

Engin nge danglamna thlen?

Sik leh sa inthlak danglam chhan bul ber chu kum 1750 vel atang khan boruak a greenhouse gas te pun nasat vang a ni a. Khawvel in khawl kan hmehhriat atang khan boruak ah he'ng carbon dioxide te, methane leh nitrous oxide, adt., te an lo pung chak em em a. Mihring te kan lo pun nasat avangin tuialththei kan hmang nasa a, leilung kan thdanglam nasa chho tak em avangin Carbon dioxide phe chu za a sawmli laiin a lo pung tawh ani. Chu'ng carbon dioxide kan tih chhuah atanga za a sawmthum lai lo hip ral thin tuifinriat pawh a danglam nasa hle bawk a. Chu'ng ho inbelhbawm in a thlen chu khawvel sik leh sa awmdan atangin kan hmu chho zel ani.

Green house gases (GHGs)

Greenhouse gas te chu he'ng carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄), ozone (O₃), tui hu leh adt. an ni a. He'ng ho mai bakah mihring te avang liau liau in greenhouse gas thenkhat Halocarbons chi hrang hrang sulphur hexafluoride (SF₆), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), leh adangte pawh an awm bawk.

Khawvel leilung hian ni zung atangin lumna a hmu a, chu lumna chu vanthengreng lamah sawhkhawk let lehin, eng emaw zat chu heng greenhouse gas te hian lo dang bet in leilung lamah a rawn let leh thin a, chumi chuan kan khawvelah hian lumna a lo siam a, chu thil thlen dan chu **greenhouse effect** tih a ni. Kum zabi 20 na chhunga khawvel lumna chawhrual hi 15.5 °C a ni a, greenhouse effect hi awm lo ta se, kan khawvel lumna hi chawhrual in -20 °C vel tura chhut a ni.

IPCC AR5 2014 sik leh sa hmahlir

- GHGs pung zelin kum 2100 velah chuan tun aiin 2.6° C atanga 4.8° C velin boruak a lum tawh anga, sik leh sa ah pawh nasa zawk in danglamna a thlen ang.
- Khawvel a ruahtui tamna hmunah a tam tial tial anga, a tlem na hmun ah a tlem tial tial ang. Monsoon thlen-na hmunah ruahtui a lo tam zel ang a, fur hun chung pawh a rei tial tial tur a ngaih a ni.
- Boruak lum zelin ozone a ti pan tial tial bawk ang.
- Tuifinriat a lum belh zel ang a, tui thuk lam te pawh he lumna hian a fan zel ang.
- Khawvel hmar tawp tuipei te chuan kum 2050 thlen hmain nipui ah vur tlang an nei tawh lovang a, kum 2100 velah chuan kumpui linglet a leilung bawh tu vur te chuan za a sawmriat chuang in chhah zawng an hloh ang
- Boruak lum leh vur tlang tui ral avangin tuifinriat chim chin pawh kum 2100 vel ah chuan meter khat vel in a sang tawh ang.

- Boruak a carbon dioxide tam zel chu tuifinriat in a hip nasat dawn avangin a tui al na pawh a tlahniam nasa dawn hle a ni.
- Carbon dioxide tam luat tawh avangin tun dinhmuhnah in control pawh ni ila, a nghawng chuan kum za tam a daih dawn a ni.

ENGTIANG A HMACHHAWN TUR NGE

Sik leh sa inthlak hi buaina namen lo tak vawiin a kan tawn mek si a ni a. Science, economics, khawtlang nundan, chhia leh tha hriatna nen zawhna chhan ngai a ni. Khawvel pumpui buaina, khawi kipah pawh min nghawng tu a ni. Eng anga nasa in nge kan tawrh ang tih chu kan nunphung in a hril dawn a ni. Wawi tam tak kan inhrilh hre tawh chungin kan nunphung erawh a danglam mawh hle. Awmze nei tak leh hmalakna tluantling neih a, thil lo thleng mil a inher rem thiam kan mamawh bawk a ni.

Sil leh sa inthlak danglam hmachhawn turin thil chi hnih a awm thei:-

- **Mitigation:** Boruak a GHGs pek chhuah tih tlem leh tam zel tur ven (entirnan tuialththei hman tlem) te, a awm tawh sa ti tlem tura hmalakna hi Mitigation chu a ni (entirnan boruak chhia hip ral thei thing phun uar). Sik leh sa insiamah mihringte sulhnu tih tlemte, khuarelin amah leh amah a in chin fel theih na tura hun a neih theih nan GHGs tih tlemte, chumi avanga kan ei leh bar tharchhuah kawnga harsatna kan tawh lohna turte leh hmasawna tluantling kan neih theih na turte hi Mitigation in a tum tlangpui te chu an ni.
- **Adaptation:** Sik leh sa inthlak danglam in a nghawng mek leh a nghawng zel tur mil a kan nunphung leh khawsak dan in her danglam thiam hi Adaptation chu a ni. Sik leh sa inthlak in a nghawng chhiatna chi hrang hrang laka kan him theihna turte leh sik leh sa inthlak avanga hlawkna awmthei ve thung, a am thei ang ber a hman tangkai (entirnan hmun thenkhat ah ruahtui tlak dan avanga thlai chin hun chung rei ta leh tharchhuah a lo pun phahte) te hi adaptation in a tum tlangpui te an ni

Hmasang atang tawh in mihring te hian sik leh sa inthlak danglam mil a khawsak dan zirin an lo damkhaw chhuak fo thin tawh a. Chutih rual in hmun thenkhat ah khawheng avang in khawpui lian then khat chu an lo til tiak ve tawh bawk. Kum sing chuang vel chung chu kan khawvel sik leh sa ah hian danglamna nasa a thleng lem lova, chu chu tun hun a mihring te, khawtlang leh ram ang pawh a kan lo dinchhuah theihna chhan a ni a. Amaherawhchu, tun hnai atangin a lo inthlak danglam nasat tak ah chuan chumi mil a khawsak chu kan inzir a lo ngai chho leh ta a, a inthlak nasat poh leh inher rem a har ve zel dawn a ni.



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In partnership with
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CLIMATE CHANGE CHU ENGE?

Climate Change chu sik leh sa awmdan tlangpui, kum eng emaw zah (kum 10 leh a aia rei) chhung Chiang taka hmuh leh hriat theih a lo inthlak hi a ni a.

Khua rel; heng ni zung kan dawn dan danglam thin te, tlangkang te, leh mihring te'n kan chenna leilung leh boruak kan tih danglam nasat vang te in sik leh sa a lo inthlak danglam thin a ni.

United Nation Framework Convention on Climate Change (UNFCCC) in Climate change a hrilfiah dan

'He lei tuam tu atmosphere chhunga boruak chi hrang hrang inchawhpawlh hi khuarel chhan hrang hrang avangin a danglam thin a, chu chuan sik leh sa ah pawh danglamna a thlen thin a, kum eng emaw zah kal ta atang khan mihring te avangin sik leh sa lo danglam nasa em em in a lo inthlak ta a ni'.

UNFCCC chuan sik leh sa ah khuarel in danglamna a thlen nasa lova, mihring te thiltih in a belhchhah erawh chuan danglamna nasa tak a thleng a ni a ti bawk.

Weather Vs Climate

Climate leh **weather** thumal pahnh te hi kan hre fo tawh in a rinawm. Eng emaw hun chhung a kan chhehvel boruak awm dan inthlak danglam sawi nan a hman an ni a. Entirnan, zing ah ruah a lo sur a, chhun ah erawh ni lo langin khua a tha leh viau thei, chu mi ni vek, tlai lamah erawh chhum lo zingin thli a lo thaw nasa em em thei bawk a. Darkar, nikhat, thla, kum emaw hun chhunga kan chhehvel boruak lo danglam thin sawi nan **weather** hman a ni thin.

Climate erawh chu **weather** awmdan tlangpui sawina ani ve thung. Chipchiar zawk in, kan chhehvel boruak awmdan he'ng khawlum lam te, ruahtui tlak dan te, thli thawt chaklam te leh adt., kum tam tak chhunga lo chhinchhiah tawh te chhiarkawp hmanga chawh chhuah a, an awm dan tlangpui leh an inthlak danglam thin dan te sawina ani a. World Meteorological Organization (WMO) chuan, a rei lo berah kum 30 chhunga **weather** awmdan tlangpui hi **climate** hrilhfi-ah na atan hman nise a ti a ni.

eng te nge DANGLAM?

BORUAK LUMNA

Boruak lumna tehna khawvel hmun hrang hranga atanga chhinchhiah dan in:-

- kum 1880 atanga a kum 2012 thleng khan khawvel leilung leh tuifinriat chung zawn boruak te hi chawhrualin celsius degree 0.85 in a sang chho.
- Kum 1850 atanga thlirin tunhnai kum 30 kal ta vel atang khan boruak lumna a sang hle.
- Khawvel hmar lam ah pheih chuan kum 1983 atanga kum 2012 kha kum 1400 kal ta chhunga boruak lum ber hun a ni hial.
- Tuifinriat chung zawn boruak lumna pawh kum 1971 leh 2010 inkar khan a pung nasa hle bawk ani.

Khawvel leilung leh tuifinriat boruak chawhrual a lo danglam chhoh dan 1850-2012

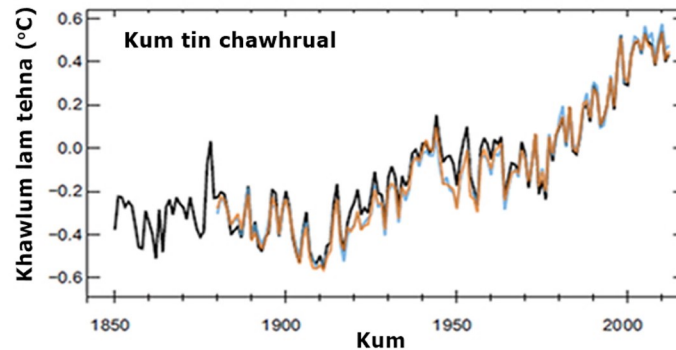
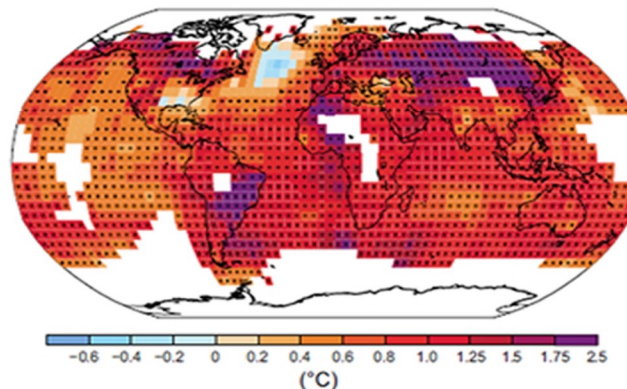


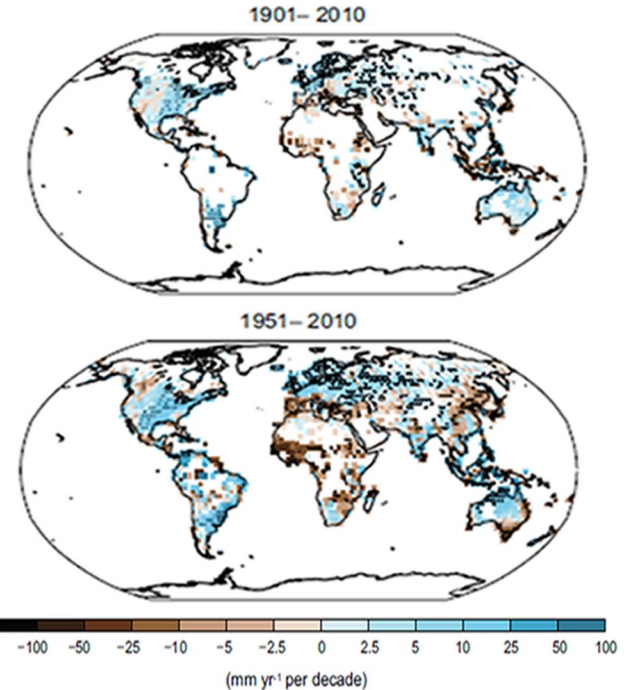
Figure: Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5), 2014 atanga lak chhuah

Lei boruak lumna danglam dan 1901 - 2012



Ruahtui, vur tla, rial leh adangte.

- Kum 1901 vel atang khan khawvel hmar lam ramah a pung nasa hle.
- A pun na hmun ah pun lam a pan char char a, a tlakhnianma hmunah tlakhniam lam a pan char char thung.
- Kum 1950 vel atang khan dan pangngai aia tam thut emaw tlem thut emaw sawi tur a tam tawh hle a, a bik takin North America leh Europe ah a thleng ngun hle a ni.
- Khawvel leilung ah chawhrual in tlakhniam aini a punna hmun a tam zawk tih chhut chhuah a ni.



Picture above : Khawvel leilung a ruahtui tla danglam chhoh dan

Vur tui tal leh Tuifinriat chim chin sang

Kum 20 kal ta atang khan Greenland leh Antarctica khuh tu vur hlawm lian pui pui te chu an lo pan ta hle a, khawvel hmun hran hran ah vur chhah tak chu pan tial tial in, khawvel hmar lam, Arctic tupui vur khuh chin te pawh an zim tial tial bawk a ni.

Tuifinriat chim chin san zawng pawh tun hnai kum zabi 19-na vel atang khan a sang zual hle a. Khawvel hmun hrang hrang a tuipui chim chin chawhrual in tunhnai kum 100 kal ta vel atang khan 0.19 m in a sang chho tawh a ni

what cause changes?

The largest contribution to the changes in climate is the increase in atmospheric concentration greenhouse gases since 1750. Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth. Carbon dioxide concentrations have increased primarily from fossil fuel emissions and from net land use change. The ocean absorbed about 30% of the emitted anthropogenic carbon dioxide, causing ocean acidification. Their effects, together with other anthropogenic drivers, have been detected throughout the climate system and have been the dominant cause of the change since the mid-20th century.

Green house gases (GHGs)

Greenhouse gases are gases in the atmosphere, both natural and anthropogenic, that absorb and emit heat radiation radiated from the Earth's surface. Water vapour (H₂O), carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄) and ozone (O₃) are primary GHGs. Other man-made GHGs include Sulphur Hexafluoride (SF₆), hydrofluorocarbons (HFCs) and Perfluorocarbons (PFCs).

The Earth's surface absorbs sunlight and emit radiation in the form of heat. Certain portion of these heat radiation escape to the outer atmosphere while majority of them are absorb and emitted back within the atmosphere by clouds, aerosols, particulate matter and the GHGs. The global average temperature is moderated by this process called **Greenhouse effect**. Without this process, the average global temperature will be about -20° C instead of 15.5°C (20th century average).

Future climate scenario (IPCC AR5 2014)

- Continued emissions of GHGs will cause further warming (about 2.6° C to 4.8° C increase by 2100) and changes in components of the climate system.
- Changes in the global water cycle: wet region will be wetter and dry region will be drier. Rainfall in monsoon areas will increase. Monsoon season will tend to lengthen in many regions.
- Continued warming will decreases surface ozone.
- The ocean will continue to warm. Heat will penetrate to deep ocean and affect ocean circulation.
- Arctic sea ice cover will become nearly ice free during summer before 2050. By 2100, the area of permafrost near the surface (upper 3.5 m) will decrease by more than 81%.
- Global mean sea level will rise by about 1 m by 2100 due to increased ocean warming and increased glaciers and ice sheets melting.

- Climate change due to cumulative emissions of CO₂ will persists for many centuries even if they are regulated.
- Increase CO₂ will increase further uptake of carbon by the ocean which will increase ocean acidification.

Responding to Climate Change

Climate change is a very complex issue we face today. It involves science, economics, society, politics and moral and ethical questions. It is a global problem, felt on local scales. The magnitude of climate change we'll face are determined by our actions. Despite increasing awareness of climate change, emissions of GHGs continue relentlessly. Limiting climate change require substantial and sustained reductions in GHGs emissions which, together with adaptation, can limit risks involved.

Responding to climate change involves a two types of approach:

- **Mitigation:** Reducing emissions of and stabilizing the levels of heat-trapping GHGs in the atmosphere by reducing sources of these gases (for eg., burning of fossil fuels) and enhancing the "sinks" that absorbs these gases (such as the oceans, forests and soil). The goal is to avoid significant human interference with the climate system, and stabilize GHGs levels in a timeframe sufficient to allow ecosystems to adapt naturally and to ensure that food production is not threatened and to enable economic development in a sustainable manner.
- **Adaptation:** Adapting to life in a changing climate which involves adjusting to actual or expected future climate and its consequences. The goal is to reduce our vulnerability to the harmful effects of climate change (like sea-level encroachment, more intense extreme weather events or food insecurity). It also encompasses making the most of any potential beneficial opportunities associated with climate change (for example, longer growing seasons or increased yields in some regions).

Throughout history, people and societies have adjusted to and coped with changes in climate and extremes with varying degrees of success. Climate change (drought in particular) has been partly responsible for the rise and fall of civilizations. Earth's climate has been relatively stable for the past 12,000 years and this stability has been crucial for the development of our modern civilization and life as we know it. Modern life is tailored to the stable climate we have become accustomed to. As our climate changes, we will have to learn to adapt. The faster the climate changes, the harder it could be.

GLOBAL WARMING & CLIMATE CHANGE

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WHAT IS CLIMATE CHANGE ?

Climate Change refers to a change in the state of the climate that can be identified by changes in the mean and or the variability of its properties, and that persists for an extended period, typically decades or longer.

E.g. Changes in temperature, rainfall pattern change, changes in frequency of flash floods

Definition by United Nation Framework Convention on Climate Change (UNFCCC)

"A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods."

The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes.

Weather Vs Climate

We all are very well acquainted with the term **climate** and **weather**. These two terms are basically used to describe atmospheric conditions at certain point of time. For instances, it may be raining at the morning of a day, but it may be bright and sunny at noon, and the atmospheric condition of that same day can change to windy or foggy in the evening. Such atmospheric condition at certain point of time viz. hours, day, month, year, etc., in a particular area may be referred to as the **weather** of that area.

Climate may be defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities such as temperature, precipitation, wind, etc. over a period of time ranging from months to thousand or millions of years. The classical period for averaging these quantities as defined by World Meteorological Organization is not less than 30 years.

the CHANGES

Temperature

Based on the data obtained from observation of the earth's climate from different measurement stations all around the world :-

- The global averaged combined land and ocean surface temperature data show a warming of 0.85°C over the period 1880 to 2012.
- Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850.
- In the Northern Hemisphere, 1983–2012 was likely the warmest 30-year period of the last 1400 years.
- It is virtually certain that ocean warmed significantly from 1971 to 2010.

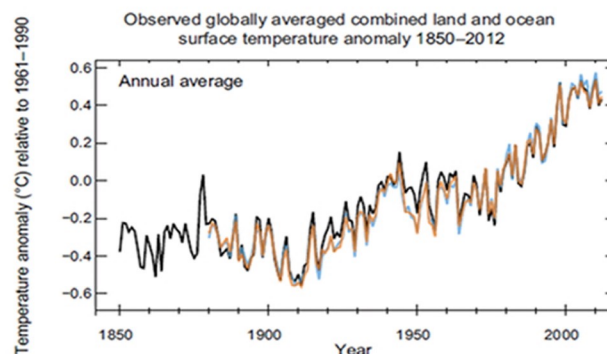
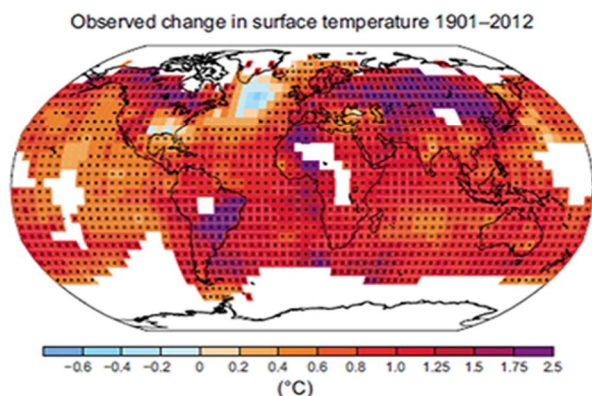
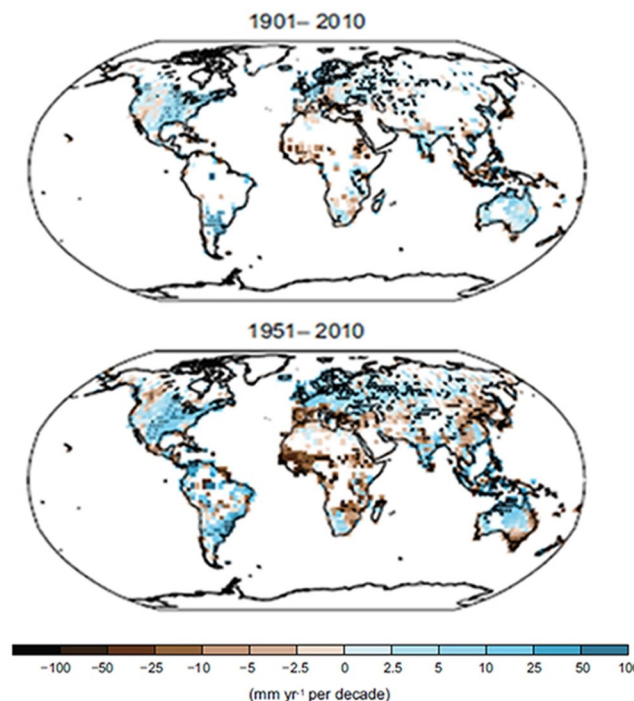


Figure: Excerpt from Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5), 2014.



Precipitation

- In the mid-latitude land areas of the Northern Hemisphere, precipitation has increased since 1901.
- Other latitudes have either long-term positive or negative trends.
- Changes in many extreme weather and climate events have been observed since about 1950 especially in North America and Europe.
- There are likely more land regions where the number of heavy precipitation events has increased than where it has decreased.



Picture above : Observed change in annual precipitation over land

Melting of Ice & Sea Level Rise

Over the last two decades, the Greenland and Antarctic ice sheets have been losing mass, glaciers have continued to shrink almost worldwide, and Arctic sea ice and Northern Hemisphere spring snow cover have continued to decrease in extent.

The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia. Over the period 1901 to 2010, global mean sea level rose by 0.19 m.