

**Cyclone:** It is one of the major meteorological disasters in coastal areas of India. Cyclones are intense low-pressure areas from the center of which pressure increases outwards. The amount of pressure drop in the center and the rate at which it increases outwards gives the intensity of the cyclones and the strength of winds. The criteria followed by the India Meteorological Department (IMD) to classify the low pressure systems in the Bay of Bengal and in the Arabian Sea as adopted by the World Meteorological Organisation (W.M.O.) are given in the following Table:

**Table : Criteria for classification of cyclonic disturbances over the North Indian Ocean**

Type of disturbance	Associated maximum sustained wind (MSW)
1. Low Pressure Area	Not exceeding 17 knots (<31 kmph )
2. Depression(D)	17 to 27 knots (31-49 kmph)
3. Deep Depression(DD)	28 to 33 knots (50-61 kmph )
4. Cyclonic Storm(CS)	34 to 47 knots (62-88 kmph )
5. Severe Cyclonic Storm(SCS)	48 to 63 knots (89-117 kmph )
6. Very Severe Cyclonic Storm(VCS)	64 to 119 knots (118-221 kmph )
7. Super Cyclonic Storm	120 knots and above ( $\geq$ 222 kmph )

We have considered IMD Cyclone data from Cyclone e Atlas for the period 1961-2020 for computation of several parameters. Since in cyclone eAtlas information on cyclone is combined for SCS, VCS and Super Cyclonic Storm and termed as SCS, in all our maps we have produced the information on Cyclonic Storm (CS) and Severe Cyclonic Storm(that combined SCS, VCS and Super Cyclonic Storm). In order view the climate vulnerability of cyclones in various decades, the information is made available for different decades and periods viz. 1961-70, 1971-80, 1981-1990, 1991-2000, 2001-2010, 2011-2020 and 1961-2020. The user has to select the period from the drop-down menu available while clicking on cyclone. After selecting the desired period/decade, one can get the vulnerability maps.

Cyclone **return periods** (CS, SCS, and combining CS and SCS) are computed in coastal districts for all the month and annual scale. The methodology is based on computing the

Hurricane return period by NOAA. Cyclone return periods are the frequency at which a certain cyclone intensity can be expected within a given distance of a given location within a specified buffer zone around the district (we have considered 50 nm as a buffer zone). (Ref: NOAA Technical Memorandum NWS NHC 38). Cyclone return periods maps are given for CS, SCS and ALL categories

The **maximum probable precipitation** of each district corresponding to cyclone days is computed from the daily station rainfall data for the period. Considering the horizontal scales of the cyclone and their effect in producing rainfall in the broader area, a buffer zone of 2.5° around each district is used. Also, to identify the rainfall related to cyclone activity only, we have considered the rainfall of all the stations for the cyclone days and within 500 km of the cyclone location. These maps are made on a monthly and annual scale.

**Cyclone Landfall Count** for each district gives the total number of cyclone (of any intensities) made landfall over the district during the period. These maps are made for all the months and on an annual scale.

For the computation of **Maximum sustained wind** in each district IMD Best Track Cyclone data for the period 1981-2020 is used, and the same buffer zone of 2.5° is considered. This map is made for an annual scale.

**Maximum Storm surge** heights map in annual scale gives the maximum storm surge heights in meter each of the coastal district experienced so far associated with cyclone.

We have also considered population density data and housing density data from Census data. The **Normalized vulnerability index** is calculated as described by equation 1 for each parameter viz. maximum probable precipitation, cyclone return period, maximum sustained wind, storm surge height, housing, and population density. Finally weighted average **Normalized Cyclone Vulnerability index** is computed with suitable weights. These maps are made on an annual scale.