

Thank you, Coriolis, its time for the monsoon!

While Mumbai swelters and the residents await the rains to break, S.Ananthanarayanan takes a look at what brings in the South West monsoon.

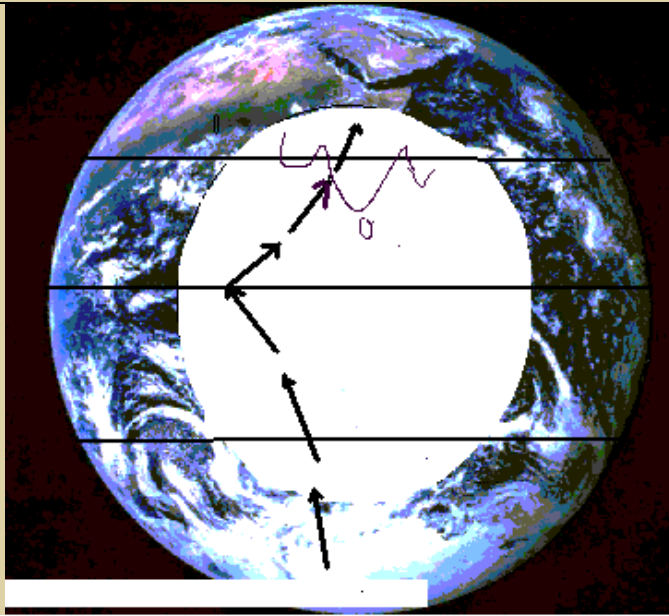
In May and June the sun is over the Tropic of Cancer and the northern hemisphere gets positively warmer than the south. This causes the building up of low pressure in the north and the south-west monsoon blows over the Arabian Sea and reaches India's west coast laden with moisture!

But why from the west?

These winds, in fact, blow from east to west in the southern hemisphere, but turn right when they cross the equator, and start blowing from the west to the east! And all this happens because the rotation of the earth and the fact that places on the equator are actually moving west to east faster than places at the poles and a phenomenon called the 'Coriolis effect'!

The Coriolis Force

The monsoon is a vivid example of this force that arises and acts on objects that move across another, rotating object. The monsoon winds arise deep down in the southern hemisphere and start out by moving directly north, towards low pressure. But while they move north, the earth also spins, from west to east. As the whole earth moves as a unit, the distance covered by places on the equator is greater than the distances covered by places nearer the poles.=



Now, as the winds move north, and come nearer the equator, the land below is moving from west to east faster than the land near the poles. As the winds have only the west-to-east speed that they had picked up in the deep South, the winds lag to the west, and seem to be blowing from the east!

And across the equator

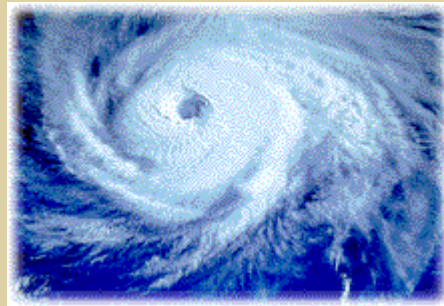
And again, when they cross the equator, they head straight for the north pole like they have been all along. But now the land below moves east slower and slower as the winds progress to the north. So the winds 'overtake' the land below and are seen as coming in from the west!

It looks like all motion of air in the northern hemisphere would be 'pushed' to the right, that is towards the east, if the motion were northward and towards the west if the motion were southward. And the reverse in the southern hemisphere.

Cyclones spiral

A dramatic illustration of the effect is in the radar pictures of cyclonic storms. Winds blowing towards a center of low pressure experience continuous 'radial' forces, towards the 'epicentre'. But the Coriolis' acceleration to the 'right', in the Northern hemisphere, generates motion along a circle, resulting in the cyclonic 'spiral'. As you would expect, cyclones in the southern hemisphere spiral the other way around!

The effect has great importance in meteorology, ocean currents, weather forecasting, and navigation. And also in the study of stellar motion, the dynamics of galaxies, and the like.



Gaspard-Gustave de Coriolis

This French scientist-mathematician (1792-1843) who discovered the effect was looking at how motion could be correctly described in the measurements made in a rotating frame of reference, like on the earth. He found that motion could be described just as in the usual case, but with a correction for the linear motion of the rotating frame, plus a 'force' to take care of the apparent acceleration due to the rotation.

