Slide: Dear students and farmers, I am very happy to meet you again after a gap of one week. In that week lessons were given by my colleague Dr. R. Nagarajan, especially on crop water interaction on certain selected crops. So basically now we move to the central core of our lessons. This is very-very important. For this central point only we have discussed something earlier, to understand this topic very well. So considering these, today we like to discuss on types of weather forecasts and details. It is very-very important. Having understood properly on crop production risk, weather sensitive crops, weather sensitive stages, weather sensitive farm operations, and crop water interaction, it is now we have come to... to discuss on the types of weather forecast and their details.

Slide 2: Now let me say, what is further forecast, this must be understood properly. So forecasting may be defined in different way. Forecasting is a general word.   Forecasting or astrology, forecasting something, so forecasting weather is something different from other things. So forecasting future weather change in especially is very-very important and also temporal. Spatial means different locations and temporal means between months and other things. So two dimensions are there, by employing different scientific tools, this is very-very important. So forecasting future weather change in spatial and temporal dimension by employing different scientific tools is very-very important. It can be also defined as predicting future weather change in spatial and temporal dimension. I have changed here future weather change in spatial and I have used it against the forecasting used to predicting.   Again I like to define in a third way foretelling. So the only forecasting, predicting, foretelling are differing from the same statement others are very-very similar. So weather forecasting is nothing but pre-telling or foretelling or predicting or informing the people of the anticipated, weather events to be expected.

Slide 3: Now let us move to some... The scales of meteorological motion. This is very-very important, unless you understand the meteorological scale, it is very difficult to develop weather forecasts or to interpret weather forecasts or something else. So on these planetary scale, the word itself indicates that it covers the entire... the part of different countries. See this horizontal scale is 2000 to 5000 kilometer and more than that. So entire India is being covered under horizontal scale and the vertical scale is 10 kilometers. So you are covering India troposphere, that we were discussing in the first week, troposphere. See from the polar it is 8 kilometer and from the equator it is 10 to 11 kilometers, so it goes up to 10 kilometers depth. Then timescale 200 to 400 hours. This weather system once develops, the scale develops, the weather system stays for 200 to 400 hours, it can be divided by 24 hours to make days. So this is the planetary scale, okay. Then coming to the synoptic scale, this is some other scale.   The horizontal distance is 500 to 2,000 kilometers may be a state or 2 or 3 states, southern India, East India, western India.   So by doing this scale only the Indian

southwest monsoon being predicted in under long-range forecast east India what would be the right, in west India what would be right, in south India what would be right, and north India, what would be right. And the vertical scale also, you were covering complete in there troposphere and the time scale is 100 hours. Now coming to the Mesoscale climate, this is between the micro and your macro climate. These both planetary and the synoptic scales are macro climate, then meso climate, this is 1 to 100 km horizontal, may be a district or a part of district, then vertical it is 1 to 10 km and the time scale is 1 to 16 hours. Coming to the micro level, if you talk about macro level there must be also the extreme microlevel also. This is lesser than 100 meter, not kilometer, meter, it is only 200 meters, small scale, and not hours, this is 6 to 12 minutes. So this is a scale being used to develop a weather forecast in meteorology and also it is being applied in agriculture also.

Slide 4: So moving to the next slide, methods of weather forecasting. How weather forecast is being given. What are the methods, the institution they adapt. Synoptic method. We were receiving synoptic scale, now under the same scale we use the synoptic model. The characters using weather elements observations are surface level, surface observatories, and upper level made from different locations okay. Weather chart is prepared to indicate present status of atmosphere, that is our weather, weather is day-to-day change in the atmosphere. So by using surface observatory observations, upper level observations of different locations the weather chart is prepared indicating the present status of the atmosphere. Then present weather, what was happening in the earlier week, were also studied, plus the information is satellite is also being put together, and also we examine analogue years analogies. When this type of weather occurred in the past. So what was the impact, how the weather system moved. so based on all those things, they develop weather forecasts for coming 5 days or 6 days or 7 days, according to the type of the forecast. This is a good method this is still being adopted in India. And the second method is statistical method. In the case of the statistical mother, multiple regression, ARIMA model automatic regressive integrated moving average, this method is being used especially for developing long-range weather forecasts, that we'll be discussing in the next slides. The third one is advanced method, numerical weather prediction. The atmosphere is divided into so many profiles and each profile, you measure the temperature, the humidity, wind speed, and all those atmospheric, evaporation, everything, then you put under matrix of different layers, then you produce equations. So equation turn from coriolis force, frictional force, pressure gradient force, and gravitational force are integrated in the multiple equation and it becomes a model. It's a very cumbersome and a precise model. Model is run from the present to future. So initial condition is very-very important, this is very-very important. Model is run from presented to future. What is happening now and what will happen in future. Then for that you have to put initial

condition. Initial... unless you put the initial condition, what is happening today, it is impossible to go for the future. What... I like to say in our home example, without any foundation you cannot built in a castle or building, so initial condition is very-very important. These are the mothers being used to develop weather forecast.

Slide 5: Now after studying the meteorological scale and the methodology to be used, now what are the types of forecasts that exist in the world, especially in India. One is now cast, now cost... now itself says that what now, instant forecast. So it is a short-time weather forecast, very-very short-time forecast, for next hours what will happen? Earlier when we were discussing about the precipitation, I was saying that they were hail storm, so hail storm cannot be predicted in advance of one day or two days, it is very-very difficult. It can be predicted another in advance. So for predicting the hail storm this now cast is very useful. So this is to warn the public. So now cast is very-very important, but not important to agriculture. For public safety, this is very-very important. Then the second type of forecast is short range forecasts. Short, a short term weather forecasts issued for 24 hours, what will happen tomorrow. This is based on the model and based on the experience of the forecaster, what will happen the next day. So 24 plus 24, this is given even for 48 hours or 2 days, that is short range forecast. Then the third forecast is medium range forecast, medium, so 3 to 10 days or 3 to 7 days like that. So median range forecast. A mother forecast issued for a period extend from 3 days to 7 days. So her focus goes, 1 hour, 2 days, and 3 to 7 days, then long range forecast. Long range, I was saying about east India forecast, when I was discussing about the synoptic and mesoscale forecast, I was mentioning about the long range forecast for southwest monsoon season rainfall. So here more than 7 days that's all, but it may go up to a season, 90 days, okay Then the... the last type of forecast is seasonal climate forecast, though it is not differing from your long-range forecast, in the case of the long-range forecast I told, the methodology used is ARIMA model, statistical model. In the case of the seasonal climate forecast, this terminology was pronounced by Australian scientist and in Tamil Nadu this type of information means being developed by employing the rain man software, this we got it from our Australian government and this is being used for seasonal climate forecasts. You must understand the difference between though these two forecasts, gives the forecast for anticipated rainfall only up to a season of 90 days, they differ very much. In the case of the long-range forecast, you give forecast only for part of India, and whole of the season, part of India, suppose eastern India, what would be the rainfall. We never bothered about state, we never bothered about district, we had never bothered about a taluka. Similarly we never bothered about the month of rainfall to be received, we bother about only seasonal rainfall. But in the case of seasonal climate forecasts, both you can have spatial dimension as well as temporal dimensions. You can be been able to predict a forecast rainfall for a particular village for different months of a

season. Suppose southwest monsoon forecast is given in the seasonal climate forecast means, it can be given for June, July, August and September. But such a thing is not available in the long range weather forecast.

Slide 6: Then coming to the other part of the details of the different weather forecasts, you could see very interestingly in the slides, now casting, that we have discussed under types of forecast, this is given by India meteorological department, India meteorological department. So the forecast, the weather elements are your thunderstorm, dust storm, cold and heat waves. These cold and heat waves we have discussed already in the part of our lessons, so this is the other elements to be forecasted in now costing. Methods used synoptic as well as weather map. So both are very-very important. Then lead time, 1 to 2 hours earlier of the events, 2 hours earlier of the events, and the accuracy is 90 to 98%. If I say the hailstorm is to come by 11:30 or 12:30, by 10 o'clock means, definitely at 90% probability, the things will happen in a particular area. Then coming to the short-range forecast, this is also again given by India meteorological department, here the forecast covers, what would be the cloud cover in the coming days and it's rainfall quantity, temperature, and cyclone warning also, the short range is being used, and the methodologies synoptic and weather map and numerical weather prediction model, that is advanced model, and this stays for 1 day plus 1 day 80 to 9
0%. Then medium range weather forecast, this is again given by IMD, earlier it was given by National Centre for medium-range weather forecasts, that institution has been amalgamated with IMD now, so IMD takes the responsibility presently for issuing the medium range weather forecast. Here rainfall, temperature, relative humidity, wind speed, wind direction and the cloud cover are covered, which are foremost important for taking farm decision especially for the crop management, to reduce the risk. Then here they use two methods, global numerical weather prediction model, it is nothing but the same numerical weather prediction model, but something precise and also regional climatic model. So these two models are being used, this is 3 to 7 days and accuracy is 70 to 75%.

Slide 7: Now coming to the other forecast, medium range, there are two things one is issued by the IMD, another one is by Tamil Nadu agriculture university. Here same weather parameters are being covered, but we use regional climate model here in TNAU, uses regional climate model, that I have pointed out in the earlier slide also, this model being also. So advancedly being given 7 days earlier and accuracy is 70 to 70%. Then long-range forecast that we have discussed already, IMD, seasonal rainfall, statistical regression like ARIMA model automatic regression integrated moving average model, 30 to 40 days in advance of the events to be occurred, and accuracy is 60%. Now a seasonal climate forecast, again TNAU, seasonal rainfall, here rain man software from Australia, then 15 to 20 days, 60%. One interesting thing is, when you start from now casting, the

accuracy is 90 to 95%, shorter in 80%, medium range 70 to 75%, then finally seasonal climate forecast 60%, long range. So when you forecast for more than 7 days, your accuracy gets reduced. That is the information to be derived from this discussion.

Slide 8: Now continuing the same thing, who are the clients how these type of weather forecast is being communicated to the farmers, such information we could see presently. So now casting the clients are public, only public. So radio and the television and dailies are being used to communicate the message develop, usefulness for agro advisory, it cannot be used for developing any agro advisory, because the event is going to occur within an hour from the time now, so we can't prepare anything... anything, so we can't prepare any agro advisory, then resolution state level. So resolution means coveraging point, suppose a 5 x 5 meter 30 x 30 meter, grid point level, so here it is a state level, so not for in a district level, state level. Short range, public including farmer, farmers also can use this. Radio, television, and dailies, and agro advisory development, it is impossible, because it is being given, 1 day plus another 1 day, 2 days only, so we can't prepare any advisory, even it is prepared, it cannot be communicated to the farmers for taking action. It is again given to state level level. Then medium range forecast mainly for farmers only, just to reduce the crop production risk. So our ex-honorable Prime Minister Rajiv Gandhi and our Indira Gandhi, after seeing all the struggles of the farmers, they have developed this medium-range weather forecast center at New Delhi and started functioning from... I hope from 1991 onwards. So what they do is, here very interesting, that we will be seeing at a latter times, the forecast is developed at the district level, not state level and they critically analyze, what is a standing crop, how the crop is there, is there any pastern disease, and based on the crop or the interaction, although that is based on your weather forecasts, what will happen to the crops requirement or crops impact, then they prepare a agro advisory and communicate it to the selected farmers, or farmers they give their mobile number to the concerned organization, the message is being given to those farmers. Highly useful, since there is a lead time of more than 3 days to take farm decisions. Suppose if I say that today is, oh yes, say first day, so if something will happen in fourth day, if I communicate by today itself, you can prepare yourself for the concerned date. So this forecast is very-very useful to the farming community. Then medium range forecast, again farmers, website, highly useful, this is for block level. This medium range weather forecast is given by our Tamil Nadu Agricultural University in India. They use regional climate model and if see, state level, state level, not useful, not useful, digit level 80% useful, this is block level highly useful to the farmers, because it covers only 50 to 60 villages. Then language forecast, again highly useful for farmers, television, dailies, and radio, moderately used for developing your agro advisory, north, south, east, and west India, that is the area they give it, then another seasonal climate forecast given by TNAU to farmers, so television dailies, State Department of

Agriculture website, and TNAU research station, highly useful for preparing agro advisories, and it is given at district levels. So these are the some things, we have land on the types of weather forecast and some more things are available in the next class that will be discussed. So we have seen today, the... what is weather forecast and what is the meteorological scale to be used, what are the methodology being used to develop a weather forecast and also different types of weather forecasts, how they are useful to the farmers, that we have seen. But one thing, you are not going to develop any weather forecast, because the weather forecast development is such a wonderful advance technology, you need very quick and big computers, that we do not have. So please understand what is weather forecast, how is this weather forecast to be used for developing agro advisory, it is very-very important, that we will be studying in the next class. Thank you very much.