Photogeology In Terrain Evaluation (Part 1)
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Lecture – 01
Introduction to Remote Sensing – Photogeology

Hello everybody. A very happy new year to you all. And welcome to this course on photogeology in terrain evaluation. Now I will start this course discussing few things mainly, and we will see that how much we can cover in this part, and what has been what whatever has been left out will be we will try to cover in the next one.

Let us get started. Now remote sensing most of you must be knowing about it. Now this is in part of remote sensing, but mainly we will look at how to handle the satellite photos, or the photographs taken by aircraft basically we will be looking at very high-resolution satellite data. And how this information which we will extract based on the interpretation of the satellite photographs, we can use to identify the landscape or to interpret the landscape, and in in total I would say that how we will evaluate the third terrain of in which we are interested.

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So, this picture which you are looking at in your on your screen was taken at car nicobar 2004 by a normal DSLR camera, that is in single lens reflex camera. So, this is also a part of a remote sensing what we are doing.

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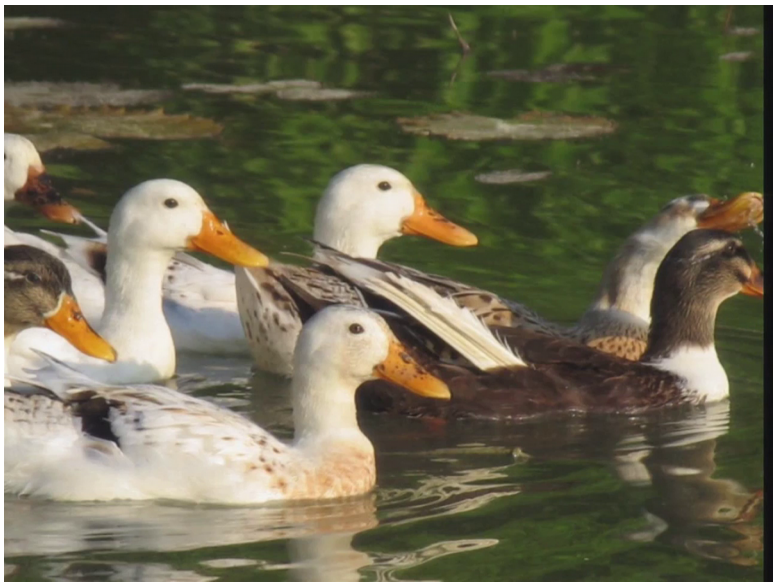

So, again this photograph what we see is in of the process which we talk about the remote sensing, this is another photograph. So, you have seen 3 photographs here like, first is this one of the landscape, here picture of some birds, animals.

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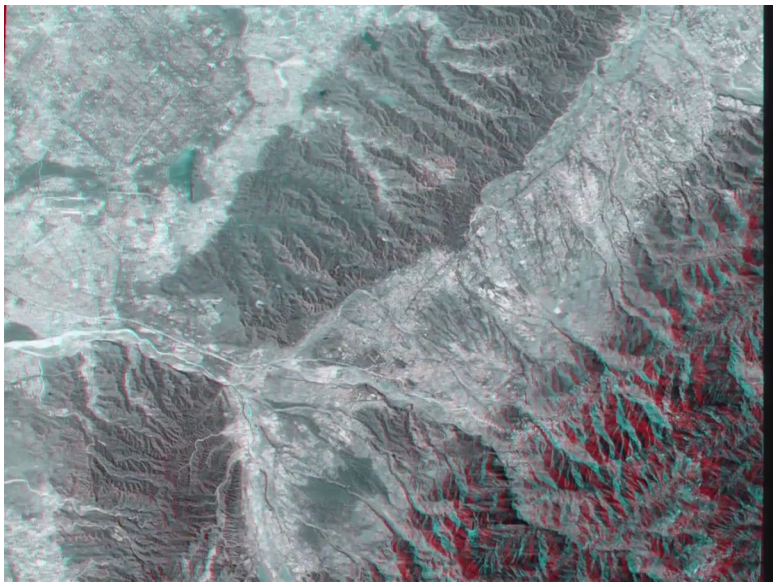

And then finally, this picture is taken by satellite. Now all what photographs we have seen, we are doing remote sensing here.

So, this is the part of the course, which we will be talking about a photo geology in terrain evaluation part one, and you can note down my details. Myself Javed Malik from

department of earth sciences. And my email address has been given. If you have any questions any queries, you can write to me or you can even contact to the ta the teaching assistant for this course.

So, if you look at the course content, which is already available to you.

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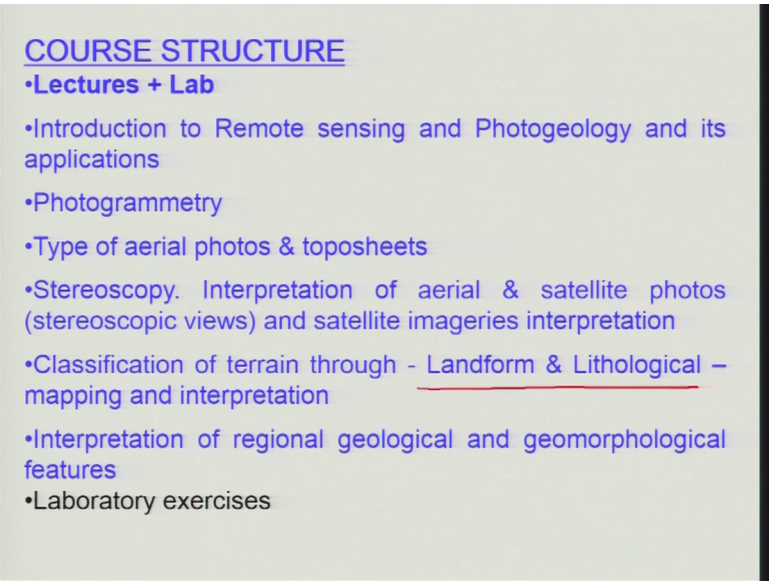

But as I told that; the part which will be left out in this will be covered in part 2. So, this will have in structure of lectures plus labs. And labs will be we will teach you how to do the labs, and the assignments which will be given to you. And you will finally, upload those things after completing it.

So, first we will talk about the introduction to remote sensing, and photo geology, and it is applications photogrammetry; which is again an very important aspect of this course. Type of aerial photographs, and toposheets, because we usually use the topographic maps also; which can help us in locating several features as well as the location of the area. Nevertheless, we have now very high resolution google earth images. But of course, the photographs which we are going to use, mainly the stereo in a stereoscopic view; this is very important; which will help us in getting the whole terrain viewed in 3 dimension, which can help us identifying various landforms easily and market the landforms very precisely.

So, this is the part which we will be talking about, and discussing when we move ahead in this course, that will be the interpretation of aerial and satellite photos. We have a set of very high resolution aerial photographs from India and abroad. So, we will discuss those photographs, how we can interpret the landforms from that how we can interpret other geological features from the aerial and satellite photos.

Partly we will talk about satellite imageries, and then interpretation. Then this is the most important part after understanding the various type of photos, types of cameras how they are been acquired the data has been acquired, we will talk about the classification of terrain, and there we need the knowledge of or the understanding of the land forms, the lithology and mapping of this landforms as well as lithology we will talk about. Then interpretation of geological and geomorphological features. This will be linked with the landforms and lithological part.

There are few books. So, as I told that this will also includes few laboratory exercises, which we will try to make you comfortable in and as we move in this course.

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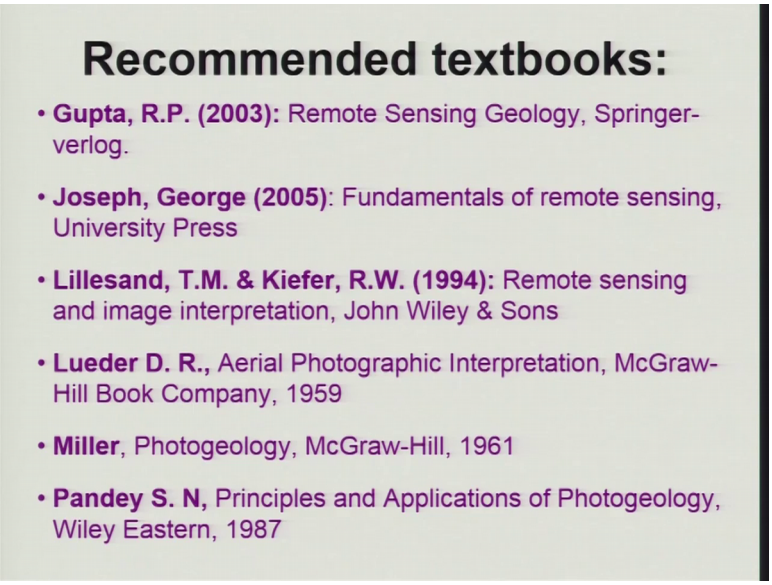

I recommend few books, but if you follow the lectures, which we are going to deliver, I think it will be more useful to you. But even then, if you need you can refer few of the books which are listed here, which are good in terms of remote sensing and fundamental of remote sensing, then remote sensing and image interpretation, then this photographic

interpretations and then photo geology. And then one book is the last one is principal, and applications of photogeology.

So, these are few books which I have listed, but nevertheless if you are coming across more books you can refer, and follow our lectures.

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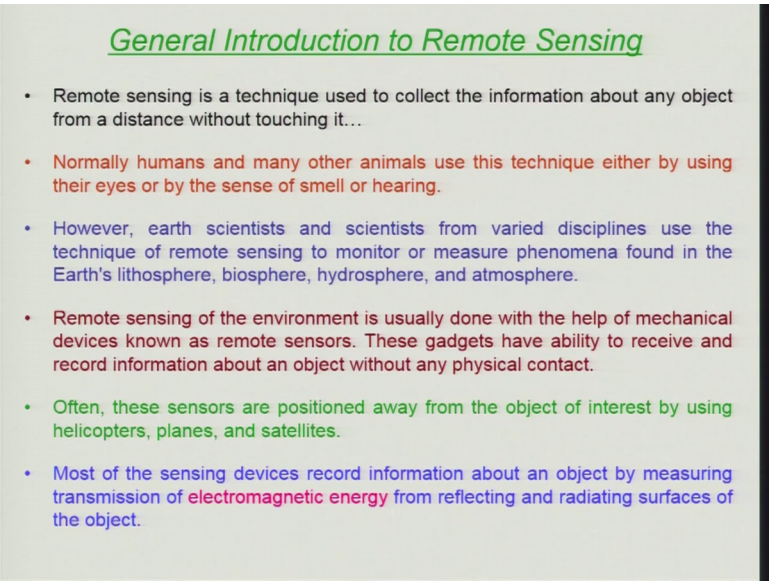

Now, basic introduction if we look at about the remote sensing. As I told that in day to day life we all keep doing remote sensing. So, remote sensing as a whole there is a technique used to collect the information about any object from a distance without touching it.

So, these photographs which I have shown you in the beginning. One was of the landscape and other was of the birds, and third one taken by the satellite. That information was collected of the landforms or the object or the landscape if you take without touching it from a distance. The mode of collection, those are what we can say the sensors or the equipments, which are used mainly the cameras were of different type.

So, normally humans and many other animals use this technique, either by using their eyes, or by the sense of smell or hearing. Even the sense of smell the things you smell or you hear is a part of remote sensing you added. But earth scientists and the scientists from very varied disciplines use this techniques of remote sensing to monitor or measure phenomena found in the earths lithosphere, biosphere, hydrosphere and atmosphere.

So, it depends on what exactly you want to look at. And in this course, we are going to use this technique to look at the landscape or the landforms of the on the earth surface. So, remote sensing of the environment. It is usually done with the help of mechanical device known as remote sensors. This remote sensors can be of different type.

This gadgets have ability to receive, and record important information about an object without coming into any type of physical contact. Often these sensors are positions away from the object of interest either it is any feature on the lands land on the earth's surface or any object by using helicopters, planes and satellite. And we will look at the photographs which we have taken either from the airplane; which we have personally taken from the helicopter as well as we have not done that from the satellite, but we have very high-resolution satellite photographs which we will be using in this course.

So, most of the sensing device record information about an object by measuring transmission of electromagnetic energy. So, you must have heard about the electromagnetic spectrum. We will briefly discuss about it. Because this is important in a way because it can help us in understanding the amount of reflection of the light, and the energy radiated from the surfaces of different objects. And this will depend on composition on the structure of the object, and many more other properties.

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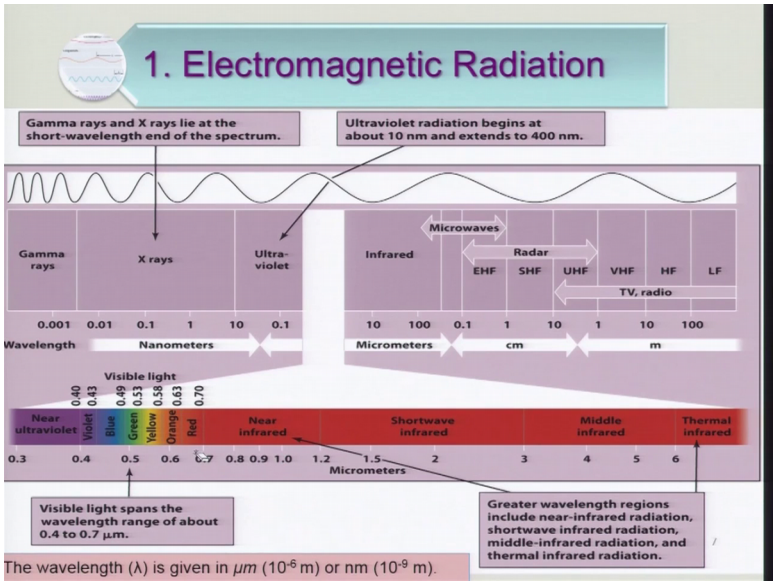

So, broadly if you look at the electromagnetic radiation, we have starting from the short wave to long wave, and we have different bands; where we find gamma rays or we have

the x rays ultraviolet rays, and this band which is which we call as an visible light; which is confined between 0.4to 0.7 micrometer. And then we have different bends which are been listed here.

For us this spectrum or the bands of this spectrum; that is a visible light will be extremely useful that we will be using for the photogeology part. So, depending on the wavelength, different bands have been classified; which I have been listed here. So, I will not go into the detail of this. You can refer it whenever you look at the slides. But we will discuss few things about this electromagnetic radiation or the spectrum and which bend is useful for our studies.

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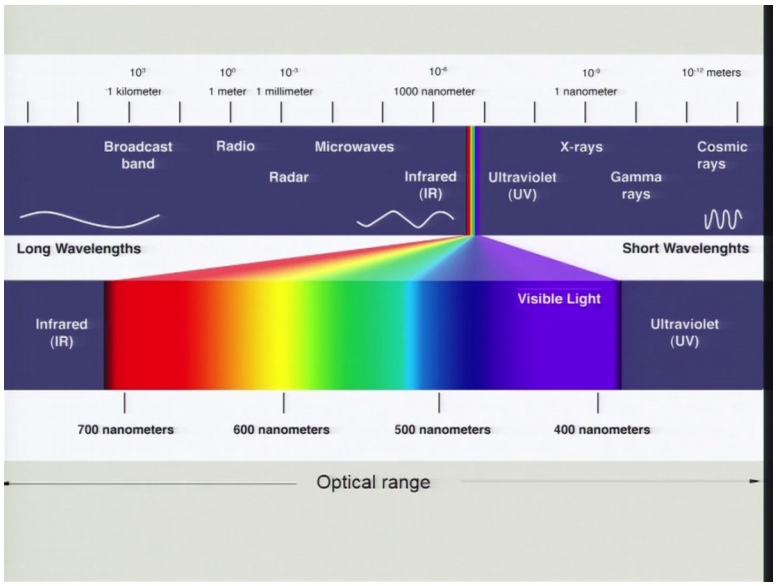

There is another slides which talks about the visible band, we are having; which lies phase b the infrared and ultraviolet. And which ranges if you take this in terms of the nanometers, then it ranges between 400 nanometers to 700 nanometers.

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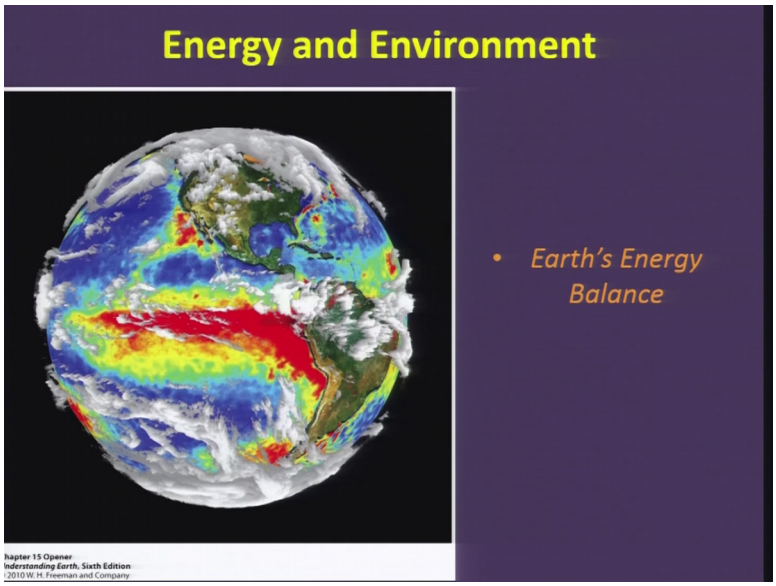

This is important part which we will discuss very briefly and quickly, but needs to understand before we get into the photo geology part. That is energy and environment around the earth.

So, earth the energy balance if we look at; so, earth energy balance is the earth receives energy from the sun, and it I will also reflects as well as radiates energy back into space.

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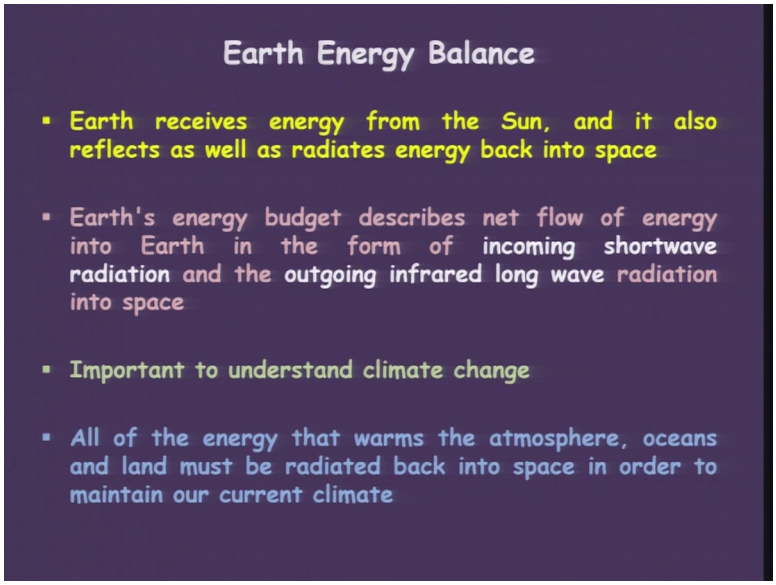

Because whatever the information we are going to look at in a form of a photograph, will depend extremely on the reflections. The amount of energy which has been reflected

back or radiated back to the sensors. So, earth energy budget describes net flow of energy into earth in the form of incoming short waves, and outgoing infrared long waves into this space.

So, this means that we are getting the energy in the form of short waves, and it has been radiated back into the atmosphere in form of a long waves. It is important to understand climate change also, all the energy that warms the atmosphere ocean and land must be radiated back into space in order to maintain our current climate. As I told that I am not going to get into the detail of this, but this part of the earth energy balance is extremely important when we are talking about the global warming also.

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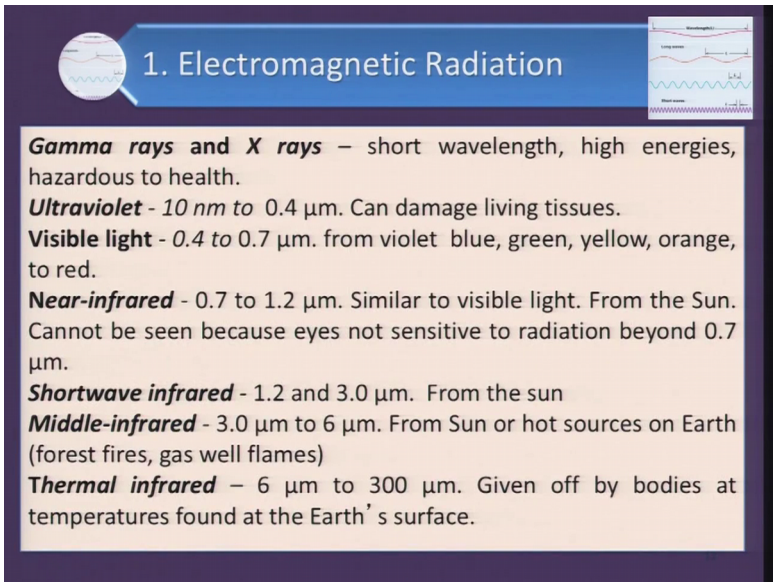

So, visible spectrum as I told will be extremely important band which we will be using for our photogeology course. Now these are few things which most of you must be knowing at for in terms of the gamma rays, and x rays, or the short waves have high energy hazardous to health ultraviolet ray can damage living tissue, visible light which is from violet to violet, blue, green, yellow, orange and red infrared similar to visible light, but the wavelength is different here; where from the sun, but cannot be seen because eyes not sensitive to radiation beyond 0.7 micrometer. So, we will be able to visible only this light which is having this wavelength. Beyond 7 we would not be able to view the mean that is the near infrared.

And then further we have shortwave wave infrared middle wave infrared thermal infrared and all that again.

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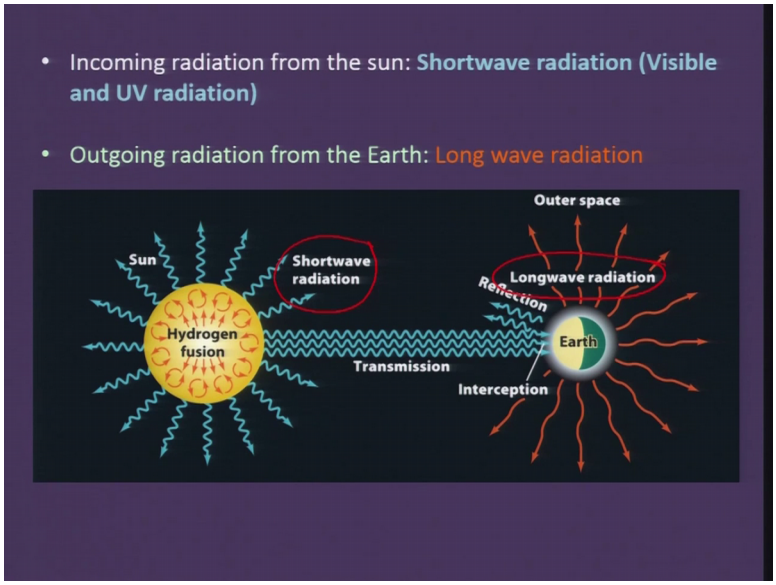

So, this is what we see and this is what has been understood until now; that we have the short waves coming in from the sun, few of the waves are reflected back from the atmosphere, and few are absorbed by the earth and radiated back into the space in form of a long wave radiation.

So, incoming radiation forms the from the sun; which is a shortwave radiation, visible as well as ultraviolet radiation; which comes in outgoing radiation is your long wave radiation.

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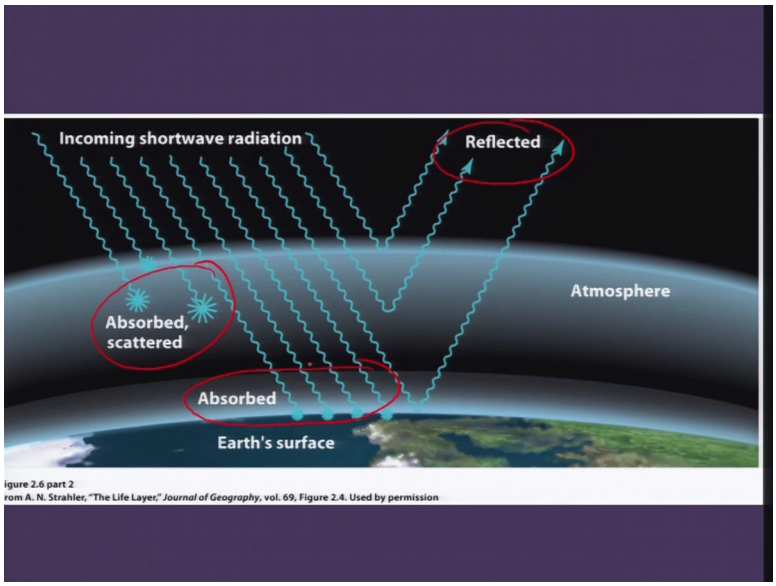

So, as we were talking about that incoming short waves. Some will be reflected back here from the atmosphere some will be absorbed within the atmosphere it is which gets scattered, and some will be absorbed by the Earth's surface.

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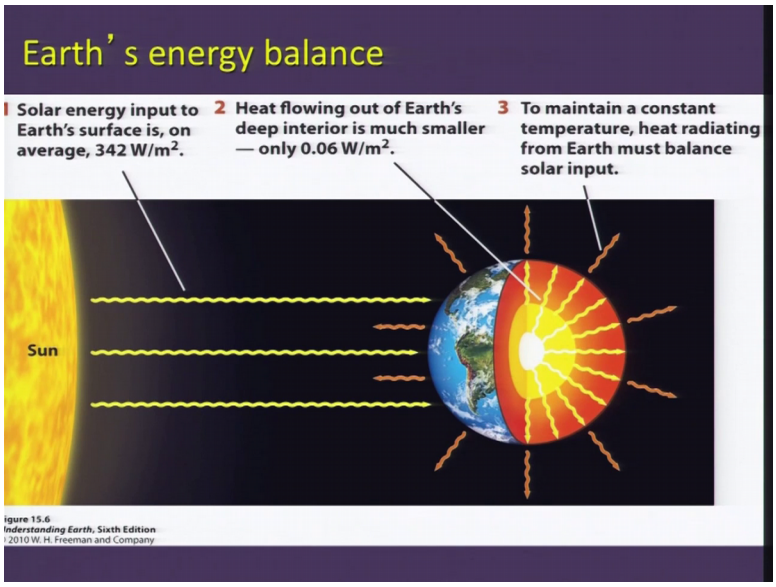

Now, if you look at the earth, earths energy balance; we have like the input to the earth's surface. Or then in terms of the solar energy is at an average of about 342 what per meter squared. Second point important point is that heat flowing from the interior of earth also

adds to the radiation which is going out. That is about 0.06 watt per meter square. It is very, very less.

So, most of the radiation or the solar energy which we are receiving that earth is receiving is from the sun. Now to maintain a constant temperature, heat radiating from earth must balance the solar input. So, how it is balanced?

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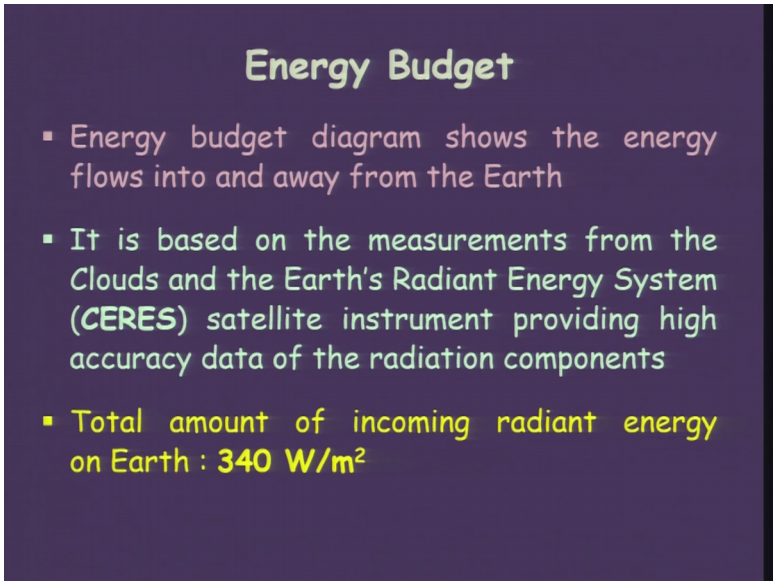

Let us see that. So, energy budget diagram shows the energy flow into and away from the earth. It is based on the measurements from cloud and earths radiate energy system; that is, CERES that is in satellite instrument providing high accuracy data of radiation component.

The total energy of incoming radiation radiates energy. That is a total amount of incoming radiate energy on earth is 344 per meter square.

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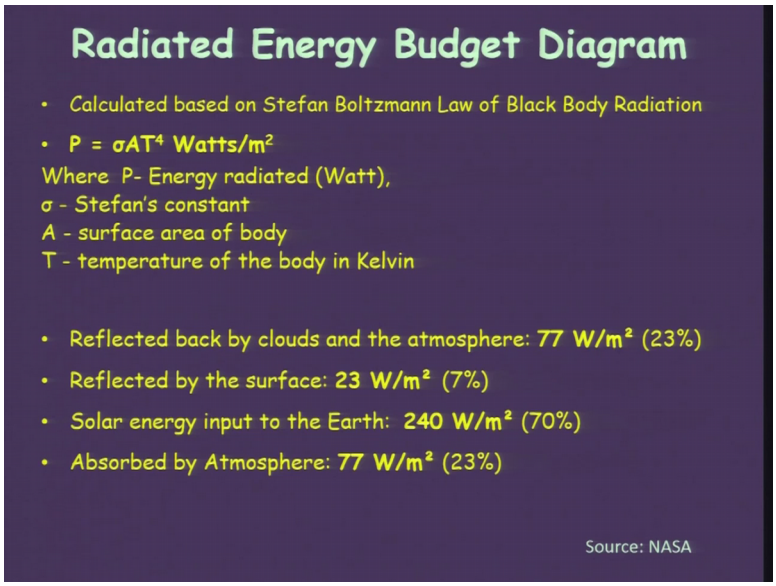

Now, this was calculated by Stefan Boltzmann law of blackbody radiation; which is given as P equal to sigma t to the power 4 watts per meter square. Where P is the energy radiated in terms of what sigma is your Stefan's constant is surface area of body. T is a temperature of the body in kelvin. So, reflected if you take in terms of a percentage, reflected back by the energy reflected back by cloud and the atmosphere is about 77 watt per meter cube it is around 23 percentage, then about 7 percentage is reflected by the surface, around 70 percent is solar energy input to this earth absorbed by atmosphere is around 23 percent.

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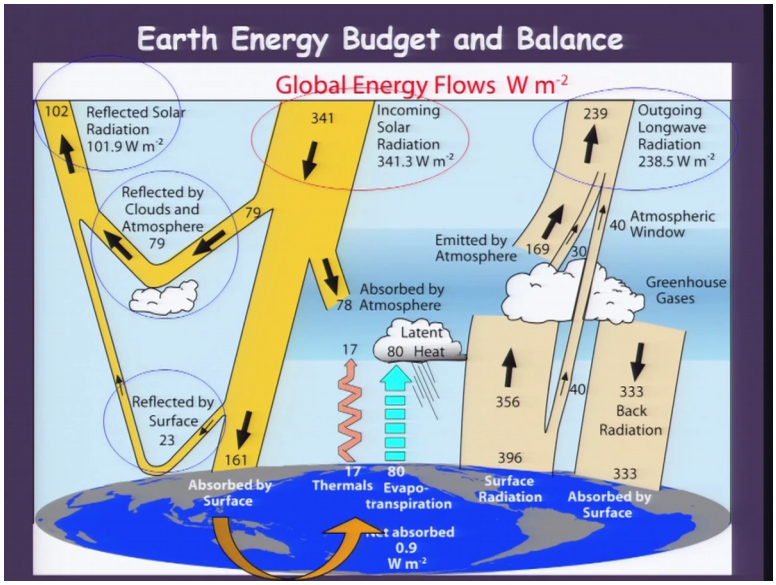

So, if you look at the total structure of the earth energy budget and balance it looks something like this. So, here we have the total incoming solar radiation; which is around 340 watt per meter square, out of which almost around 79 plus 23, 102 is reflected solar radiation into the atmosphere. And finally, outgoing long wave radiation is almost like 239 watt. So, if you add this 2, this will balance the what we are getting incoming solar radiation here.

Now, for remote sensing this is extremely important, because few amount of energy which is coming in is reflected back, but we are interested in viewing the earth's surface, and the land landforms on the earth's surface. Either it is a water body or the objects or the landforms on the earth's surface. And that is important and it can be possible only if it reflects the energy back into the atmosphere. Otherwise you will not be able to receive it by the sensors.

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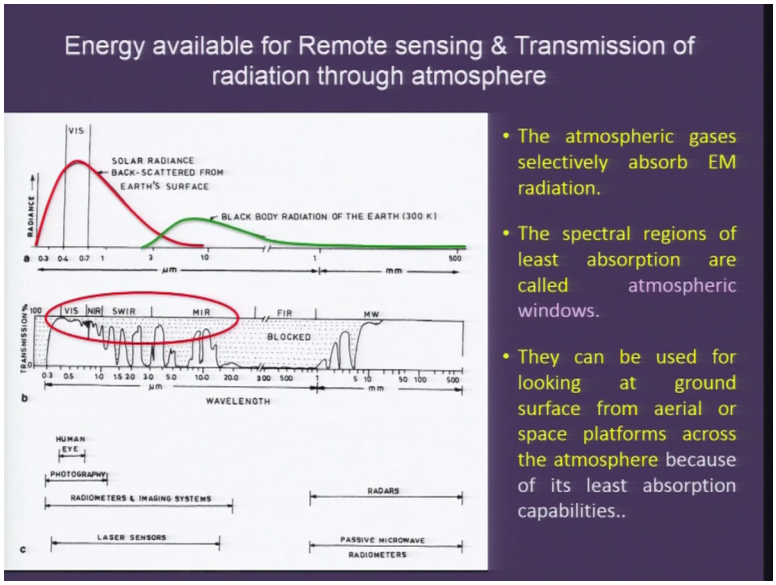

So, if you look at the energy available for remote sensing, and transmission of radiation through atmosphere, there is very narrow window which is available to us which will help us in viewing that.

Now, these are the 2 zones we have like solar radiation. So, the atmospheric gases selectively absorb the electromagnetic radiation. The spectral areas or the regions of least absorption which is termed as atmospheric windows. Now this window of least absorption is extremely important of for us. So, they can be used for looking the ground

surface from the alien or space platforms across the atmosphere. Because of it is least absorption capability. So, this atmospheric window is extremely important for us which is been shown here, and that is the visible near infrared shortwave infrared in the middle way infrared.

This window is termed as atmospheric window, because it is it has this is the region of least absorption. So, whatever the light it can pass through or the energy which is radiated from the or that is electromagnetic radiation. It will pass through and will be reflected back in form of an information which we want to collect for photo geology part or for the remote sensing. So, we will end here and we will continue in the next class.

Thank you so much.