

Wind & Climate

- ***The student will be expected to demonstrate an understanding of the cause of winds and how winds affect climate.***



Wind & Climate

- In this lesson you will:
 - 2.3.1 Define the term prevailing winds. (k)
 - 2.3.3 State the impact of the Coriolis effect on wind direction. (k)
 - 2.3.2 Describe conditions that result in land breezes and sea breezes. (k)

Defining Winds

- **What is WIND?**

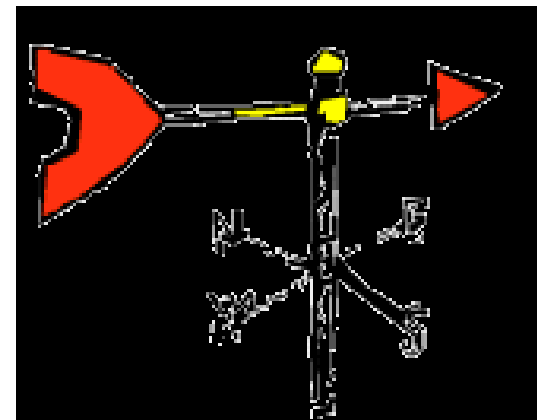
- Wind is air that blows **from areas of high air pressure to areas of low air pressure.**
- Wind is caused by:
 - 1) **Weather conditions** in a certain area.
 - 2) **Pressure belts** that circle the earth that cause **prevailing winds.**

Defining Winds...Practical Examples

- Ex. 1...Air inside a balloon:
 - If left untied the air will escape the high pressure of the balloon and create a wind blowing from high pressure inside the balloon to relatively low pressure outside the balloon.
- Ex. 2...Exhaling:
 - When you exhale the air leaves your lungs because you create a high pressure inside your chest cavity when you inhale.
 - Wind is created from high pressure inside your chest to a lower pressure outside your chest.

Prevailing Winds

- **Definition:** Regular, normal wind direction in an area of the earth.
- They are caused by global *convection cells* in the earth's atmosphere.
 - See figure 4.10 on page 63
- [Bill Nye: Wind](#)

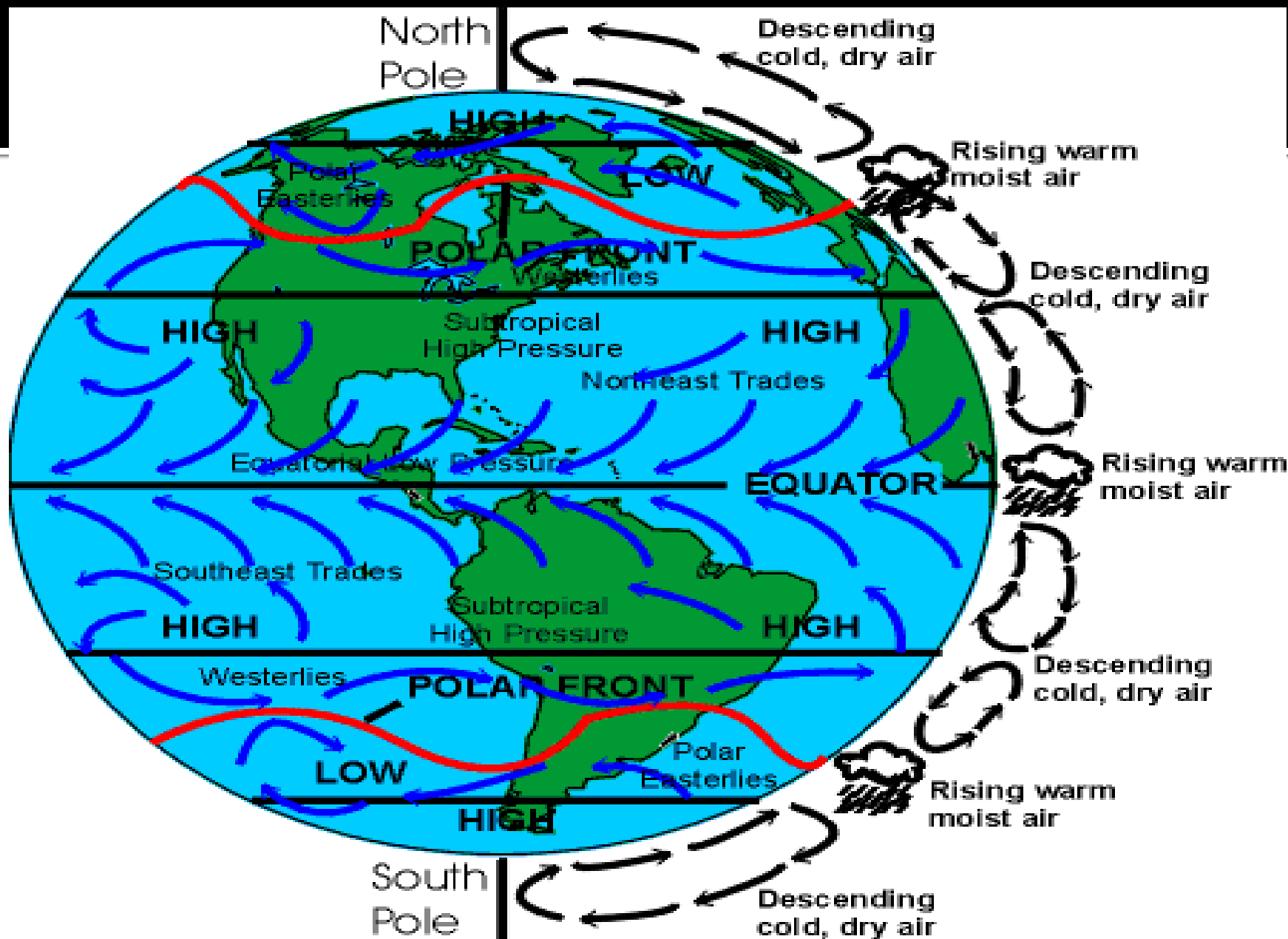


Prevailing Winds...Convection Cells

- The global convection cells are created because of the uneven heating of the earth's surface.
- In the **equatorial regions**, the sun heats the air and it rises.
- This creates a **low pressure on the ground** because low pressure air moves in to replace the rising air.
- The **air falls** to earth at **30° North and south** creating high pressures.

Prevailing Winds...Convection Cells

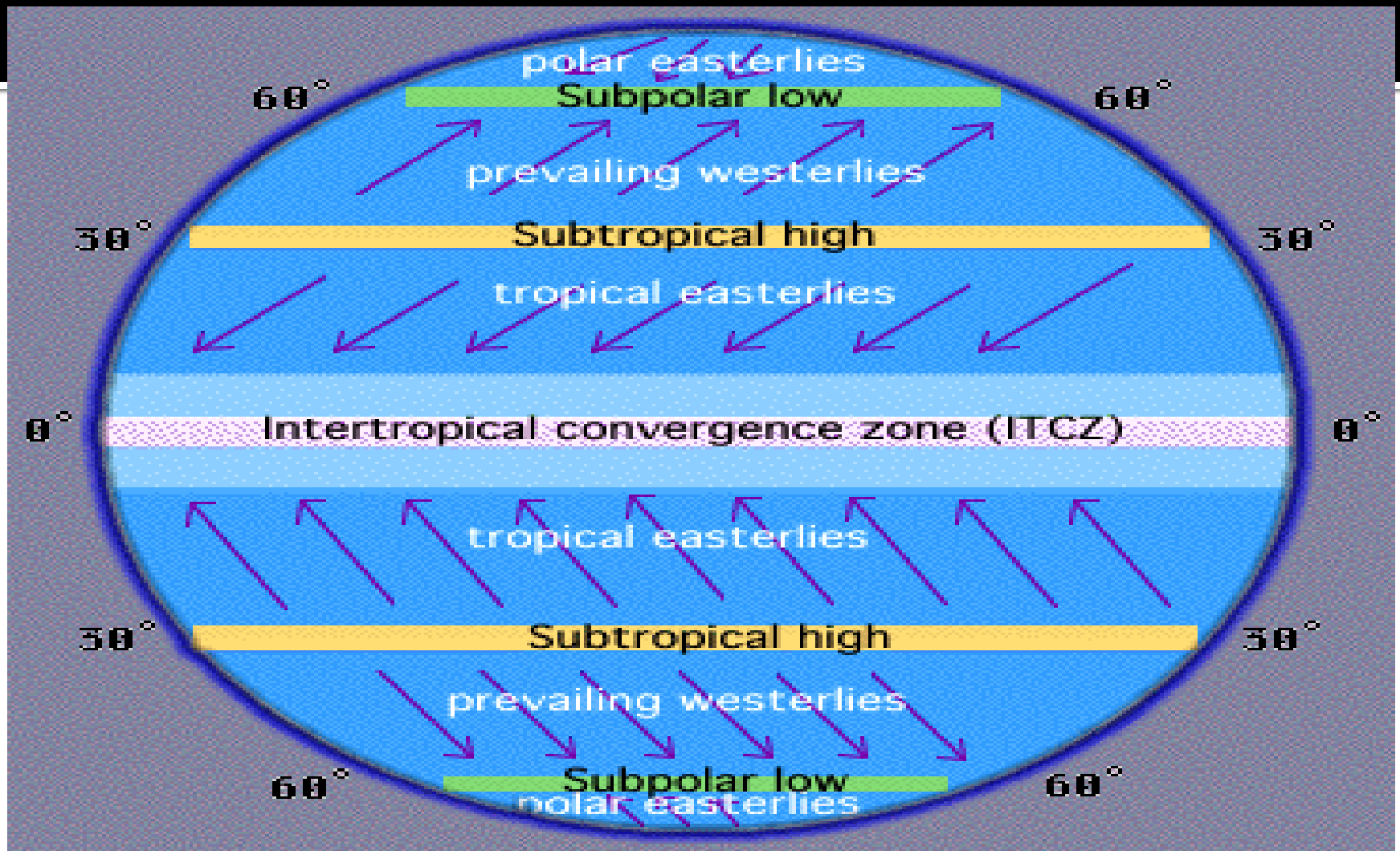
- For every 30° there is a new pressure belt.
 - **LOW pressure belts** are created at the equator and at 60° N and 60° S
 - **HIGH pressure belts** are created at 30° N and 30° S and at the poles.
- **Prevailing winds** form because of these global pressure belts.
- Winds blow from the high pressure belts to the low pressure belts.



The Coriolis Effect

- The **Coriolis Effect** is a law of physics that states:

“Objects in motion in the northern hemisphere are deflected to the right while in the southern hemisphere they are deflected to the left.”
- Therefore winds in the north are deflected right and the winds in the south are deflected left.
- [YouTube - Coriolis Effect \(2-11\)](#)
- [NOVA- Coriolis Effect](#)



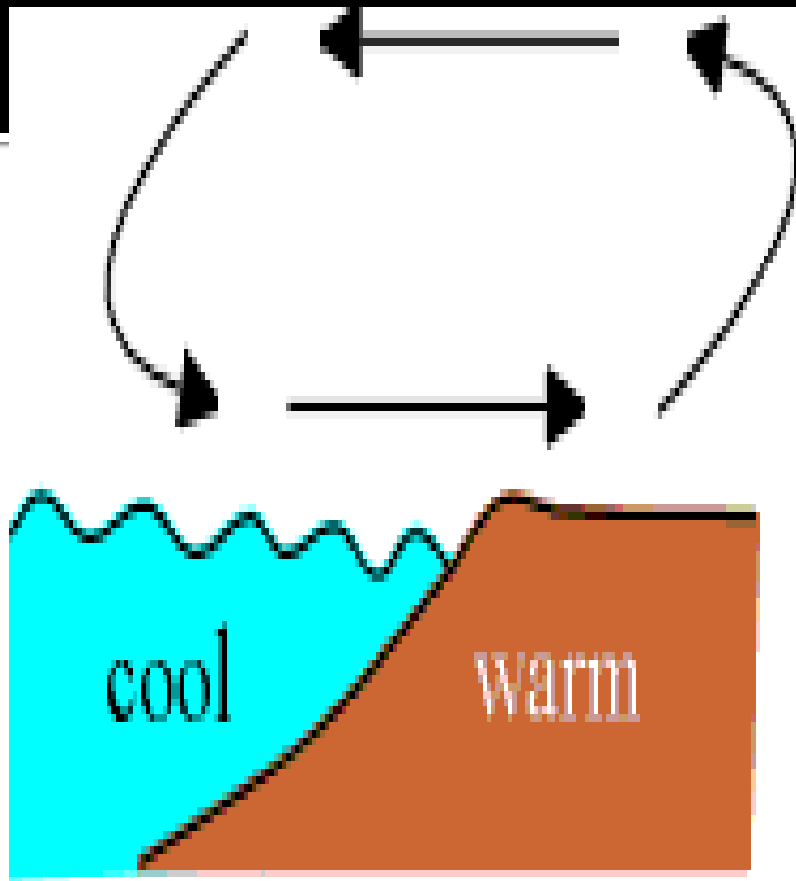
Names of Prevailing Winds (DO NOT COPY)

- 0-30° N = Northeast trade winds
- 0-30° S = Southeast trade winds
- 30-60° N and 30-60° S = Westerly winds
- 60-90° N = North Polar easterlies
- 60-90° S = South Polar easterlies

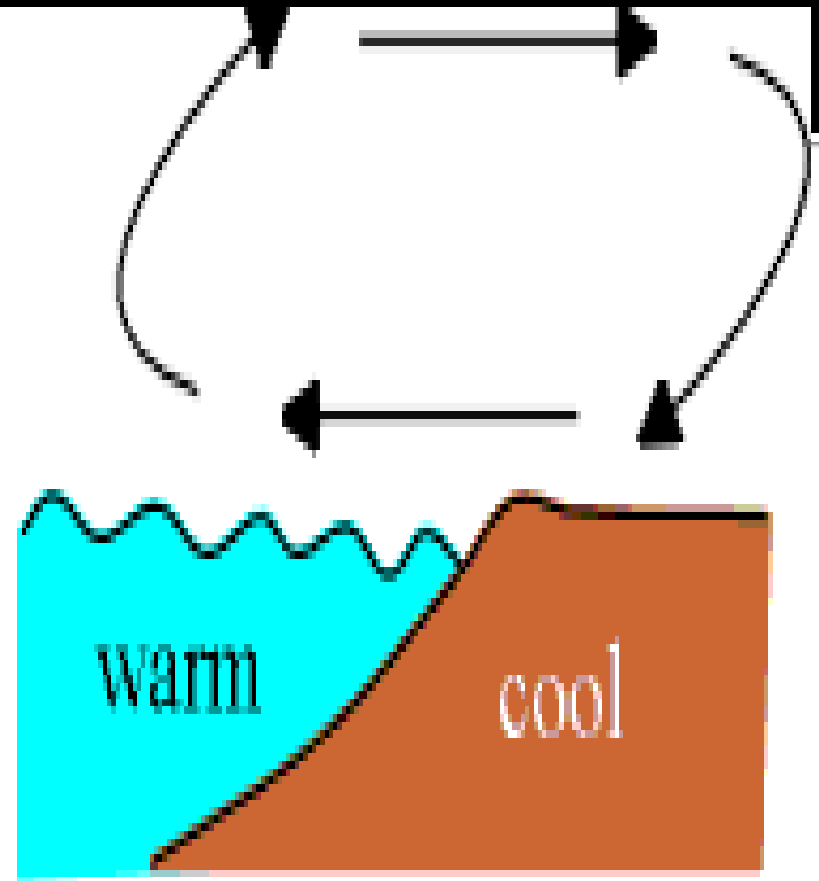
Sea Breezes

In the day time the land heats much faster than the water, so the air over the land heats and rises. (convection currents)

- The rising air over the land creates a relatively low pressure while the air pressure over the water/sea is relatively high;
- **Wind blows from the high pressure over the sea to the low pressure over the land.**
- Hence the name '**sea breeze**'—the wind is **blowing off the sea.**
- Remember—winds are named for where they come from; Easterly winds come out of the east; southerly winds come out of the south; sea breezes come from the sea.



Day - Sea breeze



Night - Land breeze

Types of Rain

- In this lesson you will:
 - 2.3.6 Define the terms windward, leeward, and rain shadow. (k)
 - 2.3.8 Explain how wind systems and precipitation are related. (k)

What is precipitation?

- **WHAT: Precipitation** is any type of moisture which falls to the earth. This includes rain, snow, hail and sleet.
- **HOW:**
 - 1) Precipitation occurs **when water vapour cools**.
 - 2) When the air reaches **saturation point** the water vapour condenses and forms tiny droplets of water.
 - 3) These tiny droplets of water form **clouds**.

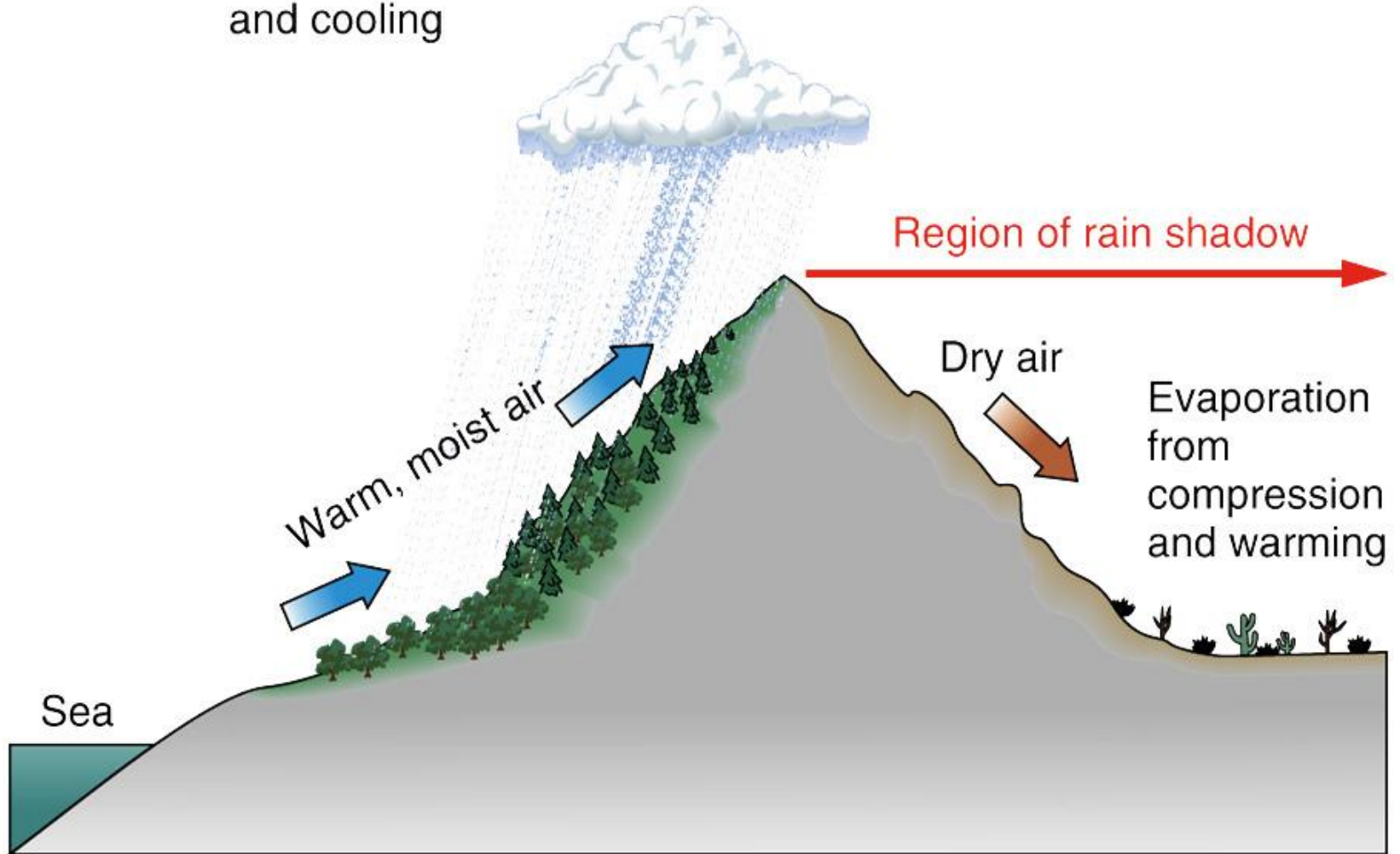
Types of Rain

- **Relief Rainfall**
- **Frontal Rainfall**
- **Convectional Rainfall**

Relief Rainfall

1. Moist air blows off the sea
 2. it is forced up by mountains (high **relief**)
 3. air cools as it rises
 4. cool air holds less moisture
 5. clouds condense and rain falls
- Most rain falls on the **windward side** of a mountain
 - The **leeward side** is often in a dry **rain shadow** because the moisture has all been lost.
 - [Video explanation](#)

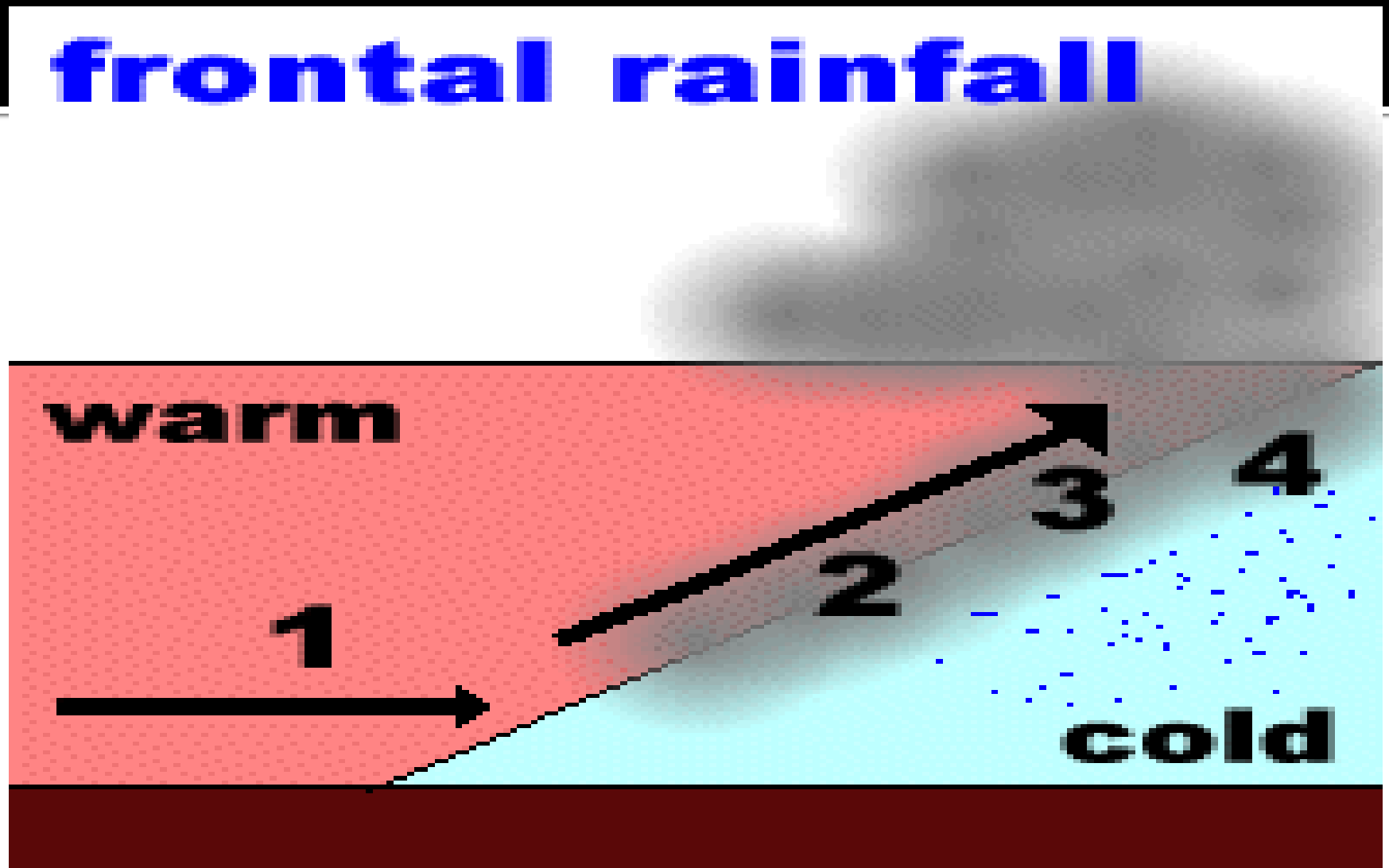
Rain from expansion
and cooling



Frontal Rainfall

1. Warm moist air meets cold air
 2. Warm air is forced up over the cooler, more dense air.
 3. Warm air cools as it rises. Then it condenses and rain falls.
- [Video explanation](#)

frontal rainfall

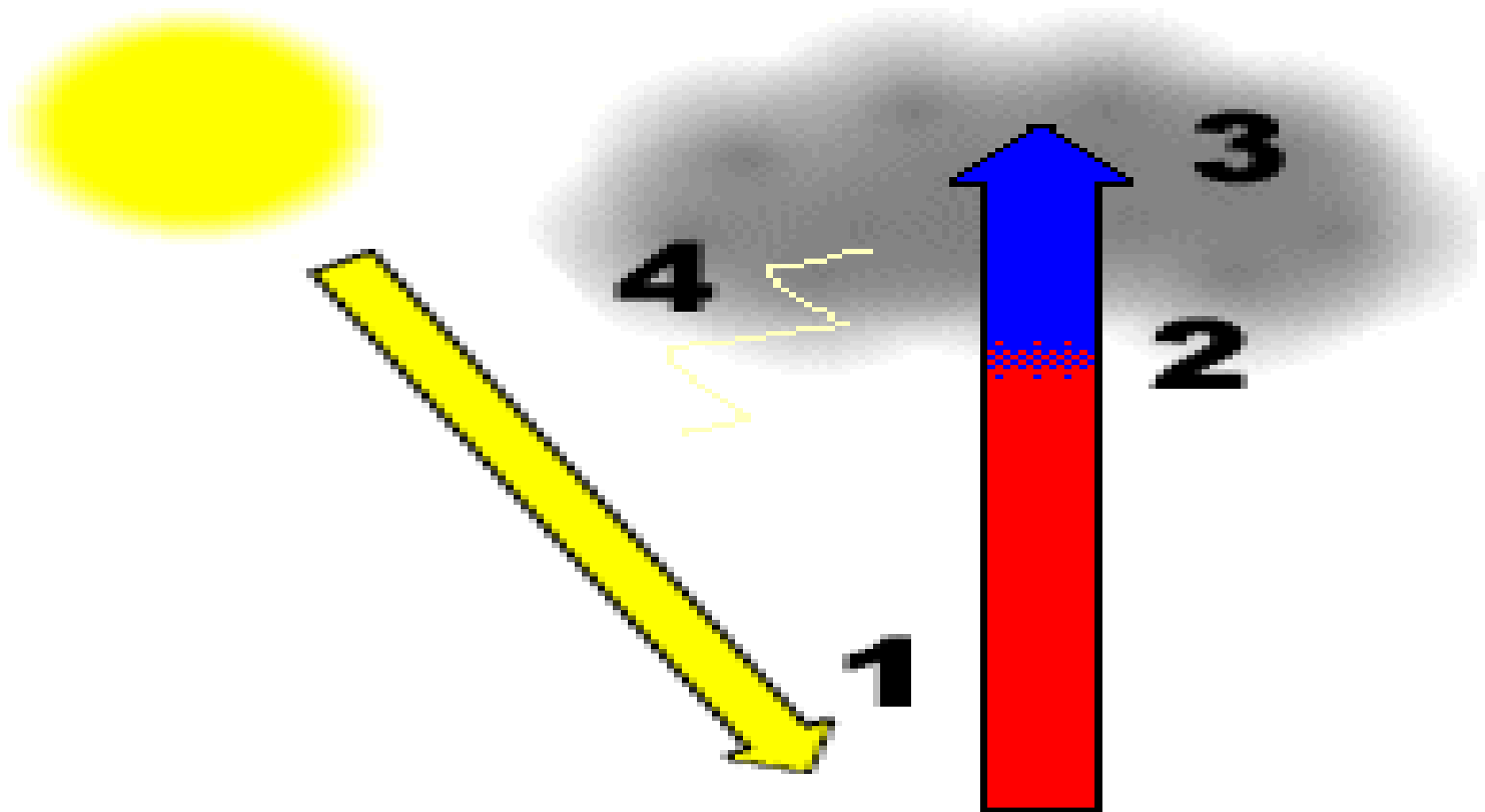


Convictional Rainfall

- Usually happens in hot areas like tropics or places away from the ocean:
 1. The sun heats the earth and the air above it.
 2. Hot air rises and takes moisture with it.
 3. The warm air cools, condenses and rain falls back down to Earth.

[Video explanation](#)

Convective Rainfall



Wind & Climate

- In this lesson you will:
 - 2.3.5 Explain how wind systems and temperature are related. (k)

Wind & Precipitation

- Prevailing winds affect precipitation. If:
 - (a) The prevailing **winds blow off the ocean** and onto the land...**higher precipitation** (warm currents help)
 - (b) The **winds are blowing off the land**, then the air will be drier...this means **lower precipitation.**

Wind & Temperature

- Prevailing winds affect temperature:

Ex. 1: Some prevailing winds bring warm air from the south toward the north, like the **westerly winds**.

Ex. 2: Some winds, like the **north polar easterlies**, bring cold air from the north toward the south.

Wind & Temperature

- The seasons affect wind temperatures too:
 - (a) Land heats up quicker than water. So in summer, wind blowing over the land will carry warm air around.
 - (b) Land also cools off quicker than water. So in winter, wind blowing over the land will lose heat and spread colder air around.