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The Earths climate is a complex and fascinating system, influencing everything from the landscapes we see to the ecosystems that thrive within them. Understanding the major climate zones is crucial to grasping global patterns and the impacts of our changing environment. In essence, the world can be divided into five primary climate zones, each characterized by distinct temperature and precipitation patterns. These zones are: Tropical, Dry, Temperate, Continental, and Polar. Lets delve deeper into each of these zones and explore what makes them unique.Understanding the Five Major Climate ZonesTropical ZoneThe tropical climate zone is primarily located near the equator, between the Tropic of Cancer and the Tropic of Capricorn. This zone is defined by its consistently high temperatures throughout the year, typically averaging above 18C (64F) in the coldest month. There are two main subcategories within the tropical zone:Tropical Rainforests: These regions experience high levels of rainfall year-round, supporting lush and diverse ecosystems. Examples include the Amazon rainforest and the Congo Basin.Tropical Savannas: These areas have distinct wet and dry seasons. During the wet season, they see high precipitation, while the dry season can be quite arid. African savannas are a prime example.The tropical zone is characterized by high humidity, abundant sunshine, and a rich biodiversity. The consistent warmth and moisture create ideal conditions for plant growth, making it home to some of the most biodiverse regions on Earth.Dry ZoneThe dry climate zone is marked by a lack of precipitation. Its not solely characterized by high temperatures; both hot and cold deserts fall into this category. The key characteristic is that evaporation exceeds precipitation. This zone is broadly divided into:Arid (Desert) Climates: These are the driest regions on Earth, with very little to no rainfall. Temperatures can vary widely, with extremely hot days and cold nights. The Sahara and Arabian deserts are classic examples.Semi-Arid (Steppe) Climates: These regions receive slightly more rainfall than deserts but still experience long dry periods. They typically border deserts and have more vegetation cover compared to arid regions. The steppes of Central Asia are an example.The dry zone is characterized by sparse vegetation, often consisting of drought-resistant plants. The lack of water significantly limits life and shapes the landscapes.Temperate ZoneThe temperate climate zone is positioned between the tropical and polar zones. This zone is known for its distinct seasons, including warm summers and mild winters. Its a region that often experiences a full range of weather conditions throughout the year. Key characteristics include:Moderate Rainfall: Temperate zones typically receive adequate rainfall throughout the year, though precipitation levels can vary depending on the specific location.Seasonal Variations: The most significant aspect of the temperate zone is its clear four-season patternspring, summer, autumn, and winter.Temperate regions support a diverse range of ecosystems, including forests, grasslands, and shrublands. Much of Europe, North America, and parts of Asia fall within this climate zone.Continental ZoneThe continental climate zone is typically found in the interiors of large continents in the mid-latitudes. This zone is characterized by its extreme seasonal temperature variations, with warm summers and very cold winters. Key features include:Large Temperature Ranges: Continental zones have the largest temperature differences between summer and winter.Moderate Precipitation: Rainfall tends to be concentrated in the summer months, with snowfall occurring in the winter.Away from Coastal Influences: These zones are typically not near large bodies of water, so they lack the moderating effects of oceans.Continental climates are prevalent in areas like central Russia, parts of the Midwestern United States, and central Canada. These climates can be challenging for many forms of life due to extreme temperature variations.Polar ZoneThe polar climate zone is located at the Earths poles, characterized by its extremely cold temperatures year-round. The key characteristics of polar regions include:Extremely Low Temperatures: The average temperature in the warmest month is typically below 10C (50F).Limited Precipitation: Precipitation, often in the form of snow, is very low.Permafrost: Much of the polar zone is covered in permafrost, permanently frozen ground, preventing vegetation from establishing.There are two main polar regions:Arctic Zone: The region around the North Pole.Antarctic Zone: The region around the South Pole, which is generally colder than the Arctic.Polar zones are characterized by their low biodiversity and harsh conditions. The landscape is dominated by ice, snow, and tundra vegetation.Frequently Asked Questions (FAQs) About Climate Zones1. What factors influence the Earths climate zones?The primary factors that influence climate zones are latitude, altitude, proximity to large bodies of water, prevailing winds, and ocean currents. Latitude is the most significant factor, as it determines the amount of solar energy received by a region.2. What is the difference between climate and weather?Weather refers to the short-term conditions of the atmosphere at a specific place and time, including temperature, precipitation, and wind. Climate, on the other hand, refers to the long-term average weather conditions in a specific region.3. What are sub-climates within these five major zones?Within the five major climate zones, there are numerous sub-climates influenced by local factors. For example, the temperate zone includes subtypes like Mediterranean, humid subtropical, and marine west coast climates.4. How does altitude affect climate?As altitude increases, temperatures generally decrease. This means that higher mountain ranges often have colder climates than the surrounding lowlands, even if they are in the same latitude.5. How do ocean currents influence climate?Ocean currents play a vital role in redistributing heat around the globe. Warm ocean currents can bring warmer temperatures to coastal areas, while cold currents can cool them down.6. Can climate zones change over time?Yes, climate zones are not static. Climate change is causing shifts in climate patterns, with some regions experiencing hotter temperatures, while others are experiencing increased precipitation and extreme weather events.7. How does the Earths axial tilt impact climate zones?The Earths axial tilt of about 23.5 degrees causes the seasons. As the Earth orbits the Sun, different regions receive varying amounts of sunlight, which leads to temperature differences and seasonal changes.8. What is a Mediterranean climate?A Mediterranean climate is characterized by mild, wet winters and warm, dry summers. It is a sub-type of the temperate climate zone and is found in regions such as the Mediterranean Basin, parts of California, and parts of Australia.9. What is a monsoon climate?A monsoon climate is characterized by distinct wet and dry seasons. Its a type of tropical climate but differs from traditional tropical wet regions in that its rainfall occurs seasonally.10. What are the main characteristics of a tundra climate?A tundra climate is a type of polar climate characterized by very cold temperatures, limited precipitation (mostly snow), and a landscape dominated by low-growing vegetation like shrubs and mosses.11. How do human activities impact climate zones?Human activities, particularly the burning of fossil fuels, deforestation, and industrial processes, contribute to greenhouse gas emissions. These emissions trap heat in the atmosphere, causing global warming and significant alterations in the earths climate patterns.12. What is meant by climate classification?Climate classification is the process of categorizing regions of the world based on their climate characteristics. The most commonly used system is the Kppen climate classification system, which categorizes climates based on temperature and precipitation.13. Are there any areas with no clear climate zone?Yes, areas with complex topography, such as mountain regions, might not fit neatly into the standard climate classifications. These areas often have highly localized climates that can vary significantly over short distances.14. What role do air masses play in determining climate?Air masses are large bodies of air that have relatively uniform temperature and humidity characteristics. They play a key role in determining the climate of a region as they move across the Earths surface and bring their properties into contact with different areas.15. What are the implications of shifting climate zones for ecosystems?Shifting climate zones can have profound impacts on ecosystems. Plants and animals may not be able to adapt quickly enough to changing temperatures and precipitation patterns. This can lead to species extinctions, altered migration patterns, and significant disruptions in food chains and biodiversity.By understanding the five major climate zones and the factors influencing them, we can gain a better appreciation for the complexity of our planet and the challenges it faces in the era of climate change. It is crucial to stay informed and take action to protect our environment and maintain the equilibrium of the Earths delicate climate system. Science Earth Science, Geologic Time & Fossils Earth Sciences Kppen climate classification, widely used, vegetation-based, empirical climate classification system developed by German botanist-climatologist Wladimir Kppen. His aim was to devise formulas that would define climatic boundaries in such a way as to correspond to those of the vegetation zones (biomes) that were being mapped for the first time during his lifetime. Kppen published his first scheme in 1900 and a revised version in 1918. He continued to revise his system of classification until his death in 1940. Other climatologists have modified portions of Kppens procedure on the basis of their experience in various parts of the world. Kppens classification is based on a subdivision of terrestrial climates into five major types, which are represented by the capital letters A, B, C, D, and E. Each of these climate types except for B is defined by temperature criteria. Type B designates climates in which the controlling factor on vegetation is dryness (rather than coldness). Aridity is not a matter of precipitation alone but is defined by the relationship between the precipitation input to the soil in which the plants grow and the evaporative losses. Since evaporation is difficult to evaluate and is not a conventional measurement at meteorological stations, Kppen was forced to substitute a formula that identifies aridity in terms of a temperature-precipitation index (that is, evaporation is assumed to be controlled by temperature). Dry climates are divided into arid (BW) and semiarid (BS) subtypes, and each may be differentiated further by adding a third code, h for warm and k for cold. As noted above, temperature defines the other four major climate types. These are subdivided, with additional letters again used to designate the various subtypes. Type A climates (the warmest) are differentiated on the basis of the seasonality of precipitation: Af (no dry season), Am (short dry season), or Aw (winter dry season). Type E climates (the coldest) are conventionally separated into tundra (ET) and snow/ice climates (EF). The mid-latitude C and D climates are given a second letter, f (no dry season), w (winter dry), or s (summer dry), and a third symbol (a, b, c, or d [the last subclass exists only for D climates]), indicating the warmth of the summer or the coldness of the winter. Although Kppens classification did not consider the uniqueness of highland climate regions, the highland climate category, or H climate, is sometimes added to climate classification systems to account for elevations above 1,500 metres (about 4,900 feet).Classification of major climatic types according to the modified Kppen-Geiger schemeletter symbol 1st 2nd 3rd criterion 1In the formulas above, r is average annual precipitation total (mm), and t is average annual temperature (C). All other temperatures are monthly means (C), and all other precipitation amounts are mean monthly totals (mm). 2Any climate that satisfies the criteria for designation as a B type is classified as such, irrespective of its other characteristics. 3The summer half of the year is defined as the months AprilSeptember for the Northern Hemisphere and OctoberMarch for the Southern Hemisphere. 4Most modern climate schemes consider the role of altitude. The highland zone has been taken from G.T. Trewartha, An Introduction to Climate, 4th ed. (1968). Data Sources: Adapted from Howard J. Critchfield, General Climatology, 4th ed. (1983), and M.C. Peel, B.L. Finlayson, and T.A. McMahon, "Updated World Map of the Kppen-Geiger Climate Classification," Hydrology and Earth System Sciences, 11:163344 (2007). A temperature of coolest month 18 C or higher f precipitation in driest month at least 60 mm m precipitation in driest month less than 60 mm but equal to or greater than 100 (r/25)1 w precipitation in driest month less than 60 mm and less than 100 (r/25) B2 70% or more of annual precipitation falls in the summer half of the year and r less than 20t + 280, or 70% or more of annual precipitation falls in the winter half of the year and r less than 20t, or neither half of the year has 70% or more of annual precipitation and r less than 20t + 1403 W r is less than one-half of the upper limit for classification as a B type (see above) S r is less than the upper limit for classification as a B type but is more than one-half of that amount h t equal to or greater than 18 C k t less than 18 C C temperature of warmest month greater than or equal to 10 C, and temperature of coldest month less than 18 C but greater than 3 C s precipitation in driest month of summer half of the year is less than 30 mm and less than one-third of the wettest month of the winter half w precipitation in driest month of the winter half of the year less than one-tenth of the amount in the wettest month of the summer half f precipitation more evenly distributed throughout year; criteria for neither s nor w satisfied a temperature of warmest month 22 C or above b temperature of each of four warmest months 10 C or above but warmest month less than 22 C c temperature of one to three months 10 C or above but warmest month less than 22 C D temperature of warmest month greater than or equal to 10 C, and temperature of coldest month 3 C or lower s same as for type C w same as for type C f same as for type C a same as for type C b same as for type C c same as for type C d temperature of coldest month less than 38 C (d designation then used instead of a, b, or c) E temperature of warmest month less than 10 C T temperature of warmest month greater than 0 C but less than 10 C F temperature of warmest month 0 C or below H4 temperature and precipitation characteristics highly dependent on traits of adjacent zones and overall elevationhighland climates may occur at any latitude The Kppen classification has been criticized on many grounds. It has been argued that extreme events, such as a periodic drought or an unusual cold spell, are just as significant in controlling vegetation distributions as the mean conditions upon which Kppens scheme is based. It also has been pointed out that factors other than those used in the classification, such as sunshine and wind, are important to vegetation. Moreover, it has been contended that natural vegetation can respond only slowly to environmental change, so that the vegetation zones observable today are in part adjusted to past climates. Many critics have drawn attention to the rather poor correspondence between the Kppen zones and the observed vegetation distribution in many areas of the world. In spite of these and other limitations, the Kppen system remains the most popular climatic classification in use today. The climate is the reoccurring average weather found in any particular place, measured over 30 year intervals. The Earth's tilt, rotation and land/sea distribution affect these global weather patterns, resulting in variations between different locations. German climatologist and amateur botanist Wladimir Kppen (1846-1940) divided the world's climates into categories based upon general temperature profile related to latitude. He worked with Rudolf Geiger to modify these categories into what is known today as the Kppen-Geiger climate classification system The major categories are as follows: A - Tropical Climates Moist tropical climates extend north and south from the equator to about 15 to 25 latitude. In these climates, all months have average temperatures greater than 64F (18C) and annual precipitation greater than 59". B - Dry Climates The most obvious climatic feature of this climate is that potential evaporation and transpiration exceed precipitation; in other words, they are very dry. These climates extend from 20-35 North and South of the equator and in large continental regions of the mid-latitudes, often surrounded by mountains. C - Moist Subtropical Mid-Latitude Climates This climate generally has warm and humid summers with mild winters. It extends from 30-50 latitude mainly on the eastern and western borders of most continents. During the winter, the main weather feature is the mid-latitude cyclone. Convective thunderstorms dominate summer months. D - Moist Continental Mid-Latitude Climates Moist continental mid-latitude climates have warm to cool summers and cold winters. The location of these climates is poleward of the"C"climates. The average temperature of the warmest month is greater than 50F(10C), while the coldest month average temperature is less than 27F (-3C). Winters are severe, with snowstorms, strong winds, and bitter cold from Continental Polar or Arctic air masses. E - Polar Climates Polar climates have year-round cold temperatures, with the warmest month less than 50F (10C). Polar climates are found on the northern coastal areas of North America, Europe, Asia, and on the land masses of Greenland and Antarctica. H - Highlands Unique climates that are a result of elevation. Highland climates occur in mountainous terrain where rapid elevation changes cause rapid climatic changes over short distances. Take it to the MAX!Learn aboutfurther sub-divisions of these climate zones. The map (below) shows where these major categories occur in the mainland United States. The major Kppen zones in the U.S. The Kppen climate classification system is one of the most common climate classification systems in the world. It is used to denote different climate regions on Earth based on local vegetation.Earth Science, Climatology, Geography, Social Studies, World HistoryImageKoppen Classification MapThe Kppen-Geiger system uses colors and shades to classify the world into five climate zones based on criteria like temperature, which allows for different vegetation growth.Map by H.E. Beck, N.E. Zimmermann, T.R. McVicar, N. Vergopolan, A. Berg, and E.F. WoodMapMaker: Kppen-Geiger Climate Classification SystemThe Kppen climate classification system categorizes climate zones throughout the world based on local vegetation. Wladimir Kppen, a German botanist and climatologist, first developed this system at the end of the 19th century, basing it on the earlier biome research conducted by scientists. These scientists learned that vegetation and climate are intricately linked. The vegetation that grows in a region is dependent on the temperature and precipitation there, which are two key factors of climate. Areas with more rainfall and higher temperatures contain more forests while regions with less rainfall tend to be deserts. The Kppen climate classification system has been enhanced and modified several times since it was first published.The system divides the world into five climate zones based on criteria, usually temperature, which allows for different vegetation growth. Kppens map used different colors and shades to represent the different climate zones of the world. While most of the zones are organized based on the temperature of a region, Zone B focuses on the aridity of a region. The zones are as follows:Zone A: tropical or equatorial zone (represented by blue colors on most maps)Zone B: arid or dry zone (represented by red, pink, and orange colors on most maps)Zone C: warm/mild temperate zone (represented by green colors on most maps)Zone D: continental zone (represented by purple, violet, and light blue colors on most maps)Zone E: polar zone (represented by gray colors on most maps)Each zone is further subdivided based on temperature or dryness. For example, Zone A has three subdivisions: Zone Af has no dry season, Zone Am has a short dry season, and Zone Aw has a winter dry season. Zone B is divided into categories related to regions such as hot, arid deserts (Zone BWh); cold, arid deserts (Zone BWk); hot, arid steppes (Zone BSh); and cold, arid steppes (Zone BSk). Climate zones C and D are broken into categories based on when the dry seasons occur in the zones, as well as the coldness of the summer or the warmth of the winter. Zone E climates are separated into tundra regions (Zone ET) or snow and ice regions (Zone EF). Additionally, some modern revisions to the system include a sixth region, known as Zone H. This represents a highland climate located at mountainous elevations.Kppens classification maps are still used by scientists and climatologists to this day. Although he published his first map in the early 1900s, Kppen continued to update it until his death in 1940. Subsequent climatologists, including Rudolf Geiger, updated versions of this map, which often include Geigers name as well. At the time of writing, a recent revision to this map was published in 2018.The audio, illustrations, photos, and videos are credited beneath the media asset, except for promotional images, which generally link to another page that contains the media credit. The Rights Holder for media is the person or group credited.Tyson Brown, National Geographic SocietyNational Geographic SocietyGina Borgia, National Geographic SocietyJeanna Sullivan, National Geographic SocietySarah Appleton, National Geographic Society, National Geographic SocietyMargot Willis, National Geographic SocietyotherFor information on user permissions, please read our Terms of Service. If you have questions about how to cite anything on our website in your project or classroom presentation, please contact your teacher. They will best know the preferred format. When you reach out to them, you will need the page title, URL, and the date you accessed the resource.MediaIf a media asset is downloadable, a download button appears in the corner of the media viewer. If no button appears, you cannot download or save the media.TextText on this page is printable and can be used according to our Terms of Service.InteractivesAny interactives on this page can only be played while you are visiting our website. You cannot download interactives.Worldwide Climate ClassificationsWorld Kppen-Geiger Climate Classification MapClimate means the usual condition of the temperature, humidity, atmospheric pressure, wind, rainfall, and other meteorological patterns in an area of the Earth's surface for a long time. In simple terms, climate is the average condition for about thirty years. Climate and weather are different: weather is the day to day conditions in the atmosphere.The types of climates are: Tropical, Desert/dry, Temperate, Polar, Mediterranean. Polar climate (also called boreal climate), has long, usually very cold winters, and short summers. For example, near the north and south poles.Temperate climates have four seasons. Some of the countries which have a temperate climate are: most of the European countries.Deserts are very dry. They just have one or two seasons such as: Saudi Arabia and many African countries.Tropical climates have warm temperature and only two seasons; wet and dry. An example of a place with a tropical climate is the Amazon Rainforest in Brazil.The Mediterranean climate is usually hot and dry in summer, and is cool and wet in winter. An example of a country with a Mediterranean climate is Spain.The latitude, ground, and height can change the climate of a location. It is also important to note if oceans or other large bodies of water are nearby. Climates are most commonly classified by temperature and precipitation. The most commonly used classification was the Kppen climate classification, first made by Wladimir Kppen. The Thornthwaite system,[1] which was used from 1948, not only uses temperature and precipitation information, but evapotranspiration too. This makes it useful for studying how many different kinds of animal species there are, and about the things that could happen when climates change. The Bergeron and Spatial Synoptic Classification systems focus more on where the air masses which help make climates come from.Climates can change after a long time. Nowadays people are making the world warmer in many places, but not in all: 12/2023 "Beijing shivers through coldest December on record" (BBC). North Korea and Japan are also unusually cold, December 2023.ClimatologyKppen climate classification C. W. Thornthwaite, "An Approach Toward a Rational Classification of Climate", Geographical Review, 38:55-94, 1948Retrieved from " zones are areas with distinct climates. These zones might correspond to weather patterns, latitude, or communities of plants and animals.There are many climate classification systems, which define zones based on different climatic factors or combinations of factors.Climate zones can track how conditions change in specific areas. They help us understand the ranges of plants and animals, including identifying species that may be under threat from habitat loss or from a shifting climate. Climate zones can even help farmers and gardeners understand which plants will grow best in their area.Kppen climate classificationThe Kppen climate classification is one of the most widely used systems of climate zones. Originally developed by the climatologist Wladimir Kppen in 1884, it has had several revisions and changes over the years but has remained in use by scientists all over the world.The Kppen system divides climates into five groups based on rainfall and temperature:Tropical climates(A)Dry climates(B)Temperate climates (C)Continental climates(D)Polar climates(E)We then subdivide these groups, first based on their seasonal precipitation and then by temperature.For example, we classify much of the UK under the Cfb category. This means we have a temperate climate (C), with no dry season (f) and a warm summer (b).What is a microclimate?A microclimate is a small area with a different climate to its surroundings. This could be due to nearby landmarks, such as lakes or hills, affecting wind patterns or sheltering the area from the sun. They can also be produced by artificial structures such as buildings.The size of a microclimate can vary as it is simply defined as having a different climate to its surroundings. It could be as small as a few square metres, such as a shaded corner of a garden which certain plants will prefer. It could be larger, such as a sheltered woodland dell or an isolated mountain peak.Many cities have their own microclimate or many microclimates, as buildings and artificial surfaces absorb heat during the day and create an urban heat island, as well as altering wind flows.You can find out more about microclimates in our microclimate factsheet.World climate zonesTo help explain climate zones, lets look at some of the main ones in a bit more detail.We divide climate zones by their latitude on the planet:Tropical climates are close to the equator and have high temperatures and rainfall.Dry climates are immediately north and south of the tropical zone.Temperate climates are north of the dry zone in the northern hemisphere and south of the dry zone in the southern hemisphere;although they often overlap in latitude with continental climates in North America and Asia. These continental climates are less influenced by oceans and may have wider climate extremes.Polar climates are only in the Arctic and Antarctic regions.A simplified map of the world's climate zones.Local weather patterns and the arrangement of continents also affect these zones.For example, the UK has the same latitude as most of Canada but has a much milder climate. This difference is because of the influence of the Gulf Stream and the North Atlantic.We also find very different climates in the western and eastern parts of continents because of the direction of prevailing winds.Lets take a closer look at some key climate zones what defines them, and where we find them.Tropical rainforest climateWe find tropical rainforest climates in:South AmericaAfricaSouth-east AsiaLying either side of the equator, we characterise tropical rainforest climates by high temperatures and year-round rainfall.Average temperatures are usually around 2030 C, with minor variation over the year.Rainfall is over 60 mm of rain in every month, giving rise to thick rainforest and some of the highest densities of biodiversity seen on land.Other tropical climatesTropical regions also contain other climate zones, which are hot but have distinct dry seasons, unlike rainforests.Tropical monsoon climates have a season of heavy rainfall, connected to a seasonal change in wind direction.Tropical savannah climates have a more pronounced dry season than monsoon areas. They also have grasslands, rather than rainforests.Desert climateDescending air north and south of the tropical zone produces almost permanent areas of high pressure across the subtropics. This produces almost cloud-free skies virtually year-round, giving rise to deserts.Desert climates are extremely dry, and their cloudless skies lead to large temperature swings. Deserts have some of the hottest temperatures on Earth, but many will drop below freezing at night.Though normally associated with hot, sandy environments, cold deserts are also widespread. The Gobi Desert of east Asia is one example, where annual average temperatures can be below 0 C.Whether hot or cold, deserts pose great challenges for the plants and animals that live there, which must adapt to extreme, prolonged water deficits.Temperate climateWe find temperate climates in:Most of Western EuropeWestern and eastern regions of USAEastern ChinaWe define temperate zones according to temperature. Their coldest month averages between 0 C and 18 C, but at least one month averages above 10 C.We subdivide temperate climates based on their maximum temperatures and whether they have a distinct dry season either in summer or winter. Prevailing weather patterns or local topography can often influence this.Continental climates (mostly found in Eurasia and North America) are broadly similar to temperate ones but have greater temperature extremes. This is because they are mostly in the continental interior, away from the temperature buffering effect of nearby oceans.Mediterranean climateA Mediterranean climate is a specific type of temperate climate, characterised by dry summers and mild, wet winters.This climate is often connected to weather patterns and prevailing winds. As a result, we typically find areas with a Mediterranean climate on the western coasts of continents.Mediterranean climates take their name from the Mediterranean Basin, but we can also find them on other continents. Much of California has a Mediterranean climate, as do parts of Western Australia, Chile and South Africa.Mediterranean climates often bring particular types of vegetation, such as the maquis in the Mediterranean, the chaparral in California and the fynbos in South Africa.Polar climateProlonged cold defines a polar climate, with no months of the year averaging above 10 C.The ice cap climate dominates the Arctic and Antarctic regions. Here, no months average above 0 C. Plants cannot grow, and snow and ice gradually accumulate until they slide or flow elsewhere as glaciers.Ice cap climates can also occur at great altitude, such as the highest Himalayan peaks.Tundra climateIf the warmest month in an area averages between 0 C and 10 C, we classify it as a tundra.In tundra climates, some plant life can grow, but the growing season is too short for trees. Instead, youll find dwarf shrubs, grasses, and other small plants.Animals in tundra climates have adapted to the cold and include reindeer, musk ox, and Arctic hare.Like polar climates, tundra climates can occur at altitude. When this happens, we usually call it an Alpine climate. The summits of Ben Nevis and Cairn Gorm are in the tundra climate zone. Northern Canada and Eurasia contain some of the largest areas of tundra, and it also occurs on various sub-Antarctic islands.Climate zone mapMap showing the current distribution of Kppen climate zones around the world. (Source:Beck et al. (2018))The map shows:Tropical climates(A)Dry climates(B)Temperate climates (C)Continental climates(D)Polar climates(E)You can see that tropical climates are close to the equator, occurring in central Africa, central America, and parts of Asia.We have dry climates in northern and southern Africa, most of Australia, parts of Asia and the western tips of the Americas.Temperate climates spread across the continents. Most of western Europe has a temperate climate, but you also find it in eastern North America, parts of Argentina and south-eastern Brazil, and even the eastern tip of Australia.Continental climates are mostly in the continental interiors of Canada and Russia, with some in the northern USA.Finally, polar climates are in the most northern reaches of Canada and Russia, Greenland, and, of course, the Arctic and Antarctic.Will climate change affect climate zones?Yes, the distribution of climate zones will change as the climate warms. You can find more information about these changes, and the precise classification of the climate zones, in a paper by Beck et al. (2018).Systems that categorize the world's climatesWorldwide Kppen climate classificationsClimate zones are systems that categorize the world's climates. A climate classification may correlate closely with a biome classification, as climate is a major influence on life in a region. The most used is the Kppen climate classification scheme first developed in 1884.[1][2]There are several ways to classify climates into similar regimes. Originally, climes were defined in Ancient Greece to describe the weather depending upon a location's latitude. Modern climate classification methods can be broadly divided into genetic methods, which focus on the causes of climate, and empiric methods, which focus on the effects of climate. Examples of genetic classification include methods based on the relative frequency of different air mass types or locations within synoptic weather disturbances. Examples of empiric classifications include climate zones defined by plant hardiness,[3] evapotranspiration,[4] or associations with certain biomes, as in the case of the Kppen climate classification. A common shortcoming of these classification schemes is that they produce distinct boundaries between the zones they define, rather than the gradual transition of climate properties more common in nature.Alpine climateDesert climate or arid climateHumid continental climateHumid subtropical climateIce cap climateOceanic climateSubarctic climateSemi-arid climateMediterranean climateTropical monsoon climateTropical rainforest climateTropical savanna climateTundra climatePolar climateLeslie Holdridge's Life Zone Classification system is essentially a climate classification scheme.Climate classification systems include:Aridity index part of many systemsAlisov climate classification (ru)Berg climate classificationKppen climate classification most widely used in the 1954 KppenGeiger variantHoldridge life zone classification relatively simpleLauer climate classificationStrahler climate classificationThornthwaite climate classificationTrewartha climate classification 1967 modification of KppenTroll climate classificationVahl climate classificationZhou climate classification (zh)The simplest classification is that involving air masses. The Bergeron classification is the most widely accepted form of air mass classification.[5] Air mass classification involves three letters. The first letter describes its moisture properties, with c used for continental air masses (dry) and m for maritime air masses (moist). The second letter describes the thermal characteristic of its source region: T for tropical, P for polar, A for Arctic or Antarctic, M for monsoon, E for equatorial, and S for superior air (dry air formed by significant downward motion in the atmosphere). The third letter is used to designate the stability of the atmosphere. If the air mass is colder than the ground below it, it is labeled k. If the air mass is warmer than the ground below it, it is labeled w.[6] While air mass identification was originally used in weather forecasting during the 1950s, climatologists began to establish synoptic climatologies based on this idea in 1973.[7]Based upon the Bergeron classification scheme is the Spatial Synoptic Classification system (SSC). There are six categories within the SSC scheme: Dry Polar (similar to continental polar), Dry Moderate (similar to maritime superior), Dry Tropical (similar to continental tropical), Moist Polar (similar to maritime polar), Moist Moderate (a hybrid between maritime polar and maritime tropical), and Moist Tropical (similar to maritime tropical, maritime monsoon, or maritime equatorial).[8]Monthly average surface temperatures from 1961 to 1990. This is an example of how climate varies with location and seasonMonthly global images from NASA Earth Observatory (interactive SVG) Main article: Kppen climate classificationThe Kppen classification depends on average monthly values of temperature and precipitation. The most commonly used form of the Kppen classification has five primary types labeled A through E. These primary types are A) tropical, B) dry, C) mild mid-latitude, D) cold mid-latitude, and E) polar.Tropical climates are defined as locations where the coolest monthly mean temperature is above 18 C (64.4 F). This tropical zone is further broken down into rainforest, monsoon, and savanna based on seasonal rainfall. These climates are most often located between the Equator and 25 north and south latitude.A monsoon is a seasonal prevailing wind which lasts for several months, ushering in a region's rainy season.[9] Regions within North America, South America, Sub-Saharan Africa, Australia and East Asia are monsoon regimes.[10]The world's cloudy and sunny spots. NASA Earth Observatory map using data collected between July 2002 and April 2015.[11]A tropical savanna is a grassland biome located in semi-arid to semi-humid climate regions of subtropical and tropical latitudes, with average temperatures remaining at or above 18C (64F) all year round, and rainfall between 750 millimetres (30in) and 1,270 millimetres (50in) a year. They are widespread on Africa, and are found in India, the northern parts of South America, Malaysia, and Australia.[12]Cloud cover by month for 2014. NASA Earth Observatory[13][14]The humid subtropical climate zone where winter rainfall (and sometimes light snowfall) is associated with storms that the westerlies steer from west to east at the time of low sun (winter). In summer, high pressure dominates as the westerlies move north. Most summer rainfall occurs during thunderstorms and from occasional tropical cyclones.[15] Humid subtropical climates lie on the east side of continents, roughly between latitudes 20 and 40 degrees away from the equator.[16]Humid continental climate, worldwideA humid continental climate is marked by variable weather patterns and a large seasonal temperature variance, cold and often very snowy winters, and warm summers. Places with more than three months of average daily temperatures above 10C (50F) and a coldest month temperature below 3C (27F) and which do not meet the criteria for an arid or semi-arid climate, are classified as continental. Most climates in this zone are found from 35 latitude to 55 latitude, mostly in the northern hemisphere.[17]An oceanic climate is typically found along west coasts in higher middle latitudes of all the world's continents, and in southeastern Australia, and is accompanied by plentiful precipitation year-round, cool summers, and small annual ranges of temperatures. Most climates of this type are found from 45 latitude to 55 latitude.[18]The Mediterranean climate regime resembles the climate of the lands in the Mediterranean Basin, parts of western North America, parts of Western and South Australia, in southwestern South Africa and in parts of central Chile. The climate is characterized by hot, dry summers and cool, wet winters.[19]A steppe is a dry grassland with an annual temperature range in the summer of up to 40C (104F) and during the winter down to 40C (40F).[20]A subarctic climate has little precipitation,[21] and monthly temperatures which are above 10C (50F) for one to three months of the year, with permafrost in large parts of the area due to the cold winters. Winters within subarctic climates usually include up to six months of temperatures averaging below 0C (32F).[22]Map of arctic tundraTundra occurs in the far Northern Hemisphere, north of the taiga belt, including vast areas of northern Russia and Canada.[23]A polar ice cap, or polar ice sheet, is a high-latitude region of a planet or moon that is covered in ice. Ice caps form because high-latitude regions receive less energy as solar radiation from the sun than equatorial regions, resulting in lower surface temperatures.[24]A desert is a landscape form or region that receives very little precipitation. Deserts usually have a large diurnal and seasonal temperature range, with high or low, depending on location daytime temperatures (in summer up to 45C or 113F), and low nighttime temperatures (in winter down to 0C or 32F) due to extremely low humidity. Many deserts are formed by rain shadows, as mountains block the path of moisture and precipitation to the desert.[25]The Trewartha climate classification (TCC) or the KppenTrewartha climate classification (KTC) is a climate classification system first published by American geographer Glenn Thomas Trewartha in 1966. It is a modified version of the KppenGeiger system, created to answer some of its deficiencies.[26] The Trewartha system attempts to redefine the middle latitudes to be closer to vegetation zoning and genetic climate systems.The Trewartha climate classification changes were seen as most effective on the large landmasses in Asia and North America, where many areas fall into a single group (C) in the KppenGeiger system.[27] For example, under the standard Kppen system, Washington and Oregon are classed into the same climate zone (Csb) as parts of Southern California, even though the two regions have strikingly different weather and vegetation. Another example was classifying cities like London or New York in the same climate group (C) as Brisbane or New Orleans, despite great differences in seasonal temperatures and native plant life.[28]Trewartha's modifications to the 1899 Kppen climate system sought to reclass the middle latitudes into three groups: C (subtropical)8 or more months have a mean temperature of 10C (50F) or higher; D temperate4 to 7 months have a mean temperature of 10C or higher; and E boreal climate1 to 3 months have a mean temperature of 10C or higher. Otherwise, the tropical climates and polar climates remained the same as the original Kppen climate classification.Main article: Thornthwaite climate classificationSee also: Microthermal, Mesothermal, and MegathermalPrecipitation by monthDevised by the American climatologist and geographer C. W. Thornthwaite, this climate classification method monitors the soil water budget using evapotranspiration.[29] It monitors the portion of total precipitation used to nourish vegetation over a certain area.[30] It uses indices such as a humidity index and an aridity index to determine an area's moisture regime based upon its average temperature, average rainfall, and average vegetation type.[31] The lower the value of the index in any given area, the drier the area is.The moisture classification includes climatic classes with descriptors such as hyperhumid, humid, subhumid, subarid, semi-arid (values of 20 to 40), and arid (values below 40).[32] Humid regions experience more precipitation than evaporation each year, while arid regions experience greater evaporation than precipitation on an annual basis. A total of 33percent of the Earth's landmass is considered either arid or semi-arid, including southwest North America, southwest South America, most of northern and a small part of southern Africa, southwest and portions of eastern Asia, as well as much of Australia.[33] Studies suggest that precipitation effectiveness (PE) within the Thornthwaite moisture index is overestimated in the summer and underestimated in the winter.[34] This index can be effectively used to determine the number of herbivore and mammal species numbers within a given area.[35] The index is also used in studies of climate change.[34]Thermal classifications within the Thornthwaite scheme include microthermal, mesothermal, and megathermal regimes. A microthermal climate is one of low annual mean temperatures, generally between 0C (32F) and 14C (57F) which experiences short summers and has a potential evaporation between 14 centimetres (5.5in) and 43 centimetres (17in).[36] A mesothermal climate lacks persistent heat or persistent cold, with potential evaporation between 57 centimetres (22in) and 114 centimetres (45in).[37] A megathermal climate is one with persistent high temperatures and abundant rainfall, with potential annual evaporation in excess of 114 centimetres (45in).[38]Ecological land classificationBiogeographical realmBiomeGeographical zoneHardiness zoneMediterranean climate or dry summer climateThis article needs additional citations for verification. Please help improve this article by adding citations to reliable sources. Unsourced material may be challenged and removed.Find sources:"Climate classification"news newspapers books scholar JSTOR (December 2018) (Learn how and when to remove this message)^ Beck, Hylke E.; Zimmermann, Niklaus E.; McVicar, Tim R.; Vergopolan, Noemi; Berg, Alexis; Wood, Eric F. (30 October 2018). "Present and future Kppen-Geiger climate classification maps at 1-km resolution". Scientific Data. 5: 180214. Bibcode:2018NatSD...580214B. doi:10.1038/sdata.2018.214. ISSN2052-4463. PMC6207062. PMID30375988.^ ~:text=The%20modified%20K%C3%B6ppen%20Climate%20Classification,averages%20of%20temperature%20and%20precipitation^ United States National Arboretum. USDA Plant Hardiness Zone Map. Archived 2012-07-04 at the Wayback Machine Retrieved on 2008-03-09^ "Thornthwaite Moisture Index". Glossary of Meteorology. American Meteorological Society. Retrieved 21 May 2008.^ Field behavior of chemical, biological, and radiological agents. 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All climates are assigned a main group (the first letter). All climates except for those in the E group are assigned a seasonal precipitation subgroup (the second letter). For example, Af indicates a tropical rainforest climate. The system assigns a temperature subgroup for all groups other than those in the A group, indicated by the third letter for climates in B, C, D, and the second letter for climates in E. Other examples include: Cfb indicating an oceanic climate with warm summers as indicated by the ending b., while Dwb indicates a semi-monsoonal continental climate, also with warm summers. Climates are classified based on specific criteria unique to each climate type.[1]The Kppen climate classification is the most widely used climate classification scheme.[2] It was first published by German-Russian climatologist Wladimir Kppen (18461940) in 1884,[3][4] with several later modifications by Kppen, notably in 1918 and 1936.[5][6] Later, German climatologist Rudolf Geiger (18941981) introduced some changes to the classification system in 1954 and 1961, which is thus sometimes called the KppenGeiger climate classification.[7][8]As Kppen designed the system based on his experience as a botanist, his main climate groups represent a classification by vegetation type. In addition to identifying climates, the system can be used to analyze ecosystem conditions and identify the main types of vegetation within climates. Due to its association with the plant life of a given region, the system is useful in predicting future changes of plant life within that region.[9]The Kppen climate classification system was modified further within the Trewartha climate classification system in 1966 (revised in 1980). The Trewartha system sought to create a more refined middle latitude climate zone, which was one of the criticisms of the Kppen system (the climate group C was too general).[10]:200201KppenGeiger climate map 19912020[9] Kppen climate classification scheme symbols description table[9][1][11]1st2nd3rdA (Tropical)f (Rainforest)m (Monsoon)w (Savanna, dry winter)s (Savanna, dry summer)B (Dry)W (Arid desert)S (Semi-arid steppe)h (Hot)k (Cold)C (Temperate)w (Dry winter)f (No dry season)s (Dry summer)a (Hot summer)b (Warm summer)c (Cold summer)D (Continental)w (Dry winter)f (No dry season)s (Dry summer)a (Hot summer)b (Warm summer)c (Cold summer)d (Very cold winter)E (Polar)T (Tundra)F (Ice cap)The Kppen climate classification scheme divides climates into five main climate groups: A (tropical), B (arid), C (temperate), D (continental), and E (polar).[12] The second letter indicates the seasonal precipitation type, while the third letter indicates the level of heat.[13] Summers are defined as the six-month period that is warmer either from April to September and/or October to March, while winter is the six-month period that is cooler.[9][11]Tropical climates have an average temperature of 18C (64.4F) or higher every month of the year, with significant precipitation.[9][11]Af = Tropical rainforest climate; average precipitation of at least 60mm (2.4in) in every month.Am = Tropical monsoon climate; driest month (which nearly always occurs at or soon after the "winter" solstice for that side of the equator) with precipitation less than 60mm (2.4in), but at least 100 (t o t a l a n n u a l p r e c i p i t a t i o n (m m) 25) {\textstyle 100-\left({\frac {\mathrm {total\,annual\,precipitation\,(mm)} }{25}}\right)} .[9][11]Aw or As = Tropical wet and dry or savanna climate; with the driest month having precipitation less than 60mm (2.4in) and less than 100 (t o t a l a n n u a l p r e c i p i t a t i o n (m m) 25) {\textstyle 100-\left({\frac {\mathrm {total\,annual\,precipitation\,(mm)} }{25}}\right)} .[9][11]Desert and semi-arid climates are defined by low precipitation in a region that does not fit the polar (EF or ET) criteria of no month with an average temperature greater than 10C (50F).The precipitation threshold in millimeters is determined by multiplying the average annual temperature in Celsius by 20, then adding:280 if 70% or more of the total precipitation is in the spring and summer months (AprilSeptember in the Northern Hemisphere, or OctoberMarch in the Southern), or140 if 30%70% of the total precipitation is received during the spring and summer, or0 if less than 30% of the total precipitation is received during the spring and summer.If the annual precipitation is less than 50% of this threshold, the classification is BW (arid: desert climate); if it is in the range of 50%100% of the threshold, the classification is BS (semi-arid: steppe climate).[9][11]A third letter can be included to indicate temperature. Here, h signifies low-latitude climates (average annual temperature above 18C (64.4F)) while k signifies middle-latitude climates (average annual temperature less than 18C). In addition, n is used to denote a climate characterized by frequent fog and H for high altitudes.[14][15][16]BWh = Hot desert climateBWk = Cold desert climateBSh = Hot semi-arid climateBSk = Cold semi-arid climateTemperate climates have the coldest month averaging between 0C (32F)[11] (or 3C (26.6F))[1] and 18C (64.4F) and at least one month averaging above 10C (50F).[11][1] For the distribution of precipitation in locations that both satisfy a dry summer (Cs) and a dry winter (Cw), a location is considered to have a wet summer (Cw) when more precipitation falls within the summer months than the winter months while a location is considered to have a dry summer (Cs) when more precipitation falls within the winter months.[11] This additional criterion applies to locations that satisfies both Ds and Dw as well.[11]Cfa = Humid subtropical climate; coldest month averaging above 0C (32F) (or 3C (26.6F)), at least one month's average temperature above 22C (71.6F), and at least four months averaging above 10C (50F). No significant precipitation difference between seasons (neither the abovementioned set of conditions fulfilled).Cfb = Temperate oceanic climate or subtropical highland climate; coldest month averaging above 0C (32F) (or 3C (26.6F)), all months with average temperatures below 22C (71.6F), and at least four months averaging above 10C (50F). No significant precipitation difference between seasons (neither the abovementioned set of conditions fulfilled).Cfc = Subpolar oceanic climate; coldest month averaging above 0C (32F) (or 3C (26.6F)) and 13 months averaging above 10C (50F). No significant precipitation difference between seasons (neither the abovementioned set of conditions fulfilled).Cwa = Monsoon-influenced humid subtropical climate; coldest month averaging above 0C (32F) (or 3C (26.6F)), at least one month's average temperature above 22C (71.6F), and at least four months averaging above 10C (50F). At least ten times as much rain in the wettest month of summer as in the driest month of winter.Cwb = Subtropical highland climate or Monsoon-influenced temperate oceanic climate; coldest month averaging above 0C (32F) (or 3C (26.6F)), all months with average temperatures below 22C (71.6F), and at least four months averaging above 10C (50F). At least ten times as much rain in the wettest month of summer as in the driest month of winter.Cwc = Cold subtropical highland climate or Monsoon-influenced subpolar oceanic climate; coldest month averaging above 0C (32F) (or 3C (26.6F)) and 13 months averaging above 10C (50F). At least ten times as much rain in the wettest month of summer as in the driest month of winter.Csa = Hot-summer Mediterranean climate; coldest month averaging above 0C (32F) (or 3C (26.6F)), at least one month's average temperature above 22C (71.6F), and at least four months averaging above 10C (50F). At least three times as much precipitation in the wettest month of winter as in the driest month of summer, and the driest month of summer receives less than 40mm (1.6in).[9]Csb = Warm-summer Mediterranean climate; coldest month averaging above 0C (32F) (or 3C (26.6F)), all months with average temperatures below 22C (71.6F), and at least four months averaging above 10C (50F). At least three times as much precipitation in the wettest month of winter as in the driest month of summer, and the driest month of summer receives less than 40mm (1.6in).[9]Csc = Cold-summer Mediterranean climate; coldest month averaging above 0C (32F) (or 3C (26.6F)) and 13 months averaging above 10C (50F). At least three times as much precipitation in the wettest month of winter as in the driest month of summer, and the driest month of summer receives less than 40mm (1.6in).[9]Continental climates have at least one month averaging below 0C (32F) (or 3C (26.6F)) and at least one month averaging above 10C (50F).[11][1]Dfa = Hot-summer humid continental climate; coldest month averaging

below 0C (32F) (or 3C (26.6F)), at least one month's average temperature above 22C (71.6F), and at least four months averaging above 10C (50F). No significant precipitation difference between seasons (neither the abovementioned set of conditions fulfilled).Dfb = Warm-summer humid continental climate; coldest month averaging below 0C (32F) (or 3C (26.6F)), all months with average temperatures below 22C (71.6F), and at least four months averaging above 10C (50F). No significant precipitation difference between seasons (neither the abovementioned set of conditions fulfilled).Dfc = Subarctic climate; coldest month averaging below 0C (32F) (or 3C (26.6F)) and 13 months averaging above 10C (50F). No significant precipitation difference between seasons (neither the abovementioned set of conditions fulfilled).Dfd = Extremely cold subarctic climate; coldest month averaging below 38C (36.4F) and 13 months averaging above 10C (50F). No significant precipitation difference between seasons (neither the abovementioned set of conditions fulfilled).Dwa = Monsoon-influenced hot-summer humid continental climate; coldest month averaging below 0C (32F) (or 3C (26.6F)), at least one month's average temperature above 22C (71.6F), and at least four months averaging above 10C (50F). At least ten times as much rain in the wettest month of summer as in the driest month of winter.Dwb = Monsoon-influenced warm-summer humid continental climate; coldest month averaging below 0C (32F) (or 3C (26.6F)), all months with average temperatures below 22C (71.6F), and at least four months averaging above 10C (50F). At least ten times as much rain in the wettest month of summer as in the driest month of winter.Dwc = Monsoon-influenced subarctic climate; coldest month averaging below 0C (32F) (or 3C (26.6F)) and 13 months averaging above 10C (50F). At least ten times as much rain in the wettest month of summer as in the driest month of winter.Dwd = Monsoon-influenced extremely cold subarctic climate; coldest month averaging below 38C (36.4F) and 13 months averaging above 10C (50F). At least ten times as much rain in the wettest month of summer as in the driest month of winter.Dsa = Mediterranean-influenced hot-summer humid continental climate; coldest month averaging below 0C (32F) (or 3C (26.6F)), average temperature of the warmest month above 22C (71.6F) and at least four months averaging above 10C (50F). At least three times as much precipitation in the wettest month of winter as in the driest month of summer, and the driest month of summer receives less than 30mm (1.2in).Dsb = Mediterranean-influenced warm-summer humid continental climate; coldest month averaging below 0C (32F) (or 3C (26.6F)), average temperature of the warmest month below 22C (71.6F) and at least four months averaging above 10C (50F). At least three times as much precipitation in the wettest month of winter as in the driest month of summer, and the driest month of summer receives less than 30mm (1.2in).Dsc = Mediterranean-influenced subarctic climate; coldest month averaging below 0C (32F) (or 3C (26.6F)) and 13 months averaging above 10C (50F). At least three times as much precipitation in the wettest month of winter as in the driest month of summer, and the driest month of summer receives less than 30mm (1.2in).Dsd = Mediterranean-influenced extremely cold subarctic climate; coldest month averaging below 38C (36.4F) and 13 months averaging above 10C (50F). At least three times as much precipitation in the wettest month of winter as in the driest month of summer, and the driest month of summer receives less than 30mm (1.2in).Polar and alpine climates has every month of the year with an average temperature below 10C (50F).[9][11]ET = Tundra climate; average temperature of warmest month between 0C (32F) and 10C (50F).[9][11]EF = Ice cap climate; eternal winter, with all 12 months of the year with average temperatures below 0C (32F).[9][11]Tropical climate distributionTropical climates are characterized by constant high temperatures (at sea level and low elevations); all 12 months of the year have average temperatures of 18C (64.4F) or higher; and generally high annual precipitation. They are subdivided as follows:Main article: Tropical rainforest climateAll 12 months have an average precipitation of at least 60mm (2.4in). These climates usually occur within 10 latitude of the equator. This climate has no natural seasons in terms of thermal and moisture changes.[10] When it is dominated most of the year by the doldrums low-pressure system due to the presence of the Intertropical Convergence Zone (ITCZ) and when there are no cyclones then the climate is qualified as equatorial. When the trade winds dominate most of the year, the climate is a tropical trade-wind rainforest climate.[17]Alofi, Niue, New ZealandAntalaha, MadagascarApia, SamoaAtuona, Hiva Oa, French PolynesiaAvarua, Cook IslandsBandar Seri Begawan, BruneiBluefields, NicaraguaBocas del Toro, PanamaBoende, Democratic Republic of the CongoBuenaventura, ColombiaCastries, Saint Lucia (bordering on Am)Changuinola, PanamaCocos Island, Costa RicaColombo, Sri LankaDavao, PhilippinesEaster Island, ChileFort Lauderdale, Florida, United States (bordering on Am)Funafuti, TuvaluGeorgetown, GuyanaHagta, GuamHamilton, Bermuda (bordering on Cfa)Higey, Dominican Republic (bordering on Am)Hilo, Hawaii, United StatesHoniara, Solomon IslandsInnisfail, Queensland, AustraliaIpoh, MalaysiaIquitos, PeruIshigaki, JapanJohor Bahru, MalaysiaKampala, UgandaKingstown, Saint Vincent and the GrenadinesKisumu, KenyaKoror, PalauKuala Lumpur, MalaysiaKuching, MalaysiaKurunegala, Sri Lanka (bordering on Am)La Ceiba, HondurasLae, Papua New GuineaMajuro, Marshall IslandsManaus, BrazilMata Utu, Wallis and Futuna, French PolynesiaMedan, IndonesiaMoroni, ComorosNakhon Si Thammarat, ThailandNarathiwat, Thailand (bordering on Am)Nuku'alofa, TongaOrchid Island, TaiwanPadang, IndonesiaPago Pago, American SamoaPalembang, IndonesiaPalikir, MicronesiaParamaribo, SurinamePapeete, Tahiti, French PolynesiaPitcairn Island, United KingdomPointe--Pitre, Guadeloupe (bordering on Am)Polomolok, PhilippinesPort Antonio, JamaicaPort Vila, VanuatuPuerto Barrios, GuatemalaPunta Gorda, BelizePuyo, EcuadorQuibd, ColombiaRatnapura, Sri LankaSaint-Laurent-du-Maroni, French GuianaSalvador da Bahia, BrazilSantos, BrazilSingaporeSri Jayawardenepura Kotte, Sri Lanka (bordering on Am)St. George's, GrenadaSuva, FijiTabubil, Papua New GuineaTacloban, PhilippinesTarawa, KiribatiToamasina, MadagascarTubuai, Austral Islands, FranceVictoria, SeychellesVilla Tunari, BoliviaWest Palm Beach, Florida, United States (bordering on Am)Yaren, NauruSome of the places with this climate are indeed uniformly and monotonously wet throughout the year (e.g., the northwest Pacific coast of South and Central America, from Ecuador to Costa Rica; see, for instance, Andagoya, Colombia), but in many cases, the period of higher sun and longer days is distinctly wettest (as at Palembang, Indonesia) or the time of lower sun and shorter days may have more rain (as at Sitiawan, Malaysia). Among these places, some have a pure equatorial climate (Balikpapan, Kuala Lumpur, Kuching, Lae, Medan, Paramaribo, Pontianak, and Singapore) with the dominant ITCZ aerological mechanism and no cyclones or a subequatorial climate with occasional hurricanes (Davao, Ratnapura, Victoria).(The term aseasonal refers to the lack in the tropical zone of large differences in daylight hours and mean monthly (or daily) temperature throughout the year. Annual cyclic changes occur in the tropics, but not as predictably as those in the temperate zone, albeit unrelated to temperature, but to water availability whether as rain, mist, soil, or groundwater. Plant response (e.g., phenology), animal (feeding, migration, reproduction, etc.), and human activities (plant sowing, harvesting, hunting, fishing, etc.) are tuned to this 'seasonality'. Indeed, in tropical South America and Central America, the 'rainy season' (and the 'high water season') is called invierno (Spanish) or inverno (Portuguese), though it could occur in the Northern Hemisphere summer; likewise, the 'dry season (and 'low water season') is called verano or vero, and can occur in the Northern Hemisphere winter).Main article: Tropical monsoon climateThis type of climate results from the monsoon winds which change direction according to the seasons. This climate has a driest month (which nearly always occurs at or soon after the "winter" solstice for that side of the equator) with rainfall less than 60mm (2.4in), but at least 100 (t o t a l a n n u a l p r e c i p i t a t i o n (m m) 25) {\textstyle 100-\left({\frac {\mathrm {total\,annual\,precipitation\,(mm)} }{25}}\right)} of average monthly precipitation.[10]:208Alor Setar, MalaysiaAracaju, BrazilBaguio, Philippines (bordering on Cwb)Bandung, Indonesia (bordering on Af)Barrancabermeja, ColombiaBasseterre, Saint Kitts and NevisBata, Equatorial GuineaBatticaloa, Sri Lanka (bordering on As)Belmopan, BelizeC Mau, VietnamCali, ColombiaCairns, Queensland, Australia[18]Cayenne, French Guiana (bordering on Af)Chichijima, Japan (bordering on Aw and Cfa)Chittagong, BangladeshChristmas Island, AustraliaCoatzacoalcos, Veracruz, MexicoConakry, GuineaCurepipe, MauritiusDa Nang, VietnamDavid, PanamaDouala, CameroonFreetown, Sierra LeoneFort Myers, Florida, United States (bordering on Cfa)Guanare, VenezuelaHat Yai, Thailand (bordering on Aw)Hu, VietnamJakarta, IndonesiaKisangani, Democratic Republic of the CongoKochi, Kerala, IndiaKo Samui, Thailand (bordering on Af)Langkawi, MalaysiaLibreville, GabonMacei, BrazilMakassar, IndonesiaMalabo, Equatorial GuineaMal, MaldivesMangaluru, Karnataka, IndiaManila, PhilippinesMrida, VenezuelaMiami, Florida, United StatesMonrovia, LiberiaNassau, The Bahamas (bordering on Aw)Pattani, ThailandPhuntsholing, Bhutan (bordering on Cwa)[19]Pingtung, TaiwanPort Harcourt, Rivers State, NigeriaPort of Spain, Trinidad and TobagoPucallpa, PeruPuerto Ayacucho, VenezuelaPuerto Maldonado, Peru[20]Qionghai, China[21]Quezon City, PhilippinesRecife, Pernambuco, BrazilRoseau, DominicaSaipan, Northern Mariana Islands, United States (bordering on Af)San Juan, Puerto RicoSanto Domingo, Dominican RepublicSihanoukville, CambodiaSylhet, Bangladesh (bordering on Cwa)Taitung, TaiwanThiruvananthapuram, Kerala, IndiaTrinidad, BoliviaVillahermosa, MexicoWanning, ChinaWenchang, China[21]Yangon, MyanmarZanzibar City, TanzaniaMain article: Tropical savanna climateAw climates have a pronounced dry season, with the driest month having precipitation less than 60mm (2.4in) and less than 100 (t o t a l a n n u a l p r e c i p i t a t i o n (m m) 25) {\textstyle 100-\left({\frac {\mathrm {total\,annual\,precipitation\,(mm)} }{25}}\right)} of average monthly precipitation.[10]:208211Abidjan, Ivory CoastAbuja, NigeriaBahir Dar, Ethiopia (bordering on Cwb)Bamako, MaliBangkok, ThailandBangui, Central African RepublicBanjul, The GambiaBarranquilla, ColombiaBelo Horizonte, BrazilBengaluru, Karnataka, IndiaBhubaneswar, Odisha, IndiaBissau, Guinea-BissauBobo-Dioulasso, Burkina FasoBraslia, BrazilBrazzaville, Republic of the CongoBridgetown, BarbadosBujumbura, BurundiCancn, Quintana Roo, Mexico (bordering on Am)Caracas, VenezuelaCartagena, ColombiaChipata, ZambiaChinandega, NicaraguaCotonou, BeninCuernavaca, Mexico (bordering on Cwa)[22]Dar es Salaam, TanzaniaDarwin, Northern Territory, AustraliaDenpasar, Bali, IndonesiaDhaka, BangladeshDili, East TimorDongfang, Hainan, ChinaGuatemala City, Guatemala (bordering on Cwa)Guayaquil, EcuadorHaikou, Hainan, China (bordering on Cwa)[23]Havana, Cuba (bordering on Af)Ho Chi Minh City, VietnamHyderabad, Telangana, India (bordering on BSh)Jashore, BangladeshJuba, South SudanKano, NigeriaKaohsiung, TaiwanKey West, Florida, United StatesKhulna, BangladeshKigali, RwandaKingston, Jamaica (bordering on BSh)Kinshasa, Democratic Republic of CongoKolkata, West Bengal, IndiaKumasi, GhanaKupang, IndonesiaLagos, NigeriaLom, TogoMalanje, Angola (bordering on Cwa and Cwb)Managua, NicaraguaMandalay, Myanmar (bordering on BSh)Maputo, Mozambique (bordering on BSh)Minamitorishima, JapanMoundou, ChadMumbai, Maharashtra, India (bordering on Am)Naples, Florida, United StatesNaypyidaw, MyanmarPanama City, PanamaPhnom Penh, CambodiaPort-au-Prince, HaitiPort Louis, MauritiusPort Moresby, Papua New GuineaPorto-Novo, BeninRio de Janeiro, Brazil (bordering on Am)San Pedro Sula, Honduras (bordering on Am)San Cristbal Island, EcuadorSan Jos, Costa RicaSan Salvador, El SalvadorSansha, Hainan, ChinaSanta Cruz de la Sierra, Bolivia (bordering on Af)Santiago de Cuba, CubaSanya, Hainan, ChinaSt. John's, Antigua and BarbudaSurabaya, IndonesiaTangail, BangladeshTegucigalpa, HondurasTownsville, Queensland, AustraliaVeracruz, Veracruz, MexicoVientiane, LaosWake Island, United StatesYaound, CameroonZiguinchor, Senegal[24]Most places that have this climate are found at the outer margins of the tropical zone from the low teens to the mid-20s latitudes, but occasionally an inner-tropical location (e.g., San Marcos, Antioquia, Colombia) also qualifies. The Caribbean coast, eastward from the Gulf of Urab on the ColombiaPanama border to the Orinoco River delta, on the Atlantic Ocean (about 4,000km (2,500mi)), have long dry periods (the extreme is the BWh climate (see below), characterized by very low, unreliable precipitation, present, for instance, in extensive areas in the Guajira, and Coro, western Venezuela, the northernmost peninsulas in South America, which receive