

Afghanistan Cold Wave Review (2000 - 2026)

April 2026 | Afghanistan

Context & Rationale

Winters in Afghanistan are associated with significant hardship for communities. Cold waves, community isolation, avalanches, and landslides occur frequently during the winter season. In a context of high structural needs, these shocks further overwhelm already limited coping capacities. Between 2000 and 2026, based on the news reports, and humanitarian organization outputs multiple cold wave events exposed affected populations to hundreds of deaths and substantial livestock losses. These impacts contribute to the deterioration of food security and livelihoods, while exacerbating broader vulnerabilities.

Humanitarian access becomes increasingly constrained during winter, particularly in mountainous and remote areas. Community isolation due to snow accumulation significantly limits the ability of response actors to reach affected populations. As a result, effective winter response requires timely planning, early warning, continuous monitoring, and well-informed decision-making. To support improved preparedness and response, REACH, with support from WFP, conducted a secondary data review of historical climate data and documented winter events between 2000 and 2026. This analysis aims to provide a clearer understanding of cold wave patterns and the dynamics of community isolation across Afghanistan.

The outputs of this work include this analytical brief and two district-level datasets, intended to support operational planning, targeting, and further analysis by humanitarian actors.

Key Messages

- Cold waves are a recurrent, high-impact hazard in Afghanistan, occurring almost annually at local scale and occasionally at nationwide scale; major events such as those in 2008 and 2023 have caused hundreds of deaths and significant livelihood losses, including up to one million livestock fatalities.¹
- La Niña conditions are strongly associated with more severe and widespread cold waves, with the number of affected districts approximately three times higher than during El Niño and neutral conditions, where events tend to be smaller in scale and less widespread.
- Winter settlement isolation follows a predictable seasonal pattern, beginning as early as September and October in high-altitude areas (e.g. Badakhshan) and expanding widely from November, with peak isolation in January–February.

Methodology

This analysis applies a structured approach to identify and assess cold wave and winter isolation patterns across Afghanistan between 2000 and 2026. Using ERA5 reanalysis climate data and the Shock Monitoring Index (SMI) framework, events are classified by severity and analysed in terms of their frequency, geographic extent, and monthly distribution. The methodology also incorporates El Niño–Southern Oscillation (ENSO) phase comparison to explore broader climatic influences on cold wave occurrence.

Data Source: ERA5 daily surface minimum temperature and daily Snow Depth (from 2000 – 2026).²

Analytical Unit: Districts (based on OCHA 401 District Boundaries) and Communities (based on REACH Basic Service Unit Boundaries)³.

Analytical Framework: To identify and classify winter-related shocks, the analysis applied the Shock Monitoring Index (SMI) - winter shock section analytical framework.⁴ The SMI generally classifies shocks according to the severity into four levels: 1 (No shock/Minimal), 2 (Moderate), 3 (High), and 4 (Very High).

Daily ERA5 data were processed at the district and community level and evaluated against SMI thresholds.

Threshold Definitions (Based on SMI trend analysis):⁵

Severity	Cold wave thresholds
Very High - 4	Daily minimum temperature for 2 or more consecutive days is less than -2 standard deviations and below -30 °C OR Daily minimum temperature for 2 or more consecutive days is less than -3 standard deviations and below -15 °C
High - 3	Daily minimum temperature for 2 or more consecutive days is less than -3 standard deviations and below -10 °C.
Moderate - 2	Daily minimum temperature for three or more consecutive days is less than or equal -3 standard deviations and above -10 °C.
No Shock - 1	Daily minimum temperature for 2 or more consecutive days is not more than -3 standard deviations

Winter Isolation Thresholds: Winter isolation severity was defined using the daily evolution of snow accumulation in the community, through measuring the daily snow depth:

Severity	Snow depth (Isolation) Thresholds
Very High - 4	When the snow depth is ≥ 15 cm, any further increase of ≥ 15 cm within 24 hours.
High - 3	When the snow depth is ≥ 15 cm, any further increase of up to (6 – 14) cm within 24 hours.
Moderate - 2	When the snow depth is ≥ 15 cm, any further increase of up to 5 cm within 24 hours.
No Shock - 1	The snow depth does not reach 15 cm at any point during the entire month.

Winter isolation events with high and very high severity, based on the above thresholds, were assessed across different months, and a district-level winter isolation timeline was developed.

ENSO Events Data: ENSO occurrence for the analysis period (2000–2026) was obtained from the ggweather.com website.⁶ Cold wave events were grouped by ENSO phase, and the relationship between ENSO conditions and the likelihood of cold wave occurrence was analysed.

Limitations

- This analysis covers the period 2000–2026 and therefore does not capture cold wave and winter isolation events that occurred prior to this timeframe.
- The climate data used in this study are derived entirely from ERA5 reanalysis (remote sensing) datasets. While comprehensive, these data may not fully capture local micro-climatic variability, particularly in complex mountainous terrain.
- The ENSO analysis identifies correlations rather than causal relationships, and other climatic and environmental factors may also influence the occurrence and severity of cold waves.
- The limited availability of ground-verified impact data (e.g. human mortality and livestock losses) constrains the ability to fully validate and quantify the impacts of identified events.

Cold Wave Trends in Afghanistan (2000–2026)

Analysis of remote sensing temperature data and reports from 2000 to 2026 highlights the recurrent nature of extreme winter events in Afghanistan. Cold waves, heavy snowfall, avalanches, and resulting settlement isolation have repeatedly led to significant human mortality and substantial livestock losses. These impacts are compounded by limited community coping capacity, restricted access to services during periods of isolation, and the presence of underlying structural vulnerabilities.

Among winter-related hazards, cold waves (extreme cold conditions) appear to be the most consistently reported driver of both human fatalities and livelihood losses. Nearly every major casualty event linked to winter conditions is associated with extreme cold temperatures.

Remote sensing analysis over the past 27 years (2000–2026) suggests three broad categories of cold waves based on geographic scale:

- Localized cold waves: Affecting up to 40 districts
- Medium-scale cold waves: Affecting 40–100 districts
- Large-scale cold waves: Affecting more than 100 districts

Localized cold waves occur almost annually and tend to have relatively limited impacts compared to medium- and large-scale events, which are associated with more severe humanitarian consequences.

Cold Wave Occurrence (2000–2026)

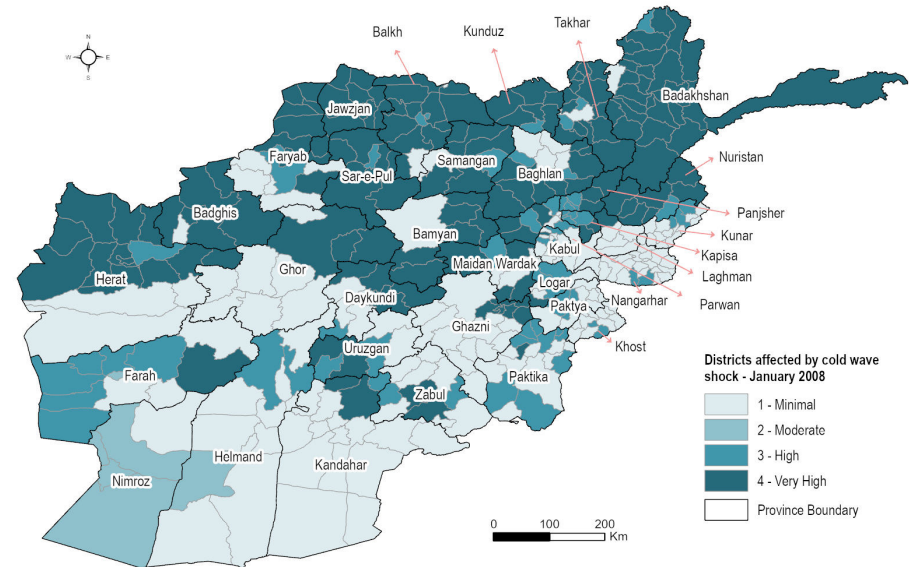
1. Large-Scale Cold Waves

Two major large-scale cold waves were identified during the analysis period, both associated with widespread geographic coverage and significant reported losses:

January 2008:⁷ A severe cold wave affected large parts of the western, northern, northeastern, eastern, and central highland regions, as well as Uruzgan province in the south. (Map 1)

Reported impacts include over 926 deaths and substantial livestock losses, with approximately 100,000 sheep and goats and nearly 315,000 cattle reported dead.

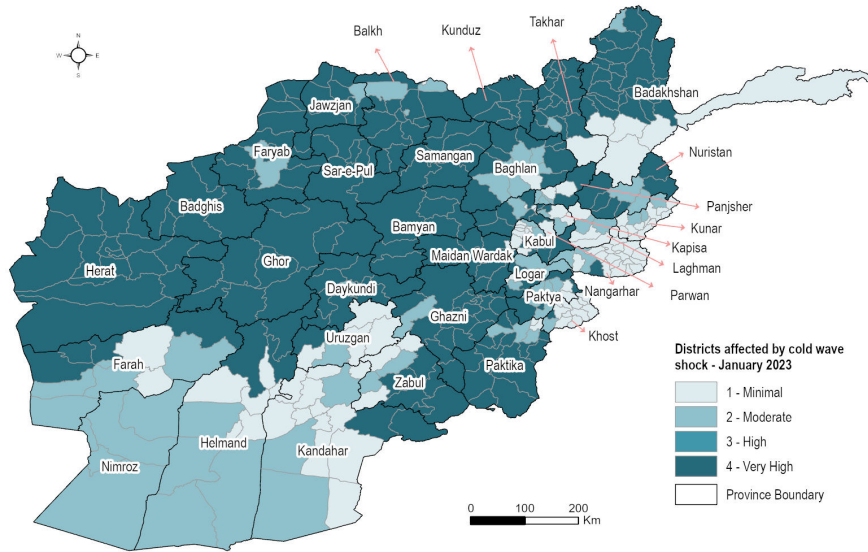
Map 1: Districts affected by cold wave shock in January 2008



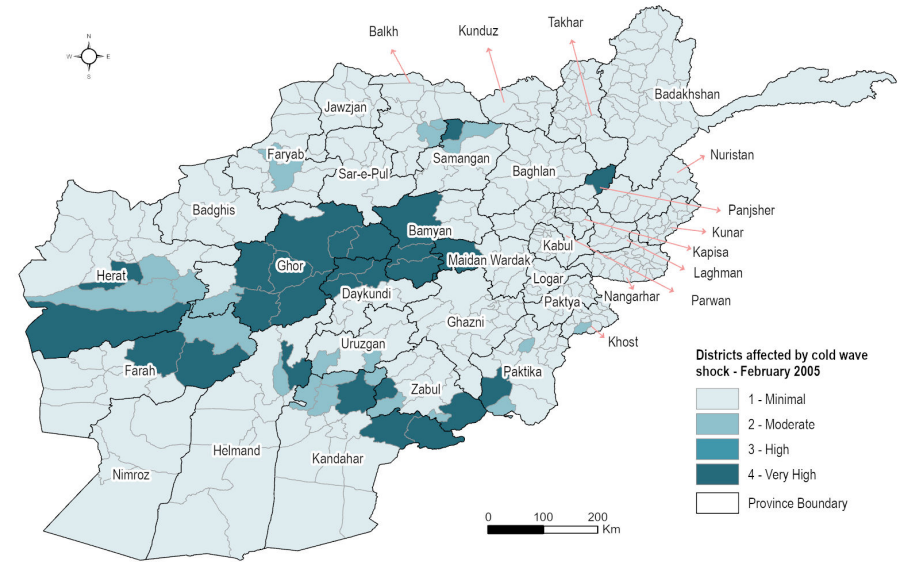
January 2023:⁸ This event represents the largest cold wave identified between 2000 and 2026, and possibly one of the most severe in Afghanistan’s recent history. It affected nearly all western regions and extended across northern, northeastern, central highlands, central, southeastern areas, as well as parts of Zabol and Nuristan. (Map 2)

Temperatures dropped as low as -33°C in some locations. According to FAO assessments (based on anecdotal sources), livestock losses ranged between 70,000 and 200,000.⁹

Map 2: Districts affected by cold wave shock in January 2023



Map 3: Districts Affected by cold wave shock in February 2005



2. Medium-Scale Cold Waves

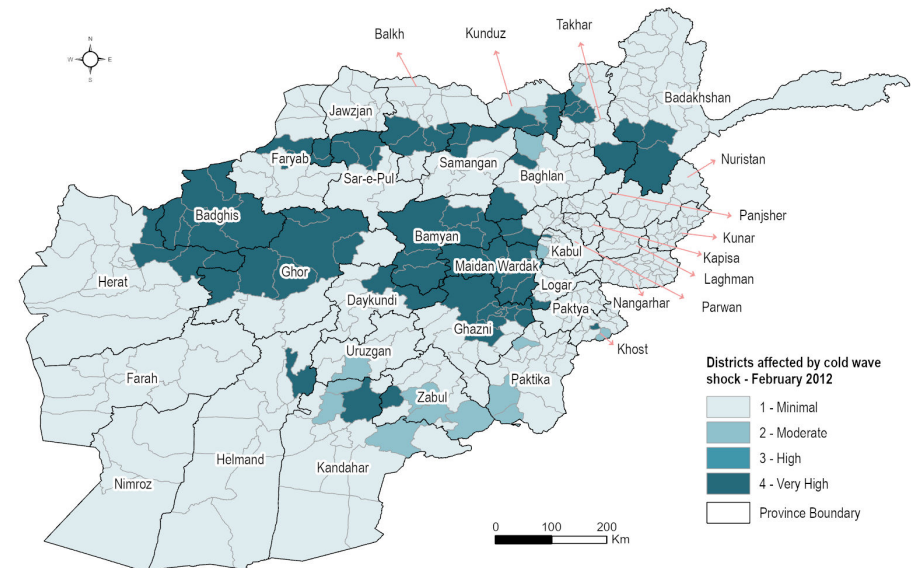
Medium-scale cold waves have occurred more frequently and, while less widespread than large-scale events, still resulted in notable humanitarian impacts:

- February 2005:¹⁰ Reported as a severe winter event, with over 500 deaths recorded. (Map 3)
- February 2012:¹¹ Identified as a severe cold wave, with more than 150 deaths reported. (Map 4)
- January 2006 and February 2014: Cold wave conditions were identified through temperature data analysis; however, no reliable reports on associated human or livestock losses were found.

3. Localized Cold Waves:

Cold waves with limited geographic extent occur regularly and are observed in most winter seasons. Despite their smaller scale, they can still expose affected communities to significant and potentially destructive impacts. As such, these events should be considered by response actors when planning and targeting emergency assistance.

Map 4: Districts Affected by cold wave shock in February 2012



ENSO Impact on Cold Wave Occurrence in Afghanistan

The El Niño–Southern Oscillation (ENSO), encompassing El Niño and La Niña phases, plays a significant role in shaping global atmospheric circulation patterns.¹² In the context of Afghanistan, these large-scale climatic phenomena are generally associated with warmer, wetter, and more humid conditions during El Niño years, and cooler and drier conditions during La Niña periods.

This study explores the potential relationship between ENSO phases and the occurrence of cold waves in Afghanistan. To do so, cold wave events identified between 2000 and 2026 - based on remote sensing temperature data and available reports, were systematically compared against ENSO classifications for the corresponding periods.

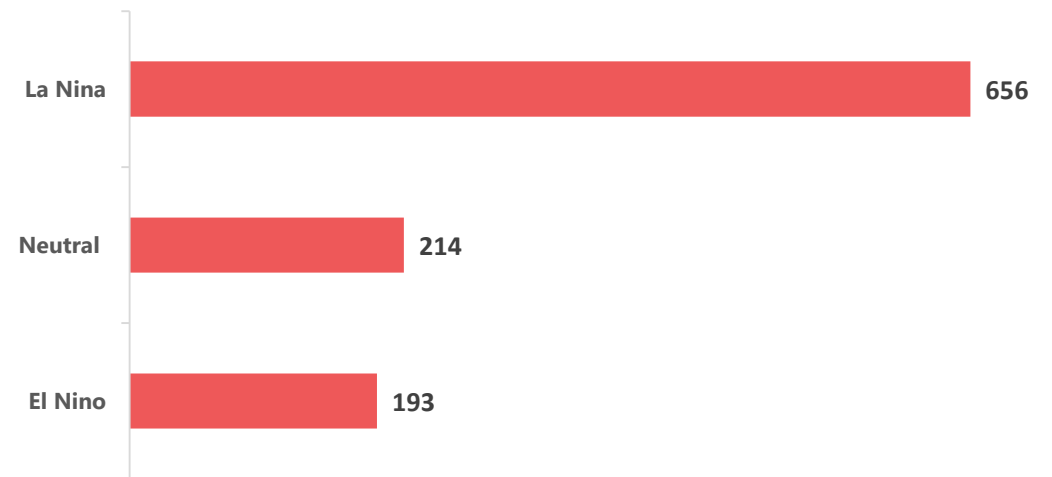
The analysis suggests a clear correlation between La Niña conditions and increased cold wave severity and extent. Specifically, the number of districts affected by cold waves or unusual cold conditions during La Niña periods is approximately three times higher compared to El Niño and neutral conditions. (Figure 1) This indicates a strong tendency for more widespread and intense cold wave events during La Niña phases.

Importantly, the two large-scale cold waves identified in January 2008 and January 2023 both coincided with La Niña periods. These events were characterized by extensive geographic coverage and significant reported human and livestock losses, further reinforcing the observed relationship.

While cold waves were also observed during El Niño and neutral conditions, these events were predominantly localized or medium in scale, with comparatively limited geographic spread and reported impacts. Additionally, the number of cold wave events occurring during neutral conditions appears slightly higher than during El Niño periods, although both remain substantially lower than during La Niña phases.

Overall, while this analysis does not establish causality, the findings indicate a strong association between La Niña conditions and the increased likelihood, scale, and severity of cold waves in Afghanistan. This has important implications for anticipatory action and early warning systems, particularly in integrating seasonal climate forecasts into winter preparedness planning.

Figure 1: # of districts affected by very high cold wave severity (December - March, 2000 - 2006), by ENSO phase



Winterization Response Critical Timelines in Afghanistan

Cold waves, winter-related settlement isolation, avalanches, and other seasonal hazards recurrently affect communities across Afghanistan. Particularly in the communities with pre-existing structural vulnerabilities, these shocks significantly increasing the exposure of populations to risk. As a result, timely and well-targeted winterization planning and response are critical to saving lives and mitigating mortality and livelihood losses.

One of the primary operational challenges during winter is settlement isolation caused by snow accumulation, which can severely restrict humanitarian access. Once communities become cut off, delivering assistance becomes significantly more difficult. Therefore, a strong understanding of seasonal patterns and the timing of isolation is essential for response actors to plan effectively and ensure assistance is delivered before access constraints intensify.

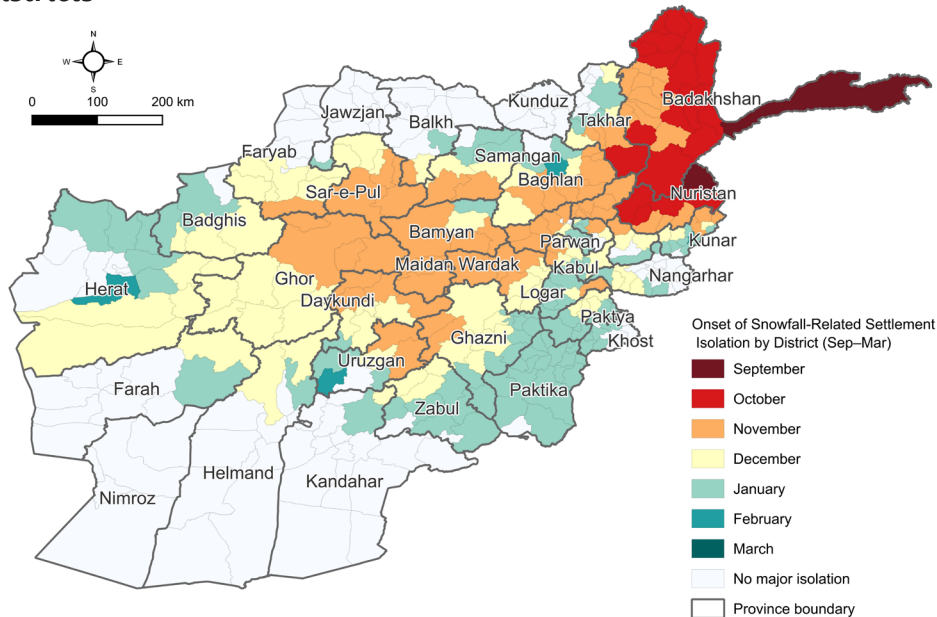
To improve understanding of community exposure to winter isolation, this study analysed daily snow depth data for each year from October to March (fall to early spring) over a 27-year period. Based on this analysis, periods of likely settlement isolation due to snow accumulation were identified and mapped.

Findings indicate that winter isolation begins as early as September–October in a number of districts in Badakhshan and Nuristan provinces, particularly in high-altitude and hard-to-reach areas. (Map 5)

- **November:** Isolation expands to provinces in the central highlands and other mountainous areas, particularly along both sides of the Hindu Kush mountain range, including Parwan, Panjshir, Baghlan, Samangan, Sar-e-Pul, and parts of Ghazni and Uruzgan.
- **December:** As conditions worsen approaching the peak winter period (January–February), isolation extends further to mountainous districts in Farah, Herat, and Badghis, in addition to eastern and southeastern highland areas.
- **January–February (peak winter):** During this period, most mountainous districts become isolated. Access is largely limited to district centres, and even these remain reachable only through continuous road clearance efforts by relevant authorities.

Overall, the findings highlight a clear seasonal progression of isolation, underscoring the importance of frontloading winterization assistance and prioritising early response in high-risk districts before access constraints peak.

Map 5: Onset of snowfall related settlement isolation in different districts



ANNEX: Analytical Datasets on Cold Wave and Winter Isolation (2000–2026)

To support evidence-based planning and operational decision-making, this research includes two analytical datasets derived from a historical review of cold wave and winter isolation patterns in Afghanistan:

1. [REACH AFG Winter Isolation Snow Accumulation Historical Review \(2000-2026\) Database April 2026](#)
2. [REACH AFG Cold Wave Shocks Historical Review \(2000 - 2026\) Database April 2026](#)

These datasets provide district-level and community-level (BSU) estimates of exposure to cold wave and winter isolation shocks, based on historical climate data from 2000 to 2026. Exposure is disaggregated by month across the winter season, enabling users to understand both the geographic distribution and seasonal progression of these risks.

Beyond descriptive analysis, these datasets serve as a baseline for anticipatory action and rapid response planning. They allow humanitarian actors including Basic Human Needs (BHN) partners to:

- Identify high-risk districts and communities prior to winter onset
- Inform pre-positioning of assistance and winterization interventions
- Support early warning systems and trigger-based response mechanisms
- Prioritise areas where access constraints are likely to emerge earliest and persist longest

The utility of these datasets is particularly evident in the context of sudden-onset shocks. For example, following the earthquake in Kunar province (August–September 2025),¹³ which left many households displaced and without adequate shelter, understanding pre-existing exposure to winter hazards becomes critical. In such scenarios, these datasets enable responders to anticipate compounded risks, prioritise the most vulnerable locations, and deliver timely, targeted assistance before winter conditions further restrict access.

Overall, these analytical products are intended to enhance forward-looking, risk-informed response planning, and to support more effective and timely humanitarian interventions during the winter season.

Endnotes

- 1 - The Associated Press - https://en.wikipedia.org/wiki/2008_Afghanistan_blizzard
- 2 - ERA5 daily temperature data - <https://cds.climate.copernicus.eu/datasets/reanalysis-era5-single-levels?tab=overview>
3. Basic Service Unit (BSU): BSUs are defined as economic and geographic service units, each of which represents multiple settlements and populations with access to similar or the same service facilities and humanitarian needs (e.g., accessing the same health facilities, schools, water systems, food distribution points, etc.).
- 4 - Shock Monitoring Index (SMI) - [Dashboard](#)
- 5 - Shock Trend Analysis Report - https://repository.impact-initiatives.org/document/impact/113cf994/REACH_AFG_Report_Shock-Trend-Analysis_November-2025.pdf
- 6 - El Niño and La Niña Years and Intensities - <https://ggweather.com/enso/oni.htm>
- 7 - The Associated Press - https://en.wikipedia.org/wiki/2008_Afghanistan_blizzard
- 8 - Multiple source on Wikipedia- [2023 Afghanistan cold snap](#)
- 9 - FAO. 2023. Afghanistan: Cold wave assessment on livestock – Data in Emergencies Impact report, July 2023.Rome. <https://doi.org/10.4060/cc7193en>
- 10 - Christian Aid - [Afghanistan: Hundreds feared dead in Afghanistan’s harshest winter for years](#)
- 11 - The New Humanitarian - [Ill-prepared for cold snap](#)
- 12 - El Niño and La niña - <https://oceanservice.noaa.gov/facts/ninonina.html>
- 13 - IFRC Afghanistan: Earthquake 2025- <https://www.ifrc.org/emergency/afghanistan-earthquake-2025>

ABOUT REACH

REACH Initiative facilitates the development of information tools and products that enhance the capacity of aid actors to make evidence-based decisions in emergency, recovery and development contexts. The methodologies used by REACH include primary data collection and in-depth analysis, and all activities are conducted through inter-agency aid coordination mechanisms. REACH is a joint initiative of IMPACT Initiatives, ACTED and the United Nations Institute for Training and Research - Operational Satellite Applications Programme (UNITAR-UNOSAT).