**Indian Ocean Dipole**

Water temperatures around the Mentawai Islands dropped about 4° Celsius during the height of a positive phase of the Indian Ocean Dipole in November 1997. During these events unusually strong winds from the east push warm surface water towards Africa, allowing cold water to upwell along the Sumatran coast. In this image blue areas are colder than normal, while red areas are warmer than normal.

The **Indian Ocean Dipole** (**IOD**), also known as the **Indian Niño**, is an irregular [oscillation](https://en.wikipedia.org/wiki/Oscillation) of [sea surface temperatures](https://en.wikipedia.org/wiki/Sea_surface_temperature) in which the western [Indian Ocean](https://en.wikipedia.org/wiki/Indian_Ocean) becomes alternately warmer (positive phase) and then colder (negative phase) than the eastern part of the ocean.

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**Phenomenon**

The IOD involves an aperiodic oscillation of sea-surface temperatures (SST), between "positive", "neutral" and "negative" phases. A positive phase sees greater-than-average sea-surface temperatures and greater precipitation in the western Indian Ocean region,[[*dubious*](https://en.wikipedia.org/wiki/Wikipedia:Accuracy_dispute#Disputed_statement) *–* [*discuss*](https://en.wikipedia.org/wiki/Talk:Indian_Ocean_Dipole#Mistake)] with a corresponding cooling of waters in the eastern Indian Ocean—which tends to cause droughts in adjacent land areas of [Indonesia](https://en.wikipedia.org/wiki/Indonesia) and [Australia](https://en.wikipedia.org/wiki/Australia). The negative phase of the IOD brings about the opposite conditions, with warmer water and greater precipitation in the eastern Indian Ocean, and cooler and drier conditions in the west.

The IOD also affects the strength of [monsoons](https://en.wikipedia.org/wiki/Monsoon) over the Indian subcontinent. A significant positive IOD occurred in 1997–98, with another in 2006. The IOD is one aspect of the general cycle of global climate, interacting with similar phenomena like the [El Niño-Southern Oscillation](https://en.wikipedia.org/wiki/El_Ni%C3%B1o-Southern_Oscillation) (ENSO) in the [Pacific Ocean](https://en.wikipedia.org/wiki/Pacific_Ocean).

The IOD phenomenon was first identified by climate researchers in 1999.[[1]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-1)[[2]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-2)

An average of four each positive-negative IOD events occur during each 30-year period with each event lasting around six months. However, there have been 12 positive IODs since 1980 and no negative events from 1992 until a strong negative event in late 2010. The occurrence of consecutive positive IOD events is extremely rare with only two such events recorded, 1913–1914 and the three consecutive events from 2006 to 2008 which preceded the [Black Saturday bushfires](https://en.wikipedia.org/wiki/Black_Saturday_bushfires). Modelling suggests that consecutive positive events could be expected to occur twice over a 1,000-year period. The positive IOD in 2007 evolved together with [La Niña](https://en.wikipedia.org/wiki/La_Ni%C3%B1a), which is a very rare phenomenon that has happened only once in the available historical records (in 1967).[[3]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-Argo-3)[[4]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-Cooper-4)[[5]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-Perry-5)[[6]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-Rosebro-6) A strong negative IOD developed in October 2010,[[7]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-7) which, coupled with a strong and concurrent La Niña, caused the [2010–2011 Queensland floods](https://en.wikipedia.org/wiki/2010%E2%80%932011_Queensland_floods) and the [2011 Victorian floods](https://en.wikipedia.org/wiki/2011_Victorian_floods).

In 2008, [Nerilie Abram](https://en.wikipedia.org/wiki/Nerilie_Abram) used coral records from the eastern and western Indian Ocean to construct a coral Dipole Mode Index extending back to 1846 AD.[[8]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-8) This extended perspective on IOD behaviour suggested that positive IOD events increased in strength and frequency during the 20th century.[[9]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-9)

**Effect on Southeast Asian and Australian droughts**

A positive IOD is associated with droughts in Southeast Asia[[10]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole" \l "cite_note-10),[[11]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-11) and Australia. Extreme positive-IOD events are expected.[[12]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-12)

A 2009 study by [Ummenhofer](https://en.wikipedia.org/wiki/Caroline_C._Ummenhofer) *et al.* at the [University of New South Wales](https://en.wikipedia.org/wiki/University_of_New_South_Wales) (UNSW) [Climate Change Research Centre](https://en.wikipedia.org/wiki/Climate_Change_Research_Centre) has demonstrated a significant correlation between the IOD and drought in the southern half of Australia, in particular the south-east. Every major southern drought since 1889 has coincided with positive-neutral IOD fluctuations including the [1895–1902](https://en.wikipedia.org/wiki/Federation_Drought), 1937–1945 and the [1995–2009](https://en.wikipedia.org/wiki/2000s_Australian_drought) droughts.[[13]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-13)

The research shows that when the IOD is in its negative phase, with cool western Indian Ocean water and warm water off northwest Australia ([Timor Sea](https://en.wikipedia.org/wiki/Timor_Sea)), winds are generated that pick up moisture from the ocean and then sweep down towards southern Australia to deliver higher rainfall. In the IOD-positive phase, the pattern of ocean temperatures is reversed, weakening the winds and reducing the amount of moisture picked up and transported across Australia. The consequence is that rainfall in the south-east is well below average during periods of a positive IOD.

The study also shows that the IOD has a much more significant effect on the rainfall patterns in south-east Australia than the [El Niño-Southern Oscillation](https://en.wikipedia.org/wiki/El_Ni%C3%B1o-Southern_Oscillation) (ENSO) in the Pacific Ocean as already shown in several recent studies.[[14]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-14)[[15]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-15)[[16]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-16)

**Effect on rainfall across East Africa**

A positive IOD is linked to higher than average rainfall during the East African Short Rains (EASR) between October and December.[[17]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-17) Higher rainfall during the EASR are associated with warm SST in the western Indian Ocean and low level westerlies across the equatorial region of the ocean which brings moisture over the East Africa region.[[18]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-18)

The increased rainfall associated with a positive IOD has been found to result in increased flooding over East Africa during the EASR period. During a particularly strong positive IOD at the end of 2019, average rainfall over East Africa was 300% higher than normal.[[19]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-19) This higher than average rainfall has resulted in a high prevalence of flooding in the countries of Djibouti, Ethiopia, Kenya, Uganda, Tanzania, Somalia and South Sudan.[[20]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-20) Torrential rainfall and increased risk of landslides over the region during this period often results in widespread destruction and loss of life.[[21]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-21)[[22]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-22)[[23]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-23)[[24]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-24)

It is expected that the Western Indian ocean will warm at accelerated rates due to climate change [[25]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-25)[[26]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-26) leading to an increasing occurrence of positive IODs.[[27]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-27) This is likely to result in the increasing intensity of rainfall during the short rain period over East Africa. [[28]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-28)

**Effect on El Niño**

A 2018 study by Hameed et al. at the [University of Aizu](https://en.wikipedia.org/wiki/University_of_Aizu) simulated the impact of a positive IOD event on Pacific surface wind and SST variations.[[29]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-29) They show that IOD-induced surface wind anomalies can produce El Nino-like SST anomalies, with the IOD's impact on SST being the strongest in the far-eastern Pacific. They further demonstrated that IOD-ENSO interaction is a key for the generation of Super El Ninos.[[30]](https://en.wikipedia.org/wiki/Indian_Ocean_Dipole#cite_note-30)

**2020 IOD positive cycle**

IOD is [related to multiple cyclones](https://www.bbc.com/news/science-environment-50602971) that have ravaged East Africa in 2019 killing thousands aided by warmer than normal waters offshore (starting with [Cyclone Idai](https://en.wikipedia.org/wiki/Cyclone_Idai) and continuing on to the [2019–20 South-West Indian Ocean cyclone season](https://en.wikipedia.org/wiki/2019%E2%80%9320_South-West_Indian_Ocean_cyclone_season)), Australian drought & [bushfires](https://en.wikipedia.org/wiki/2019%E2%80%9320_Australian_bushfire_season) (convective IOD cycle brings dry air down on Australia), [2020 Jakarta floods](https://en.wikipedia.org/wiki/2020_Jakarta_floods) (convective IOD cycle prevents moist air near tropics from going south to Australia, concentrating it), and more recently East Africa's [mega locust swarms](https://www.france24.com/en/20200124-billions-of-locusts-swarm-through-east-africa-after-year-of-extreme-weather) (via number of supportive weather factors).

**The Indian Ocean Dipole (IOD)**

The Indian Ocean Dipole (IOD) is defined by the difference in sea surface temperature between two areas (or poles, hence a dipole) – a western pole in the Arabian Sea (western Indian Ocean) and an eastern pole in the eastern Indian Ocean south of Indonesia. The IOD affects the climate of Australia and other countries that surround the Indian Ocean Basin, and is a significant contributor to rainfall variability in this region.

Like ENSO, the change in temperature gradients across the Indian Ocean results in changes in the preferred regions of rising and descending moisture and air.

In scientific terms, the IOD is a coupled ocean and atmosphere phenomenon, similar to ENSO but in the equatorial Indian Ocean. It is thought that the IOD has a link with ENSO events through an extension of the Walker Circulation to the west and associated Indonesian throughflow (the flow of warm tropical ocean water from the Pacific into the Indian Ocean). Hence, positive IOD events are often associated with El Niño and negative events with La Niña. When the IOD and ENSO are in phase the impacts of El Niño and La Niña events are often most extreme over Australia, while when they are out of phase the impacts of El Niño and La Niña events can be diminished.

**The Indian Ocean Dipole**

**Positive event:**

* warmer sea surface temperatures in the western Indian Ocean relative to the east
* easterly wind anomalies across the Indian Ocean and less cloudiness to Australia's northwest
* less rainfall over southern Australia and the Top End.

**Negative event:**

* cooler sea surface temperatures in the western Indian Ocean relative to the east
* winds become more westerly, bringing increased cloudiness to Australia's northwest
* more rainfall in the Top End and southern Australia.

**Walker circulation**

A schematic diagram of the quasi-equilibrium and [La Niña](https://en.wikipedia.org/wiki/El_Ni%C3%B1o) phase of the southern oscillation. The **Walker circulation** is seen at the surface as easterly trade winds which move water and air warmed by the sun towards the west. The western side of the equatorial Pacific is characterized by warm, wet low pressure weather as the collected moisture is dumped in the form of typhoons and thunderstorms. The ocean is some 60 cm higher in the western Pacific as the result of this motion. The water and air are returned to the east. Both are now much cooler, and the air is much drier. An El Niño episode is characterised by a breakdown of this water and air cycle, resulting in relatively warm water and moist air in the eastern Pacific.

The **Walker circulation**, also known as the **Walker cell**, is a conceptual model of the air flow in the [tropics](https://en.wikipedia.org/wiki/Tropics) in the lower atmosphere ([troposphere](https://en.wikipedia.org/wiki/Troposphere)). According to this model, parcels of air follow a closed circulation in the [zonal](https://en.wikipedia.org/wiki/Zonal_and_meridional) and vertical directions. This circulation, which is roughly consistent with observations, is caused by differences in heat distribution between ocean and land. It was discovered by [Gilbert Walker](https://en.wikipedia.org/wiki/Gilbert_Walker). In addition to motions in the zonal and vertical direction the tropical atmosphere also has considerable motion in the [meridional](https://en.wikipedia.org/wiki/Meridional) direction as part of, for example, the [Hadley Circulation](https://en.wikipedia.org/wiki/Hadley_Circulation).

The term "Walker circulation" was coined in 1969 by the Norwegian-American meteorologist [Jacob Bjerknes](https://en.wikipedia.org/wiki/Jacob_Bjerknes).[[1]](https://en.wikipedia.org/wiki/Walker_circulation#cite_note-1)

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* [4 See also](https://en.wikipedia.org/wiki/Walker_circulation#See_also)
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  + [5.1 In-line citations](https://en.wikipedia.org/wiki/Walker_circulation#In-line_citations)

**Walker's methodology**

[Gilbert Walker](https://en.wikipedia.org/wiki/Gilbert_Walker) was an established applied mathematician at the [University of Cambridge](https://en.wikipedia.org/wiki/University_of_Cambridge) when he became director-general of observatories in India in 1904.[[2]](https://en.wikipedia.org/wiki/Walker_circulation#cite_note-IndianBio-2) While there, he studied the characteristics of the [Indian Ocean](https://en.wikipedia.org/wiki/Indian_Ocean) [monsoon](https://en.wikipedia.org/wiki/Monsoon), the failure of whose rains had brought severe [famine](https://en.wikipedia.org/wiki/Famine) to the country in 1899. Analyzing vast amounts of weather data from India and the rest of the world, over the next fifteen years he published the first descriptions of the great seesaw oscillation of [atmospheric](https://en.wikipedia.org/wiki/Earth%27s_atmosphere) pressure between the Indian and [Pacific Ocean](https://en.wikipedia.org/wiki/Pacific_Ocean), and its correlation to [temperature](https://en.wikipedia.org/wiki/Temperature) and rainfall patterns across much of the Earth's tropical regions, including India. He also worked with the [Indian Meteorological Department](https://en.wikipedia.org/wiki/Indian_Meteorological_Department) especially in linking the monsoon with Southern Oscillation phenomenon. He was made a Companion of the [Order of the Star of India](https://en.wikipedia.org/wiki/Order_of_the_Star_of_India) in 1911.[[2]](https://en.wikipedia.org/wiki/Walker_circulation#cite_note-IndianBio-2)

Walker determined that the time scale of a year (used by many studying the atmosphere) was unsuitable because geospatial relationships could be entirely different depending on the season. Thus, Walker broke his temporal analysis into December–February, March–May, June–August, and September–November.

Walker then selected a number of "centers of action", which included areas such as the Indian Peninsula. The centers were in the hearts of regions with either permanent or seasonal high and low pressures. He also added points for regions where rainfall, wind or temperature was an important control.

He examined the relationships of the summer and winter values of pressure and rainfall, first focusing on summer and winter values, and later extending his work to the spring and autumn.

He concludes that variations in temperature are generally governed by variations in pressure and rainfall. It had previously been suggested that sunspots could be the cause of the temperature variations, but Walker argued against this conclusion by showing monthly correlations of sunspots with temperature, winds, cloud cover, and rain that were inconsistent.

Walker made it a point to publish all of his correlation findings, both of relationships found to be important as well as relationships that were found to be unimportant. He did this for the purpose of dissuading researchers from focusing on correlations that did not exist.

**Oceanic effects**

Average equatorial Pacific temperatures

Graph showing a tropical ocean thermocline (depth vs. temperature). Note the rapid change between 100 and 1000 meters. The temperature is nearly constant after 1500 meters depth.

The Walker Circulations of the tropical Indian, Pacific, and Atlantic basins result in westerly surface winds in Northern Summer in the first basin and easterly winds in the second and third basins. As a result, the temperature structure of the three oceans display dramatic asymmetries. The equatorial Pacific and Atlantic both have cool surface temperatures in Northern Summer in the east, while cooler surface temperatures prevail only in the western Indian Ocean.[[3]](https://en.wikipedia.org/wiki/Walker_circulation#cite_note-3) These changes in surface temperature reflect changes in the depth of the thermocline.[[4]](https://en.wikipedia.org/wiki/Walker_circulation#cite_note-4)

Changes in the Walker Circulation with time occur in conjunction with changes in surface temperature. Some of these changes are forced externally, such as the seasonal shift of the Sun into the Northern Hemisphere in summer. Other changes appear to be the result of coupled ocean-atmosphere feedback in which, for example, easterly winds cause the sea surface temperature to fall in the east, enhancing the zonal heat contrast and hence intensifying easterly winds across the basin. These enhanced easterlies induce more equatorial upwelling and raise the thermocline in the east, amplifying the initial cooling by the southerlies. This coupled ocean-atmosphere feedback was originally proposed by Bjerknes. From an oceanographic point of view, the equatorial cold tongue is caused by easterly winds. Were the earth climate symmetric about the equator, cross-equatorial wind would vanish, and the cold tongue would be much weaker and have a very different zonal structure than is observed today.[[5]](https://en.wikipedia.org/wiki/Walker_circulation#cite_note-5) The Walker cell is indirectly related to [upwelling](https://en.wikipedia.org/wiki/Upwelling) off the coasts of [Peru](https://en.wikipedia.org/wiki/Peru) and [Ecuador](https://en.wikipedia.org/wiki/Ecuador). This brings [nutrient](https://en.wikipedia.org/wiki/Nutrient)-rich cold water to the surface, increasing fishing stocks.[[6]](https://en.wikipedia.org/wiki/Walker_circulation#cite_note-Jennings-6)

**El Niño**

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|  | This section **needs additional citations for** [**verification**](https://en.wikipedia.org/wiki/Wikipedia:Verifiability). Please help [improve this article](https://en.wikipedia.org/w/index.php?title=Walker_circulation&action=edit) by [adding citations to reliable sources](https://en.wikipedia.org/wiki/Help:Introduction_to_referencing_with_Wiki_Markup/1). Unsourced material may be challenged and removed. *Find sources:* ["Walker circulation"](https://www.google.com/search?as_eq=wikipedia&q=%22Walker+circulation%22) – [news](https://www.google.com/search?tbm=nws&q=%22Walker+circulation%22+-wikipedia) **·** [newspapers](https://www.google.com/search?&q=%22Walker+circulation%22+site:news.google.com/newspapers&source=newspapers) **·** [books](https://www.google.com/search?tbs=bks:1&q=%22Walker+circulation%22+-wikipedia) **·** [scholar](https://scholar.google.com/scholar?q=%22Walker+circulation%22) **·** [JSTOR](https://www.jstor.org/action/doBasicSearch?Query=%22Walker+circulation%22&acc=on&wc=on) *(April 2019) (*[*Learn how and when to remove this template message*](https://en.wikipedia.org/wiki/Help:Maintenance_template_removal)*)* |

Main article: [El Niño Southern Oscillation](https://en.wikipedia.org/wiki/El_Ni%C3%B1o_Southern_Oscillation)

The Walker circulation is caused by the [pressure gradient force](https://en.wikipedia.org/wiki/Pressure_gradient_force) that results from a [high pressure system](https://en.wikipedia.org/wiki/High_pressure_area) over the eastern Pacific Ocean and a [low pressure system](https://en.wikipedia.org/wiki/Low_pressure_system) over [Indonesia](https://en.wikipedia.org/wiki/Indonesia). The Walker circulation causes an upwelling of cold deep sea water, thus cooling the sea surface. El Niño results when this circulation decreases or stops, as the impaired or inhibited circulation causes the ocean surface to warm to above average temperatures. A markedly increased Walker circulation causes a La Niña by intensifying the upwelling of cold deep sea water; which cools the sea surface to below average temperatures.

A scientific study published in May 2006 in the journal [*Nature*](https://en.wikipedia.org/wiki/Nature_(journal)) indicates that the Walker circulation has been slowing since the mid-19th Century. The authors argue that [global warming](https://en.wikipedia.org/wiki/Global_warming) is a likely causative factor in the weakening of the wind pattern.[[7]](https://en.wikipedia.org/wiki/Walker_circulation#cite_note-7) However, a 2011 study from The Twentieth Century Reanalysis Project shows that, aside from El Niño Southern Oscillation cycles, the overall speed and direction of the Walker circulation remained steady between 1871 and 2008.[[8]](https://en.wikipedia.org/wiki/Walker_circulation#cite_note-8)

# Walker Circulation Southern Oscillation- El Nino and La Nina

## El Nino and La Nina

For understanding the phenomena of El Nino and La Nina, first, we need to understand Walker Circulation. Trade winds, Westerlies, and Polar Easterlies form the general circulation patterns of the atmosphere. But there are some exceptions. One of the El Nino and La Nina is Walker Circulation. The typical East-West circulation of the tropical and equatorial winds comprises the Walker Circulation, named after G.T. Walker. It is basically a convective cell of air circulation, most predominantly formed over the Pacific Ocean, which consists of easterly winds at the lower troposphere, westerly winds at the upper troposphere, rising motion over the western Pacific, and subsidence over the eastern Pacific. It is the result of pressure gradient development from east to west in the equatorial Pacific Ocean. This general condition of the east to west pressure gradient is reversed after every two to three years. This kind of oscillations in the pressure gradient, causing reversals of winds also, is termed as Southern Oscillation.

## ****Ocean-Atmosphere Coupling****

Bjerknesinterpreted the Walker Circulation as an atmospheric circulation driven by the gradient of sea surface temperature along the Equator and suggested that the characteristics of the Walker circulation were largely determined by the coupling between the tropical atmosphere and oceans. In normal conditions, there is high pressure on the sea surface of the equatorial eastern Pacific Ocean and western coastal lands of South America. These regions witness upwelling of cold oceanic water and subsidence of air from above. This is the time when low pressure is formed over the western equatorial Pacific Ocean due to the rise of air from the warm sea surface. The pressure gradient is from east to west causing easterly circulation of trade winds and a reverse westerly upper air circulation (as shown in the figure below). Due to east-west air circulation, the warm water pool over gets driven away from the western coast of South America towards the west. The upwelling over the Peruvian and Ecuador coasts causes further cooling of the air, high air pressure, atmospheric stability, and dry weather condition. On the contrary, the equatorial western Pacific Ocean witnesses atmospheric instability and precipitation. **Read Also:** [**Cyclone Vayu**](https://jatinverma.org/cyclone-vayu/)

### ****El-Nino****

The term El Niño translates from Spanish as 'the boy-child' or ‘the Christ Child’. Peruvian fishermen originally used the term to describe the appearance, around Christmas, of a warm ocean current off the South American coast. During an El Nino, a relaxation of the lower level easterlies, signaling a weakening of the Western Circulation is accompanied by weaker upwelling in the eastern Pacific. The low air pressure of the tropical western Pacific is shifted to the tropical eastern Pacific causing weakening of trade winds. Around the coasts of Peru and Ecuador, the upwelling of cold seawater stops along with the formation of low air pressure. The warm air rises above causing rainfall after condensation. The upper air pattern also gets reversed and follows a westerly flow from Eastern Pacific finally descending in the Western Pacific regions. During an El  Nino, the weakening Walker circulation causes widespread drought in Indonesia/maritime continent, drought in northeastern   Brazil, severe floods in Peru and Ecuador, and in south-easternBrazil and northern Argentina. It also affects Indian Monsoon negatively and average monsoonal rainfall in India decreases. These changes in the Pacific Ocean and its overlying atmosphere occur in a cycle known as the El Niño–Southern Oscillation (ENSO).

#### ****La-Nina****

La Niña translates as 'girl-child' and is the opposite ENSO phase to El Niño. During a La Nin ̃a, theWalker Circulation intensifies and leads to rainfall anomalies with reverse sign compared to El Nino. Places like Indonesia and Australia can get much more rain than usual. However, the cold water in the eastern Pacific causes fewer rain clouds to form there. So, places like the southwestern United States can be much drier than usual. Generally, La Nina years are marked with a good Indian Monsoon also.

**Read More Articles:** [**Can India’s cities accommodate climate migrants?**](https://jatinverma.org/can-indias-cities-accommodate-climate-migrants/) [**By 2027, India population to cross China’s: UN**](https://jatinverma.org/by-2027-india-population-to-cross-chinas-un/)

**Definition** of **Southern Oscillation**. climatology. : a periodic seesaw fluctuation in sea-level atmospheric pressures over the **southern** Pacific and Indian oceans that is believed to be linked to El Niño and La Niña events — compare arctic **oscillation**, north atlantic **oscillation**.

On what timescale does the El Niño Southern Oscillation ENSO occur?

There is a flip side to **El Niño** called La Niña, which **occurs** when the trade winds blow unusually hard and the sea temperature become colder than normal. **El Niño** and La Niña are the warm and cold phases of an **oscillation** we refer to as **El Niño**/**Southern Oscillation**, or **ENSO**, which has a period of roughly 3-7 years

**EL Nino** The periodic development of warm ocean current along the coast of Peru as a temporary replacement of the cold Peruvian current, is called **EL**-**Nino**. Features of **EL Nino**. (i) The presence of the **EL**-**Nino** leads to an increase in sea-surface temperatures.

EL Nino The periodic development of warm ocean current along the coast of Peru as a temporary replacement of the cold Peruvian current, is called EL-Nino.  
Features of EL Nino  
(i) The presence of the EL-Nino leads to an increase in sea-surface temperatures.  
(ii) It weakens the trade winds in the regions and causes heavy rainfall, floods or droughts in different regions of the world.