

# ANNEX I

## SUMMARY GUIDELINES TO THE USE OF KOEPPEN CLIMATE CLASSIFICATION SYSTEM

### Classification description

The Koeppen climate classification subdivides climate in the five classes that follows.

#### Class A: Tropical

Temperature of the coldest month:  $> 18^{\circ}\text{C}$ . This is the climate where the most water- and heat-demanding crops (e.g. for instance oil palm and rubber) are grown. The climate is also ideal for yams, cassava, maize, rice, bananas and sugarcane. Sub-classes are:

- Af - No dry season, at least 60 mm of rainfall in the driest month
- Am - Monsoon type. Short dry season but sufficient moisture to keep ground wet throughout the year.
- Aw - Distinct dry season. One month with precipitation  $< 60$  mm.
- i - Isothermal subtype. Annual range of temperature  $< 5^{\circ}\text{C}$

#### Class B: Dry

Arid regions where annual evaporation exceeds annual precipitation. Even the wettest variants of this climate are characterized by a marked dry season. The climate is, therefore, mostly unsuitable for the crops that require year-round moisture. The main crops are usually millet, sorghum and groundnuts. Sunshine is usually high, which leads to high productivity where a sufficiently long rainy season or irrigation ensure a sufficient water supply: rice, sugarcane and maize are also common crops under this climate.

The two main subclasses refer to the dominant vegetation types: BS (steppe climate) and BW (desert). They are further subdivided as h subtype (subtropical desert with average temperature  $> 18^{\circ}\text{C}$ ), k subtype (cool dry climate of the middle latitude deserts), and k' (temperature of the warmest month  $< 18^{\circ}\text{C}$ ).

#### Class C: Temperate

Average temperature of the coldest month  $< 18^{\circ}\text{C}$  and  $> -3^{\circ}\text{C}$ , and the average temperature of warmest month  $> 10^{\circ}\text{C}$ . The main crops are the temperate cereals such as wheat, barley and Irish

(white) potatoes. An important variant of this climate is the Mediterranean climate, characterized by the olive tree, and also very suitable for grapes. The main subdivisions include:

- Cw - Winter dry season. At least 10 times as much precipitation in wettest month of summer as in driest month of winter
- Cs - Summer dry season. At least three times as much rain in the wettest month of winter as in the driest month of summer, the latter having less than 30mm precipitation.
- Cf - At least 30 mm precipitation in the driest month, difference between wettest month and driest month less than for Cw and Cs

Additional qualifiers are a (hot summer, average temperature of warmest month  $> 22^{\circ}\text{C}$ ), b (cool summer, average temperature of warmest month  $< 22^{\circ}\text{C}$ ) and c (cool - short summer less than four months  $> 10^{\circ}\text{C}$ ). Note that the "raw" temperate climate extends into what is actually BS and BW, as the "Dry" B type is superposed on the other types where only temperature is used to define the climate.

#### **Class D: Cold**

Average temperature of the warmest month  $> 10^{\circ}\text{C}$  and that of coldest month  $< -3^{\circ}\text{C}$ . This climate grows essentially the same crops as the temperate climate, but seasons tend to be shorter and limited at the beginning and end by frost.

This climate type comprises mainly the Df subtype (at least 30 mm of rain in the driest month, difference between wettest month and driest month less than for Cw and Cs) and Dw (winter dry season - at least 10 times as much precipitation in wettest month of summer as in driest month of winter). Other codes used are: a (hot summer, average temperature of warmest month  $> 22^{\circ}\text{C}$ ), b (cool summer, average temperature of warmest month  $< 22^{\circ}\text{C}$ ), c (cool, short summer less than four months  $> 10^{\circ}\text{C}$ ) and d (average temperature of coldest month  $< -38^{\circ}\text{C}$ ).

#### **Class E: Polar**

Average temperature of the warmest month  $< 10^{\circ}\text{C}$ . No crops are grown under this climate. The two main subdivisions - ET (tundra, average temperature of warmest month  $> 0^{\circ}\text{C}$ ), and EF (no month with temperature  $> 10^{\circ}\text{C}$ ) - are sometimes qualified by d if the average temperature of coldest month  $< -38^{\circ}\text{C}$ .

### **Methodology**

Detailed Procedure for Determining Koppen Climate Type

#### **1. Determine whether a Climate is arid/semiarid (B climates)**

- Determine annual rainfall in mm and annual average temperature in  $^{\circ}\text{C}$
- If  $r > 20(t+14)$  it is not a **B** climate. Go to Step 2

c. Determine seasonality of rainfall. Then determine **BS**, **BW** or neither according to the criteria below:

<u>Rainfall Distribution</u>	Not a <b>B</b> climate Go to Step 2	<b>BS</b> (Semi-arid)	<b>BW</b> (Arid)
70% of rainfall in warmest 6 months	$r > 20(t+14)$	$10(t+14) < r < 20(t+14)$	$r < 10(t+14)$
70% of rainfall in coldest 6 months	$r > 20t$	$10t < r < 20t$	$r < 10t$
Even rainfall distribution (neither of above)	$r > 20(t+7)$	$10(t+7) < r < 20(t+7)$	$r < 10(t+7)$

d. For **BS** or **BW**, go to Step 3.

**2. If not a B climate, identify the climate as A, C, D, or E according to temperature data**

- Temperature of coldest month  $> 18^{\circ}\text{C}$ , it is an **A** climate.
- Temperature of coldest month in  $-3^{\circ}\text{C}$  to  $18^{\circ}\text{C}$  range, warmest month  $> 10^{\circ}\text{C}$ , it is a **C** climate.
- Temperature of coldest month  $< -3^{\circ}\text{C}$ , warmest month  $> 10^{\circ}\text{C}$ , it is a **D** climate.
- Warmest month  $< 10^{\circ}\text{C}$ , it is an **E** climate.

**3. After identifying A, BS, BW, C, D, or E, determine additional letters for subcategories.**

**A climates:**

**Af:** Rainfall in driest month at least 60mm

**Am:** Rainfall in driest month less than 60mm, but  $> 100 - (\text{annual rainfall}/25)$

**Aw:** Not **Af** or **Am**

**B climates:**

**BSh** or **BWh:** average annual temp.  $> 18^{\circ}\text{C}$

**BSk** or **BWk:** average annual temp.  $< 18^{\circ}\text{C}$

**C climates:**

**Cw:** at least 10 times as much precip. in wettest summer month as in driest winter month.

**Cs:** at least 3 times as much precip. in wettest winter month as in driest summer month.

**Cf:** Not **Cw** or **Cs**

See step 4 below.

**D climates:**

**Dw:** at least 10 times as much precip. in wettest summer month as in driest winter month.

**Ds:** at least 3 times as much precip. in wettest winter month as in driest summer month.

**Df:** Not **Dw** or **Ds**

See step 4 below.

**E climates:**

**ET:** warmest month in 0 - 10 °C range

**EF:** warmest month below 0 °C

**4. For C and D climates, determine a third letter:**

a (e.g. **Cfa**) : warmest month > 22 °C

b (e.g. **Dsb**): warmest month < 22 °C; at least 4 months > 10 °C

c (e.g. **Cfc**) : warmest month < 22 °C; 1-3 months > 10 °C

d (e.g. **Dwd**): coldest month < -38 °C