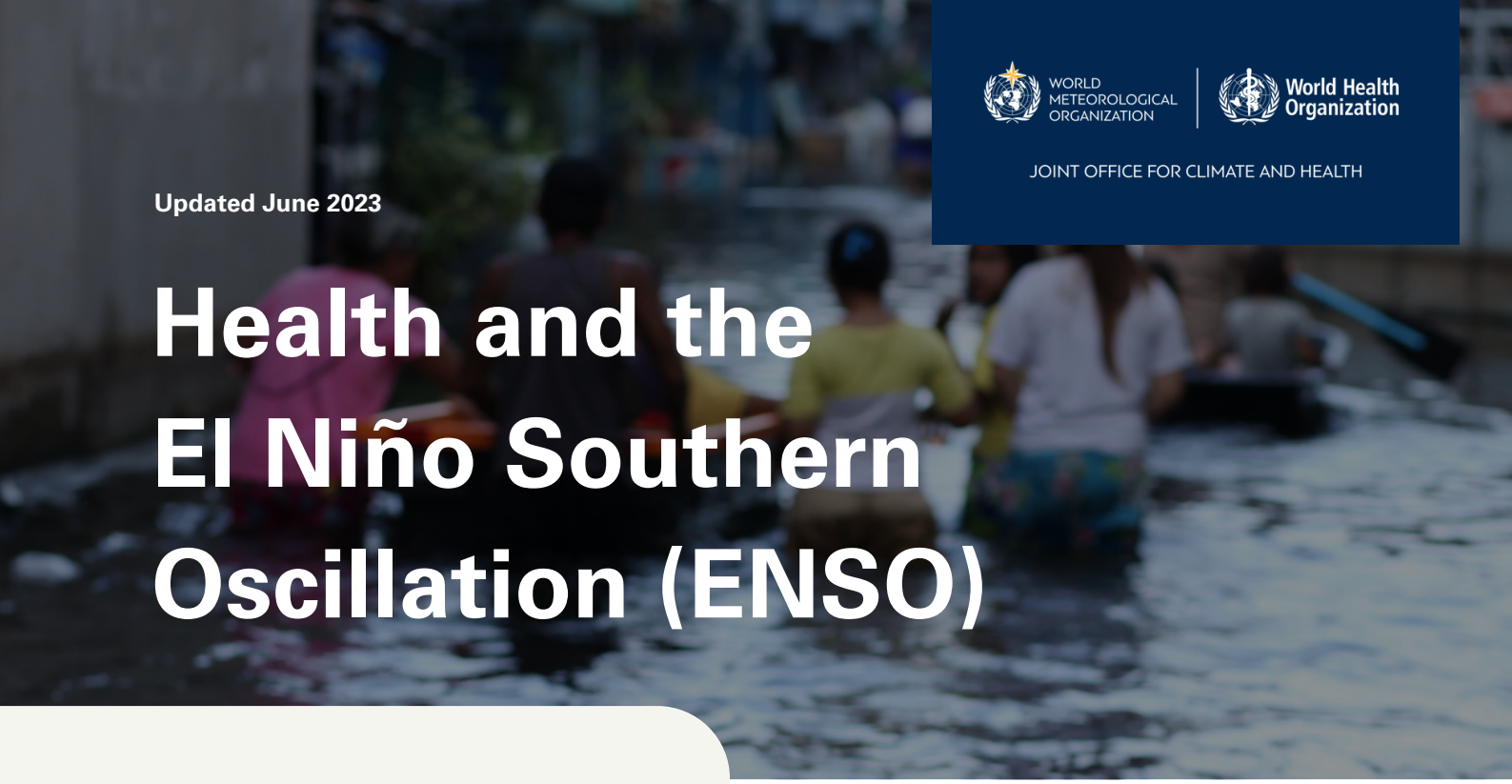


WORLD METEOROLOGICAL ORGANIZATION | World Health Organization

JOINT OFFICE FOR CLIMATE AND HEALTH

Updated June 2023

Health and the El Niño Southern Oscillation (ENSO)

Key Facts

1. **El Niño Southern Oscillation (ENSO) is a fluctuation of the ocean–atmosphere system that originates in the tropical Pacific. The warm phase is known as El Niño and the cold phase La Niña.**

2. **ENSO is one of the most important sources of annual global climate variability, second only to the earth–sun relationships that drive the seasons. El Niño and its counterpart La Niña are associated with characteristic patterns of rainfall and temperature, which can include extreme events such as flooding and drought.**

3. **ENSO affects many parts of the globe, but most intensely impacts the tropics, including countries and areas in Africa, Latin America and South and South-East Asia that are particularly vulnerable to natural hazards.**

4. **By altering climate conditions, ENSO can have severe effects on key health determinants through, among other factors, impacts on food security, air and water quality, ecosystems and health infrastructure safety.**

5. **ENSO is also associated with altered transmission patterns of vector-borne, rodent-borne and waterborne diseases, as well as fish and shellfish poisoning.**

6. **Early warning systems and anticipatory action can help reduce the impacts of ENSO exacerbated extreme weather conditions.**

El Niño Southern Oscillation (ENSO) is a naturally occurring large-scale climatic phenomenon involving fluctuating ocean temperatures in the central and eastern equatorial Pacific, coupled with changes in the overlying atmosphere (e.g. sea-level pressure, cloudiness and winds). El Niño and La Niña are the oceanic components, while the Southern Oscillation is the atmospheric counterpart, thus giving rise to the term 'El Niño Southern Oscillation'. ENSO occurs in irregular cycles of two to seven years, and presents three phases: El Niño, La Niña and a neutral phase.

An El Niño event is characterized by a period of sea-surface warming and consequent suppression of the nutrient-rich cold-water up-welling off the coast of Peru and Ecuador. The typically prevailing east to west surface-wind flow is also weakened, or even reversed, under these conditions.

- El Niño events typically last between 12 and 18 months, starting around April and peaking in intensity between November and February of the following year.

- The strongest El Niño events of the past century occurred in 1982–83, 1997–98, and 2015-16.

In contrast, a La Niña event is characterized by a period of colder than average sea surface temperatures in the central and eastern Pacific Ocean and an intensification of the prevailing east to west surface winds. La Niña events typically follow El Niño events but not always.

- The strongest La Niña events of the past 40 years occurred in 1973–76, 1988–89, 1998–2000 and 2010–11.

ENSO and Climate

El Niño and La Niña can have widespread impacts on climate and weather patterns, with changes in temperature and rainfall in various parts of the world. It is the dominant feature of climate variability on inter-annual timescales.

The effects of each El Niño/La Niña event vary depending on the intensity, duration, time of year when it develops, and the interaction with other modes of climate variability. Not all regions of the world are affected, and even within a region, the impacts can be different. While air temperatures tend to warm across the tropics during an El Niño, the impact on rainfall is region and season specific.

Common regional influences of El Niño include:

- In Africa: Drier conditions in Southern African and some areas in the Sahel; and wetter conditions in equatorial East Africa during the short rainy season (October–December).
- In Asia Pacific: Lower rainfall in South and South-East Asia; and wetter conditions in the Eastern-Central Pacific islands and Hindu Kush mountain range
- In Latin America: Drier conditions in northern Brazil; and heavy rainfall in Central America, Northern Peru, Ecuador, and the northern and south eastern parts of South America.

Scientific progress on the understanding and modelling of ENSO has improved prediction skills within a range of one to six or more months in advance, helping society to prepare for the associated hazards such as heavy rains, floods, and drought. The value of these predictions can also translate into hundreds of millions of dollars in potential savings.

ENSO and Climate Change

There is yet no conclusive evidence of the impact of climate change on the frequency or intensity of El Niño/La Niña events. However, climate change is likely to affect the impacts related to El Niño and La Niña in terms of the intensity and frequency of extreme weather and climate events.

Value of Understanding ENSO for Health Preparedness

ENSO events can be predicted with some reliability several months in advance, allowing the climate community to prepare seasonal forecasts with enhanced precision. The increased predictability of climate events on seasonal to inter-annual timescales can help planners and health professionals anticipate, prepare for and respond to ENSO-related health risks. For example:

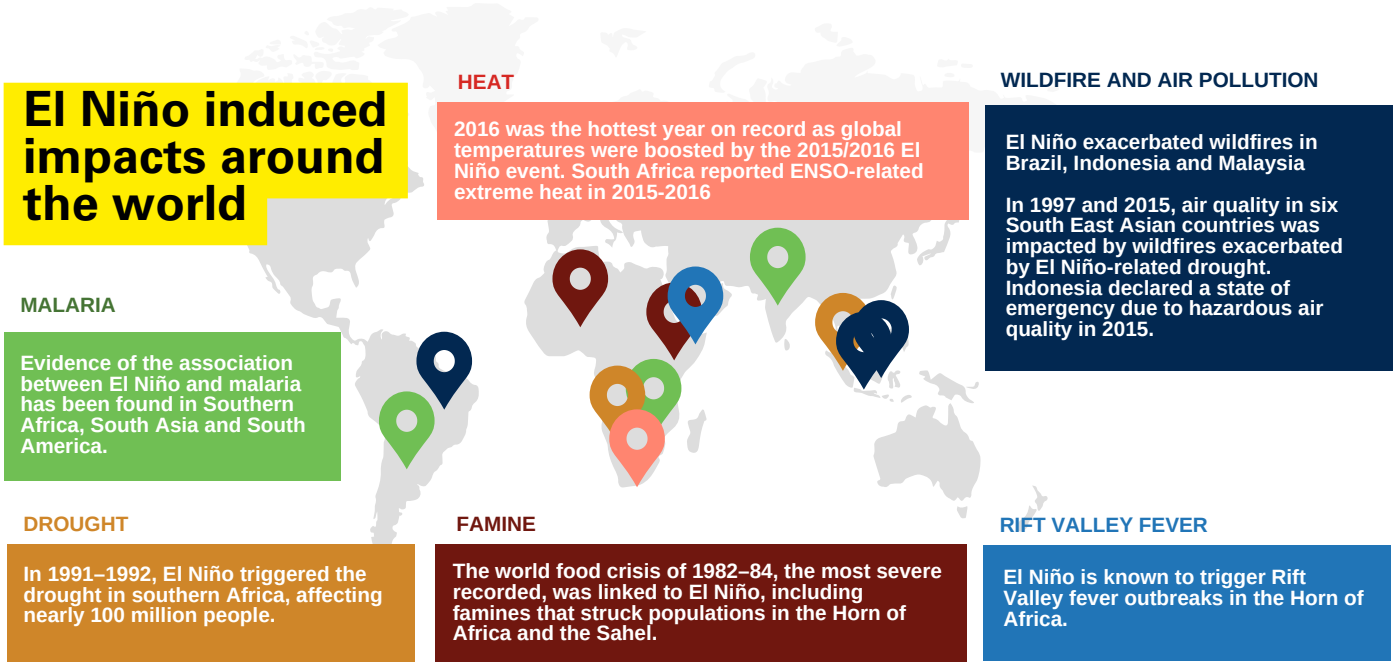
- ENSO-based seasonal climate forecasts are being used to improve crop yields and provide early warning of famine risk in Africa.
- Understanding of Rift Valley Fever and ENSO dynamics in Eastern Africa enables forecasting models and early warning systems that can inform authorities of when and where to implement measures to avert impending epidemics.
- In 2008, based on above-normal seasonal rainfall forecasts, the International Federation of Red Cross and Red Crescent Societies was able to improve availability of health supplies to high-risk areas up to 40 days in advance of floods.
- In 2014 and 2015, ENSO-related information produced by the International Research Institute for Climate and Society (IRI) for the malaria community in East Africa provided time-sensitive information for interventions to reduce malaria transmission in high-risk areas.
- Countries with Enhanced National Climate Services (ENACTS) can share information on the past impacts of ENSO events, particularly related to the spatial and temporal distribution of rainfall and temperature changes at the district level. In Tanzania, for example, droughts during the short rains are largely absent during El Niño events.

Health Impacts of ENSO

Local incidence of vector-borne and waterborne diseases, wildfire smoke exposure, heat stress, and flood- and drought-related health and nutritional impacts have all been observed to be influenced by ENSO events.

Observed associations between ENSO and health impacts are not linear or unequivocal, but depend on the ENSO intensity, time of the year and other factors. Impacts tend to be more intense in less developed countries where populations have limited coping capacity and are often more vulnerable to the impacts of extreme weather and climate. Their livelihoods are often highly dependent on natural resources and rain-fed agricultural practices; housing typically lacks protection against extreme weather events; access to health care and safe drinking-water and adequate sanitation facilities may be limited; and infectious diseases determined by environmental conditions are often pre-existing.

Areas of the world to focus early action include zones where disease burdens are easily amplified by disruption or changes to the human environment and life-sustaining activities and services. Displaced persons and refugees may be especially vulnerable, and a significant proportion of these populations live in countries affected by El Niño.



ENSO and Vector-borne Diseases

Vectors, such as mosquitoes, that are responsible for the transmission of malaria, dengue, and rift valley fever are sensitive to changes in temperature, rainfall and humidity, which determine the suitability of ecosystems for vector reproduction, development and activity. Studies have shown malaria and rift valley fever are affected by ENSO conditions with locally variable impacts.

Malaria
The effects of ENSO on malaria are most pronounced in epidemic-prone areas where climate conditions are generally not suitable for year-round vector reproduction. Small changes in climate conditions in these areas have the potential to change normally unsuitable habitats into viable habitats for mosquitoes that transmit malaria, or to temporarily extend the period of malaria susceptibility. Decreased immunity acquired over time by inhabitants of these new malaria-prone areas can further increase the risk of outbreaks.

- Evidence of the association between El Niño and malaria has been found in Southern Africa, South Asia and South America.
- The effect of ENSO on malaria is mediated by its impact on rainfall and temperature patterns.
- In dry areas, intense rainfall can create water puddles; in wet areas, drought can result in reservoirs of stagnant water, both conducive to generating new mosquito breeding sites.

Rift Valley fever
Rift Valley fever is a viral disease of animals and humans transmitted by mosquitoes that occurs throughout sub-Saharan Africa, Egypt, and the Arabian Peninsula. Outbreaks of the disease are episodic and closely linked to climate variability, especially widespread elevated rainfall that often results from ENSO events.

- Since 1950, each of the seven documented moderate or large RVF outbreaks in the Horn of Africa have been associated with ENSO-associated patterns of above-normal and widespread rainfall.

Dengue
The mosquitoes that transmit dengue breed in domestic containers, such as flower pots, cisterns or drains, breed mainly around human habitation, resulting in the effect of rainfall on transmission being strongly mediated by social and behavioural factors. Higher temperatures associated with El Niño can affect water usage practices that encourage mosquito breeding, such as increased water collection and storage that are conducive to increased transmission of the virus.

- There is weak evidence of the association between El Niño and dengue in South America, Mexico and some areas of Asia.

ENSO and Extreme Heat

El Niño events can have the overall effect of increasing global average surface temperatures, whereas La Niña events have a cooling tendency. The strong El Niño event of 1997/1998 was followed by a prolonged La Niña phase that extended from mid-1998 to early 2001, with a clear impact on global temperatures. At the time, 1998 was the second hottest year on record. 2016 is the hottest year on record, global temperatures were boosted by the 2015/2016 El Niño event.

Any transition from a La Niña to an El Niño phase will likely produce a rise in global average surface temperature, with warming tendencies affecting the development of extreme heat in the Southern Hemisphere. The joint influence of both El Niño warming and rising global temperatures caused by climate change amplifies the potential for extreme heat and heatwaves in many regions, creating deadly conditions for millions of people.

Some populations are more vulnerable than others to physiological stress, exacerbated illness, and an increased risk of death from exposure to hot weather. Especially vulnerable populations include those over 65 years of age – particularly those with chronic medical conditions, infants and children, pregnant women, outdoor workers, athletes and attendees of outdoor events, and the poor. Gender can also play an important role in determining heat exposure.

ENSO and Water-borne diseases

Cholera
Research on the association of ENSO and waterborne diseases has focused mostly on cholera.

- In Bangladesh, studies have identified effects of increasing sea surface temperatures influenced by El Niño to amplify marine reservoirs of the cholera pathogen.
- Major cholera outbreaks in Tanzania and other parts of East Africa have been associated with strong El Niño years such as 1997 and 2015.

ENSO and Air Pollution

El Niño-related drought conditions can increase the risk of wildfires resulting in local and trans-boundary smoke pollution. The inhalation of fire smoke is a major public health problem, causing respiratory diseases and other harmful effects.

- The El Niño-related drought of 1997 contributed to the exacerbation of wildfires in Brazil, Indonesia, and Malaysia.

In 2015, air quality in six South East Asian countries was impacted by wildfires exacerbated by El Niño-related drought, including Indonesia where a state of emergency was declared due to hazardous air quality.

Drought and Food Insecurity

Food production is extremely sensitive to droughts and heavy rainfalls that can jeopardize food and nutritional security. Some of the worst food crisis events have been associated with El Niño years:

- In 1991-1992 El Niño triggered the drought in southern Africa, affecting nearly 100 million people.
- The world food crisis of 1982–84, the most severe recorded, was linked to El Niño, including famines that struck populations in the Horn of Africa and the Sahel.
- In Peru, a study found that children born during and after 1997–1998 El Niño, while controlling for other factors, were on average shorter and had less lean mass for their age and sex than expected had El Niño not occurred.
- Droughts in Brazil, north-east China, Indonesia, Marshall Islands, Papua New Guinea, and the Philippines have also been associated with ENSO.

ENSO and the impacts of ENSO-Related Disasters

ENSO increases the likelihood of extreme weather events that can exacerbate health risks among vulnerable populations. The health impacts of these events depend on local health vulnerability and coping capacities.

Floods
By altering rainfall patterns, ENSO exerts strong and widespread influences on both flood hazards and risks.

- Abnormal precipitation events during El Niño or La Niña years contribute to increased flood risk in basins spanning almost half of Earth's land surface, especially in Southern Africa, parts of the Sahel and western Africa, Australia, the western United States and parts of South America.
- In 1997, central Ecuador and Peru received more than 10 times the typical levels of rainfall, resulting in flooding, extensive erosion and mudslides, and leading to the loss of lives, destruction of homes and infrastructure, damage to food supplies and, in Peru, destruction of an estimated 10% of existing health facilities.

WHO ENSO Activities

WHO protects human health from risks related to climate variability through its programmes on the environmental and social determinants of health, emergency preparedness and response, infectious disease prevention and control, improving health research and evidence, and health system strengthening.

WHO supports countries to identify high and imminent risks through national risk assessments and to build and maintain effective and functioning capacities and systems to prevent, detect, protect against, control and provide a public health response to public health emergencies of all types of emergencies, including those associated with climate-related hazards and diseases. This includes the development of multi-hazard emergency response plans complemented by hazard- and disease-specific contingency and readiness plans.

In accordance with mandates from the World Health Assembly, WHO supports countries to improve awareness and evidence of local climate impacts on health, as well as to strengthen health system capacity to manage consequent health risks of extreme weather and climate change.

A joint WHO/World Meteorological Office (WMO) office supports WHO to improve health preparedness and decision making through the enhanced use of weather and climate information, including in relation to ENSO.

WMO ENSO Activities

WMO issues quarterly El Niño/La Niña updates on the monitoring and predicting of this phenomenon, prepared in collaboration with the International Research Institute for Climate and Society (IRI) and based on contributions from designated meteorological authorities around the world. These updates contain the observational monitoring of the current situation in the equatorial Pacific, and consensus-based outlook for the next season.

WMO El Niño/La Niña Updates and GSCU are available to support governments, the United Nations partners, including the United Nations Inter-Agency Task Force on Natural Disaster Reduction, humanitarian organizations, decision-makers and stakeholders in climate sensitive sectors to mobilize preparedness actions and protect lives and livelihoods.

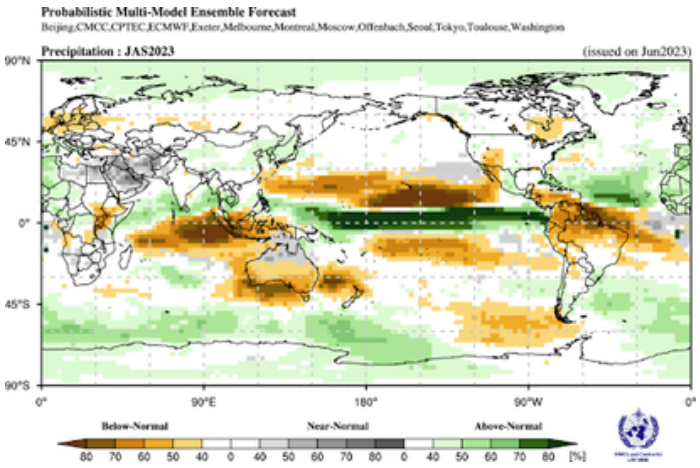
WMO also issues regular Global Seasonal Climate Updates, which incorporate influences of the other major climate drivers such as the North Atlantic Oscillation, the Arctic Oscillation and the Indian Ocean Dipole.

Heightened Risk and Global Preparedness in 2023

The global climate system is entering an El Niño phase, which may have implications for health impacts in 2023-2024. In order to enhance preparedness measures for the increased health risk conditions, WHO is providing information and technical support to Member States and health partners.

For more information refer to: WMO ENSO Updates

Forecast for June 2023



Additional resources

ClimaHealth.info: The WMO-WHO Knowledge Platform for Climate and Health

WHO Climate and Health

WHO Health Emergencies Programme

WHO Health Emergency and Disaster Risk Management

WMO El Niño/La Niña Update

PMME Global Seasonal Climate Update (GSCU)

WMO Lead Center for Long-Range Forecast Multi-Model Ensemble (LC-LRFMME)

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