

Tropical Cyclone Heat Potential V2.1

Project homepage: www.aoml.noaa.gov/phod/cyclone
Daily maps available online at www.aoml.noaa.gov/phod/cyclone/data/gl.html

TCHP DATA

Data is presented in ASCII files. The date corresponding to each field is indicated in the filenames. The data is formatted in columns:

Col#	Field	Units	Range
1	Longitude	Degree East	-180/180
2	Latitude	Degree North	-40/40
3	TCHP	kJ cm^{-2}	

METHODOLOGY V2.1

Sea surface temperature (SST) provides a measure of the surface ocean conditions, however no information about the subsurface ocean thermal structure (approximately the upper 50 m of the ocean) can be derived from SST alone. For instance, it is known that the oceanic skin temperature erodes when the sea surface is affected by strong winds, creating a well-mixed layer that can reach depths of several tens of meters. Moreover, warm ocean features, mainly anticyclonic rings and eddies, are characterized by a deepening of the isotherms towards their centers with a markedly different temperature and salinity structure than the surrounding waters. Several studies have shown that observations of sea surface height (SSH) are strongly correlated with the thermal structure of the upper ocean (e.g. Goni et al. 1996; Gilson et al. 1998; Mayer et al. 2001; Willis et al. 2004). Based in this virtually ubiquitous relationship, a methodology was developed to estimate fields of isotherm depth from the SHA fields derived from satellite observations.

The Tropical Cyclone Heat Potential (TCHP), is defined as a measure of the integrated vertical temperature from the sea surface to the depth of the 26°C isotherm. This parameter is computed globally from the altimeter-derived vertical temperature profiles estimates in the upper ocean (Shay et al., 2000). Different methods have been developed to calculate this vertical thermal structure of the upper ocean. The current methodology (version 2.1) to estimate the TCHP consists of the following steps:

- In-situ temperature profiles obtained mostly from expendable BathyThermograph and profiling-float observations from 1992 to 2010 are grouped in $3^{\circ} \times 3^{\circ}$ bins with a $1^{\circ} \times 1^{\circ}$ resolution.
- The depth of the 26°C to 28°C isotherms is estimated from each profile.
- The weekly SHA gridded fields derived by AVISO are interpolated into the location and time of the temperature profiles.
- In each $1^{\circ} \times 1^{\circ}$ bin the depth of each isotherm is linearly regressed onto the corresponding SHA value.

- Only regression parameters that are statistically significant within a 1-sigma level are considered. Any small gaps in the resulting fields of regression parameters are interpolated.
- The regression coefficients are interpolated in a $1/4^\circ \times 1/4^\circ$ grid.
- A synthetic temperature profile is derived from the regression parameters and the daily delayed-time, when available, or real-time SHA fields distributed by AVISO, which have $1/4^\circ \times 1/4^\circ$ resolution and allows to identify mesoscale features.
- The altimetry-derived synthetic profiles are completed with global TMI-AMSR-E SST fields for the $z = 0$ temperature.
- The TCHP is computed as the anomalous heat storage associated with temperatures larger than 26°C in each grid-point:

$$TCHP(x, y) = C_p \rho \int T(x, y, z) dz,$$

where x and y are the horizontal coordinates, $C_p = 3990 \text{ J kg}^{-1} \text{ K}^{-1}$ is the heat capacity of the water, $\rho = 1025 \text{ kg m}^{-3}$ is the water density, and $T(x, y, z)$ is the temperature profile.

The SHA fields are:

Merged Ssalto/Duacs Gridded Sea level anomalies ($1/4^\circ \times 1/4^\circ$ on a Mercator grid)

<http://www.aviso.oceanobs.com/en/data/products/sea-surface-height-products/global/index.html>

The SST fields are:

TMI Sea Surface Temperature

http://www.remss.com/tmi/tmi_browse.html

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How to acknowledge data from NOAA/AOML Tropical Cyclone Heat Potential

We would appreciate it if you added the following acknowledgment to any publications that use this data:

"The Tropical Cyclone Heat Potential (TCHP) is made freely available by the Atlantic Oceanographic and Meteorological Laboratory (www.aoml.noaa.gov/phod/cyclone) and has been funded by the NASA and NOAA at different stages of the project. The sea surface height and temperature products incorporated in the TCHP are supplied by the CLS Space Oceanography Division, France (www.cls.fr) and Remote Sensing, USA (www.remss.com/tmi/) respectively."

The project scientists would also appreciate it if you informed us of any publications or presentations that you prepare using this data. Continued funding of this project depends on us being able to justify to NOAA the usefulness of this data.

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