Photogeology In Terrain Evaluation (Part - 1)
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Lecture – 02
Introduction to Remote Sensing – Photogeology

Welcome back. So, in the last lecture we were talking about the atmospheric window, and as I told that this is the spectrum of the area which will be acting as an atmospheric window and this is important because, this region will have minimum absorption and this is extremely important.

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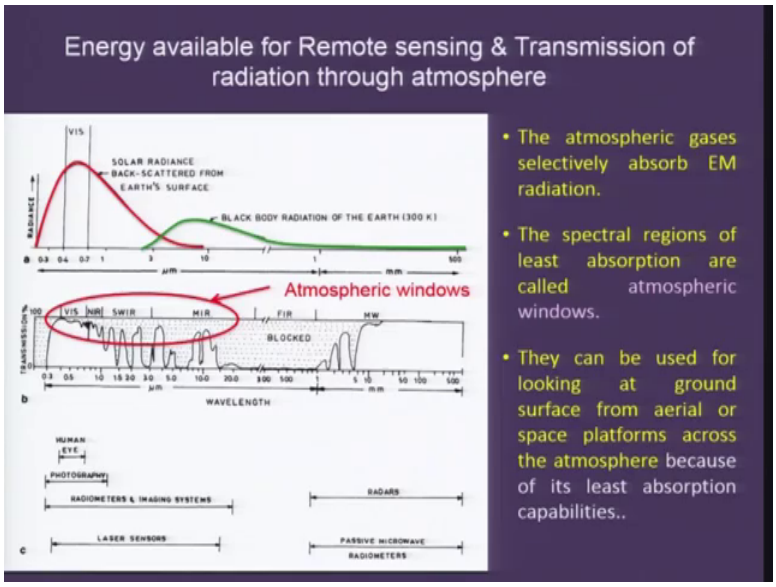

So, please remember this will be talking more on this part, when we were talking about the absorption and all that.

So, this is termed as the atmospheric window, they can be used for looking at ground surface from aerial or space platform across the atmosphere, because of it is least absorption capability, because if it is a light is or the energy which is coming in it is absorbed, then you will not be able to view anything in your data which you are collecting in terms of the photographs or if you are doing remote sensing.

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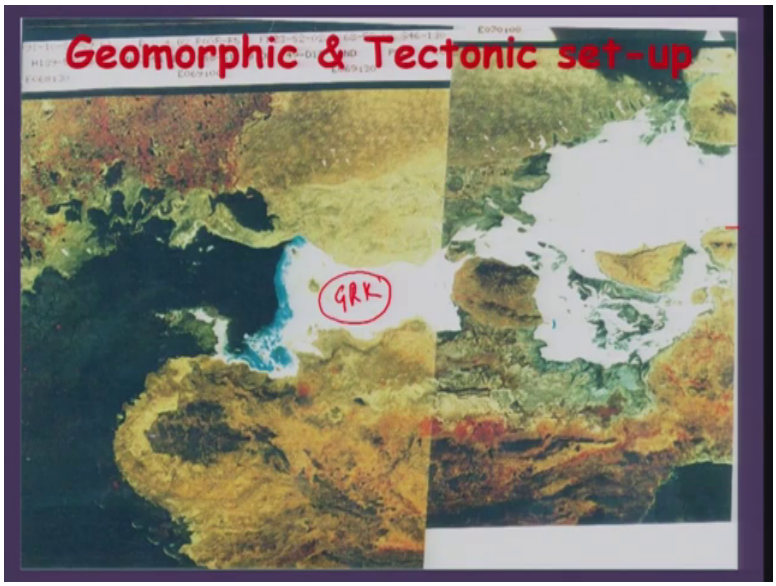

For example, this is false colour composite satellite imagery of kachchh religion, which I wanted to just show you, but if in this you see a different colours and different landforms, we will quickly looked at that that there are few areas which are marked by red here. This all are indicative of the good vegetation, some part here if you look at this is all white.

Because, there is no option here light which was incident on this area was completely reflected back, and this is what we will call great rann of kachchh. We have some features which are outline like this, or here these are all rocky areas, or the hilly areas over here and we have some dark features over here in the lower part even at this place these are all rocky areas.

Let me tell you, that along with this dark patches the whole portion which I am marking right now, is rocky this also rocky here of course, there will be some thin winner of sediments covering this rocky region, but these are all rocky, but now if you look at that we have still different colours which are marked here some portion is dark some portion is lighter in colour again, this is because of the different type of material here. So, this great rann of kachchh the light is completely reflected back hence it appears white it is if you come this side this is what we call the creek area and this is the tidal zone or the high tide or low tide zone in this part.

So, the area which is appearing dark is the area of maximum absorption. So, light or the energy which is when coming and falling on this is getting absorbed, it is not reflected back. Hence, you will see those portions of the earth surface or that area as dark, now if you look at further in the northern portion this feature is appearing different then this one if you ask me, because we have seen the area in the field.

So, we can easily tell you, but then also you can make out that there is some difference between this to landscape.

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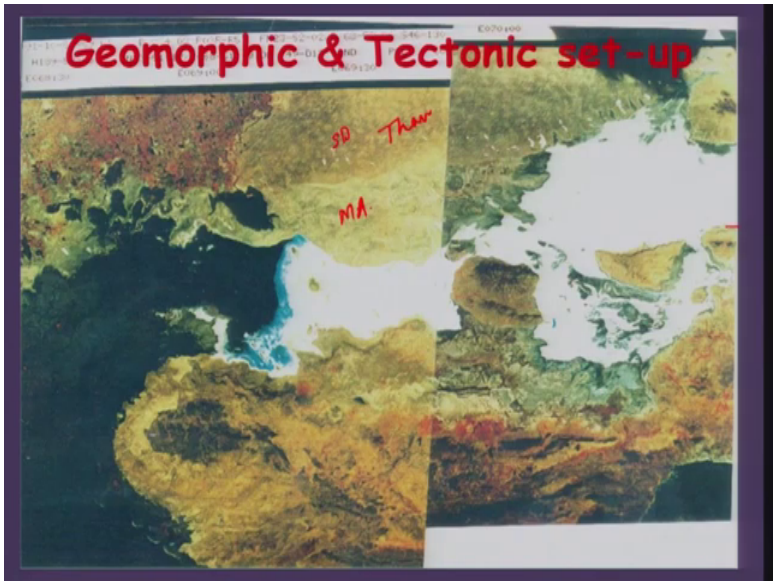

So, this is an marshy area and this region, if you see that shows some features like linear features over here, like this these are all sand dunes and this is the area known as thar desert.

And there is a stream here. So, I am putting the pointer which is appearing slightly darker than the surrounding region showing a divide between the thar sand dunes and again a red toned area, which is a vegetated region and this is in Pakistan. So, basically what I would like to emphasize here is that, that taking into consideration the tonal variations you can identify the different features or the landforms on the earth surface very quickly another feature very important. This small patch is appearing little bit darker, than the surrounding regions this is again a small water body, which is when identified in this area.

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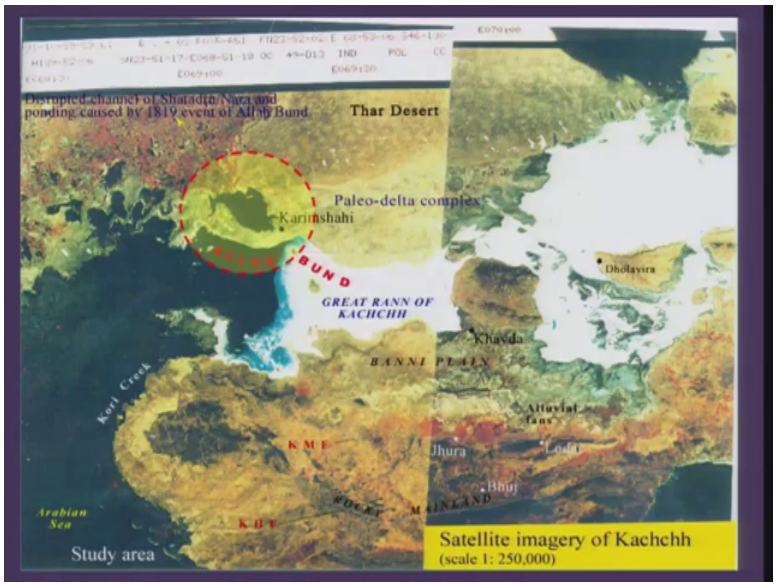

So, based on the tonal variation we can identify different landforms. So, if you look at this portion in field, this is what we have marked as the lake which was been formed, because of the destruction of nara river which got founded due to 1819 a 11th earthquake.

And in total now, if you see you are having lot of other features which are been marked here, we will discuss when we talk more about the interpretation part, but most important point here which I would like to make is that based on the tonal variation, you can identify the landforms and other features on the earth surface. So, this is the ground photograph of this lake here.

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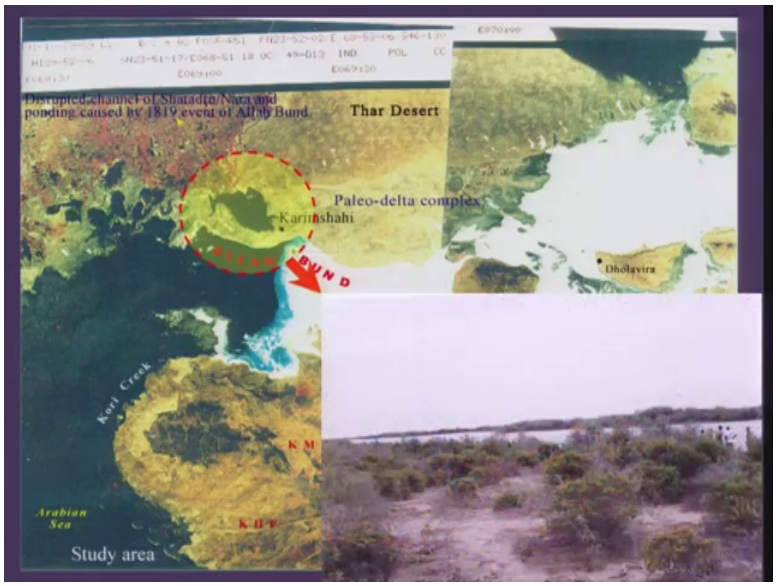

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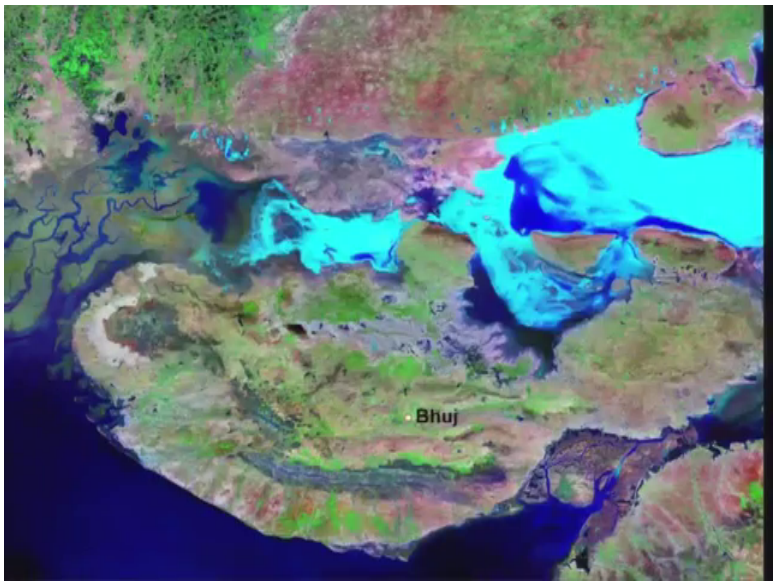

Again, another satellite data, that was in the previous part was in false colour composite again based on the combination of different brands, but there this is unreal tonal car also, even then you can easily make out here the green is because, these are in true colours. So, green shows the vegetation and then you can be easily make out the rocky areas here, and as I told even this portions are all rocky, but the composition of this material is different from this one, and we can also say that the rock type here, which you see is different than the surrounding rock types.

Now, here you can see the that is the creek area deeper part region, and then bluish is again the area which I was talking about the great rann of kachchh and here is the small lake boundary which marks between the marshy land and the sand dunes here, you can see the linear features which are the sand dunes here, and the river which marks the boundary between the vegetated areas and the desert.

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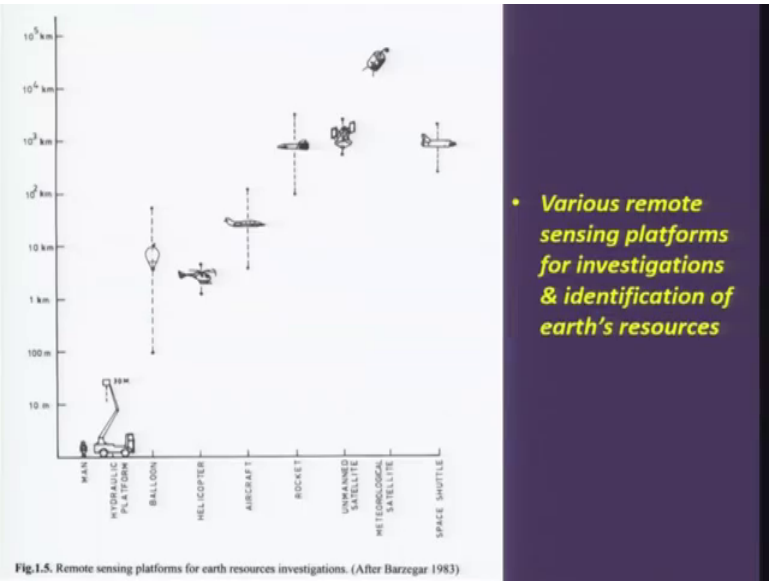

Fig.1.5. Remote sensing platforms for earth resources investigations. (After Barzegar 1983)

Now, this information the type of information which required can be collected by plot many ways. So, the only point is that, we should not come into the contact of the object or any feature. So, various remote sensing platforms for investigations and identification of earth resources, you can use either camera mounted on some vehicle, or you can use the balloons you can use the helicopter, aircraft, rockets, satellites or you are using the meteorological satellites or a space shuttle.

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So, these are the various techniques or the platforms through, which you can collect the data which is required for this is another one, which is now getting very common and it is a uav, where you can have an mounted high-resolution camera and you can collect the aerial photographs and that to with incapability doing in 3 dimension.

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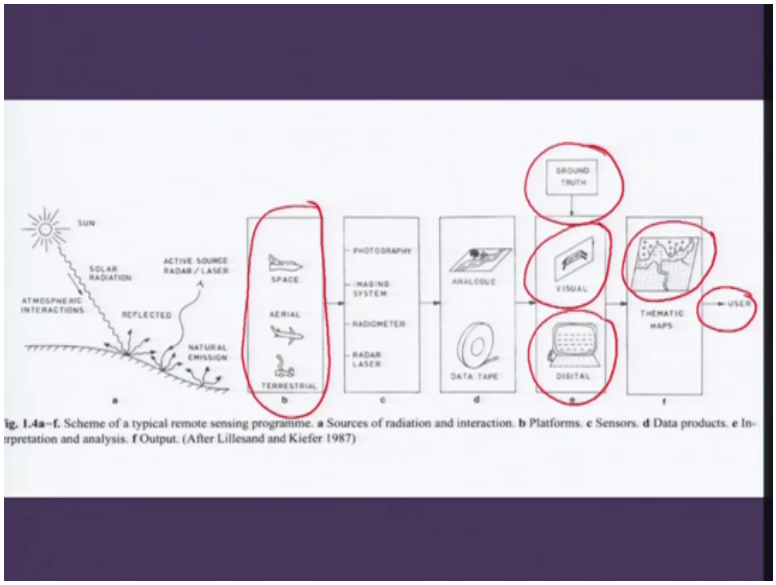

ig. 1.4a–f. Scheme of a typical remote sensing programme. a Sources of radiation and interaction. b Platforms. c Sensors. d Data products. e In-rpretation and analysis. f Output. (After Lillesand and Kiefer 1987)

So, this equipments can collect the photographs, having stereo scopic capabilities. So, we can view this and generate digital elevation model and 3D images. So, scheme of a typical remote sensing program, if you look at we can have first the data collection using different platforms as we were discussing in the previous slide.

Then what type of data we need either it is in the term of in the in the form of photograph, or it is in term of the digital data either, we can store this on the data types which are in earlier we will be used or with an analogue and typical paper print photographs we were looking at we can store, and view this data either digitally on our screens of personal PCs or maybe you can have laptops or anything or give you this fine very, we will follow our convection techniques this using stereoscopes and of course, you do the ground truthing.

And then finally, you generate different maps that is what we call thematic maps depending on what information you want to extract from the data which is available. To you because you cannot keep on distracting each and every data and make the interpretation sheet crowded.

So, depending on the user what about the information you need for example, you need only river channels to be extracted, you can strike that and try to prepare your particular map, I will just skip this maybe we can move further ahead.

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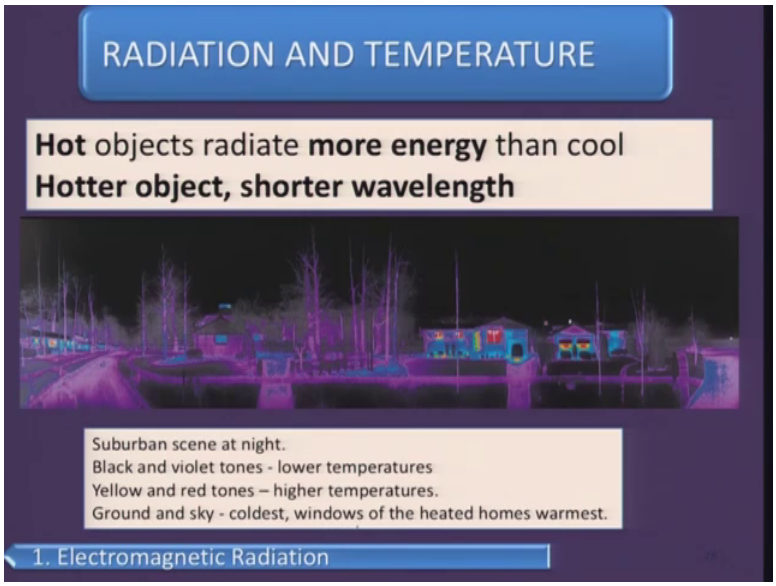

Now, this is again talking about little bit about the radiation, the information which has been seen on the screen here, is a gain of the type of body either it is hot or cool it will radiate the amount of energy is been radiated back.

So, hotter objects radiate more energy than cool, hotter objects will radiate energy with the short wavelength, now the scene above if you look at there are few colours which you can identify here, say black and violet it has been shown here the house a low temperature black and violet us are the area of low temperature, here is the yellow and red tones are indicative of high temperature bodies ground and sky coldest windows of heated warmed.

So, sky is area or this area is coldest, and black and violet part is with the lower temperature it is the high temperature is this yellow and red here. So, this is the electromagnetic radiation, which can be received from different objects having different conditions either it is hot or cool.

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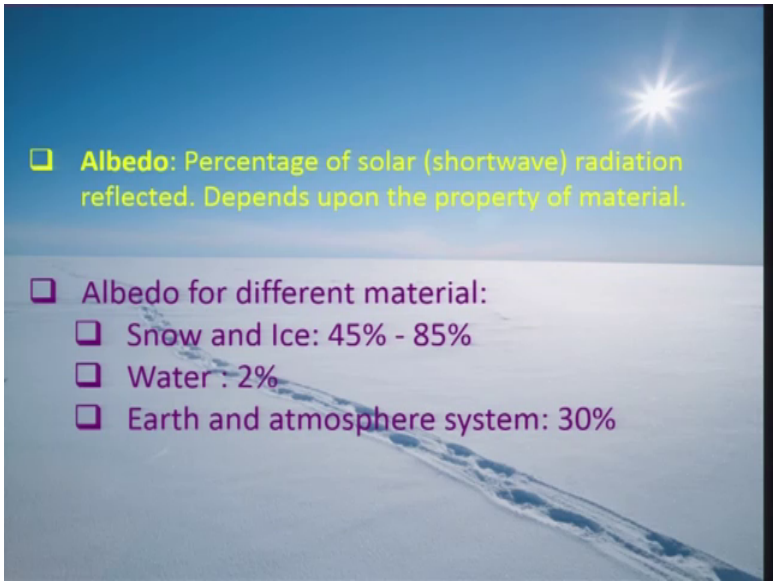

This is again important when as I was talking about, that if you look at the region which reflects maximum energy back, will appear white. So, this is the photograph from the snow field and the phenomena or the terminology which has been used for this type of radiation is termed as albedo. So, albedo is percentage of solar radiation reflected, it depends upon the property of material.

So, for example, albedo for different material if you look at snow and ice is having the albedo of 45 to 85 percent. So, it will have very high albedo and most of the light will be reflected back to the atmosphere, water is having 2 percent only earth and atmosphere

system depending on which area, and type of material it is around 30 percent. So, water is having the least.

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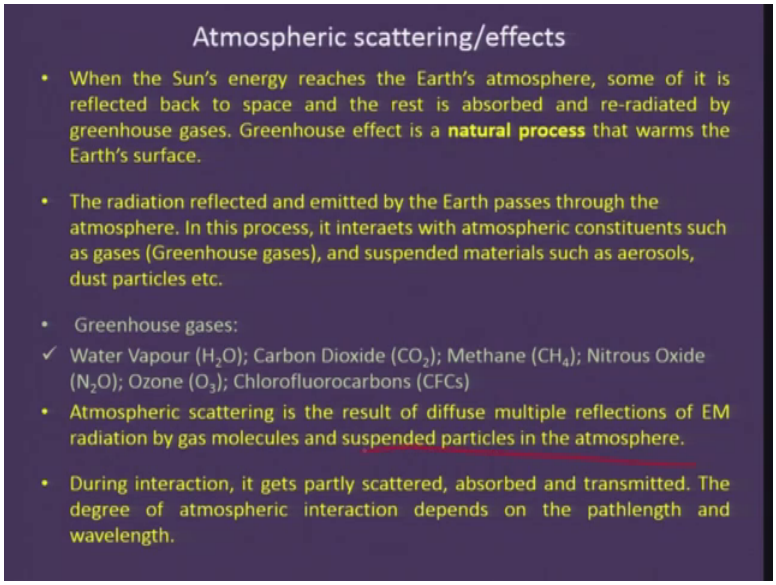

This is another important part, that is atmospheric scattering and it is effects. So, when the sun energy reaches the earth's atmosphere some of it is reflected back to the space, and the rest is absorbed and radiated by the greenhouse gases. So, if you go back in the lecture we discussed about in the previous, first lecture you will understand the importance of what we were talking about the atmosphere, because some of the energy will be absorbed and some will be reradiated back into the atmosphere.

And this phenomena also plays an important role, in keeping our earth warm and hence we are talking about the global warming and all that. So, the greenhouse effect is a natural process that warms the earths surface, the radiation reflected and emitted by the earth passes through atmosphere, and this process it interacts with atmospheric constitutions, such as gases what we call greenhouse gases and suspended material such as aerosols and dust particles.

So, sometime in few areas of the regions in India, we find that there is no sunlight coming in and the days are very dull in winters particularly and that is, because of the that the energy is not completely transmitted to the earth's surface, and that maybe because of the aerosols or the dust particles in the atmosphere. So, greenhouse gases just

for your reference, if you take we have hydrogen or water vapour, carbon dioxide methane, nitrous oxide, ozone, chlorofluorocarbon etc.

Now, the atmospheric scattering is the effect of diffuse multiple reflections of electromagnetic radiation by gas molecules and suspended particles in the atmosphere. So, during the interaction it gets partly scattered, absorbed and transmitted. This is important because not everything will be absorbed, it will be partly scattered, absorbed and transmitted, a degree of atmospheric interaction depends on the path length and the wavelength. So, this is the complete the spectrum, if you look at you will be able to understand that this interaction will depend on the wavelength as well as the path length.

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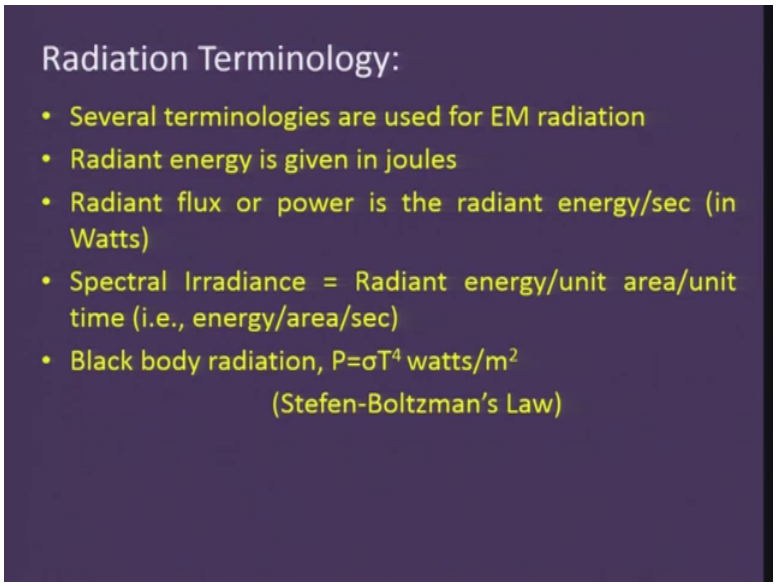

So, several terminologies are used for electromagnetic radiations, radiant energy is given in joule radiant flux or power is the radiant energy per second and watts, spectral radiance is equal to your radiant energy per unit area per unit time and we have discussed this is the black body radiation it is stefen Boltzmann's law.

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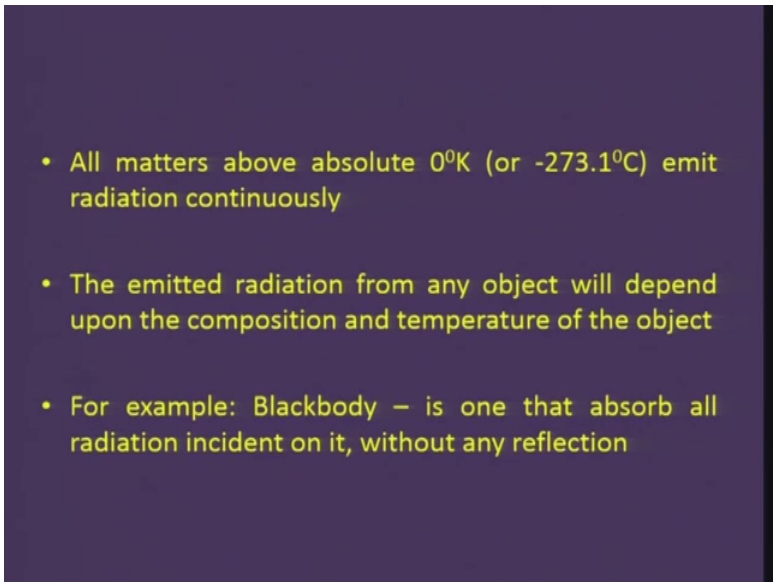

So, all matter about absolute 0-degree Kelvin, will radiate continuously the emitted radiation from any object will depend upon the composition and temperature of the object. So, if you are having very heated or hotter object you will have different radiation if you are having cooler and you are having different. So, the emitted radiation from any object will depend upon the composition and temperature of the object.

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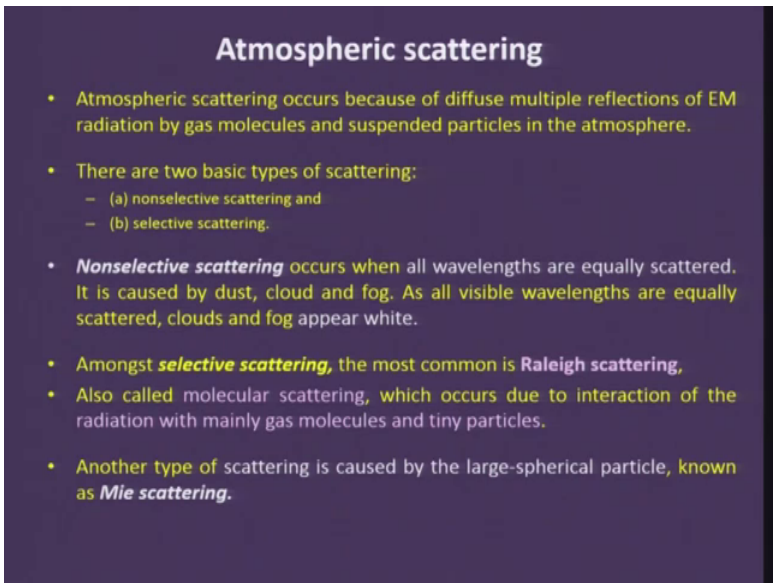

So, for example, black body is one that absorb all radiation incident on it without any reflection atmospheric scattering, if you look at scattering that occurs because of

diffusion of multiple reflection of electromagnetic radiation by gas molecules and suspended particle in atmosphere, there are 2 basic types of scattering one is nonselective scattering and another is selective scattering.

If you classify this then, what we have the non-selective scattering occurs, when all wavelengths are equally scattered. So, whatever the light or the electromagnetic radiation coming in of the same wavelength, all wavelengths are equally scattered it is caused by dust, cloud or fog. As all visible wavelengths are equally scattered clouds and fog appears white, this is one of the very important point that if you are having all wavelength are equally scattered, then that object or the area will appear white. Among selective scattering the most common is termed as raleigh scattering also called molecular scattering which occurs due to the interaction of radiation with mainly gas molecules and tiny particles.

So, here there will be some absorption which will take place, and another type of scattering is caused by large spherical particles known as mie scattering. So, you have to remember this different type of scattering nonselective, selective scattering, Raleigh and mie scattering.

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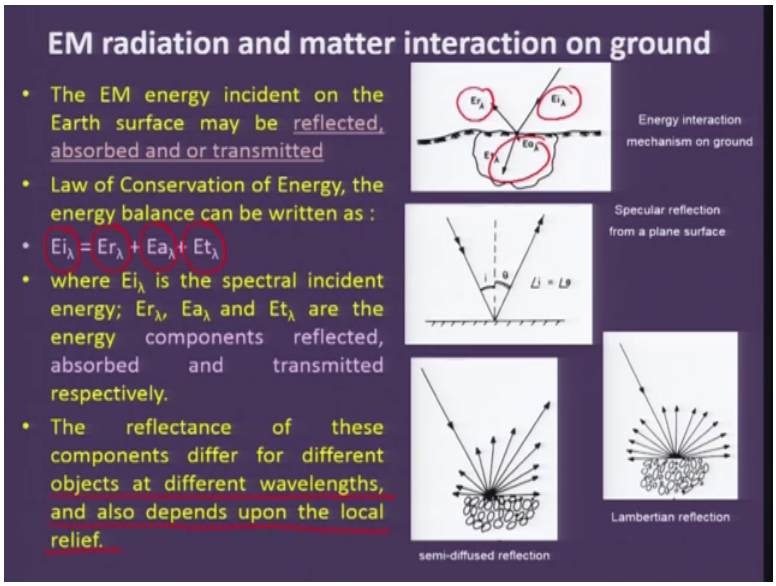

So, how electromagnetic radiation interact on ground so, the electromagnetic energy incident on the earth surface may be reflected, absorbed or transmitted. So, you are having the incident here the electromagnetic energy some will be reflected and absorbed

within the earth surface. So, energy interaction mechanism on ground will be of this type again it depends on the material on which it is incident.

So, law of conservation of energy, the energy balance can be written as that is you are having the incident energy, which is will be filled to your radiated absorbed and transmitted. So, the reflectance of these components, differ from different objects at different wavelength and also depends upon the local relief this is important.

So, the reflectance will vary from place to place, and will have will differ for different object at different wavelengths and depends upon the local relief also. So, this is an example of semi diffuse reflection and this is the lambertian reflection, which is having all complete energy has been radiated back.

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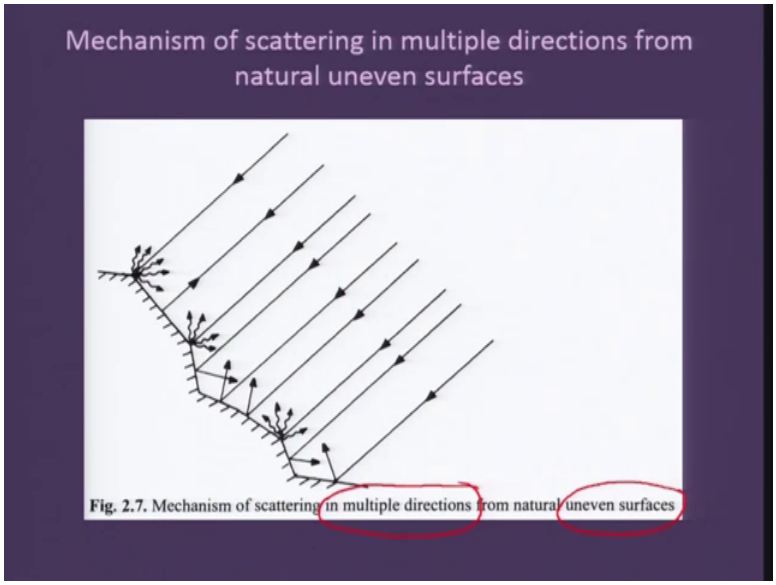

Now, depending on the relief and the material not all the energy which is falling on the surface will be transmitted back. So, it will get reflected or transmitted in multiple directions or scattering will occur in multiple direction depending on the relief or the topography of the surface.

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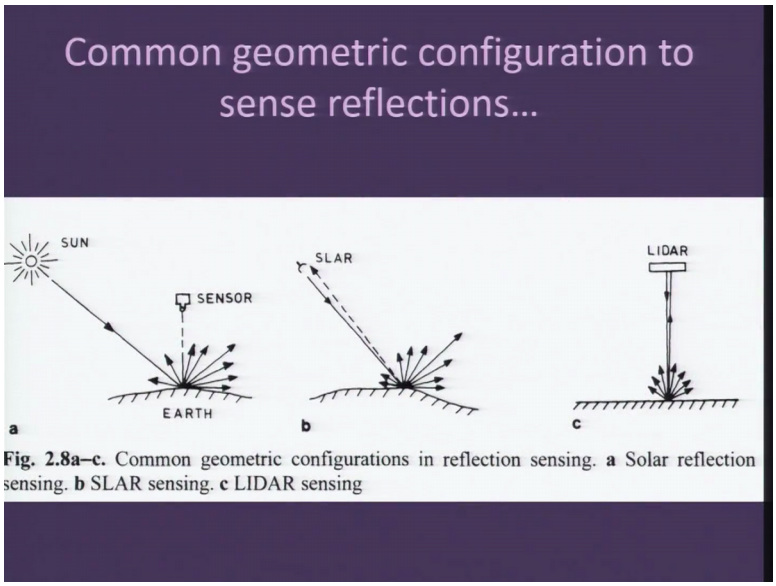

So, if you look at the common geometric configuration to the sense of reflection, then you will have you have different sensors which can be used either you are using SLAR or you are using LIDAR for this. So, I will stop here and we will continue in the next lecture discuss more on the photogeology part.

Thank you so much.