

1 | Hydrology and fluvial geomorphology

Drainage Basin: Area drained by a river and its tributaries, also known as a river catchment.

Watershed: Boundary dividing one drainage basin from another, usually a ridge of high land.

Input: Addition of water into the drainage basin system, primarily precipitation.

Precipitation: Water falling to the ground in various forms (rain, snow, sleet, hail).

Output: Water leaving the drainage basin system (evaporation, river discharge into the sea).

Store: Water held in soil, vegetation, groundwater, or surface water (e.g., lakes, reservoirs).

Transfer: Movement of water within the system (e.g., throughflow, infiltration, surface runoff).

Infiltration: Water entering the soil from the surface.

Percolation: Downward movement of water through soil and rock layers.

Throughflow: Water moving laterally downslope through soil.

Baseflow: Groundwater flow feeding into rivers.

Overland Flow: Water flowing over the land surface when the soil's infiltration capacity is exceeded.

Interception: Water captured by vegetation before reaching the ground.

Water Table: The upper level of saturated soil or rock.

Groundwater: Water stored below the water table in permeable rock.

Rainfall Intensity: The rate at which rain falls (measured in mm/hour).

Discharge: Volume of water flowing through a river channel (measured in cumecs).

Hydrograph: Graph showing how a river's discharge responds to rainfall over time.

Rising Limb: Increasing discharge following rainfall on a hydrograph.

Peak Discharge: Maximum river flow during a rainfall event.

Lag Time: Time delay between peak rainfall and peak discharge.

Falling Limb: Decline in river discharge after peak flow.

Flashy Hydrograph: Hydrograph with short lag time, steep rising limb, and high peak discharge.

Permeability: Ability of soil/rock to allow water movement.

Antecedent Conditions: Soil moisture levels before a rainfall event.

Drainage Density: Length of streams per unit area in a basin.

Erosion: Processes wearing away the riverbed/banks:

Hydraulic Action: Water pressure breaking rock particles.

Abrasion: Rocks scraping the riverbed/banks.

Attrition: Rocks colliding and breaking into smaller pieces.

Solution (Corrosion): Dissolving of soluble minerals by water.

Transportation: Movement of materials within the river:

Traction: Rolling of large boulders along the riverbed.

Saltation: Bouncing of small stones along the riverbed.

Suspension: Fine sediment carried in the water.

Solution: Dissolved materials transported in water.

Deposition: Dropping of sediment when the river loses energy.

Hjulström Curve: Graph showing relationship between velocity and sediment movement (erosion, transport, deposition).

River Capacity: Total amount of load a river can carry.

River Competence: Largest particle size a river can transport.

Thalweg: Line of fastest flow within a river channel.

Deforestation: Removal of trees reducing interception, increasing surface runoff.
Urbanisation: Growth of impermeable surfaces causing higher runoff and flooding.
Channelisation: Modification of rivers to prevent flooding or improve navigation.
Dams/Reservoirs: Structures controlling water flow and storing water.
Agriculture: Activities like irrigation, drainage, and ploughing affecting water flow.
Abstraction: Removal of groundwater or river water for human use, potentially reducing flow.
Floodplain Encroachment: Human development on flood-prone areas increasing risks.
Climate Change: Alterations in precipitation patterns and extreme weather affecting river regimes.

2 | Atmosphere and Weather

Insolation: The amount of incoming solar radiation (heat energy from the sun) that reaches the Earth's surface as short-wave radiation.
Longwave radiation: Radiation of energy from the Earth (a cold body) into the atmosphere, & eventually, some of it into space.
Short-wave radiation: Also known as ultraviolet radiation, it is radiation from a very hot body, such as the sun. It travels in very short wavelengths.
Reflected solar radiation: The energy from the sun that is not absorbed by surfaces & is reflected back.
Surface absorption: When solar energy reaches the Earth's surface, it heats up the ground.
Subsurface absorption: The heat transferred to soil & bedrock during the day, released back to the surface at night.
Albedo: The proportion of energy that is reflected back into the atmosphere, represented as a percentage.
Sensible heat transfer: Heat exchanged by conduction or convection between warmer & cooler bodies.
Latent heat: The heat energy required to change a substance from a liquid to a gas.
Evaporation: The change of state of water to gas by the addition of heat.
Condensation: The change of state from water vapor to liquid due to cooling.
Sublimation: The process of changing from a gas to a solid or a solid to a gas without passing through the liquid phase.
Convection: The upward movement of air caused by surface heating, making air less dense.
Insulation: The act of covering something to prevent heat loss or entry, often in the form of clouds maintaining overnight temperatures near the ground.
Climate Change: A long-term change in the average weather patterns that define Earth's local, regional, & global climates.
Global Warming: The long-term heating of Earth's climate system observed since the pre-industrial period, primarily due to human activities like fossil fuel burning, increasing heat-trapping greenhouse gases in the atmosphere.
Humidity: The amount of water vapor in the air, expressed as a percentage of the maximum amount air can hold at a given temperature (relative humidity).
Saturation: The point at which air cannot hold any more water vapor at its current temperature & pressure, leading to condensation.
Dew Point: The temperature at which air becomes saturated, & condensation begins, forming dew.
Precipitation: Any form of water, liquid or solid, that falls from clouds & reaches the ground (e.g., rain, snow, sleet, hail).
Cloud formation: Clouds form when air containing water vapor rises, cools to its dew point, & condenses

around condensation nuclei.

Condensation nuclei: Tiny particles like dust or salt in the atmosphere around which water vapor condenses to form cloud droplets.

Convectional rainfall: Rainfall caused by warm air rising due to surface heating, leading to cooling, condensation, & precipitation.

Frontal rainfall: Rainfall occurring when a warm air mass meets a cold air mass, causing the warm air to rise, cool, & condense, resulting in precipitation.

Orographic (relief) rainfall: Rainfall produced when moist air is lifted over a mountain range. As the air rises, it cools, condenses, & forms precipitation.

Environmental Lapse Rate (ELR): The rate at which air temperature decreases with altitude, typically around 6.5°C per kilometer.

Dry Adiabatic Lapse Rate (DALR): Rate at which dry air cools as it rises or warms as it descends, $\sim 10^{\circ}\text{C}$ per kilometer.

Saturated Adiabatic Lapse Rate (SALR): The rate at which saturated air cools as it rises, less than the DALR ($\sim 5\text{--}9^{\circ}\text{C}$ per kilometer) due to latent heat release during condensation.

Stable air: When the environmental lapse rate is less than the DALR & SALR, preventing air from rising & resulting in clear weather.

Unstable air: When the environmental lapse rate is greater than the DALR, allowing air to rise, forming clouds & potentially causing thunderstorms.

Urban Heat Island (UHI): A localized microclimate where urban areas are warmer than surrounding rural areas due to human activities, concrete surfaces, & reduced vegetation.

Shelterbelts: Areas of vegetation, reduce wind speed, stabilise soil, & influence microclimates in agricultural regions.

Energy Budget: The balance between incoming solar radiation & outgoing terrestrial radiation, determining the Earth's temperature & climate.

Solar Radiation: Energy emitted by the sun, primarily in short-wave radiation, driving weather & climate systems.

Greenhouse Effect: The process by which certain gases trap heat in the atmosphere, warming the Earth.

Net Radiation: The difference between incoming solar radiation & outgoing longwave radiation, indicating the energy available for heating the Earth's surface.

Latent Heat Flux: The transfer of heat energy via phase changes of water, such as evaporation & condensation, playing a key role in weather processes.

Sensible Heat Flux: Heat transferred between the Earth's surface & the atmosphere that can be sensed or measured, affecting local temperatures.

Conduction: Heat transfer through a substance without its movement, significant in the exchange of heat between the Earth's surface & the air above.

Radiation Balance: The equilibrium between incoming & outgoing radiation, influencing temperature & climate over time.

Tropical Climate: A climate with high temperatures & rainfall, influenced by high solar insolation.

Polar Climate: A climate with low temperatures & limited sunlight, affecting the energy budget & heat distribution.

Local Energy Budget: The balance of incoming & outgoing energy in a specific area, affecting local climate.

Insolation: Solar radiation received by the Earth's surface, measured in watts per square meter.

Albedo: The percentage of solar energy reflected back into space, with surfaces of higher albedo reflecting more.

Convection: Heat transfer via fluid movement (liquid or gas), critical for atmospheric heat distribution.

Latent Heat: Heat involved in water's phase changes, influencing local energy budgets.

Evapotranspiration: Combined evaporation & plant transpiration from land to the atmosphere, impacting local climates.

Surface Absorption: Solar energy absorbed by the Earth's surface, warming it & influencing local temperature.

Heat Island Effect: Phenomenon where urban areas are warmer than rural surroundings due to human activities.

Microclimates: Localized climate conditions differing from surrounding areas due to topography, vegetation, & human activities.

Thermal Inertia: A material's resistance to temperature changes, affecting surface heating or cooling rates.

Here are concise keywords for 2.1 Local Energy Budgets in CAIE AS Geography 9696:

Daytime Energy Budget: Processes operating during daylight hours, including insolation, reflection, absorption, & transfer of heat.

Nighttime Energy Budget: Processes occurring after sunset, involving longwave radiation loss, cooling, & condensation.

Solar Angle: The height of the sun in the sky, affecting the intensity of insolation.

Seasonality: Variation in insolation due to Earth's tilt & orbit, influencing energy budgets.

Ground Heat: Heat transferred between the ground surface & subsoil, influencing daytime & nighttime temperatures.

Net Radiation Balance: Difference between incoming solar & outgoing terrestrial radiation, crucial for temperature changes.

Diurnal Temperature Range: The difference between the highest & lowest temperatures in a 24-hour period.

Atmospheric Obstructions: Clouds, aerosols, & pollutants affecting the energy budget by scattering or absorbing radiation.

Urban vs. Rural Budget: Differences in energy processes due to surface characteristics like concrete versus vegetation.

Latitudinal Variation: Differences in energy budgets between equatorial, temperate, & polar regions.

Cloud Cover Impact: Influence of clouds on reducing insolation during the day & trapping heat at night.

Surface Conductivity: Ability of surfaces to absorb & transfer heat, affecting energy exchange.

Albedo Variation: Changes in reflectivity based on surface type (e.g., water, forest, ice).

Wind Influence: Movement of air redistributing heat & impacting local energy exchanges.

Temperature Inversions: Occurrence of warmer air trapping cooler air below, altering the nighttime energy budget.

3 | Rocks and weathering

Lithosphere: The rigid outer layer of the Earth, including the crust and upper mantle.

Asthenosphere: The semi-molten layer beneath the lithosphere that allows plate movement.

Plate Tectonics: The theory explaining the movement of Earth's plates and associated phenomena.

Divergent Boundary: Where plates move apart, forming features like mid-ocean ridges.

Convergent Boundary: Where plates move toward each other, causing subduction or mountain building.

Transform Boundary: Where plates slide past each other, leading to earthquakes (e.g., San Andreas Fault).

Subduction Zone: Area where one plate sinks beneath another, forming trenches and volcanic arcs.

Mantle Convection: Movement in the mantle driving plate motion.

Sea-Floor Spreading: Creation of new oceanic crust at mid-ocean ridges.

Continental Drift: Early hypothesis by Alfred Wegener proposing continents were once joined.

Hot Spots: Volcanically active areas not associated with plate boundaries (e.g., Hawaii).

Weathering: Breakdown of rocks in situ by physical, chemical, or biological processes.

Physical Weathering: Mechanical breakdown of rocks without altering their composition.

Freeze-Thaw: Water freezing in cracks, expanding, and breaking rocks.

Exfoliation: Layers peeling off due to temperature fluctuations.

Salt Crystallisation: Salt growth in pores causing rock disintegration.

Chemical Weathering: Decomposition of rocks by chemical reactions.

Carbonation: Reaction of carbon dioxide in rainwater with calcium carbonate in limestone.

Hydrolysis: Reaction of water with minerals forming clay.

Oxidation: Reaction of oxygen with minerals like iron, causing rusting.

Biological Weathering: Breakdown of rocks by living organisms (e.g., roots, burrowing).

Igneous Rocks: Formed by cooling and solidification of magma/lava (e.g., basalt, granite).

Sedimentary Rocks: Formed by deposition and compaction of sediments (e.g., limestone, sandstone).

Metamorphic Rocks: Formed by heat and pressure altering existing rocks (e.g., marble, schist).

Mass Movement: Movement of soil, rock, and debris downslope under gravity.

Soil Creep: Slow movement of soil down gentle slopes.

Slumping: Rotational movement of material on a curved slip plane.

Landslides: Rapid movement of rock and debris down steep slopes.

Rockfall: Free fall of rock from cliffs or steep slopes.

Flows: Saturated material moving rapidly downslope (e.g., mudflows, debris flows).

Shear Strength: Resistance of slope material to movement.

Shear Stress: Forces causing materials to move downslope.

Slope Stability: Balance between shear stress and shear strength.

Angle of Repose: Maximum slope angle at which material remains stable.

Deforestation: Removal of vegetation increasing erosion and slope instability.

Urbanisation: Building on slopes altering stability and increasing runoff.

Agriculture: Practices like overgrazing and ploughing destabilising slopes.

Mining and Quarrying: Excavation weakening slope structures.

Slope Management: Techniques like terracing, retaining walls, and drainage to reduce risks.

Road Construction: Cutting into slopes increases risk of landslides.

Afforestation: Planting trees to stabilise slopes and reduce erosion.