

Monsoons-Mechanism

Welcome students, my name is Dixita Shingadi, Assistant Professor in Geography, Government college Quepem.

Course title is Physical Geography of India and in this module, we will be learning about monsoon mechanism.

This is the outline of the presentation.

Learning outcomes.

At the end of this module, you will be able to understand the mechanism of Indian Monsoon. Basically, we will be talking about the working system and what are the factors which are playing a very important role in the formation of this monsoon system. You must have already learned about the monsoon topic in the last few modules.

Monsoon

Now let's see the meaning of monsoon.

The word monsoon is derived from the Arabic word **mausim** which literally means the season. Arab traders when they were coming to India in the past, they encountered this seasonal reversal of the wind system, which they called it as a monsoon. This monsoon refers to the seasonal reversal in the wind direction during a year. Basically, monsoon refers to the change in the wind direction, that is during the summer season it is from sea to land and during winter season it is from land to sea.

Origin of monsoon

You all have already learnt about the origin of monsoon in the last module. And now we know that the thermal concept is the widely accepted theory for the origin

of monsoon. Now besides this, there are many modern theories which has been put forth by the several geographers which explains the role of Tibetan Plateau or maybe the jet streams and many other factors which are playing a very important role in the formation of monsoon.

Mechanism of Indian Monsoon

Now we will be talking about the mechanism of Indian Monsoon and we will be seeing this mechanism through three different phases i.e. summer monsoon, retreating south-west monsoon and winter monsoon.

Summer Monsoon

First one is the summer monsoon. During this phase, the sun is at the Tropic of Cancer. The low pressure is formed in the north-western part of the subcontinent due to the intense heating of land and high pressure is formed over Indian Ocean and Australia. Besides these since the sun is in the Tropic of Cancer or it is in the northern hemisphere, the pressure belts and the wind belts shifts to the north. Hence ultimately the ITCZ also shifts northward. When this low pressure centre is fully developed in the north-western part of the Indian subcontinent, the pressure gradient becomes steep and the trade winds from the southern hemisphere are drawn to the low pressure which is position in the north-western part of the subcontinent. And this trade winds are deflected to their right after crossing the equator due to the Coriolis force.

Let me explain this with the help of diagram.

Here you can see the low pressure is formed in the north-western part of the Indian subcontinent and high pressure is formed over Australia and the Indian Ocean. The wind moves from high pressure to low pressure. So here you can see the wind is moving from high pressure and it is attaining the southeast direction and that is why they are called as South-East trade winds. After crossing the equator that is after crossing the ITCZ (Intertropical Convergence zones) due to the Coriolis force

the winds gets deflected towards it's right in the northern hemisphere and they gain the southwest direction. Hence that is why they are called as South-West monsoon winds. Now since these winds move over Indian Ocean that is approximately thousands of kilometres distance they travel; they attain a lot of moisture and that is why they are able to yield a heavy rain.

Originally, they are the southeast trade winds, but after crossing the equator they become south westerly monsoon winds and these as I said, the south-westerly monsoon winds is full of moisture that is why they are able to give the heavy rain.

This South-West monsoon splits into 2 branches due to the shape of Indian Peninsula i.e. Arabian Sea branch and the Bay of Bengal branch. So here you can see, once this trade winds cross the equator and once, they move towards its right that is through southwest direction you can notice that due to the shape of Indian Peninsula this monsoon winds are split into the two parts that is Arabian Sea branch and another one is the Bay of Bengal branch. These two branches hits or strikes different places in and around Indian country.

A. Arabian Sea Branch

First one is the Arabian Sea branch. It strikes the western coast of India at almost right angle and here it gives rise to orographic precipitation. Now what do you mean by orographic precipitation? In this the windward slopes of the mountains that is the Western ghats receives the heavy rainfall whereas the leeward side that is the opposite side of the mountain receives the less rainfall, and that is called as the rain shadow area.

The few currents from these mean Arabian Sea branch are diverted northward toward Run of Cutch, Thar desert and it continues up to Kashmir. You have to remember that in Rajasthan it does not give much of the rain or sometimes there is no precipitation because the wind movement is parallel to the Aravali Mountain ranges.

B. Bay of Bengal Branch

Next one is the Bay of Bengal branch. This branch flows up between Ceylon and Sumatra. Ceylon basically means the Sri Lanka. Here also it gives rise to orographic precipitation, wherein it strikes the western coast of Arakan and Tenasserim, the mountain ranges which are located in Myanmar. The windward side receives the heavy rainfall whereas the lee ward side receives the less rainfall, again giving the orographic precipitation. Then another current of the Bay of Bengal branch moved towards Assam, where Mawsinram records the highest rainfall in the world. Now why this Mawsinram records the highest rainfall in the world? The Mawsinram is flanked by Garo, Khasi and Jaintia hills on all the sides except the path through which this rain bearing winds enters the place. There is no gap through which the winds can escape. So instead of that they rise up and gives heaviest rainfall at this place and that is why it receives the highest rainfall.

Then a current of this Bay of Bengal branch recurves, changes its direction and it moves westward and advances up to the Gangetic plain i.e. they move up to Punjab. As they move from east to West, that is as they move from northeast part of India to the north-western part of India, the rainfall starts decreasing due to the increasing distance from the Sea.

We have learnt about summer monsoon theory. We know that the wind movement is from sea to land. Now let's see how this monsoon changes its direction.

2. Retreating south-west monsoon:

Second one is retreating SW monsoon. By late September or early October, Circulation pattern near the Himalayas is returned to its winter region and by this time the low pressure in the north-western part of India appears to be broken up. When this low pressure center becomes weaker, it ultimately shifts to the Equatorial region and monsoon begins to retreat. End of September the rainfall starts decreasing in the northern plain of India. By 15th of September, winds are

withdrawn from Punjab, then by 1st of October it is withdrawn from the Uttar Pradesh and by 15th of October it is withdrawn from West Bengal. One thing when it comes to retreating monsoon, you have to remember is that it gives rainfall to Karnataka in the month of October and November. Even Chennai in Tamil Nadu also receives approximately 55 cms of rainfall through this retreating monsoon. During this phase that is in September or October, some depressions are developed over Bay of Bengal and the Arabian Sea, and sometimes they are hurricane intensity, thereby producing occasionally heavy rains and the strong winds. Also you have to remember that the winter precipitation of southern India that is in Karnataka and Tamil Nadu especially due to the retreating monsoon.

Now let's talk about the wind direction.

The wind gradually starts blowing from westerly directions in the northern part of the subcontinent, that means it has started changing its direction and in the South southern part of India the winds gradually changed to a north-easterly direction. In this way, the winter monsoons developed gradually over the whole of the Indian subcontinent.

3. Winter Monsoon:

Last one is the winter monsoon. Here the position of sun, the wind movement and Low pressure, high pressure is completely opposite to that of the summer monsoon. Here the sun is at the Tropic of Capricorn that is inclined towards the southern hemisphere. Pressure belts and the wind belts shifts towards the South. Also, the Intertropical Convergence zones also shift through the South, and by this time the entire landmass of Asia becomes the center of high pressure. The powerful anti-cyclone, is developed over Mongolia, which blows out cold, dry and stable air, but this air does not reach India due to the blockage exerted by the Himalayas.

Another high pressure is developed over Kashmir and Punjab which controls the prevailing wind direction during this particular period. High pressure is developed

in the north-western part of the Indian subcontinent and low pressure is developed over the Indian Ocean, Bay of Bengal and the northern part of Australia. Let's learn this winter monsoon with the help of this diagram. Here you can see the sun is in the southern hemisphere. The high pressure is developed over the Asia and the low pressure is developed over Australia and the surrounding nation. That is why the wind direction or the wind is moving from land towards the sea. Since the wind is moving from northeast direction it is called as north-east monsoon rains. Therefore, the pressure gradient is from land to sea and hence it is called as northeast or winter monsoons of the northern hemisphere all over the country. The winds are light and variable. Anticyclonic winds are dry and have no capacity to yield precipitation. Parts of Punjab and Uttar Pradesh receives winter precipitation through westerly disturbances.

The southern part of the Indian Peninsula receives rainfall from the north-east monsoon currents because when they are traveling over Bay of Bengal, this current pick up the moisture. The amount of winter rainfall on the eastern side of peninsula is much heavier than on the other side. Here in this winter monsoon the wind movement is from land to sea.

In this module we have basically learnt the working system of the Monsoon season. We know that during a particular season the wind moves from sea to land and another season it moves from land to sea. Basically, we should focus on the mechanism of monsoon because the onset of monsoon, withdrawal of monsoon their dates are very important, especially to the farmers who are located in the Indian subcontinent.

These are the references.

Thank you.