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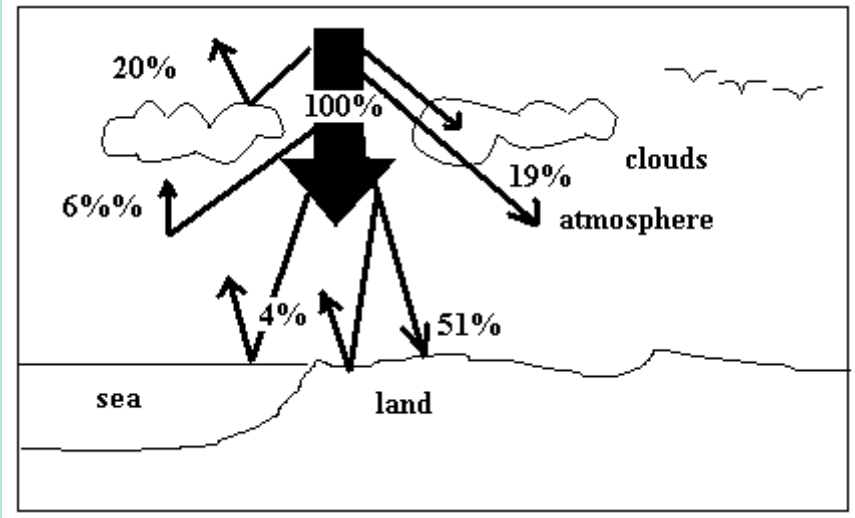
# The rains are here again!

It is the time to talk about the monsoon, says S.Ananthanarayanan.

It is only once in every several years that the monsoon comes right ‘as per schedule’. Each year it is a week late, or early or two weeks late, and so on. But it is still a marvel that it does come, ‘on the average’ at the same time.

**Driven by the sun**

All movement of the atmosphere is because of the sun’s energy and the way the energy gets spread around the earth. It has been worked out that of all the energy that comes from the sun, about 30% gets reflected back - 20 % by clouds, 6% by the atmosphere and 4% by the earth’s surface. Of the 70% that remains, 19% is absorbed by the atmosphere and clouds and 51% by the earth’s surface.




This 30% part that is reflected back by a planet is called its ‘albedo’. If the albedo increases, the planet will cool and ice-sheets may advance. As ice is highly reflective, this would further increase the albedo. On the other hand, in a cooler planet less clouds would form and that would decrease the albedo. How much of the sun’s heat the earth retains, thus, is not the same from year to year.

**The energy that stays**

The heat that stays is stored in a number of ways. The first effect is that the landmass, the oceans and the air get heated. The warm earth and oceans warm the air in contact with them and also lose heat by radiation. The oceans, being water, can flow and ocean currents arise, which are important carriers of heat from one part of the globe to another. The air too is warmed by contact with the earth and the sea and also by radiation. Air is not only fluid it is also elastic, ie, it can expand and be compressed. This results in very complex motion, N,S,E and W and also up and down, getting warmer, lighter, cooler, denser, all the time.

**The earth's rotation**

As if the dynamics of the atmosphere were not complex enough, the earth's rotation puts its foot in. While the earth rotates from west to east, the atmosphere that surrounds the earth also rotates with the earth at the same speed. The air at the poles is then not moving much, in the sense of rotation, but the air at the equator is doing a whole 40.000 kms, at sea level, in a 24 hour day! Now, in the months of March to June, when the air in the northern hemisphere warms up because of the sun and rises, cooler air from the south blows in North, towards the equator. Now the air near the South Pole, which started with little rotational motion is moving to places where the ground below is moving from west to east at tremendous speed.

The result is that as it approaches the equator, it gets 'left behind' and to an observer on the earth, seems to be blowing to the west. When it crosses the equator, and moves towards the North Pole, the speed of the earth's rotational motion begins to drop. And this time the north-moving air appears to be driven towards the East! If there were a local low pressure point towards which air rushed in from all sides, the moving air would be pushed to the right, all round and the result would be a whorl or cyclone. The effect is called the Coriolis effect and is responsible for the south west monsoon, which is striking India's west coast, coming in from the west after it crossed the equator.

**Ocean currents**

While the ample sunshine in the tropics keeps seawater warm, the ice masses near the poles cools the water to near freezing. Cool and heavily saline water sinks and flows in a deep-sea stream to the south, while warm seawater from the tropics flows at the surface to the north. Seawater is also affected by the Coriolis force and also another effect called the Ekman effect, where a layer of water set in motion by a layer of water above does not move the same way but curves to the east, in the northern hemisphere.

The whole effect is complex and billions of factors change from year to year. But on the whole, it's the northern hemisphere that is warmer in June and the land profile is the same. And so we have rains at nearly the same time each year.