2.2. **Upper Air Circulation Features**

The upper air circulation features from Oct to Dec are shown in Fig.2.7, 2.8 and 2,9 respectively. These maps show the mean wind pattern at 850, 700, 500 and 200 hPa levels. During October, an east-west trough is seen extending from the lower levels to 700 hPa from South Bay to the South Arabian Sea. This east-west trough is seen shifting southwards from October to December, consistent with the equatorward shifting of the ITCZ. By December, the east-west trough is seen close to 5^0 N. This east-west trough is the region with positive vorticity and convergence, thus causing abundant rainfall over this region. This shear zone in the lower troposphere contributes to the genesis of low-pressure systems over the Bay of Bengal and the Arabian Sea.

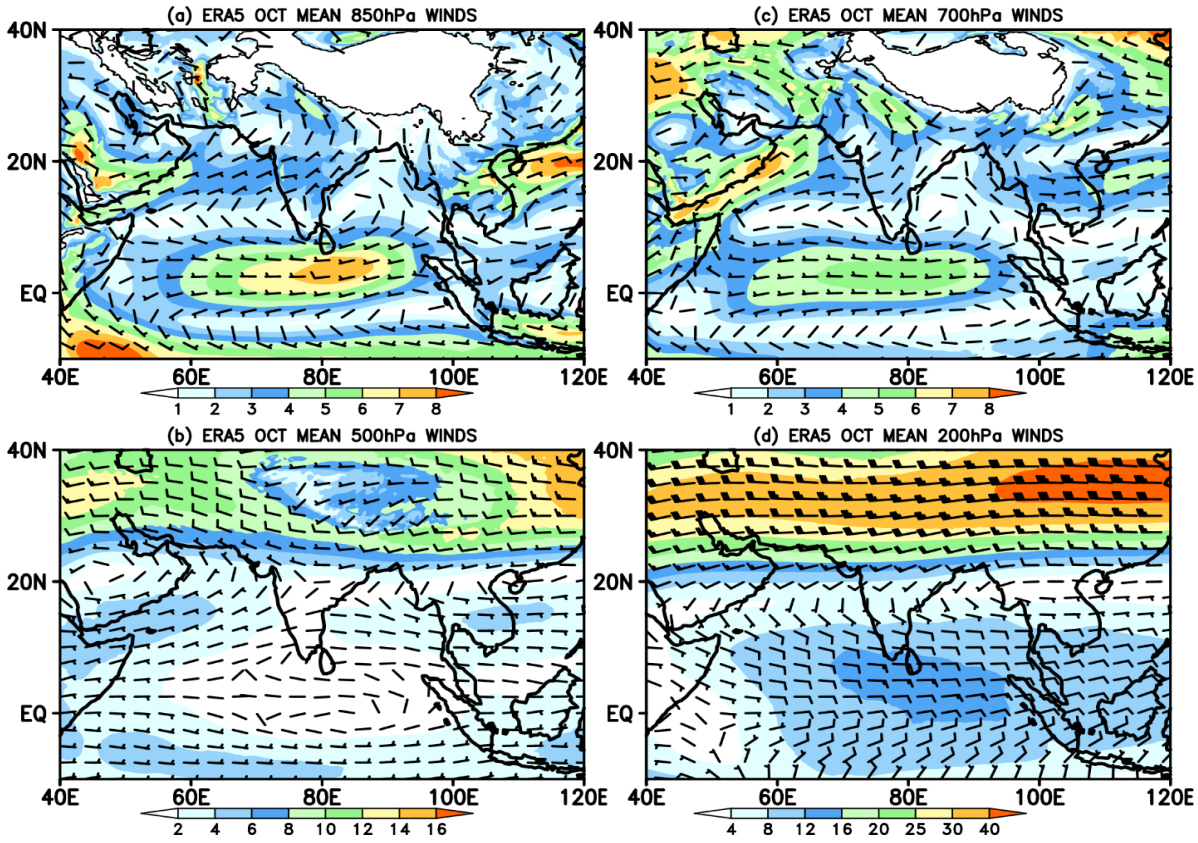

Fig. 2.7. Mean wind flow pattern during October at a) 850 hPa b) 700 hPa c) 500 hPa and d) 200 hPa levels. Source: ERA5 reanalysis. The colour shading represents wind speed in m/s. The data period: 1979-2021.

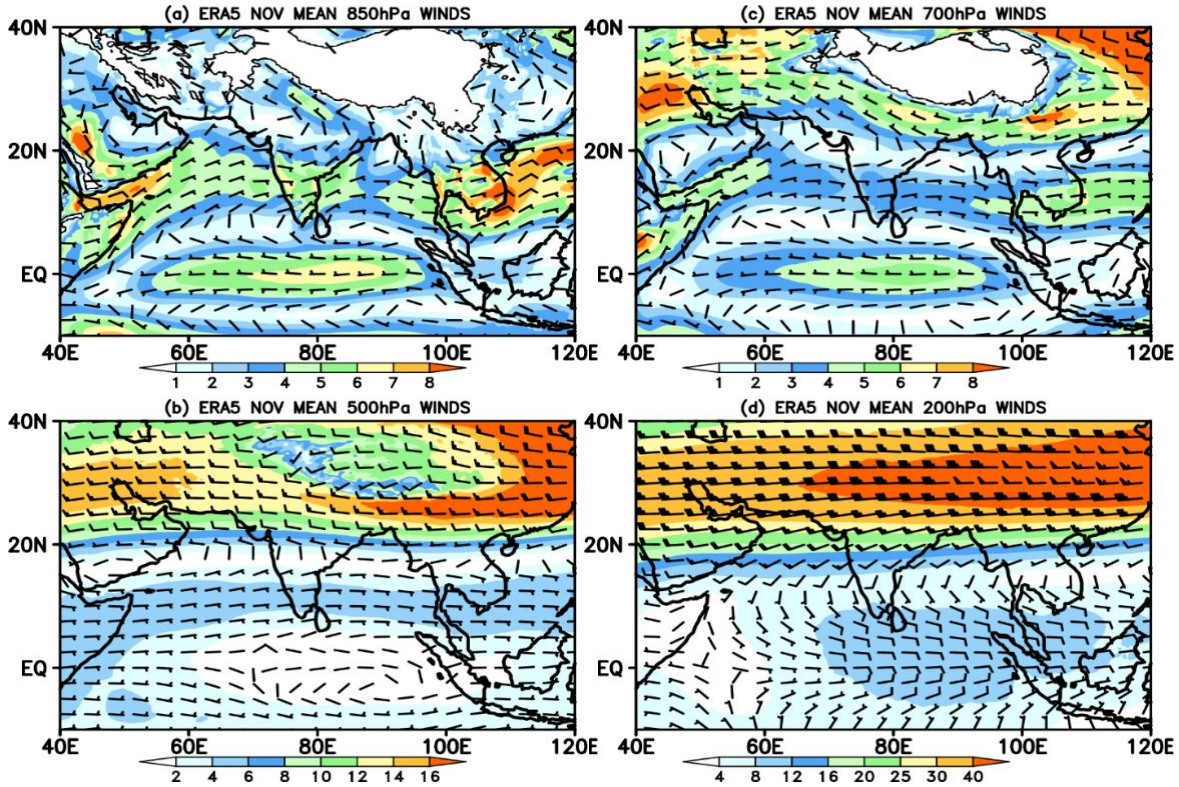

Fig. 2.8. Same as Fig 2.7 but for November.

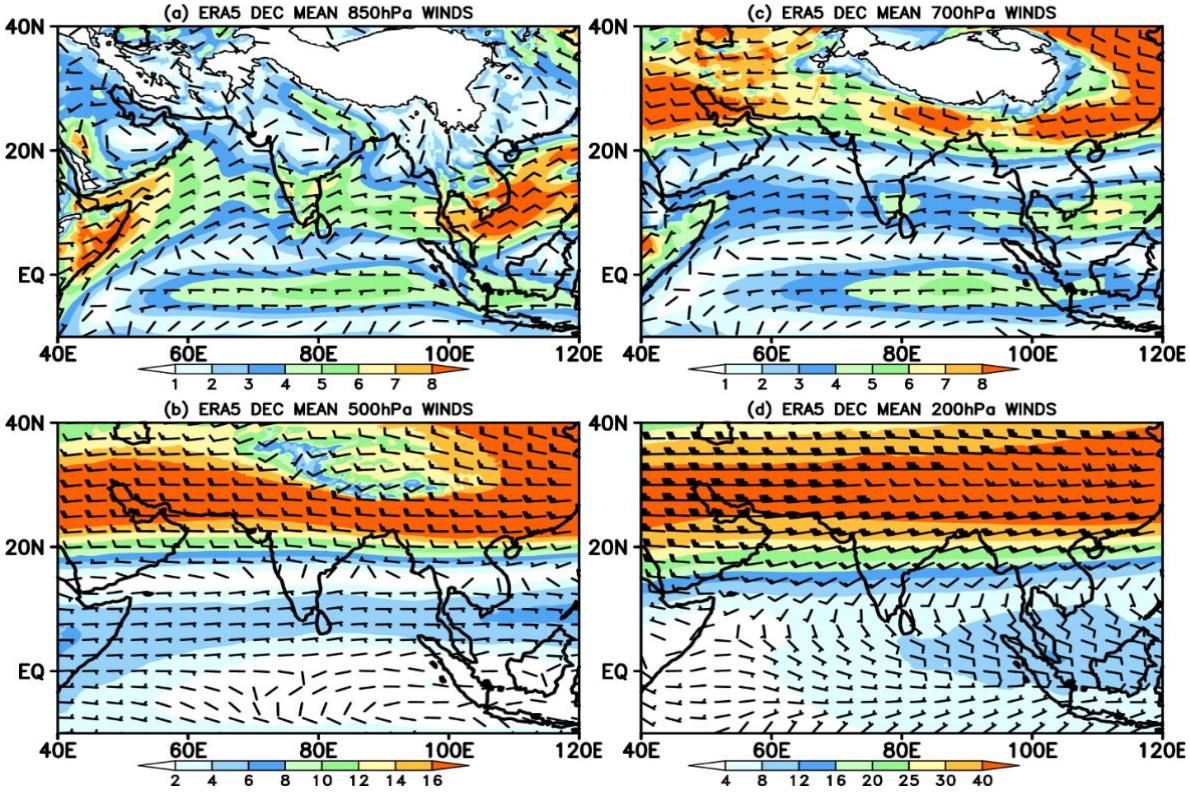

Fig. 2.9. Same as Fig 2.7, but for December.

In the middle and upper troposphere (500 hPa and 200 hPa), easterlies prevail over the south Peninsula and adjoining seas. The sub-tropical ridge at these levels also shifts southwards from October to December. The sub-tropical ridge in the upper levels is an area of divergence and contributes to the intensification of low pressure systems over the region. The Tropical Easterly Jet (TEJ), which is one of the semi-permanent systems during the southwest monsoon totally disintegrates once the southwest monsoon is withdrawn from the country. From October to December, the sub-tropical westerlies over the northern parts of the country also get strengthened and start moving to lower latitudes. An upper tropospheric ridge gets established over the southern parts of India by October and November at the 200 hPa level.

2.3. **Mean Precipitable Water Content (PWC)**

Spatial distribution of mean precipitable water content provides useful information on moisture sources and sinks over the region during the NE monsoon season. Mean precipitable water content is calculated as the weighted average of moisture from surface to upper troposphere (normally up to 300 hPa). It provides information of moisture content in the whole atmospheric layer. Higher values suggest moisture sources.

The PWC is a measure of available moisture for precipitation in the atmosphere. It measures the maximum possible precipitation of water, which may precipitate out from a given atmospheric column, if nothing else (e.g., surface evaporation, moisture advection) happens over a given time span. Of course, this is rather an oversimplified picture, because it is hard to imagine that all PWC would condensate within a given column under any conceivable process. Nevertheless, it would be good enough to interpret PWC as an upper bound for a possible precipitation at a given moment with a given atmospheric column.

Fig. 2.10 a, b and c show the spatial distribution of precipitable water content during October, November and December respectively. During October, the maximum