

## Description of the Extended Best Track Files

### Atlantic

(ebtrk\_atlc\_1851\_YYYY.txt, YYYY=most recent year available)

### Eastern North Pacific

(ebtrk\_epac\_1949\_YYYY.txt)

### Central North Pacific

(ebtrk\_cpac\_1949\_YYYY.txt)

Version 3.0.0    March 1, 2021

### Summary of Changes in Version 3.0.0

1. Files extended back to beginning of NHC's HURDAT2 files
2. Central Pacific file added
3. New file format introduced (legacy format also updated for continuity)

### Input Data Sources:

1. NHC Atlantic HURDAT2 Downloaded January, 10 2021,  
<https://www.nhc.noaa.gov/data/>
2. East Pac HURDAT2 Downloaded January 10, 2021  
<https://www.nhc.noaa.gov/data/>
3. ATCF a- and b-deck data downloaded from NHC FTP,  
<https://ftp.nhc.noaa.gov/atcf/>
4. Data from the previous version of the Extended Best Track 1988 - 2003

### Project History:

Major update in 2021 provided by  
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Updates since 2014 Provided by CIRA/CSU Staff  
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### Background Information:

The National Hurricane Center (NHC) maintains a climatology of all Atlantic tropical cyclones since 1851, East North Pacific Tropical Cyclones since 1950, and Central North Pacific Tropical Cyclones since 1949. For each storm, the data file contains estimates of the latitude, longitude, 1-minute maximum sustained surface winds, minimum sea-level pressure, and an indicator of whether the system was purely tropical,

subtropical or extra-tropical at 6-hour intervals. This data set is sometimes referred to as HURDAT2. One limitation of the HURDAT2 file is that it contains only limited information about the storm size.

As part of the operational forecasting procedure, NHC routinely estimates the radii of 34, 50 and 64 kt winds, the radius and pressure of the outermost closed isobar, the radius of maximum wind, and the diameter of the storm eye, if one exists. HURDAT2 includes 34, 50 and 64 kt winds for all 3 basins starting in 2004. However, HURDAT 2 does not include wind radii prior to 2004 and also does not include the radius of maximum wind, and the diameter of the storm eye. Under original support from the Risk Prediction Initiative, this operational data for the period 1988-1997 was digitized and combined with the information from the HURDAT file. Although the RPI project was completed in 1999, the files have been updated by NESDIS/STAR for development of satellite algorithms, using data supplied by NHC personnel. Starting in 2020 the database has been used by multiple CIRA tropical cyclone projects and the recent updates have been funded by the projects that currently use this dataset.

#### Version History:

Version 1.0 - Feb 1998 - All variables for 1990-1997

Version 1.1 - Apr 1998 - All variables for 1988-1997  
except max wind radii for 88-89

Version 1.2 - Feb 1999 - All variables for 1988-1997

Version 1.3 - Apr 2000 - All variables for 1988-1999

Version 1.4 - Mar 2001 - All variables for 1988-2000

Version 1.5 - Apr 2003 - All variables for 1988-2002, updated NHC best track file 1988-2002 used, which includes category 5 upgrade of Andrew 1992

Version 1.6 - Feb 2004 - All variables for 1988-2003

Version 1.7 - Mar 2007 - All variables for 1988-2006  
- All changes to HURDAT as of March 2007 included.  
- 34, 50 and 64 kt wind radii since 2004 are from NHC best track. NHC began creating best track wind radii in 2004; radii from 1988-2003 are still the operational radii  
- An east Pacific extended best track was added in version 1.7 called ebtrk17\_epac.txt. It includes the years 2001-2006.

Version 1.8 - Feb 2008 - Cases from 2007 season added.

Version 1.9 - May 2009 - Cases from 2008 season added.  
- Some missing data from tropical storm Zeta (2005-06) added  
- Storm numbers from 1997 modified for consistency with NHC numbering convention  
- Minor changes to HURDAT since 2008 incorporated

Version 1.10 - Nov 2010 - Cases from 2009 season added.  
 Version 1.11 - Jun 2011 - Cases from 2010 season added.  
 Version 2.00 - Aug 2012 - Cases from 2011 season added.  
                   - New field added to end of record showing  
                   distance to nearest major landmass (km).  
  
 Version 2.01 - Feb 2013 - Cases from 2012 season added.  
 Version 2.02 - Feb 2014 - Cases from 2013 season added.  
 Version 2.03 - Feb 2015 - Cases from 2014 season added.  
 Version 2.04 - Jul 2016 - Cases from 2015 season added.  
 Version 2.05 - Jan 2018 - Cases from 2016 season added.  
 Version 2.06 - Aug 2018 - Cases from 2017 season added.  
 Version 2.07 - Dec 2019 - Cases from 2018 season added.  
  
 Version 3.0.0- Mar 2021 - The existing databases have been verified using  
                           NHC's ATCF data for 1851  
                           - 2019 and the most recent available HURRDATA2  
                           database. In the updated version the radius and  
                           pressure of the outermost closed isobar, the  
                           radius of maximum wind, and the diameter of the  
                           storm eye are always taken from b-deck if b-  
                           deck values are available.  
  
 Version 3.0.1- Aug 2021 - Data from the final NHC 2020 best track added  
                           A couple of minor errors corrected

The radius and pressure of the outer closed isobar and the radius of maximum wind were not routinely estimated as part of the NHC operational forecast procedure prior to 1990. The outer closed isobar radii and pressures from 1988-89 that were added in version 1.1 were estimated from the tropical surface analyses, which were prepared operationally by NHC. These surface analyses were extracted from the NHC microfilm archive and the radius and pressure were estimated manually by J. Pennington. The radius of maximum winds for 1988-89 that were added in version 1.2 were obtained from the vortex messages of aircraft reconnaissance missions. These values were smoothed in time (the nearest three observations were averaged) to give the estimates included in the extended best track data file. The wind radii for this period (1988-89) are only included for cases where aircraft data was available.

All of the parameters not available in the HURDATA2 file were estimated from operational data sources, including ship and other surface reports, aircraft reconnaissance data and satellite imagery. At present, there are no error estimates for these variables. Generally speaking, these parameters are more reliable west of 55 longitude, where aircraft reconnaissance data is usually available. Also, because the data is operational, there is no guarantee that all of the parameters are consistent. For example, the radius of 50 kt winds might be smaller than the radius of 64 kt winds, even though this arrangement is not physically possible. Note that in version 1.7 and higher the wind radii are from the NHC best track for 2004 and later.

Original File Format (see below the description of the new format):

The extended best track file uses a simple ASCII format. There is one line of data for each date and time period (00, 06, 12 or 18 UTC) of each storm (see sample line listed below). The information is given in the following order: Storm identification number, storm name, month, day, time, year, latitude (deg N), longitude (deg W), maximum wind speed (kt), minimum central pressure (hPa), radius of maximum wind speed (nm), eye diameter (nm), pressure of the outer closed isobar (hPa), radius of the outer closed isobar (nm), radii (nm) of 34 kt wind to the NE, SE, SW and NW of the storm center, radii (nm) of 50 kt wind to the NE, SE, SW and NW, radii (nm) of 64 kt wind to the NE, SE, SW, NW, and a storm type code. This code is either \* for a tropical system (tropical depression, tropical storm, or hurricane), W for tropical wave, D for a tropical disturbance, S for a subtropical storm, E for an extra-tropical storm, or L for remnant low. The last record is the distance to the nearest major landmass (km), where the island of Trinidad is the smallest area considered to be land. Negative values indicate the storm center is over land.

Each item above is separated by a space in the file except the following: The month, day, and time are listed as one 6-digit number following the storm name. For example, 06 UTC on July 10 would be listed as 071006. Also the 34, 50, and 64-knot wind radii are separated from one another, but the radii for the four directions (NE, SE, SW, NW) are grouped together (12 characters). If any of these radii are less than 100 nm, a space will occur within the grouping. Thus, a wind radii group 125 25100100 indicates that winds at the given speed occur 125 nm to the NE, 25 nm to the SE, 100 nm to the SW, and 100 nm to the NW of the storm center. The following is a complete line of text from the extended best track file:

```
AL0290 ARTHUR      072518 1990 13.1  63.7  60  995  30 -99 1012 180  60 60
60 60  30  0  0 30   0  0  0  0 *   267.
```

A -99 in any parameter is a default value that means no estimate was available.

Major updates for 2021 and the new file format:

Multiple changes have been made in 2021. Specifically:

1. Atlantic and Eastern North Pacific Databases have been extended to use all data available in NHC databases, starting with 1851 in the Atlantic and 1949 in the Eastern North Pacific;

2. Central North Pacific database for the years 1949 - 2019 has been added;

3. For the 1988 - 2003 the wind radii for 34, 50, and 64 knots are not available in HURDAT2. In some cases those values are available in ATCF a-deck files. The old version of the Extended Best Track data contained wind radii for 1988 - 2003. In many cases data in the Extended Best Track include wind radii not available in a-decks. In the updated version we preserved all wind radii data available in the old Extended

Best Track data. Note that some of those values could be different from wind radii available for 1988 - 2003 in a-deck files.

4. For 2004 - 2019 wind radii for 34, 50, and 64 knots were obtained from HURDAT2. The same wind radii are also available in post-season ATCF b-deck files;

5. For radius or maximum wind, eye diameter, and radius and pressure of the outer closed isobar multiple sources were used. The b-deck values were used when available. If a variable is not provided in b-deck, then a-deck value from the CARQ line is used. If neither b- or a-deck CARQ values are available, then values are taken from the OFCL line in the a-deck at  $t = 0$ , and then next from OFCL at  $t = 3$  h. Finally, if none of the previous sources are available, the data are taken from the old Extended Best Track. In most cases data from the old Extended Best Track were used prior to 2004, and values from ATCF for 2004 and later data.

6. A new column, after the DTL has been added to indicate the source of data for radius of maximum wind speed (nmi), eye diameter (nmi), pressure of the outer closed isobar (hPa), radius of the outer closed isobar (nmi). The new column has 4 digits, corresponding to 4 variable. Each of the 4 digits, 0 - the corresponding variable has been obtained from b-deck file, 1 - from a-deck CARQ line, 2 - from OFCL at  $t = 0$  h, 3 - from OFCL at  $t = 3$  h, 4 - from the previous version of the Extended Best Track file, and 9 - variable is missing in all sources;

7. New storm types have been added to include all storm types available in ATCF and HURDAT2 databases. The full list of storm types is obtained from ATCF database: TD - tropical depression, TS - tropical storm, TY - typhoon, ST - super typhoon, TC - tropical cyclone, HU - hurricane, SD - subtropical depression, SS - subtropical storm, EX - extratropical systems, MD - monsoon depression, IN - inland, DS - dissipating, LO - low, WV - tropical wave, ET - extrapolated, XX - unknown. These type are now mapped to the storm types used in the Extended Best Track as: "DB" - D, "TD", "TS", "TY", "ST", "TC", "HU", "HR" - "\*" for all tropical cases; "SD", "SS", "SH" - "S" for all subtropical cases; "EX" - "E", "PT" = P for Potential Tropical Cyclone in the Atlantic; "IN" - "I", "DS", "LO" - "L"; "WV" - "W", "ET" - "A", "MD" - "M", "XX", "" - "X" - for all unknown or when the storm type is missing in the input databases.

8. The distance to land for all cases has been updated using the 2019 updated SHIPS model database for distance to land with 0.1 deg precision;

9. Storm names were used when available in HURDAT2, -b-deck, or -a-deck. When the storm names are not available, or generic storm names used in HURDAT2 or ATCF, including "UNKNOWN", "SUBTROP", or number is used as a storm name, the storm names for the Extended Best Track have been created using the following rules. If the maximum intensity for the storm is less than 35 kt, then the name is "TD01" where 01 is replaced by the storm name from ATCF ID. For the storms named "SUBTROP", "SS01" was used where the number is replaced by the ATCF id; in all other cases when storm name is missing or generic, the storm name was created by using 2-letter basin (AL, EP, CP) and 2-digit ATCF id, for example "AL01".

10. A new format was added. Changes relative to the old format include: added 2 spaces to storm name column to allow for longer storm names. The updated column with matches the wind of the storm name column used in ATCF; added 1 space to longitude and to latitude columns to

accommodate 3-digit negative longitudes and 2-digit negative latitudes; changed storm ID in the first column to use 4-digit year; added extra column to describe data source for radius of maximum wind speed, eye diameter, pressure of the outer closed isobar, radius of the outer closed isobar. The new column is described above in change 6.

The 2021 ver3.0.0 updates that resulted in changes to the radius of maximum wind speed, eye diameter, pressure of the outer closed isobar, and radius of the outer closed isobar data include:

1. These values are not officially best tracked, so in the previous versions the b-deck values for those variables have not been used. The 2021 ver3.0.0 includes values from b-deck when available.
2. In the previous version the data at the very beginning or very end of the storm were sometimes not recorded due to a bug in the processing software. That has been fixed in version 3.0.0.

Note: If you need to refer to the extended best track file in a publication, a very brief description can be found in the following paper:

Demuth, J., M. DeMaria, and J.A. Knaff, 2006: Improvement of advanced microwave sounder unit tropical cyclone intensity and size estimation algorithms. *J. Appl. Meteor.*, 45, 1573-1581.