

3.1.1 Water and carbon cycles

This section of our specification focuses on the major stores of water and carbon at or near the Earth's surface and the dynamic cyclical relationships associated with them. These are major elements in the natural environment and understanding them is fundamental to many aspects of physical geography.

This section specifies a systems approach to the study of water and carbon cycles. The content invites students to contemplate the magnitude and significance of the cycles at a variety of scales, their relevance to wider geography and their central importance for human populations. The section offers the opportunity to exercise and develop geographical skills including observation, measurement and geospatial mapping skills, together with data manipulation and statistical skills including those associated with and arising from fieldwork.

3.1.1.1 Water and carbon cycles as natural systems

Systems in physical geography: systems concepts and their application to the water and carbon cycles inputs – outputs, energy, stores/components, flows/transfers, positive/negative feedback, dynamic equilibrium.

3.1.1.2 The water cycle

Global distribution and size of major stores of water – lithosphere, hydrosphere, cryosphere and atmosphere.

Processes driving change in the magnitude of these stores over time and space, including flows and transfers: evaporation, condensation, cloud formation, causes of precipitation and cryospheric processes at hill slope, drainage basin and global scales with reference to varying timescales involved.

Drainage basins as open systems – inputs and outputs, to include precipitation, evapo- transpiration and runoff; stores and flows, to include interception, surface, soil water, groundwater and channel storage; stemflow, infiltration overland flow, and channel flow. Concept of water balance.

Runoff variation and the flood hydrograph.

Changes in the water cycle over time to include natural variation including storm events, seasonal changes and human impact including farming practices, land use change and water abstraction.

3.1.1.3 The carbon cycle

Global distribution, and size of major stores of carbon – lithosphere, hydrosphere, cryosphere biosphere, atmosphere.

Factors driving change in the magnitude of these stores over time and space, including flows and transfers at plant, sere and continental scales. Photosynthesis, respiration, decomposition, combustion, carbon sequestration in oceans and sediments, weathering.

Changes in the carbon cycle over time, to include natural variation (including wild fires, volcanic activity) and human impact (including hydrocarbon fuel extraction and burning, farming practices, deforestation, land use changes).

The carbon budget and the impact of the carbon cycle upon land, ocean and atmosphere, including global climate.

3.1.1.4 Water, carbon, climate and life on Earth

The key role of the carbon and water stores and cycles in supporting life on Earth with particular reference to climate. The relationship between the water cycle and carbon cycle in the atmosphere. The role of feedbacks within and between cycles and their link to climate change and implications for life on Earth.

Human interventions in the carbon cycle designed to influence carbon transfers and mitigate the impacts of climate change.

3.1.1.5 Quantitative and qualitative skills

Students must engage with a range of quantitative and relevant qualitative skills, within the theme water and carbon cycles. Students must specifically understand simple mass balance, unit conversions and the analysis and presentation of field data.

3.1.1.6 Case studies

Case study of a tropical rainforest setting to illustrate and analyse key themes in water and carbon cycles and their relationship to environmental change and human activity.

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Case study of a river catchment(s) at a local scale to illustrate and analyse the key themes above, engage with field data and consider the impact of precipitation upon drainage basin stores and transfers and implications for sustainable water supply and/or flooding.