COSPPac Ocean Portal
About: Ocean Temperature

In Brief

*Daily **sea surface temperature** (SST) is available in near-real time (2-days lag). SST can be viewed as **temperature** in degrees Celsius; as an **anomaly** (degrees difference from normal conditions); or, as **deciles** (ranking from lowest to highest based on the climatology).*

*Along with the daily data, there are also options to view the parameters as averages over various periods of time (**monthly**, **3-monthly**, **6-monthly**, **12-monthly**).*

*The **'Reynolds'** sea surface temperature dataset dates back to 1982, while the **'ERSST'** dataset dates back to 1950 and is of coarser resolution.*

***Sub-surface** mean temperature data are available from 1993 to 2006 in monthly blocks.*

Introduction

The temperature of the ocean varies at different locations and different depths. The main source of ocean warming is solar irradiance (energy from the sun), which varies depending on solar cycles, cloud cover and stratospheric aerosols. The turbidity (clarity) of the water can also affect the penetration of the shortwave radiation from the sun, and ocean mixing (driven by winds and waves) can warm layers of the ocean below the surface. The highest sea surface temperatures in the Pacific exist in the middle of the 'Warm Pool', typically located close to the equator in the west of the Pacific basin.

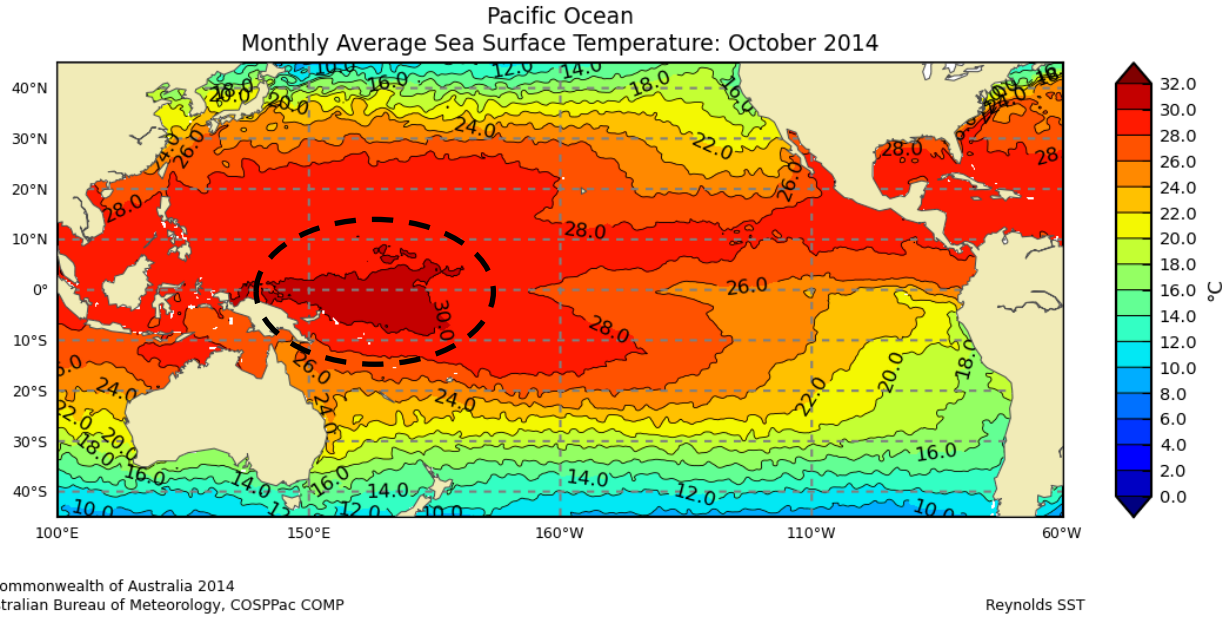

Figure 1. The warmest waters in the Pacific called the 'Warm Pool' are indicated within the dashed line.

Under the ocean surface, the temperature decreases with increasing ocean depth. The 'thermocline' is where the temperature change occurs over a shorter vertical distance than it does in the layers above

or below, and is located typically near the 20°C isotherm in the tropical Pacific Ocean. Near the equator, the thermocline is usually located at about 150 metres depth in the western Pacific, sloping up to about 50 metres in the eastern Pacific.

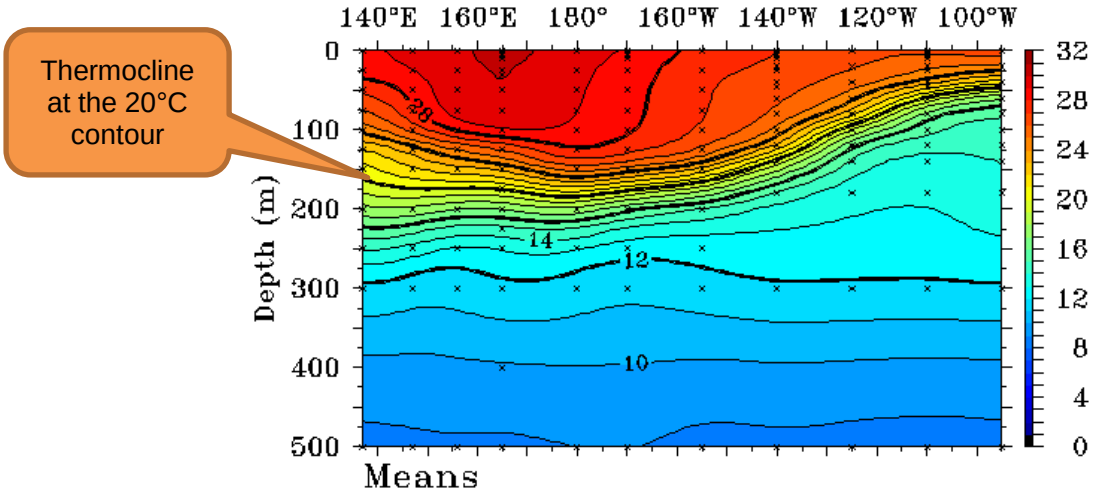

Figure 2. Sub-surface ocean temperature along with equator for 28th February 2015. The thermocline is observed as the area where the isotherm lines are bunched together (typically around the 20°C isotherm).

Ocean temperature has implications for climate, rainfall, cyclone development, ocean currents, coral bleaching and fish habitat. Data sources for ocean temperature are derived from satellite measurements, *in situ* observations and numerical modelling.

Using the Portal

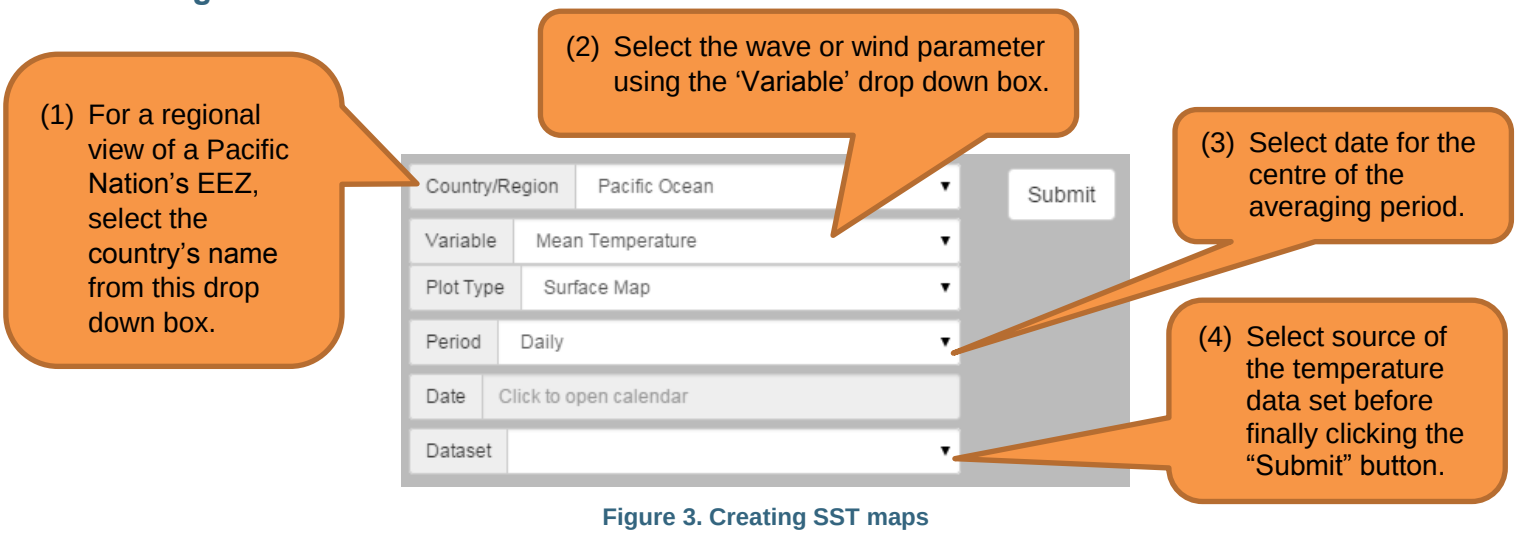

Figure 3. Creating SST maps

Figure 4. Creating sub-surface cross section plots

Description of Parameters

Ocean temperature data is available in multiple datasets. The choice of dataset depends on the application of the data.

Reynolds – Mean Temperature (Surface Map), Anomalies, Deciles:

Select this dataset if you are interested in observed SST data in near-real time, or historical data dating back to September 1981. Note that although the Reynolds SST values are supplied on a 25 km grid, due to the data interpolation method used the product actually resolves SST features at spatial scales of around 150 km. The Reynolds SST product will therefore not usually reflect the small-scale changes in SST within 150 km of coasts.

ERSST – Mean Temperature (Surface Map), Anomalies, Deciles, Trend:

Select this dataset if you would like to compare SST data from January 1950 to the present, with the added option of looking at the trend. The dataset depends entirely on *in situ* SST observations and can be used for studying long-term changes in SST over spatial scales of several hundred kilometres.

Note: the original data goes back until 1854 but the early period is excluded due to poor observation coverage in the Pacific (see Smith et. al. (2003) for further information).

BRAN – Mean Temperature (Sub-surface Maps):

Select this dataset if you are interested in sub-surface temperature.

Table 1. Summary of datasets included in the Ocean Portal as part of Ocean Temperature

Dataset	Resolution	Time Period	Available Averaging Periods	Data Types	Updating Frequency
Reynolds	0.25 degrees	September 1981 to present	Daily, monthly, 3-monthly, 6-monthly, yearly	Mean Temperature (SST at ~ 1 mm to 1 m depth), Anomaly, Deciles	Daily (two day lag)
ERSST	2 degrees	January 1950 to present	Monthly, 3-monthly, 6-monthly, yearly	Mean Temperature (SST at 20 cm to 10 m depth), Anomaly, Deciles, Trend	Monthly
BRAN	0.9 × 0.1 degrees horizontal, 47 vertical levels with 10 metre resolution down to 200m	1993 to 2006	Monthly, 3-monthly, 6-monthly, yearly	Mean Temperature (SST at 5 m depth and Sub-surface)	No Update

Definition of Data Types

Mean Temperature: Temperature in degrees Celsius.

Anomalies: Shows the temperature difference between the temperature and normal (normal is defined as the average temperature for the specified time period occurring from 1971-2000).

Deciles: Shows the temperature ranking in terms of the entire dataset (e.g. near the average, or towards lowest/highest within the record).

Trend: Shows how the average ocean temperature has changed since 1950. Maps display degree change per decade.

Examples of Applications

- **Fisheries:** Different species of fish are sometimes known to be found at certain temperature ranges. Near real time SST maps can help inform where good fishing locations might be.

Table 2. Ranges of sea surface temperature that different species of tuna a present in the Pacific (Sund, Blackburn & Williams 1981).

Common name	Species	All occurrences (°C)	Abundant occurrences (°C)
Skipjack	**Katsuwonus pelamis**	**17–30**	**20–29**
Yellowfin	Thunnus albacares	18–31	20–30
Bigeye	T. obesus	11–29	13–27
Albacore	T. alalunga	13–25	15–21
Southern	bluefin T. maccoyii	10.5–21	17–20

- **ENSO:** Sea surface temperature is used as one of the indicators of the El Niño Southern Oscillation. Past events can be diagnosed by looking at average SST maps over various periods of time. The thermocline depth gives an indication of sub-surface warming or cooling during past ENSO events.

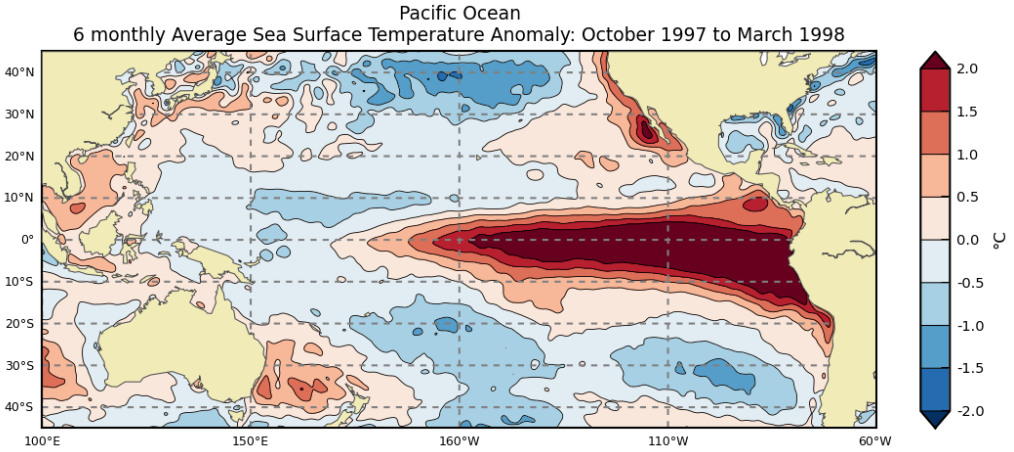

Figure 5. El Niño event from 1997/1998 showing significant warming in the eastern equatorial Pacific

- **Climate:** The atmosphere and ocean processes are connected. Ocean temperature influences rainfall patterns around the world. Rainfall amounts can be anticipated by monitoring patches of warmer and cooler anomalies. Warmer SSTs in the tropics are often associated with more rainfall.

- **Cyclones:** The formation of tropical cyclones requires SSTs higher than 26.5 degrees Celsius, although major storms require higher temperatures (Webster, Gulledge & Curry 2006). Monitoring warm patches of ocean gives insight into the potential for cyclone formation, and the possible start or finish of the cyclone season.

Data Sources

Reynolds

Reynolds is a global sea surface temperature and ice-coverage dataset developed and maintained by the NOAA National Climate Data Center (USA). The original data are produced using a high-resolution, blended optimum interpolation analysis (Reynolds et al. 2007).

All the analyses on this Portal have been derived from the daily data on a 0.25° global grid. These are, in turn, based on interpolating observations of ocean surface temperature from ships, drifting and moored buoys, and Advanced Very High Resolution Radiometers (AVHRR) on polar-orbiting satellites. Where no recent observations were available, the long-term average SST ("climatology") was used in the analysis.

ERSST

Extended Reconstructed Sea Surface Temperature (ERSST) is a global monthly sea surface temperature analysis developed and maintained by the NOAA Earth System Research Laboratory (USA). With a resolution of 2° (latitude and longitude), the ERSST analysis is intended to complement the NOAA Optimum Interpolation SST V2 (referred to in this portal as Reynolds SST). The longer period of time spanned by ERSST is more suitable for statistical analyses, including trends and deciles.

All the ERSST analyses on this portal have been derived from monthly data. These are, in turn, based on observations of ocean surface temperature from ships, buoys (both drifting and moored) and other *in situ* platform types (Smith & Reynolds 2003, 2004).

BRAN

The Bluelink Re-ANalysis (BRAN) 2.1 is a high-resolution ocean reanalysis for a 14-year period from 1993-2006 (Schiller et al. 2008; Oke et al. 2008). This product was developed by the Bluelink Project, which is a partnership between the Bureau of Meteorology, CSIRO and the Royal Australian Navy to deliver ocean forecasts for the Australian region. The ocean reanalysis was constructed by combining observational data with a high-resolution ocean model to establish an eddy-resolving best estimate of the ocean state.

The analyses presented here are derived from the BRAN2.1 daily data sourced from the Centre for Australian Weather and Climate Research (CAWCR), which is a partnership between the Australian Bureau of Meteorology and the CSIRO. To generate the ocean reanalysis, observations of the ocean temperature, salinity and sea-level were assimilated from satellites and in-situ ocean monitoring instruments such as ARGO profiling floats, tide gauges, XBTs and the TOGA TAO moored array (see Schiller et al. 2008 for more information).

Links

Reynolds SST:

http://www.ncdc.noaa.gov/oisst

ERSST:

http://www.ncdc.noaa.gov/ersst/

BRAN:

http://www.cmar.csiro.au/staff/oke/BRAN.htm

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References

Oke, PR, Brassington, GB, Griffin, DA & Schiller, A 2008, 'The Bluelink ocean data assimilation system (BODAS)', *Ocean Modelling*, vol. 21, pp. 46–70.

Reynolds, RW, Smith, TM, Liu, C, Chelton, DB, Casey, KS & Schlax, MG 2007, 'Daily high-resolution-blended analyses for sea surface temperature', *Journal of Climate*, vol. 20, pp. 5473–5496.

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Webster, P, Gulledge, J & Curry, J 2006, 'Expanding tropical warm pool: Increased tropical cyclone season length and storm duration', in *American Geophyscial Union, Fall Meeting*, pp. 709–719.

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in any documents or publications using these data. We would also appreciate receiving a copy of the relevant publications. This will help PSD to justify keeping the NOAA_ERSST_V3 and NOAA High Resolution SST data set freely available online in the future. Thank you!"

In addition, you should also acknowledge our Bluelink partners, the Australian Navy and the CSIRO (Wealth from Oceans, National Research Flagships) when using the BRAN product.

Contact

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