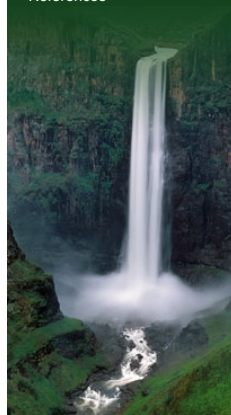


Orange-Senqu River Awareness Kit

The River Basin

- Introduction
- Geography
- Climate and Weather**
- Principles of Climate and Meteorology
- Hydrologic Cycle
- Climate Variability
- Climate Classification**
- Water Scarcity
- Drought
- Climate of the Orange-Senqu River Basin
- Climate Change
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- Water Quality
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Climate and Weather: Principles of Climate and Meteorology: **Climate Classification**

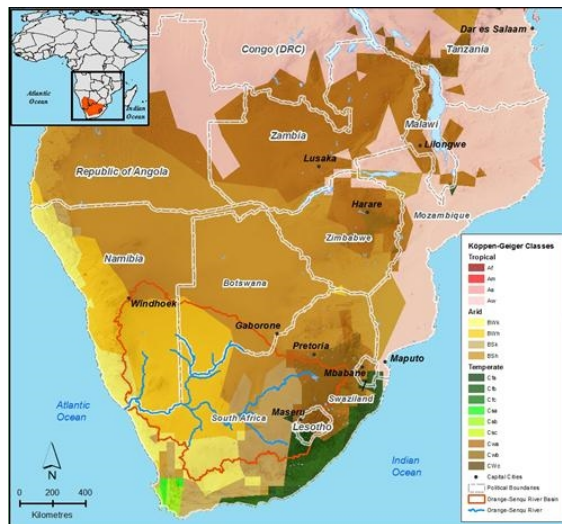
One of the most widely used climate classification systems today is the Köppen Climate Classification system. Based on annual and monthly averages of temperature and precipitation, it includes five major climatic types; each type represented by a capital letter.

- **A** - Tropical moist climates: all months have average temperatures above 18° Celsius
- **B** - Dry climates: deficient precipitation throughout most of the year
- **C** - Moist mid-latitude climates: with mild winters
- **D** - Moist mid-latitude climates: with cold winters
- **E** - Polar climates: with extremely cold winters and summers

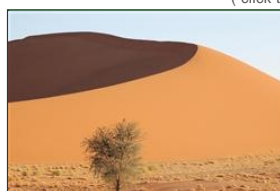
For details of each of these major climate types, see the Box below.

The map below shows the distribution of Köppen-Geiger Climate Classes across southern Africa

Most of the Orange-Senqu River basin falls in category B, with a smaller eastern portion of the basin in category C.



Köppen-Geiger Climate Classification for southern Africa.
 Source: Kottek et al. 2006
 (click to enlarge)



An example of a B climate type - Sossusvlei Namibia.
 Source: Huber 2008
 (click to enlarge)



An example of a C climate type - Lesotho highlands.
 Source: Lesotho Water Commission 2003
 (click to enlarge)

Box: Detailed Description of the Köppen Climatic Types

Tropical Moist Climates (A)

Tropical moist climates extend northward and southward from the equator to about 15 to 25° of latitude. In these climates all months have average temperatures greater than 18° Celsius. Annual **precipitation** is greater than 1 500 mm. Three minor Köppen climate types exist in the A group, and their designation is based on seasonal distribution of rainfall. **Af** or tropical wet is a tropical climate where precipitation occurs all year long. Monthly temperature variations in this climate are less than 3° Celsius. Because of intense surface heating and high humidity, **cumulus** and **cumulonimbus** clouds form early in the afternoons almost every day. Daily highs are about 32° Celsius, while night time temperatures average 22° Celsius. **Am** is a **tropical monsoon** climate. Annual rainfall is equal to or greater than **Af**, but most of the precipitation falls in the 7 to 9 hottest months. During the dry season very little rainfall occurs. The **tropical wet and dry** or savanna (**Aw**) has an extended dry season during winter. Precipitation during the wet season is usually less than 1 000 millimeters, and only during the summer season.

Dry Climates (B)

The most obvious climatic feature of this climate is that **potential evaporation** and **transpiration** exceed **precipitation**. These climates extend from 20 - 35° North and South of the equator and in large continental regions of the

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mid-latitudes often surrounded by mountains. Minor types of this climate include:

BW - dry arid (desert) is a true desert climate. It covers 12% of the Earth's land surface and is dominated by xerophytic vegetation (plants able to survive in climates with little or no water). The additional letters **h** and **k** are used generally to distinguish whether the dry arid climate is found in the subtropics or in the mid-latitudes, respectively.

BS - dry semiarid (steppe). Is a grassland climate that covers 14% of the Earth's land surface. It receives more precipitation than the **BW** either from the **intertropical convergence zone** or from **mid-latitude cyclones**. Once again, the additional letters **h** and **k** are used generally to distinguish whether the dry semiarid climate is found in the subtropics or in the mid-latitudes, respectively.

Moist Subtropical Mid-Latitude Climates (C)

This climate generally has warm and humid summers with mild winters. Its extent is from 30 to 50° of 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. Three minor types exist: **Cfa - humid subtropical**; **Cs - Mediterranean**; and **Cfb - marine**. The humid subtropical climate (**Cfa**) has hot muggy summers and frequent thunderstorms. Winters are mild and precipitation during this season comes from mid-latitude cyclones. A good example of a **Cfa** climate is the southeastern USA. **Cfb** marine climates are found on the western coasts of continents. They have a humid climate with short dry summer. Heavy precipitation occurs during the mild winters because of the continuous presence of mid-latitude cyclones. Mediterranean climates (**Cs**) receive rain primarily during winter season from the mid-latitude cyclone. Extreme summer aridity is caused by the sinking air of the **subtropical highs** and may exist for up to 5 months. Locations in North America are from Portland, Oregon to all of California.

Moist Continental Mid-latitude Climates (D)

Moist continental mid-latitude climates have warm to cool summers and cold winters. The location of these climates is pole ward of the C climates. The average temperature of the warmest month is greater than 10° Celsius, while the coldest month is less than -3° Celsius. Winters are severe with snowstorms, strong winds, and bitter cold from Continental Polar or Arctic air masses. Like the C climates there are three minor types: **Dw - dry winters**; **Ds - dry summers**; and **Df - wet all seasons**.

Polar Climates (E)

Polar climates have year-round cold temperatures with the warmest month less than 10° Celsius. Polar climates are found on the northern coastal areas of North America, Europe, Asia, and on the landmasses of Greenland and Antarctica. Two minor climate types exist. **ET** or **polar tundra** is a climate where the soil is permanently frozen to depths of hundreds of meters, a condition known as permafrost. Vegetation is dominated by mosses, lichens, dwarf trees and scattered woody shrubs. **EF** or **polar ice caps** has a surface that is permanently covered with snow and ice.

Source: Pidwirny 2006

[Next: Water Scarcity](#) ►