香港天文台
HONG KONG OBSERVATORY

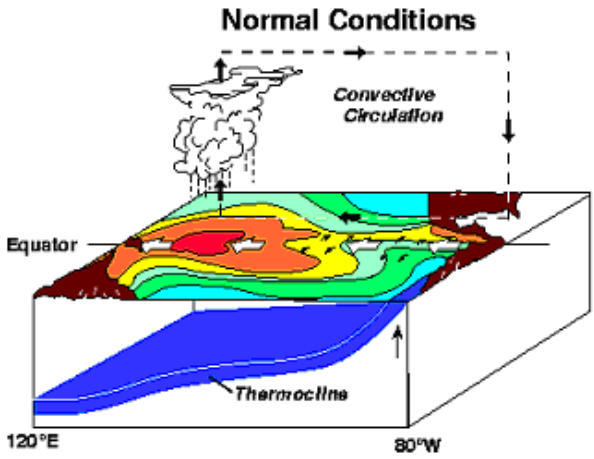
# El Niño and La Niña

## Background Information

El Niño and La Niña refer respectively to the warming and cooling of surface waters over the central and eastern equatorial Pacific Ocean which affect the atmospheric circulation worldwide.

El Niño usually peaks around Christmas, hence the name of the phenomenon (Spanish for "the little boy" or "the Christ Child"). It recurs every few years, lasting 12 months or so. La Niña, "the little girl" in Spanish, occurs less frequently but lasts longer compared with El Niño.

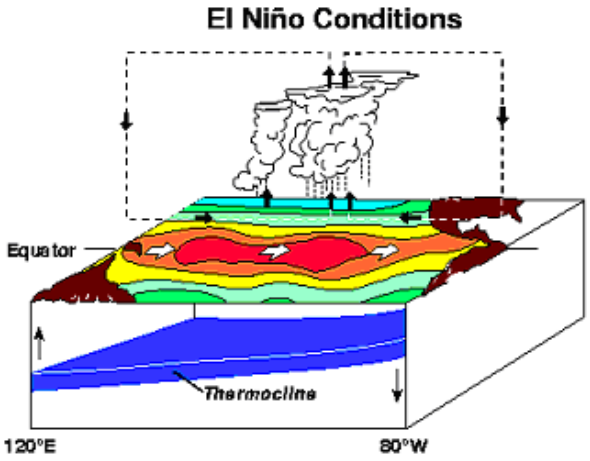
Under normal atmospheric and oceanic conditions (i.e. without El Niño and La Niña, also known as the ENSO-neutral state), trade winds over the equatorial Pacific pile up warm surface water to the east of Indonesia. Warm water drives air to rise. Part of the air mass moves east aloft and descends near South America to form a feedback loop which is called the Walker Circulation (Figure 1).




(Source: National Oceanic and Atmospheric Administration, USA)

Figure 1 Normal atmospheric and oceanic conditions

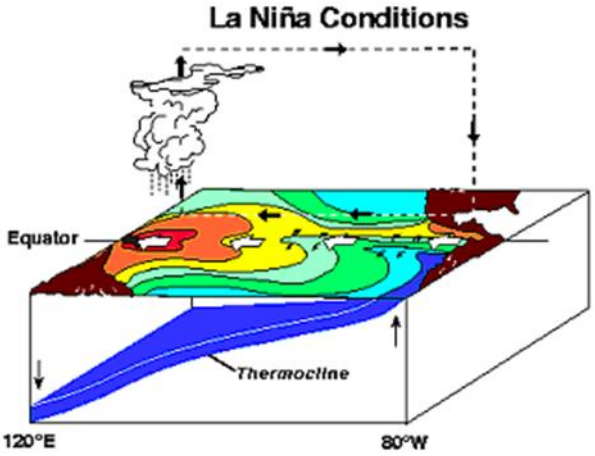
During El Niño, trade winds over the equatorial Pacific are weaker than normal. Warm surface water over the western equatorial Pacific retreats east, causing sea surface temperature over the central and eastern equatorial Pacific to become higher than normal. Convection over the equatorial Pacific shifts east and hence affects the Walker Circulation (Figure 2).




(Source: National Oceanic and Atmospheric Administration, USA)

Figure 2 Atmospheric and oceanic conditions during El Niño

During La Niña, trade winds over the equatorial Pacific are stronger than normal. Warm surface water of the ocean is pushed further west. Convection over the ocean and the Walker Circulation shift accordingly (Figure 3).




(Source: National Oceanic and Atmospheric Administration, USA)

Figure 3 Atmospheric and oceanic conditions during La Niña

Another phenomenon, the Southern Oscillation, is closely related to El Niño and La Niña. The Southern Oscillation is an east-west balancing movement of air masses between the Pacific and the Indo-Australian areas. It is roughly synchronised and associated with typical wind patterns of El Niño and La Niña. The oscillation is measured by the Southern Oscillation Index (SOI), the difference between sea level atmospheric pressures at Tahiti and Darwin.

El Niño and La Niña are the oceanic components while the Southern Oscillation is the atmospheric counterpart. This combination gives rise to the term El Niño-Southern Oscillation (ENSO). In general, negative values of the SOI are associated with El Niño while positive values with La Niña. ENSO conditions are commonly defined with reference to the sea surface temperatures in the Niño regions (Figure 4).

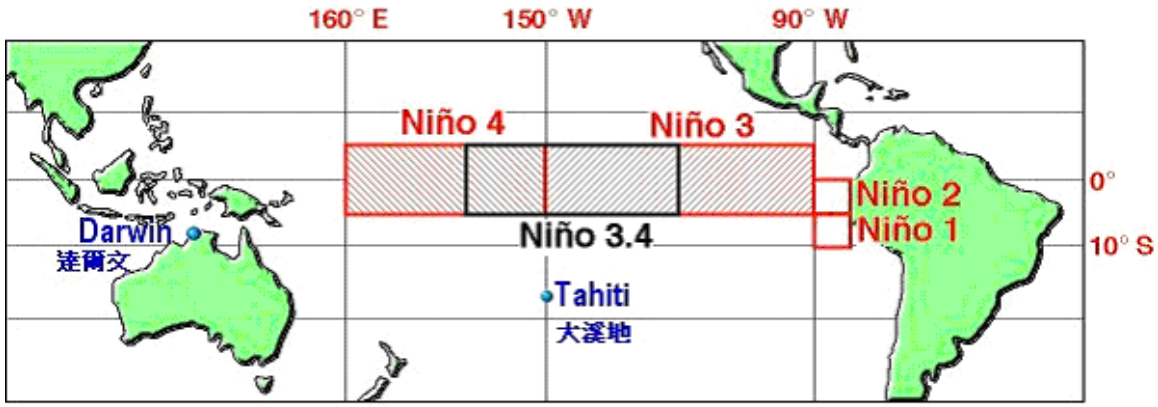



Figure 4 Graphical depiction of the four Niño regions and the location of Tahiti and Darwin for SOI

## Definition of El Niño and La Niña Event

The Observatory defines El Niño (La Niña) event based on the sea surface temperature (SST) anomaly index of the composite Niño region, i.e. Niño 1 to 4 region (see Figure 4). An El Niño (A La Niña) event is established when

(i) the SST anomaly index maintains at +0.5℃ or above (-0.5℃ or below) for at least 5 to 6 months; or

(ii) the SST anomaly index remains at +0.5℃ or above (-0.5℃ or below) for 5 consecutive months and the sum of anomaly reaches +4.0℃ or above (-4.0℃ or below).

Statistically, the influence of El Niño and La Niña on the climate of Hong Kong when compared to the ENSO-neutral state[1] can be summarized below:

**El Niño**

1. Generally wetter winter (Dec-Feb) and spring (Mar-May).
2. Unlikely to have tropical cyclones affecting Hong Kong before June.

**La Niña**

1. Generally cooler autumn (Sep-Nov) and winter.
2. Likely to have more tropical cyclones affecting the territory during August-October.

Note:

1. The ENSO-neutral state refers to the situation with neither an El Niño nor a La Niña in place.
2. El Niño or La Niña is not the sole factor for determining seasonal temperature and rainfall in Hong Kong. Please refer to https://www.hko.gov.hk/en/wxinfo/season/season.htm for the latest seasonal forecast.