

Episode No. 11

Radio Serial on Climate Change and Global Warming

How life affects the climate : Internal Factors

Two Sides of the Same Coin

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Life on the Earth and Climate are like two sides of the same coin. Climatic conditions affect the life. We experience biodiversity in different regions according to the climatic conditions present there.

Similarly, life on the Earth also affects climatic conditions. There are many phenomena like evapotranspiration, Albedo effect, formation of clouds, ozone layer around the Earth, etc. which affect the climatic conditions. These phenomena are strongly related to the life processes on the Earth. These natural phenomena also affect the climatic conditions though the climate is changing mainly due to various human activities on the Earth.

This episode depicts how internal factors (natural) affect the local and global climatic conditions with some interesting examples in the past.

List of Characters: (In the sequence they appear in the script)

Digu :	A school going boy – Age 10 to 12 years
Grandma :	Digu's grandmother (About 70 years old)
King :	(Age about 50 years)
Minister :	King's Minister (About 50 years of age)
Shripal :	An expert in the kingdom (Age about 40 years)

(Scene of heavy rains and thunderstorm during night time. Sound of heavy lightening is frequently heard. Digu has frightened due to the sound of lightening during night time. The dialogue between Digu and Grandma starts on the background of frightening lightening sound)

Digu : Grandma, when all this will stop? I am getting frightened with the lightening.

Grandma : Digu, don't worry beta. Nothing will happen.

Digu : (almost crying) But, Grandma, if this lightening strikes our home, then?

Grandma : (laughing) no... no. The lightening will not strike our home, don't worry. (In explaining voice) And Digu, this will stop soon, once the clouds get cleared. See the rain has started. When water in those clouds will finish, the clouds will vanish and lightening will automatically stop.

Digu : (enthusiastically) Grandma, are you sure?

Grandma : Yes, Digu. Once the clouds will disappear, lightening will stop.

Digu : Hushhhh. I am really relieved. Once water in the clouds finishes, there won't be clouds again and no more lightening.... So this is the last time! God, please empty the clouds fast....come on. I don't want to hear the lightening again in life time!

Grandma : (surprisingly) What? In life time?

Digu : Yes! You only have said, once the clouds drain out, they will disappear!

Grandma : (laughing) Digu beta, the clouds will disappear for today. Tomorrow they may again come.

Digu : (with fear) What?

Grandma : Yes! This is natural process! This happens again and again!

(Suddenly again sound of lightening is heard and Digu gets frightened)

Digu : Ohhh, my god! Please help me!

Grandma : Don't get frightened, Digu! Okay.... I will tell you a story, so that your mind will get diverted.

Digu : Hmm....

Grandma : Okay.... Now listen! Once upon a time, there was a 'foolish' King –

Digu : (laughing) 'foolish'?

Grandma : Yes.... A foolish king. He believed that he was the cleverest of all the people in his kingdom. He was convinced that nobody could trick him. Every day he displayed his wisdom in his palace, and predictably, his ministers applauded every word he spoke. One day, in his court, the king gave a foolish order to his ministers.....

(Change over Music piece. Scene of Court where King is ordering his Minister)

King : Minister, I have an idea in mind to teach lesson to our neighbouring king...

Minister : Yes, your majesty!

King : Minister, within a month, we will shut down the water supply to our neighboring kingdom, by building a wall in the river and we will cut their water supply! Ha ha ha ha! (laughs)

Minister : But your majesty...

King : Minister, follow my orders!

Minister : But, your majesty, the neighboring king is very powerful. If they start war against us then we can not sustain in front of their strong army.

King : That's why Minister, we will not do war against them...but will cut their water supply and ruin their kingdom! Ha ha ha ha! (*laughs*) So start working immediately.

Minister : As you wish, your majesty!

(Change over Music piece. Scene of Digu and his Grandma)

Digu : So what happened next, Grandma?

Grandma : (Laughing) Digu, the Minister was wise unlike the King. He kept quiet for a week and did a splendid trick instead of cutting water supply to the neighboring kingdom.

Digu : Which trick Grandma?

Grandma : That was winter season. So nights are longer than days....

Digu : Yes, I understand!

Grandma : On one night, the minister called Shripal.

Digu : Who was Shripal?

Grandma : Shripal was the advisor and was in good faith of minister.

Digu : Okay.

Grandma : Minister secretly called Shripal and told him to do one important thing during that night.

Digu : Which was that?

Grandma : Minister told Shripal to strike the huge time bell six times at two o'clock in the night!

Digu : Time bell?

Grandma : Yes! In those days, there were no clocks. The time was measured centrally and people were made aware by striking the bell.

Digu : Ohhh....

Grandma : So the plan was to give six strokes at two o'clock, seven strokes at three o'clock....

Digu : Eight strokes at four o'clock and so on....

Grandma : Correct!

Digu : What happened then?

Grandma : Everything went correct... according to the plan. At two o'clock in the night, the huge time bell rang six times. The King woke up....

Digu : (Laughs) Hahahahaa....

Grandma : When the bell rang seven times, the king surprised to know that there is complete dark outside! And after an hour when the bell rang eight times, he was afraid and called immediate meeting of the ministers. He was not having any clue of darkness even if it was eight o'clock!

Digu : (Laughs) Hahahahaa....

(Change over Music. The scene of court where King has called the Minister and also Shripal to discuss the mystery)

King : Minister, what has happened today? Why is so much dark outside even after eight of clock?

Minister : Sorry to say, Your majesty.... but-

King : What's the reason? I don't want any excuses from you. I want to know what's the reason of this darkness. Why there is no sunrise today?

Minister : Your majesty, this is because of us only!

King : Meaning?

Minister : We have cut down water supply of the neighboring kingdom, so they have covered the sunlight!

King : What?

Minister : Yes, your majesty! You can ask Shripal even!

King : Shripal, is this a truth? What the Minister is saying?

Shripal : Yes, your Majesty!

King : But how did they manage to block the sunlight?

Shripal : Sorry your majesty, but I really don't know that. But yes, I certainly know one thing!

King : What's that?

Shripal : By blocking the water of the river, we are not only starving our neighboring kingdom, but also we are affecting nature, its biodiversity and even the climatic conditions.

King : What?

Shripal : Yes, your majesty!

King : Shripal, you cannot make statements like these in front of your King. You need to justify your statements.

Shripal : Yes, your majesty. I will explain to you, if you grant me the permission.

King : Go ahead!

Shripal : Your majesty, I will ask some questions to all the members in the court, just to clarify myself regarding how much information all have.... so accordingly, I will proceed with the explanation. Is this okay, your majesty?

King : Yes, Shripal. Go ahead!

Shripal : Your majesty, we all know that resources on the Earth are limited. For example, water. It is limited, but every body of us consumes water. Then the question is how this water is not finished?

King : Every year we get water through rains!

Shripal : Correct. But how rains are formed? From where this water comes?

Minister : It's due to evaporation of sea water!

Shripal : You are correct, Minister! The rain is a part of a water cycle. Water in the sea evaporates due to the heat from the Sun and these vapors eventually condense at low temperature to form clouds. When clouds get saturated with water vapors, they cannot hold water and the rain comes.

King : And thereby we get water!

Shripal : Yes, your majesty. But water is not created here. It is just being circulated through various processes. More importantly, these processes are occurring naturally. Thus, it's a water cycle.

Minister : Yes!

Shripal : Similarly, there is carbon cycle also!

King : What is that?

Shripal : Carbon is very important chemical element.... And I can say that it is important for the life on the earth. This Carbon is also getting processed through various activities in nature and we have carbon cycle in nature. Similarly, we have nitrogen cycle, oxygen cycle, mineral cycle, etc.

King : This is okay, but what is the relevance of all these cycles here? I want sunshine now. That's all. (At the background, bell ranges and nine strokes are heard) It's nine o'clock now!

Shripal : Yes, your majesty! I will explain. In nature, nothing is isolated. Everything has a connection with one or more things. If one factor in all these cycles becomes weak,

entire balance may be lost. So if we block the river flow or if we change the course of river, we are altering the natural things. Eventually, all these connections are concerned with our environment and also climate. If favorable climatic conditions are not available then it may affect all components of environment.

Minister : I agree with you, Shripal!

Shripal : If we think of our climate, human interference in nature is drastically affecting the climate.

Minister : Yes!

Shripal : But, your majesty, life on the earth is also affecting the climate through carbon and water cycles!

King : How?

Shripal : Life affects climate through mechanisms such as albedo, evapotranspiration, cloud formation, and weathering.

King : Don't be so technical, Shripal. You elaborate what you want to say!

Shripal : Yes, your majesty! We all know that, the basic strategies employed by people who live in hot places. For example, buildings at such places are finished with white exteriors to keep them cool, because white surfaces reflect the sun's energy. On the other hand, black surfaces reflect much less. People wear light colors in summer rather than dark ones for the same reason.

King : Yes, I understood!

Shripal : Our Earth's surface is a vast patchwork of colors, ranging from the dazzling white of ice and snow, to the dark surfaces of oceans and forests.

Minister : Yes, absolutely!

Shripal : Each surface on the Earth has a specific effect on the Earth's temperature. Snow and ice reflect a lot of the sun's energy back into space. The darker oceans absorb energy, which warms the water. Oceans help keep the Earth warm because they absorb most of the heat. This warming increases water vapor, which acts as a greenhouse gas and helps to keep temperatures within ranges.

Minister : But, Shripal.... how is it measured? How do we know that certain surface is absorbing more heat and keeping our Earth cool?

Shripal : Good question, Minister! The fraction of solar radiation reflected by a surface or object, often expressed as a percentage. Oceans absorb approximately 90 per cent of the heat incident on them. In fact 'albedo' is a measure of the reflectivity of a surface.

King : Albedo?

Shripal : Yes, your majesty! The term ‘albedo’ is derived from the Latin for ‘whiteness’. The albedo effect is a measure of how much of the Sun’s energy is reflected back into space. Snow-covered surfaces have a high albedo, because these are shiny white surfaces and thereby can reflect most of the incident heat. On the other hand, the surface albedo of soils ranges from high to low, and vegetation-covered surfaces and oceans have a low albedo.

King : Because these surfaces absorb most of the heat!

Shripal : Absolutely right, your majesty! So higher albedo has a cooling effect and lower albedo a warming effect. The Earth’s planetary albedo varies mainly through varying cloudiness, snow, ice, leaf area and land cover changes. The most significant projected impact on albedo is through future global warming.

Minister : (Curiously) How?

Shripal : Due to global warming, ice on the polar regions of the Earth is disappearing quite fast. As the white surfaces decrease in area, less energy is reflected into space, and the Earth will warm up even more.

Minister : Ohhhh....

Shripal : Sea level is rising. By exposing the ocean surface to sunlight, the water warms up. This melts the ice from underneath. Humidity also increases; water vapor is a powerful greenhouse gas. So it contributes global warming and thereby climate change. There are other factors also due to which the life affects the climate.

King : Which are those?

Shripal : There is a factor called, ‘evapotranspiration’

King : What is that evapotranspiration?

Shripal : Evapotranspiration is the process of transferring moisture from the earth into the atmosphere. In fact, it is the combination of both, evaporation and transpiration.

Minister : We know, evaporation. But what is transpiration?

Shripal : Transpiration is the process by which moisture is carried through plants from roots to small pores on the underside of leaves, where it changes to vapor and is released to the atmosphere. Transpiration is essentially evaporation of water from plant leaves. But it takes place through other aerial parts of the plant also, such as stems and flowers. Farmers generally call this as ‘plant sweat’. Some farmers use this water for irrigation!

King : For irrigation? How is it possible?

Shripal : Your majesty, during a growing season, a leaf transpires many times more water than its own weight. An acre of corn gives off about eleven thousand to fifteen thousand liters of water each day, and a large oak tree can transpire one lakh fifty thousand liters per year.

King : Ohhh my god!

Shripal : So, evapotranspiration means evaporation plus transpiration! It is a key process in nature, and is responsible for nearly fifteen percent of the atmosphere's water vapor. Without it, clouds couldn't form and rain wouldn't fall.

King : So, if we cut trees in excess amount, it directly affects the water vapor content in the atmosphere!

Shripal : Yes, your majesty! Not the big trees, but small fern like Azolla also had an effect on the Earth's climate.

King : (Curiously) How?

Shripal : (*The silent tune of music starts giving the effect of flashback*) About fifty-five million years ago, when our Earth was in a near-runaway state, dangerously overheated by greenhouse gases. The Arctic Ocean was also a very different place. It was a large lake, connected to the greater oceans by one primary opening: the Turgay Sea. When this channel closed or was blocked nearly 50 million years ago, the enclosed body of water became the perfect habitat for a small-leaved fern called Azolla.

Azolla took advantage of the abundant nitrogen and carbon dioxide, two of its favorite foods, and flourished. Large populations formed thick mats that covered the body of the lake. When rainfall increased from the changing climate, flooding provided a thin layer of fresh water for Azolla to creep outward, over parts of the surrounding continents.

Azolla bloomed and died like this in cycles for roughly one million years, each time laying down an additional layer of the thick blanket of sediment. Due to this thick sediment of about eight meters, carbon dioxide gas from the atmosphere got absorbed. It was estimated that about 80 per cent drop in carbon dioxide from the atmosphere by this one phenomenon alone. This drop initiated the switch from a greenhouse to the current icehouse Earth; the Arctic ocean cooled from an average sea-surface temperature of 13 degree Celsius to today's minus 9 degree Celsius.

King : Amazing!

Shripal : The Earth has witnessed such events in the history where life itself on the Earth has affected the climate.

Minister : Shripal, this is caused by the nature itself. But, we... humans are interfering the nature thereby causing huge problems for our future generations!

Shripal : Yes, that's true Minister! We are more responsible for the climate change rather than natural activities. So we must –

King : (Interrupting Shripal) Minister, I got the point..... And I must confess, that it was my mistake to cut water supply of our neighboring kingdom. I do not have right to interfere in nature!

(Change over Music Piece. Again the scene of Grandma and Digu starts)

Grandma : So Digu, the King ordered the Minister to release the water to the neighboring kingdom. (Digu laughs) Shripal and Minister looked at each other and smiled.

Digu : So it's a sugar coated pill for the foolish King!

Grandma : Yes! By that time, Sun was setting to rise and the King became happy. (Grandma laughs) So, what is the moral of the story?

Digu : Moral of the story is, we should not interfere nature! Let the nature takes it's own course.

Grandma : (laughing) Correct! Now the rain has stopped! The sky has become clear.... No lightening and no thundering! But it's pretty cool now, due to heavy rains. Now go to your bed and sleep quietly!

Digu : Yes Grandma, now I will not afraid of thundering.... It's part of natural events! Like the King, I also learned a lot! (Grandma laughs with satisfaction) And.... Grandma, thanks for the very good story! Good night!

Grandma : Good night, beta!

(Both laughs. Music piece. Episode ends.)

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