agMOOCs
Basic aspects of Atmosphere, Climate, Weather
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My dear students, dear farmers, and my friends, I invite you all for this online course on weather forecasts in agriculture and agro advisories. This is a practical output from the field of agricultural meteorology. Why this is required? You may ask certain questions at this topic. This is mostly required considering; number one, the cultivable area comes down. There is threatening from the change in the weather and the climate. And the third dimension is the food demand from the increasing population. So this topic is being discussed timely in this online course.

Now let me say something on this. Shall we go rightly to the topic without understanding the basic things? We must have some understanding on the basic aspects of metrology. And you may ask sometimes why this course is necessary why should I understand? This is mostly required to reduce the crop production risk under open field conditions. Now let me start some basic aspects of atmosphere. How crop interacts with weather, may be positive or negative. How this risk is being reduced by management like weather forecasts and advisories. And I also like to focus certain case studies also.
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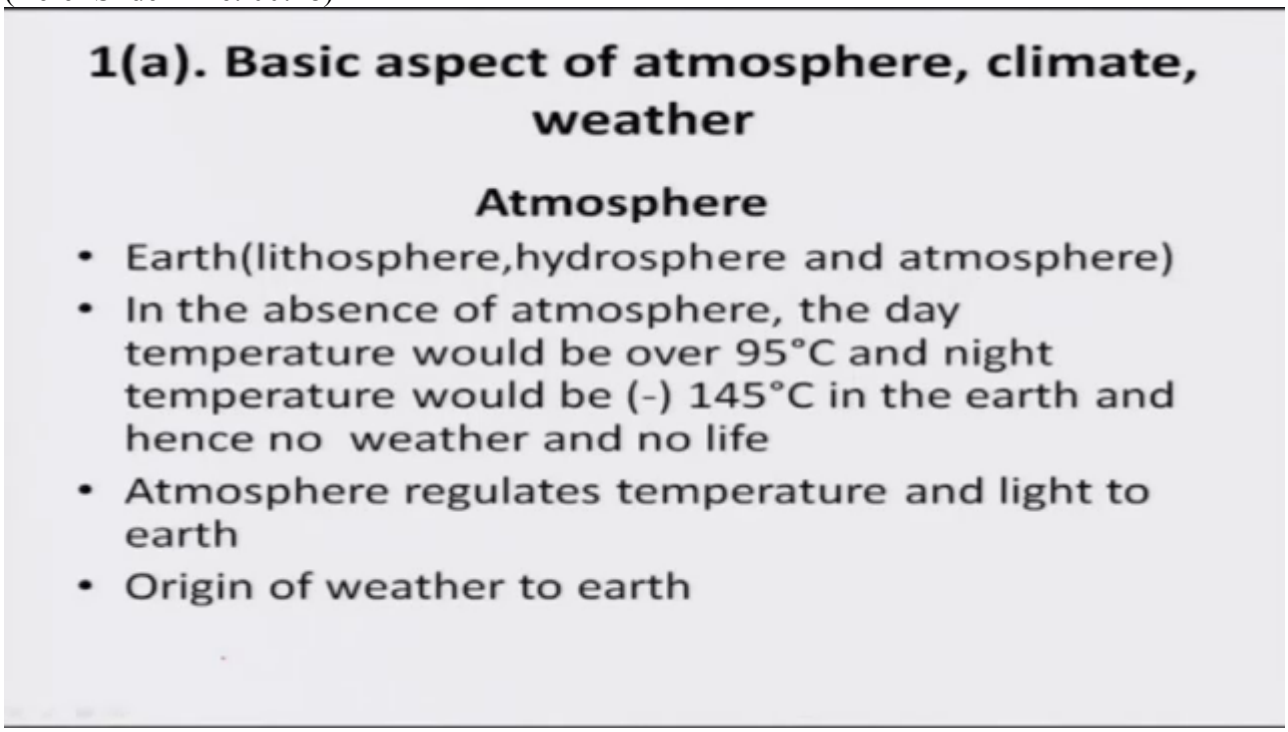

Now let us start some basic aspects of meteorology so that you can understand the topic very well. Now let me say about atmosphere. This is for mostly important you have to understand. if I say atmosphere, it is a component of your earth. Earth has three sectors. One is atmosphere. Another one is your hydrosphere. And the third one is earth itself lithosphere. There is always interaction may be positive or may be negative between earth and atmosphere, between earth and the ocean, between ocean and atmosphere, between atmosphere and the earth, so triple interaction always going on whether it gives positive or negative, we have to adapt to these situations.

Suppose there is no atmosphere to the earth, can we have life? There is no life. Because the gaseous component that envelops our atmosphere is up to a depth of 10,000 kilometres. So it is a gaseous component. This regulates the radiation or energy and the light to the -- your earth from the atmosphere. It's an intermittent, interface layer between your sun and your earth. If there is no atmosphere what will happen in the day. The day temperature goes up to 95 degree centigrade. See how much. Similarly after all outgoing radiation the night temperature would fall to minus 145 degree centigrade. Hence there is no life. So this is very very important. The presence of atmosphere is very important considering this aspect.
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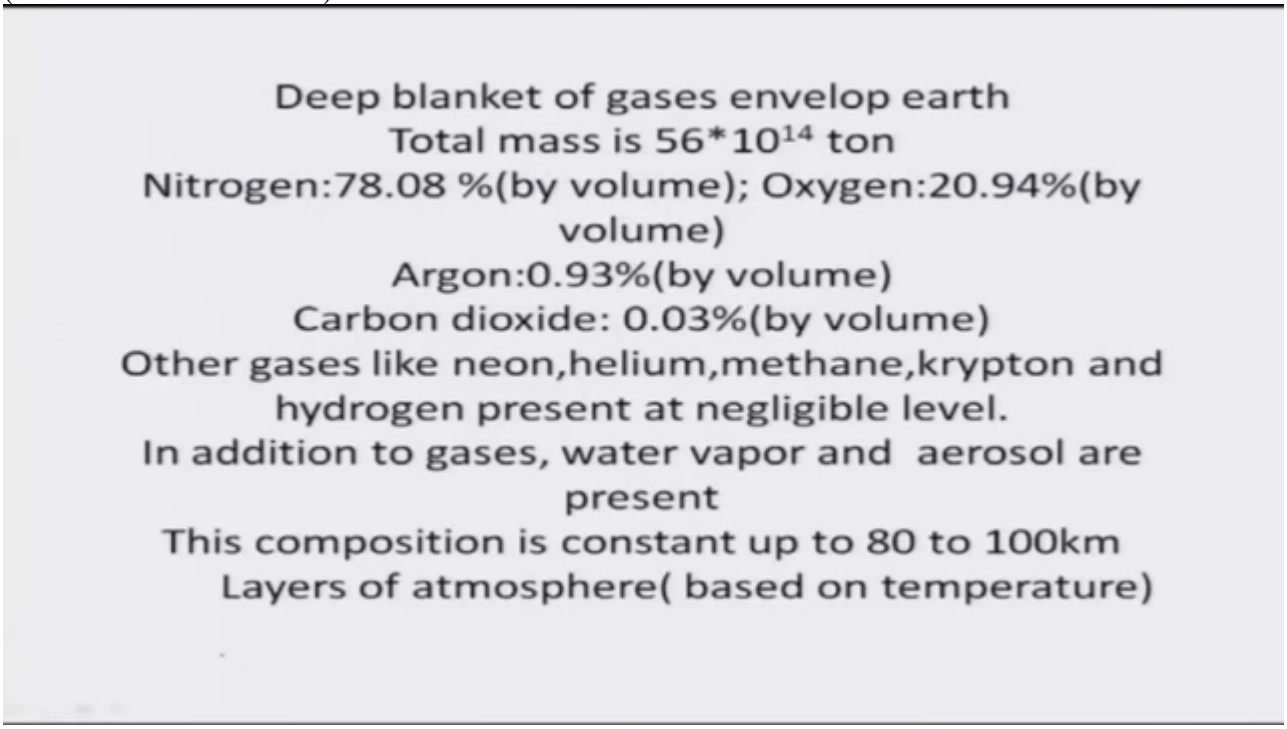

Now I like to say certain things about the atmosphere. The atmosphere has deep blanket of gases, the total mass estimated to be 56 into 10 to the power 14 ton. Since it is a gaseous component it contains a nitrogen up to 78% by volume, oxygen by 20.9% by volume, argon, 0.93% by volume, carbon dioxide 0.03% by volume and in addition to these gases neon, helium, methane, Krypton and hydrogen present at negligible level. These are all gaseous components. In addition we have solid components also like aerosol and water vapor present at the atmosphere. You can ask question, is it constant up to the level of the atmosphere or will it be varying at the different heights? I say this is constant up to 80 to 100 kilometer. So now you could understand, appreciate some physics of the atmosphere.
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Name of the layer	Height from the earth	Properties
Exosphere	Up to 10000km and beyond space	——
Thermosphere	Up to 400 km(D ,E,F,and G layers)	Density is less, oxygen and nitrogen present, molecular and atoms of oxygen present, temperature increase with height. Temperature up to 980°C
Mesopause		Temperature begin to increase
Mesosphere(Ozonosphere)	Around 80 km from the earth	Temperature decreases to a minimum of (-90°) C around 80 km
Stratopause		Maximum temperature with absorption of UV rays
Stratosphere	50 km from troposphere	Temperature constant up to 20 km. increases up to 50 km
Tropopause		Temperature inversion layer(warm air over cold one - 28°C
Troposphere	16 to 18 km at equator, 8km from poles	75%of total gas, ,water vapour and aerosols,decrease in temp. with height @6.5°/km.This is up to (-)28°C

Now let me say how the atmosphere arrange the layers based on the temperature this is very very important. You see from the bottom you can see here it goes from here. The lowermost layer is troposphere. It is 60 to 80 kilometre at the equator, 8 kilometre from the poles because of the arrangement of the earth shapes and size. This troposphere contains total 70% of the total gases, water vapour, aerosol and there is a decrease in temperature at the every kilometre height the decrease is 6.5 degree centigrade per kilometre. This continues up to minus 28 degree centigrade. So there is a temperature decrease with height at the troposphere.

The next to troposphere there is a media or a middle component that we call it as your tropopause. The tropopause here it is above the troposphere where the warm air start is coming there after. So after the tropopause you have stratosphere. This is 50 kilometre from your troposphere. Here the temperature though it is increasing as compared to your troposphere, it is constant up to 20 kilometre and exceed up to 50 kilometre. Then after that that is stratopause. This is a maximum temperature with the absorption of UV rays. So first troposphere, decrease in temperature with height. Then stratosphere, here temperature gets warmed and the stratopause, maximum temperature with the absorption of UV rays.

The next one is your mesosphere. It is a around 80 kilometre from the earth. Temperature decreases to a minimum of minus 90 degree around 80 kilometres height. Then after that there is miss of Oz then there is a mesopause, then there is thermosphere, the density/oxygen, nitrogen present, molecular and atoms of oxygen present, temperature increase with height, temperature is up to 980 degree centigrade. Then thereafter your exosphere, it has got height of 10,000 kilometres, beyond that there is space. So this is very very important one for these things. Okay. We have understood the layers of atmosphere by texture. Now let me see through pictorial representation also.

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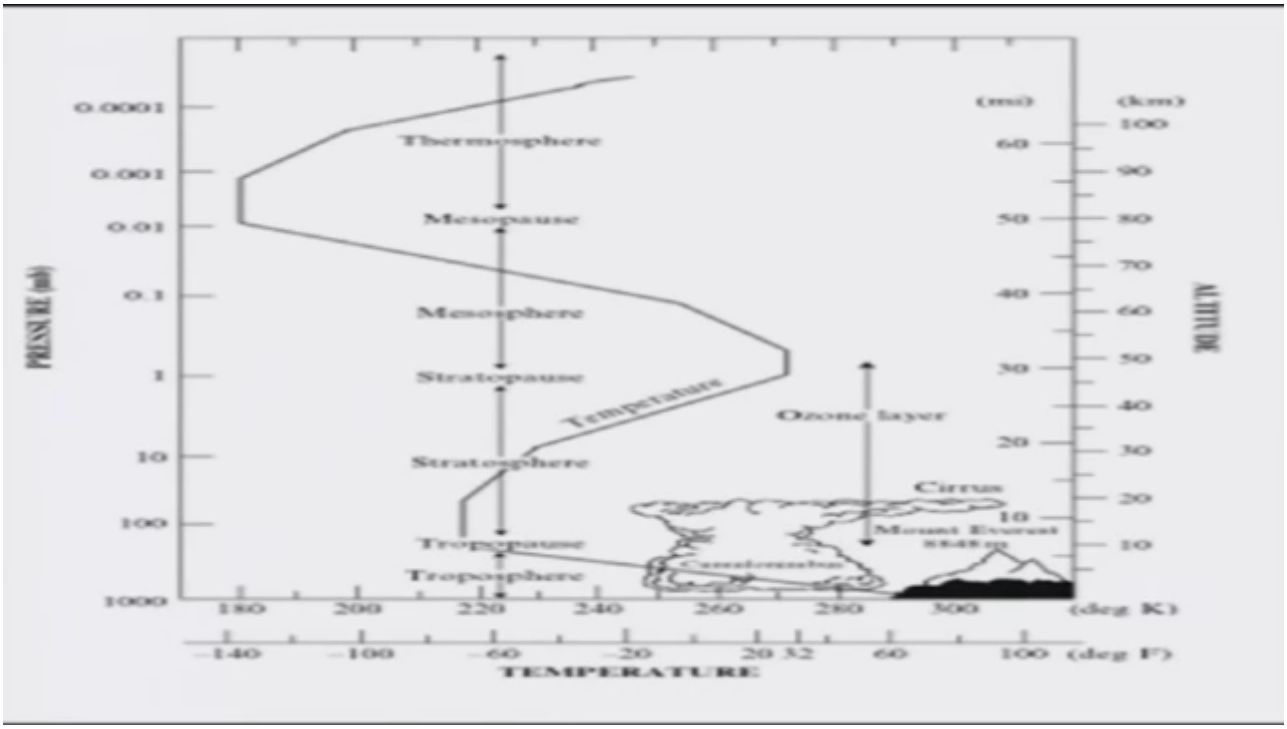

In the left side y-axis how the pressure gets varied, that pressure means, atmospheric pressure gets varied with altitude, and also there is a change in temperature. As I indicated earlier in our earlier discussion with height the temperature gets decreased at the troposphere level, then beyond that there is increase in the temperature. So this is very very important basically for other things.

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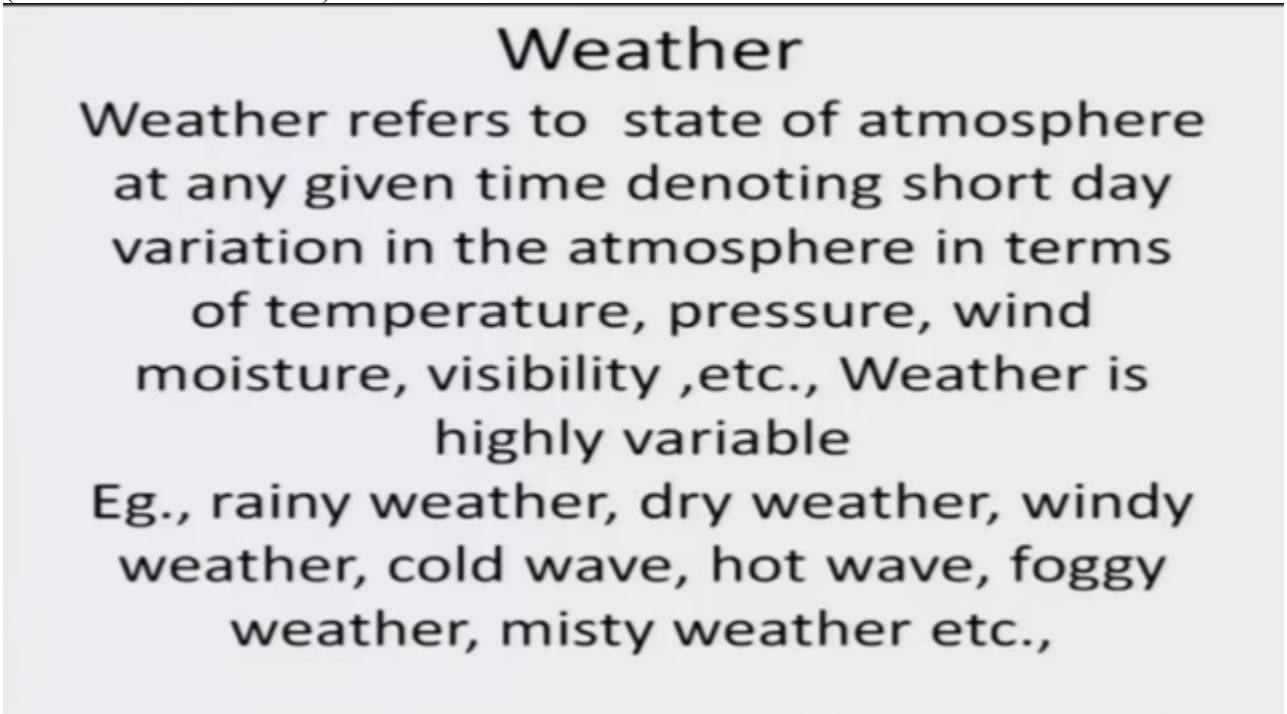

Now you can see why this atmosphere is there? What we enjoy today weather and climate? The birthplace of weather is the atmosphere, because the simple interaction between the land, atmosphere and between the land and ocean and between ocean and your atmosphere. So the

birthplace of weather is your atmosphere that to the pertinent layer is troposphere, the lower most layer of the atmosphere.

Can you define the weather? Yes. Weather is day to day change in the atmosphere. What is the component of day to day change? It is nothing but heat and moisture. See change in heat and moisture in the atmosphere we call it whether that is a short-term change. So whether it is nothing but today we have example, rainy weather, completely we get a rainfall. Then dry weather, windy weather or misty weather or fog weather. So the weather refers to a day of change in the atmosphere.
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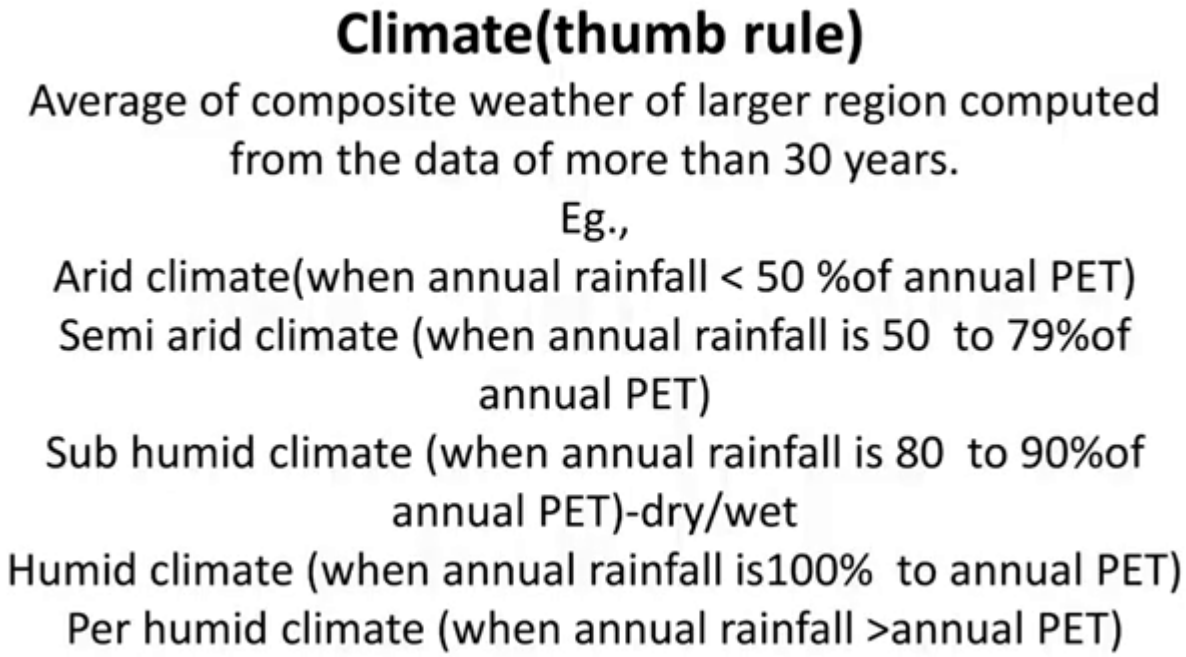

Let us go to the other component, climate. People use wrongly the word climate for day-to-day change in the atmosphere. I can quote some example. Two fellows are going on a street. One fellow is saying that today the climate is very good. This is a wrong verdict. Today the weather is very good. Climate does not reflect weather. Both are entirely different. Then how to define the climate? So average of composite weather, composite weather, so many months weather, so many years weather. So average of composite weather of larger region maybe a district, maybe a state, maybe a country, computed from the data of more than thirty years. The World Meteorological Organization prescribes that climate must be characterized by taking 30 years data. Now I want to go to some example, simple thumb rule, say they say climate they offer different areas but I have developed my own based on the annual totally evaporation and also total annual rainfall.

Now arid climate, you can say, it is a dry climate. When the annual rainfall is 50% lesser than or 50% of the PET, suppose PET is annually 2000 millimetre, if the rainfall is 1000 millimetre then we can call it arid climate, less than 50%. Then semi-arid climate, when the annual rainfall is 50% to 79% of the annual PET we call it as semi-arid climate. Then sub-humid climate; when the annual rainfall is 80% to 90% of the annual PET then we call it as

sub-humid climate. Here there are two subtypes based on the temperature. One is dry, another one is wet. The annual rainfall is 80% to 90% of the annual PET, but when the temperature is more than 30 degree centigrade we call it as dry sub-humid. When the temperature is lesser than 20 degree centigrade we call it as wet sub-humid climate. Then the other climate is humid climate. Here the annual rainfall is 100% to annual PET, economically we can call it as a break-even point, rainfall and PET are in equal. Per humid climate; when annual rainfall is more than annual PET. So these are some example for climate.

So today's class I have given certain basic aspects of atmosphere. With this we'll be seeing some interesting subject in the next class. Thank you very much.