Climate Change Definitions

A	
Adaptation	An adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory, autonomous, and planned adaptation.
Aerosols	A collection of airborne solid or liquid particles, with a typical size between 0.01 and 10 micrometer (a millionth of a meter) that reside in the atmosphere for at least several hours. Aerosols may be of either natural or anthropogenic origin. Aerosols may influence climate in several ways: directly through scattering and absorbing radiation, and indirectly through acting as cloud condensation nuclei or modifying the optical properties and lifetime of clouds.
Annual mean temperature	The average of all daily high and low temperatures.
Anthropogenic	Resulting from or produced by human beings.
Attribution	Climate varies continually on all time scales. Detection of climate change is the process of demonstrating that climate has changed in some defined statistical sense, without providing a reason for that change. Attribution of causes of climate change is the process of establishing the most likely causes for the detected change with some defined level of confidence.
C	
Climate	Climate in a narrow sense is usually defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization. The relevant quantities are most often surface variables such as temperature, precipitation and wind. Climate in a wider sense is the state, including a statistical description, of the climate system.
Climate Divisions	The five NOAA National Climatic Data Center (NCDC) official climate divisions group Colorado climate data into regions by river basins, but these divisions are not necessarily representative of the complex regional climates in the state. A new set of climate divisions has been developed (Wolter and Allured 2007). These new divisions are based on groups of observing stations that vary in a similar manner for year to year, and are thought to reflect similar regional climate processes.
Climate variability	Climate variability refers to variations in the mean state and other statistics (such as standard deviations, statistics of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability). See also climate change.
Cryosphere	The component of the climate system consisting of all snow, ice and frozen ground (including permafrost) on and beneath the surface of the Earth and ocean.
D	
Downscaling	Downscaling is a method that derives local- to regional-scale (10 to 100 km) information from larger-scale models or data analyses. Two main methods are distinguished: dynamical downscaling and empirical/statistical downscaling. The dynamical method uses the output of regional climate models, global models with

	variable spatial resolution or high-resolution global models. The empirical/statistical methods develop statistical relationships that link the large-scale atmospheric variables with local/regional climate variables. In all cases, the quality of the downscaled product depends on the quality of the driving model.
Drought	Drought can be defined in a number of ways. In general terms, drought is a 'prolonged absence or marked deficiency of precipitation', a 'deficiency that results in water shortage for some activity or for some group', or a 'period of abnormally dry weather sufficiently prolonged for the lack of precipitation to cause a serious hydrological imbalance'. Agricultural drought relates to moisture deficits in the topmost 1 meter or so of soil (the root zone) that affect crops, meteorological drought is mainly a prolonged deficit of precipitation, and hydrologic drought is related to below-normal streamflow, lake, and groundwater levels. A megadrought is a long-drawn out and pervasive drought, lasting much longer than normal, usually a decade or more.
E	
El Niño Southern Oscillation (ENSO)	The term El Niño was initially used to describe a warm-water current that periodically flows along the coast of Ecuador and Perú,disrupting the local fishery. It has since become identified with a basin-wide warming of the tropical Pacific Ocean east of the dateline. This oceanic event is associated with a fluctuation of a global-scale tropical and subtropical surface pressure pattern called the Southern Oscillation. This coupled atmosphere-ocean phenomenon, with preferred time scales of two to about seven years, is collectively known as the El Niño-Southern Oscillation (ENSO). It is often measured by the surface pressure anomaly difference between Darwin and Tahiti and the sea surface temperatures in the central and eastern equatorial Pacific. During an ENSO event, the prevailing trade winds weaken, reducing upwelling and altering ocean currents such that the sea surface temperatures warm, further weakening the trade winds. This event has a great impact on the wind, sea surface temperature and precipitation patterns in the tropical Pacific. It has climatic effects throughout the Pacific region and in many other parts of the world, through global teleconnections. The cold phase of ENSO is called La Niña.
Emissions scenarios	A plausible representation of the future development of emissions of substances that are potentially radiatively active (e.g., greenhouse gases, aerosols), based on a coherent and internally consistent set of assumptions about driving forces (such as demographic and socioeconomic development, technological change) and their key relationships. Concentration scenarios, derived from emission scenarios, are used as input to a climate model to compute climate projections. *A2* *The A2 storyline and scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in continuously increasing population. Economic development is primarily regionally oriented and per capita economic growth and technological change more fragmented and slower than other storylines.* *A1B* The A1 storyline and scenario family describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies. Major underlying themes are convergence among regions, capacity building, and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income. The A1 scenario family develops into three groups that describe alternative directions of technological change in the energy

	system. The three A1 groups are distinguished by their technological emphasis: fossil intensive (A1FI), non-fossil energy sources (A1T), or a balance across all sources (A1B) (where balanced is defined as not relying too heavily on one particular energy source, on the assumption that similar improvement rates apply to all energy supply and end use technologies). *B1* The B1 storyline and scenario family describes a convergent world with the same global population, that peaks in mid-century and declines thereafter, as in the A1 storyline, but with rapid change in economic structures toward a service and information economy, with reductions in material intensity and the introduction of clean and resource-efficient technologies. The emphasis is on global solutions to economic, social and environmental sustainability, including improved equity, but without additional climate initiatives.
Evapotranspiration	The combined process of evaporation from the Earth's surface and transpiration from vegetation.
Extreme	An extreme weather event is an event that is rare at a particular place and time of year. Definitions of rare vary, but an extreme weather event would normally be as rare as or rarer than the 10th or 90th percentile of the observed probability density function. By definition, the characteristics of what is called extreme weather may vary from place to place in an absolute sense. Single extreme events cannot be simply and directly attributed to anthropogenic climate change, as there is always a finite chance the event in question might have occurred naturally. When a pattern of extreme weather persists for some time, such as a season, it may be classed as an extreme climate event, especially if it yields an average or total that is itself extreme (e.g., drought or heavy rainfall over a season).
F	
Forcing	The climate system can be driven, or "forced" by factors within and external to the system. Processes within the system include those related to the atmosphere, the cryosphere, the hydrosphere, the land surface, and the biosphyere. Volcanic eruptions, solar variations and anthropogenic changes in the composition of the atmosphere and land use change are external forcings.
G	
General Circulation Models	*Climate model:* (spectrum or hierarchy) A numerical representation of the climate system based on the physical, chemical and biological properties of its components, their interactions and feedback processes, and accounting for all or some of its known properties. The climate system can be represented by models of varying complexity, that is, for any one component or combination of components a spectrum or hierarchy of models can be identified, differing in such aspects as the number of spatial dimensions, the extent to which physical, chemical or biological processes are explicitly represented, or the level at which empirical parameterizations are involved. *Coupled Atmosphere-Ocean General Circulation Models:* (AOGCMs) provide a representation of the climate system that is near the most comprehensive end of the spectrum currently available. There is an evolution towards more complex models with interactive chemistry and biology. Climate models are applied as a research tool to study and simulate the climate, and for operational purposes, including monthly, seasonal and interannual climate predictions.
Greenhouse effect	Greenhouse gases effectively absorb thermal infrared radiation, emitted by the Earth's surface, by the atmosphere itself due to the same gases, and by clouds.

	Atmospheric radiation is emitted to all sides, including downward to the Earth's surface. Thus, greenhouse gases trap heat within the surface-troposphere system. This is called the greenhouse effect. Thermal infrared radiation in the troposphere is strongly coupled to the temperature of the atmosphere at the altitude at which it is emitted. In the troposphere, the temperature generally decreases with height. Effectively, infrared radiation emitted to space originates from an altitude with a temperature of, on average, –19°C, in balance with the net incoming solar radiation, whereas the Earth's surface is kept at a much higher temperature of, on average, +14°C. An increase in the concentration of greenhouse gases leads to an increased infrared opacity of the atmosphere, and therefore to an effective radiation into space from a higher altitude at a lower temperature. This causes a radiative forcing that leads to an enhancement of the greenhouse effect, the so-called enhanced greenhouse effect.
Greenhouse gas	Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation emitted by the Earth's surface, the atmosphere itself, and by clouds. This property causes the greenhouse effect. Water vapor (H2O), carbon dioxide (CO2), nitrous oxide (N2O), methane (CH4), and ozone (O3) are the primary greenhouse gases in the Earth's atmosphere. Moreover, there are a number of entirely human-made greenhouse gases in the atmosphere, such as the halocarbons and other chlorine- and bromine-containing substances, dealt with under the Montreal Protocol. In addition to CO2, N2O and CH4, the Kyoto Protocol deals with the greenhouse gases sulphur hexafluoride (SF6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).
H	
Hydroclimatic variables	Physical parameters relevant to both hydrology and climate, including temperatures, precipitation, and snowpack.
Hydrologic drought	Hydrologic drought is related to below-normal streamflow, lake, and groundwater levels.
I	
Interstate Compacts	Interstate waters are allocated under agreements between two or more states that govern specific interactions among those states, and require consent by the United States Congress. These compacts are intended to allow each state to exercise its own water law and to use its allocated water within its boundaries whenever it might choose.
IPCC	The Intergovernmental Panel on Climate Change (IPCC) established by World Meteorological Organization (WMO) and United Nations Environmental Programme (UNEP) provides an assessment of the state of knowledge on climate change based on peer-reviewed and published scientific/technical literature in regular time intervals.
IPCC Fourth Assessment Report	The Fourth Assessment Report "Climate Change 2007", also referred to as AR4, is a series of reports by the IPCC and provides an assessment of the current state of knowledge on climate change including the scientific aspects of climate change, impacts and vulnerabilities of human, natural, and managed systems, and adaptation and mitigation strategies.
L	
Likelihood	The likelihood of an occurrence, an outcome or a result, where this can be estimated probabilistically.
M	
Model bias	Known systematic error of a climate model; biases can be assessed by comparing the temperature and precipitation (and other variables) at the model grid with a gridded observational dataset over a given period.

Model grid	Spatial scale represented in a climate model.
N	
North American monsoon	The North American monsoon (NA monsoon), variously known as the southwest United States monsoon, the Mexican monsoon, or the Arizona monsoon, is experienced as a pronounced increase in rainfall from an extremely dry June to a rainy July over large areas of the southwestern United States and northwestern Mexico. These summer rains typically last until mid-September when a drier regime is re-established over the region. Geographically, the NA monsoon precipitation region is centered over the Sierra Madre Occidental in the Mexican states of Sinaloa, Durango, Sonora, and Chihuahua. The regime extends northward into the Arizona, New Mexico, and Colorado. Typically, the NA Monsoon region is defined by sites that receive at least 50% of its annual precipitation in July, August, and September.
P	
Pacific Decadal Oscillation	The Pacific Decadal Oscillation (PDO) is a pattern of ocean variability in the North Pacific that is similar to ENSO in some respects, but has a much longer cycle (20–50 year). Specifically, it is defined as the standardized difference between sea surface temperatures (SSTs) in the north-central Pacific and Gulf of Alaska.
Paleoclimate	Climate during periods prior to the development of measuring instruments, including historic and geologic time, for which only proxy climate records are available.
Palmer Drought Severity Index	An index formulated by Palmer (1965) that compares the actual amount of precipitation received in an area during a specified period with the normal or average amount expected during that same period. The PDSI is based on a procedure of hydrologic or water balance account by which excesses or deficiencies in moisture are determined in relation to average climatic values. Values taken into account in the calculation of the index include precipitation, potential and actual evapotranspiration, infiltration of water into a given soil zone, and runoff. This index builds on Thornthwaite's (1931; 1948) work; adding 1.) soil depth zones to better represent Climate 50 regional change in soil water-holding capacity; and 2.) movement between soil zones and, hence, plant moisture stress, that is, too wet or too dry.
Prior Appropriations System	A simplified way to explain this system is often referred to as "first in time, first in right." An appropriation is made when an individual physically takes water from a stream (or underground aquifer) and places that water to some type of beneficial use. The first person to appropriate water and apply that water to use has the first right to use that water within a particular stream system. This person (after receiving a court decree verifying their priority status) then becomes the senior water right holder on the stream, and that water right must be satisfied before any other water rights can be fulfilled.
PRISM	Parameter-elevation Regressions on Independent Slopes Model.
Projection	A projection of the response of the climate system to emission or concentration scenarios of greenhouse gases and aerosols, or radiative forcing scenarios, often based upon simulations by climate models. Climate projections are distinguished from climate predictions in order to emphasize that climate projections depend upon the emission/concentration/radiative forcing scenario used, which are based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realized and are therefore subject to substantial uncertainty.
R	
Regional climate models	These models typically input the global model grids surrounding their geographical domain and then simulate wind, temperature, clouds,

	evapotranspiration, and other variables on a much finer grid.
S	
SNOTEL	Abbreviation for SNOwpack TELemetry. A west-wide system for obtaining snow water equivalent, precipitation, air temperature, and other hydrologic measurements from remote data sites via radio transmission.
Snow water equivalent (SWE)	The amount of water contained within the snowpack. It can be thought of as the depth of water that would theoretically result if you melted the entire snowpack instantaneously.
Streamflow	Water flow within a river channel, for example expressed in m3/s. Also a synonym for river discharge.
T	
Time series analysis	Time series analysis, including trend analysis, uses statistical methods to analyze records from a period of time.
U	
Urban heat island effect	Urban heat island (UHI) The relative warmth of a city compared with surrounding rural areas, associated with changes in runoff, the concrete jungle effects on heat retention, changes in surface albedo, changes in pollution and aerosols, and so on.
V	
Variability	Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic or external forcing(external variability).
W	
Water Year	The 12-month period, October 1 through September 30. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. Thus, the year ending September 30,1992, is called the “1992 water year.”