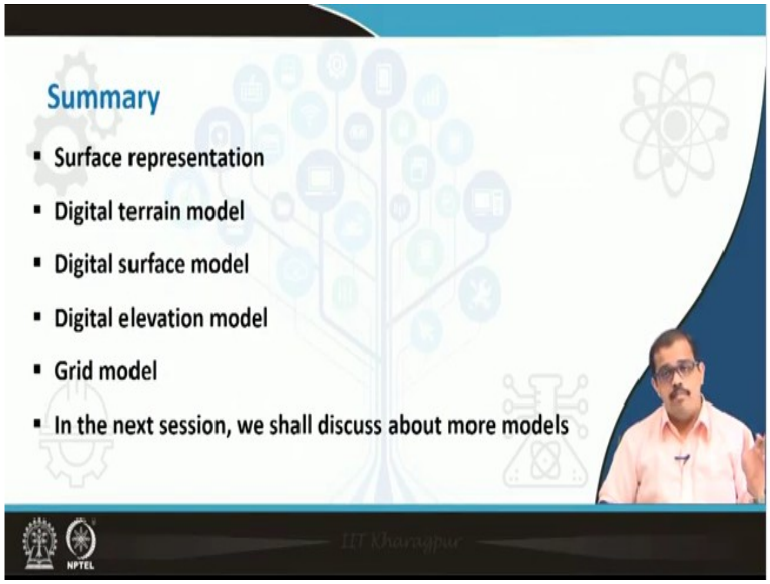

So, this is about the grid model. So when you look at the entire chapter here may be spoke about the surface representation, how do we represent a surface we looked ay that digital terrain model, terrain model, you have a z one z value that defines a digital terrain model, when you have a surface related to it. So you add features on the surface to it then it becomes a digital surface model.

Then you have when we looked at how digital elevation model is useful number of z coordinates encoded, then you have a grid model, which is actually giving you gridded values of the same space. So, if you have elevation values in the grid, so it gives only single elevation value for the entire grid. So it is extremely disadvantages. So, in the next session we will also discuss more about certain different kinds of models.

But as of now the very important part that both of us have to do is that the first thing is when we take up probably hands-on in using QGS we will try to generate digital elevation model of a particular place, so that we understand how you represent elevation as a 3 D space okay. Then the very important thing that I would request most of you guys to look at as go back and try to read some of the textbook I have mentioned earlier.

And understand how the surface representation is important and how your DEM or DTM is extremely capable of handling such surface representation. Why is that when you are looking at the real word it is what the 3 D representation will really give you much information. Whereas when you are looking at just maps it can just give you some thematic information which can give you some details.

But, if you are representing any detail in a 3 D map that gives you an accurate information and it is visibly important for any person to understand. So, if you have a 3 D data it is much easier to understand, but if you have just an information about what is there on the ground in terms of a map, it may not be extremely useful, especially when you are trying to give this model to decision-makers or planners or any of those kinds.

So always try to look at the 3 D representation, so I would request everyone to go back understand again that digital terrain, digital surface, and digital elevation model, I have not discussed the mathematics behind how do you actually represent a digital terrain or how do derive additional terrain or digital elevation model I would request if possible, if you guys have some of the resources to study.

Please try to look at the mathematical part of how do you establish a terrain or a surface or even the elevations, let us meet in the next class, thank you very much.