

From pressure and uplift to rainfall

How solar heating, convergence and terrain drive the precipitation cycle

• Atmospheric moisture and rain cycle

01 1 · Heating and moisture

- Solar heating warms land and water, driving evaporation and adding water vapour.
- Near the Equator, trade winds converge in the low-pressure ITCZ, called the doldrums.
- Calm or light variable surface winds accompany strong upward air currents.

02 2 · Air rises

- Convectonal uplift: intense surface heating makes warm, moist air parcels buoyant.
- Orographic (relief) uplift: moist winds are forced up windward mountain slopes.
- Frontal or cyclonic uplift: warmer air rises over cooler, denser air masses.

03 3 · Cooling and precipitation

- Rising air expands in lower pressure and cools adiabatically with altitude.
- Cooling to the dew point condenses vapour onto nuclei, forming clouds.
- Large water drops or ice particles eventually fall as precipitation.

04 4 · Descent and water return

- After crossing a ridge, air descends the leeward slope, compresses and warms.
- Descending air warms and its relative humidity falls, favouring a leeward rain shadow.
- Runoff returns water to water bodies; evaporation supplies atmospheric moisture again.

REMEMBER Moist air must rise and cool: mountain uplift produces orographic rain, often with a leeward rain shadow.