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Tropical Cyclone Products

Products are generated for all tropical cyclones that have been officially observed (by a Regional Specialized Meteorological Center (RSMC)) at the initial time of the forecast. Both the strike probability charts and the Lagrangian meteograms (i.e. following the tropical cyclone forecast positions) are dependent on these official reports from around the world and do not take tropical cyclone genesis into account. The available charts are:

- **Cyclone position:**
  
  Once official reports signify the existence of a tropical cyclone, it is automatically tracked. The tracking algorithm uses HRES output and is based on using the extrapolation of past movement and the mid-tropospheric steering flow to obtain a first-guess position 6 hours into the future. The actual forecast position is then determined by searching for mean sea level pressure (MSLP) and 850hPa vorticity extremes around the first-guess position. In some circumstances the thickness maximum, the central MSLP, surface winds, and the orography are also considered in the evaluation. This process repeats at 6 hour intervals through the forecast until either the tropical cyclone dies or the end of day 10 is reached.

  When two Tropical Storms are relatively close the possibility arises that the tracking algorithm may jump from one to another - e.g. if one is decaying (see Fig8.1.10.1.5). This seems to be a very rare occurrence and which is under investigation, but users should be aware of the potential for this error.

- **Strike probability charts:**

  Strike probability is defined as the proportion of members that predict that the tropical cyclone will pass within a 120km radius of a given location at any time during the next five days. In other words, the time dimension is integrated over the forecast range (see Fig8.1.10.1.2B). This allows for a quick assessment of high-risk areas, regardless of the exact timing. A 40% probability at a specific location means that approximately 40% of ENS members will place that particular tropical cyclone centre within a 120km radius of that location at some point during the coming 10 days. If a tropical cyclone is forecast to loop back on itself, and so pass close to the same location two or more times, as happens occasionally, the probability shown on the plot will be the highest probability encountered in any given 6h time interval during the forecast period.

- **Lagrangian meteograms:**

  Lagrangian meteograms are a convenient way of evaluating the forecast for a specific tropical cyclone. They contain time series of the central pressure and of the 10m wind speed maximum predicted within a 7ºx7º lat-long box centred on the cyclone and following its motion in each forecast member. The "box and whisker" symbols are similar to those used on the Ensemble Meteograms. However, unlike the standard meteograms, the number of ENS members represented by the boxes and whiskers varies, and can be assessed by reference to the strike probability chart or individual forecast trajectories chart.
Fig8.10.1.1: To view tropical cyclone forecasts:

1. In the main charts page, click on tropical cyclones.
2. On the tropical cyclones page find the WMO region of interest (eg Regional Specialized Meteorological Center (RSMC) Miami has responsibility for both Region1 and Region2).
3. Select WMO Region.
4. Select cyclone product of interest.
5. Select cyclone of interest.
6. Display of product (in this case probability that Jose will pass within 120km radius, with probabilities for cyclone intensity and Lagrangian meteograms of maximum associated 10m mean wind speed and central pressure).

A quick alternative to steps 2 to 5 is to click on the coloured spot on the blue-brown chart that corresponds to the tropical cyclone of interest (position shown at analysis time).

Examples of forecast tropical cyclone products

On web site

The ENS Forecast Tropical Storm Products for tropical cyclone 07S over the western Indian Ocean in the spring of 2017 are used as an example below.

ECMWF ENS forecast with data time 00UTC 08 March 2017. Time series (Fig8.10.1.2C) are plotted for the ENS mean (black dotted) and HRES (black solid); this convention is is also used on the map track plot (Fig8.10.1.2B). On the individual trajectories plot in Fig8.10.1.2A the Control track is shown instead of the ENS mean.
Fig8.1.10.1.2A(Left): Individual ENS forecast trajectories of the centre of tropical cyclone 07S.

Fig8.1.10.1.2B(Centre): Strike probability chart. Colours show the proportion of members that predict that the centre of Tropical Cyclone 07S will pass within a 120km radius at any time during the next five days. ENS mean (dotted line) and HRES (solid line).

Fig8.1.10.1.2C(Right): Top: ENS probabilities (not including HRES) for the intensity of this tropical cyclone to fall into each of the 5 tropical cyclone intensity categories shown at 6hr intervals to 10 days. Centre and Bottom: Lagrangian meteograms of distribution the full ENS (in box and whisker format), the ENS mean (dotted line) and HRES (solid line) for the maximum 10m mean wind speed (kts) associated with tropical cyclone 07S, and MSLP (hPa) at the Tropical Cyclone 07S pressure centre. Note the categories used on the top panel are derived on the basis of the variable shown on the middle panel.

Fig8.1.10.1.3A: Web chart of tropical cyclone activity (including genesis) showing tropical storm strike probability. The web chart is clickable (shown by an arrow icon in top left corner) and a click at any location gives meteograms, plumes, wavegrams or a sequence of EFIs and CDFs for 2m temperature, rainfall and 24hr maximum wind gust. Forecast for 00UTC 10 January 2018, T+72 ENS data time 00UTC 8 January 2018.
Fig8.1.10.1.3B: Sample wavegram (at the point indicated by the arrow) for the same time as shown in Fig8.1.10.1.3A. Note waves early on 10 January are forecast to move towards the westsouthwest with a small probability of significant wave height exceeding 10m. When referring to such products one must understand innate difficulties of correctly representing the winds around tropical cyclones, and this will also impact upon the representation of waves nearby.
Fig8.1.10.1.3C: Sample CDFs (at the point indicated by the arrow) for the same ENS forecast as shown in Fig8.1.10.1.3A. Note the high EFI for 24hr maximum 10m wind gust, which can be very useful, though the user needs to be aware of the innate difficulties of representing the absolute values of winds around tropical cyclones.

On ecCharts

Tropical cyclone activity charts for named or pre-existing tropical cyclones are also available on ecChards. The information can be combined with other significant weather parameters (e.g. 10m winds, significant wave height, etc).
Fig 8.1.10.1.4: ecChart showing the ENS member tracks of TC03S up to 1 February 2017 (T+72) and the associated probabilities of significant wave height >= 4m based on ENS members (probability given by colour in the scale below the chart). TC tracks from the ENS forecast sequence are shown as thin lines (fading for older times) and HRES forecast sequence as the black line. Data time of forecast, 12UTC 29 January 2017.
Fig 8.1.10.1.5A (Left): Precipitation and surface isobaric forecast NW Australia and NE Indian Ocean T+156 VT12UTC 29 Feb 2020. TC Ferdinand is moving slowly off NW Australia and weakening. TC Esther is moving towards the SW and strengthening.

Fig 8.1.10.1.5A (Right): Locations of TC Ferdinand from HRES forecast DT 00UTC 23 Feb 2020 (solid line on chart). At 12UTC 29 Feb 2020 the algorithm incorrectly identifies the location of Ferdinand at the location of TC Esther and subsequently follows the movement and developments of TC Esther. The sudden change in the HRES forecast values of central pressure (much lower) and 10m wind (much higher) are shown on the respective graphs - these correspond to TC Esther. On this occasion the forecast values of ENS mean and ENS probabilities do not suffer from the same problem.

RSMC official forecasts of tropical cyclones take precedence

Note: IFS products on these pages regarding tropical cyclones are generated automatically without any editing by forecast experts. RSMCs (Regional Specialized Meteorological Centres) have ultimate responsibility for official forecasts of tropical cyclones within their respective regions (ECMWF is one of them).
a number of centres that provide data to them). Up-to-date information is available by direct access to official RSMC forecasts through the WMO Severe Weather Information Centre. For up-to-date forecast information for their own local area users should refer to forecasts from their own National Meteorological Service.

**Additional Sources of Information**

*(Note: In older material there may be references to issues that have subsequently been addressed)*

- Read more on [ECMWF presentation of tropical cyclones](#) (with up-to-date locations of TCs).

Updated/Amended 28/02/20 - Potential tracking algorithm error.