

# Global Precipitation Measurement Mission

## Expert Group- Weather and Climate in Sargodha, Pakistan



Figure 1: Developed using [Google Maps](#)

In Pakistan, agriculture is the largest sector of the economy, and all of Pakistan's people depend on farmers for their food. The main crops that are produced are wheat, sugarcane, rice, and maize. Of all the crops grown here, however, wheat is the biggest agricultural crop by far. The Sargodha region is known for being a major grain producer, and the main crop grown in this region is wheat. The season for growing wheat begins in February and runs through the beginning of August. As there is not always enough precipitation to water wheat crops throughout the growing season, wheat farmers will irrigate their wheat crops by flooding their fields with water.

Sargodha is the 11<sup>th</sup> largest city in Pakistan. It is also known as the City of Eagles. There are approximately 1.5 million people who live in this city (as of the last census in 2017), with another 3.9 million people living in the outlying towns. The Sargodha region includes 60 towns which lay on mostly flat fertile plains, and the Jhelum river flows on the western and northern sides of the region. It is 189m/ above sea level.

### *Weather and Climate:*

Weather and climate are different. Weather helps you decide what to wear when you go outside, and climate helps you know which clothes to have ready for possible weather conditions during that season. Weather is what is happening outside right now in the atmosphere. Climate is an average of the weather conditions over the past, and usually includes at least 30 years of weather data to determine these typical conditions. Watch [this](#) video (6:24) to learn the difference between weather and climate.

It is important to know the difference between weather and climate to understand how our climate is changing and why it is hard to predict the weather, but easy to determine

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the climate. Climate is based on mathematical averages and not dependent on atmospheric variables that are changing by the minute. Climate is determined by altitude, latitude, geography, and topography. Most people think of weather in terms of temperature, humidity, precipitation, cloudiness, brightness, visibility, wind, and atmospheric pressure, as in high and low pressure.

Earth operates as a complex series of interrelated systems. As you can see in Figure 2, both natural and human-made processes are continually interacting and causing changes in our weather, which results in changes being noted in our climate. As change occurs in one system, such as a volcanic eruption, it results in changes in the atmospheric composition and modifications in the geologic structure. As humans modify the land for different purposes, they also are creating changes in the atmosphere, the carbon cycle, and in the water of water resources.

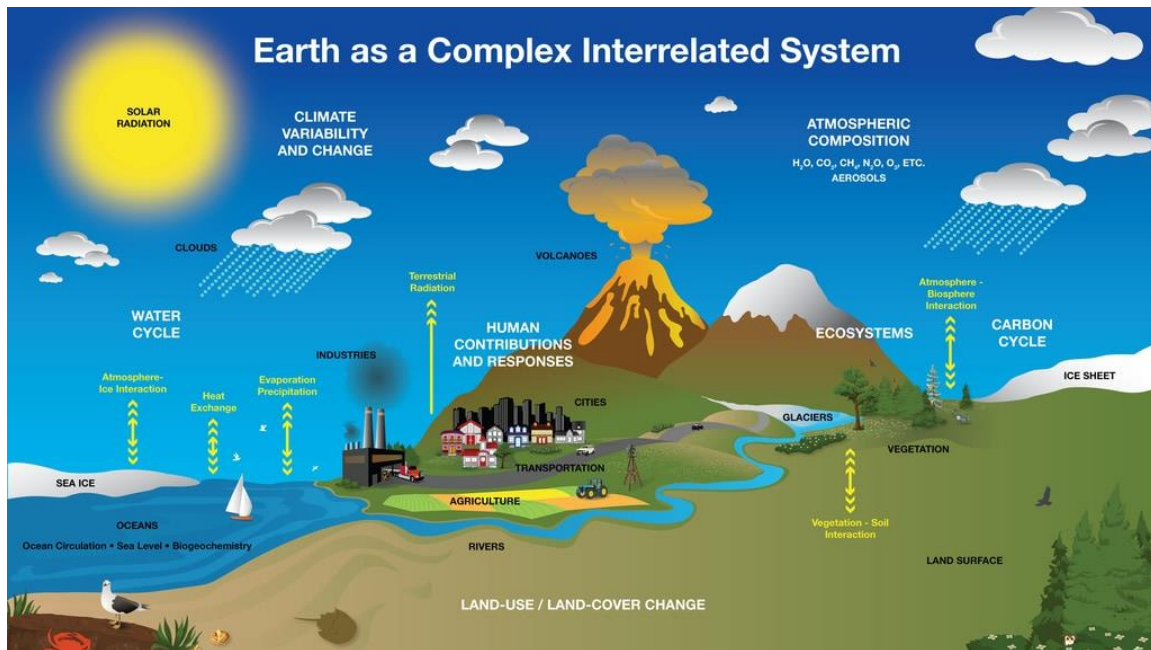


Figure 2: Image credit: NASA GSFC

Like the human body, Earth comprises diverse processes and systems that interact with one another in complex ways. The purpose of NASA's Earth science program is to advance our scientific understanding of Earth as an integrated system and its response to natural and human-induced changes. NASA works with its domestic and international partners to support a large number of Earth-observing satellite and airborne missions to observe and understand our planet on global and regional scales. These missions are able to collect measurements of surface temperature, winds, water vapor, clouds, precipitation, soil moisture, ocean salinity, and other aspects of the environment. While scientists learn a great deal from studying individual phenomena, improved observational capabilities, coupled with process-level and global numerical models increasingly allow them to study component system interactions, leading to unprecedented insight into how Earth

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functions as one integrated system of systems. In [this](#) short animation (0:58) you can see the patterns of vegetation emerge and retreat over the seasons as measured by NASA satellites.

The Köppen-Geiger Climate Classification is a widely used, vegetation-based system which was initially developed by German botanist-climatologist Wladimir Köppen in 1900. Köppen developed a climate classification system for world climate types using annual and seasonal patterns of temperature and precipitation as well as vegetation types. In 1954, Rudolf Geiger updated Köppen's system and made it available as a world map.

Today, this system, known as the Köppen-Geiger Climate Classification system is widely used and identifies 31 different climatic regions. There are five major climate types: Equatorial (A), Arid (B), Warm Temperate (C), Snow (D), and Polar (E). Köppen was able to devise formulas that defined climatic boundaries to correspond to those of the vegetation zones ([biomes](#)) that were being mapped for the first time during his lifetime.

Pakistan map of Köppen climate classification

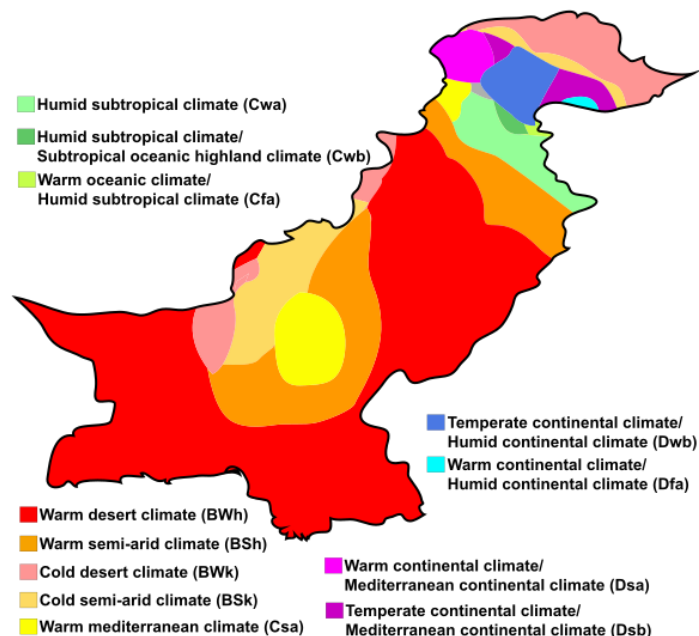


Figure 3: Image credit: Creative Commons

Sargodha is located in what is considered to be “BSh” according to the Köppen-Geiger climate classification. It is also known as a “local steppe” climate. A steppe is a dry, grassy plain that is found in temperate climates between the tropics and the polar regions. In the U.S., steppe climate zones are found in the Midwest, in states such as Kansas. Steppe climates are semi-arid, meaning that they receive about 25-50 cm/10-20 inches of precipitation per year. In the summer months, it can get extremely hot, and the winters are fairly mild.



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Like temperate grasslands everywhere, the steppes have suffered high losses due to overgrazing of livestock and conversion to cropland. As much as 70% of steppe grasslands have already been severely degraded. Some “novel threats” to the steppe include energy infrastructure, such as wind and photovoltaic farms, oil and gas extraction, and the cultivation of new crops such as biofuels. Climate change also threatens to convert some of this arid grassland to desert. You can where Sargodha is located on the climate zone map in Figure 4 below.

## Climate Zones

Global

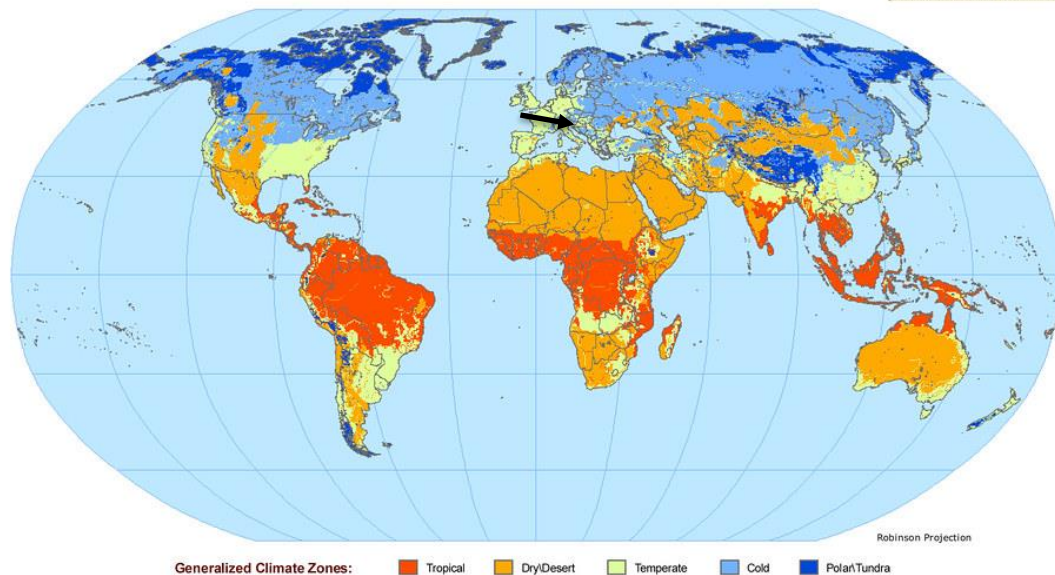


Figure 4: Global Climate Zones/ Image credit: [Creative Commons](#)

The graph in Figure 5 contains data on the climatic averages for both temperature and precipitation amounts are in Sargodha, Pakistan.

	January	February	March	April	May	June	July	August	Sep- tember	October	November	December
Avg. Temperature (°C)	11.8	14.5	19.9	25.4	30.2	34.1	32.4	31.1	29.9	25.3	18.2	13.1
Min. Temperature (°C)	3.7	6.7	12.3	17.5	22	26.9	27.2	26.3	23.7	17	9.2	4.2
Max. Temperature (°C)	19.9	22.3	27.5	33.3	38.4	41.3	37.7	36	36.2	33.6	27.3	22
Avg. Temperature (°F)	53.2	58.1	67.8	77.7	86.4	93.4	90.3	88.0	85.8	77.5	64.8	55.6
Min. Temperature (°F)	38.7	44.1	54.1	63.5	71.6	80.4	81.0	79.3	74.7	62.6	48.6	39.6
Max. Temperature (°F)	67.8	72.1	81.5	91.9	101.1	106.3	99.9	96.8	97.2	92.5	81.1	71.6
Precipitation / Rainfall (mm)	17	21	29	22	25	24	105	114	28	8	5	12

The precipitation varies 109 mm | 4 inch between the driest month and the wettest month. The average temperatures vary during the year by 22.3 °C | 72.1 °F.

Figure 5: Sargodha Weather by Month/ Image Credit: [Climate-Data.org](#)

developed by the



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You can see the variability of how much precipitation Sargodha receives over the year. Variability refers to the way that the amount of precipitation varies across time or location. What factors do you think might be responsible for the variability of precipitation in Sargodha? When does the majority of precipitation fall in Sargodha? Pakistan has a yearly “monsoon” season. You can learn more about monsoons in this video entitled “[Monsoons: Wet, Dry, Repeat](#)” (03:48).

Now you know the difference between weather and climate, and also a lot about the climate in Pakistan and in the region around Sargodha. You will be ready to contribute to your Project Team by helping them know what the climate is like during the wheat growing season for this region.

## *Resources:*

- [Encyclopedia Britannica: Sargodha](#)
- [Pakistan Bureau of Statistics](#)
- [National Geographic: Steppe climate](#)
- [Climate Change Profile of Pakistan](#)
- [NASA Earth Day 2020](#)
- [NASA's "Precipitation Education" website](#)

