

Scheme of work

Physical geography: Glacial systems and landscapes

This resource is a scheme of work for our accredited AS and A-level Geography specifications (7036, 7037). It is not exhaustive or prescriptive, it is designed to suggest activities and resources that you might find useful in your teaching.

**3.1 Physical geography**

Core topic

3.1.4 Glacial systems and landscapes

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| **Specification content**  **Week Number** | **Subject-specific skills development** | **Learning outcomes** | **Suggested learning activities (including ref to differentiation and extension activities)** | **Resources** |
| **Week 1**  **Systems in physical geography**  (If students have already studied the unit on Water and Carbon cycles, then they should revisit the introductory section of that unit on “Systems in Physical Geography”. Then return to the end of this section to introduce “Glaciers as natural systems”. If this is the first physical geography element studied, then complete an introductory lesson covering the “systems in physical geography” material outlined in this section)   * Systems in physical geography: Systems concepts and their application to the development of glaciated landscapes – inputs, outputs, energy, stores/components, flows/transfers, positive/negative feedback, dynamic equilibrium. * The concepts of landform and landscape and how related landforms combine to form characteristic landscapes. | Use of key subject specific and technical terminology.  To identify **connections** and interrelationships between different aspects of geography.  Constructing and using systems and models.  Labelling and annotation of diagrams.  Develop an understanding of the concept of ‘landscape’ as a combination of related landforms. | An overview of the concept and use of '**models**' by geographers as simplifications of a complex world.  Understanding of the concept of '**systems frameworks**' as a type of model fundamental to most areas of geographical understanding.  Students will be able to identify, describe and explain the elements of geographical systems, including:   * Stores/Components * Flows/Connections * Elements * Attributes * Relationships   Students will be able to identify, describe and explain common characteristics of systems including:   * Boundaries * Inputs * Outputs * Flows   Students will understand systems that are classified as:   * Isolated systems * Closed systems * Open systems   Students will understand systems as being in a state of dynamic equilibrium that includes:   * Positive feedback * Negative feedback   Students will be able to identify the four major subsystems of the earth:   * Atmosphere * Lithosphere * Hydrosphere * Biosphere   To understand that these are interlinked as a ‘cascading system’.  **Glaciers as natural systems**  Students will be able to identify glaciers as open systems in glacial environments.  Students will be able to identify the different elements of a glacial system, including:   * Inputs * Components/stores * Transfers/flows * Outputs   Students will be able to understand glacial (cold) landscapes as being in dynamic equilibrium that includes:   * Positive feedback * Negative feedback   **Glaciated (cold) environments as characteristic landscapes**  Students will all understand the concepts of:   * Landform * Landscape   Students will appreciate that characteristic glaciated (cold) landscapes are the combination of related landforms. | Small group discussions followed by feedback - what models used in geography do students know?  Students to draw and annotate a model system to show the key elements of a system.  Students to draw and annotate a diagram of an example of a positive feedback system and a negative feedback system.  Repeat group discussion to now think of any more examples of systems in geography.  Students to work in pairs/small groups to think of ways in which the 4 ‘spheres’ are interlinked, then feedback and share ideas.  Opportunity here for a short research task for interconnections.  Practice low-tariff exam questions to assess learning – peer assessment opportunity.  Small group discussion/Q&A to understand glaciers as open systems.  Construct and annotate a diagram to illustrate various elements of a glacier as an open system.  Paired/small group task to identify examples of positive and negative feedback in glacial landscapes.  Students draw and annotate a diagram of an example of a positive or negative feedback in a glacial landscape.  Once all students have illustrated one example of feedback in a cold environment, there is the opportunity for individuals/small groups to research for others.  Small group discussion to identify prior knowledge of glacial landforms.  Discuss what represents a characteristic glaciated landscape.  (Specific landforms and landscapes are studied in detail later). | [Introductory presentation on Natural Systems](https://prezi.com/waun8urselvh/water-and-carbon-cycles-as-natural-systems/)  [Simple summaries of a number of earth systems](https://eo.ucar.edu/kids/green/cycles1.htm)  [A summary of the features of the lithosphere](http://nationalgeographic.org/encyclopedia/lithosphere/)  [A summary of the features of the hydrosphere](http://nationalgeographic.org/encyclopedia/hydrosphere/)  [A summary of the features of the cryosphere](http://oceanservice.noaa.gov/facts/cryosphere.html)  [More information on the cryosphere](https://nsidc.org/cryosphere/)  [A summary of the features of the atmosphere](http://nationalgeographic.org/encyclopedia/atmosphere/)  [Online lesson activity investigating connections in the atmosphere](http://authoring.concord.org/sequences/47/activities/279?show_index=true)  There are various resources on glaciers as systems available online, such as [AceGeography information on glacial budgets](http://www.acegeography.com/glacial-budgets.html)  Example of a positive feedback system in a cold environment, such as [the ice-albedo feedback](http://www.ncdc.noaa.gov/paleo/abrupt/story2.html) which is also explained in this [short video](https://www.youtube.com/watch?v=5rqREjFaRho)  [Imagery of glaciers and glacial landscapes](http://www.swisseduc.ch/glaciers/)  [Explanations and images of different glacial landforms](http://nsidc.org/cryosphere/glaciers/gallery/grooves.html) |
| **Week 1-2**  **The nature and distribution of cold environments**   * The global distribution of cold environments. * Physical characteristics of cold environments: climate, soils and vegetation (and their interaction) * The global distribution of past and present cold environments (polar, alpine, glacial and periglacial) and of areas affected by the Pleistocene glaciations. | Use of key subject specific and technical terminology.  Opportunities to develop skills such as drawing, labelling and annotating diagrams.  Opportunities to engage with a range of maps.  Develop an understanding of change through geological time scales.  Handling primary and secondary sources of data.  Online research.  Opportunity to use a range of sources of information to research the impacts of historical climate changes on the distribution of types of cold environments.  Develop understanding of the concept of ‘landscape’ as a combination of related landforms. | Students will be able to describe and explain the past and present distribution of cold environments, including:   * Polar environments * Alpine environments * Glacial environments * Periglacial environments   Students will understand the idea of advancing and retreating ice during the Pleistocene glaciations and be able to describe the areas affected.  Students will be able to describe and analyse the interactions between the various characteristics of cold environments, including:   * Climate * Soils * Vegetation | Q&A/discussion – where are cold environments located?  Draw and annotate world map to identify present day distribution of different cold environments and produce accompanying notes to explain this distribution.  Research the occurrence and extent of glacial advances and retreats during the Pleistocene glaciations.  Students draw and annotate a map of northern Europe to show the extent of glacial ice at the last glacial maximum and highlight the extent of retreat during the last ca. 10,000 years.  Students to research the physical characteristics of cold environments. Resources here focus on polar and tundra landscapes. Students produce a table including information on:   * climate, soils, vegetation.   Followed by exam style questions to assess how these interact. | [Information sheet on the global distribution of cold environments](http://d1n7iqsz6ob2ad.cloudfront.net/document/pdf/55924a0e02737.pdf)  National Snow & Ice Data Center: [Where are glaciers located?](http://nsidc.org/cryosphere/glaciers/questions/located.html)  The RGS has provided some [simple lesson resources on the location of cold environments](http://www.rgs.org/OurWork/Schools/Teaching+resources/Key+Stage+3+resources/Glaciation+and+geological+timescales/An+icy+world+-+glaciers+and+glacial+environments.htm)  [Background information on the Pleistocene glaciations](http://paleobiology.si.edu/geotime/main/htmlversion/pleistocene1.html)  Overview of [The Pleistocene – Age of Ice](http://www.atmo.arizona.edu/students/courselinks/fall12/atmo336/lectures/sec5/pleistocene.html)  BBC Nature [information on the Pleistocene epoch](http://www.bbc.co.uk/nature/history_of_the_earth/Pleistocene)  [45 minute documentary on Earth’s Ice Age](https://www.youtube.com/watch?v=1nSIj9tvhbY)  Geographical Association [information sheet on the characteristics of polar environments](http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwi3nc782o7MAhXG6Q4KHfiLCzoQFggoMAA&url=http%3A%2F%2Fwww.geography.org.uk%2Fdownload%2FGA_EYPSq2Polar.pdf&usg=AFQjCNEvjU-6zEUPea6fRcVIYewdTEGszg)  IPCC information on [distinctive characteristics of polar regions](http://www.ipcc.ch/ipccreports/tar/wg2/index.php?idp=596)  [Introduction to tundra (periglacial) environments](http://www.antarcticglaciers.org/glacial-geology/glacial-landforms/antarctic-periglacial-environments/)  Information and diagrams of [periglacial processes](http://www.physicalgeography.net/fundamentals/10ag.html)  [Information on the tundra biome](http://www.ucmp.berkeley.edu/exhibits/biomes/tundra.php)  National Geographic [information on the tundra](http://environment.nationalgeographic.com/environment/habitats/tundra-profile/) |
| **Week 3**  **Systems and processes**   * Glacial systems including budgets. * Ablation and accumulation – historical patterns of ice advance ad retreat. * Warm and cold based glaciers: characteristics and development. * Geomorphological processes – weathering: frost action, nivation; ice movement: internal deformation, rotational, compressional, extensional and basal sliding; erosion: plucking, abrasion; transportation and deposition. * Fluvioglacial processes: meltwater, erosion, transport and deposition. * Periglacial features and processes: permafrost, active layer and mass movement. | Constructing and interpreting a range of graphical and statistical techniques – including climate graphs.  Opportunity to apply systems theory to identify the inputs, processes, and outputs operating in glacial landscapes.  Opportunities to develop skills such as drawing, labelling and annotating diagrams.  Opportunity to conduct fieldwork to investigate glacial processes in the field.  Handling primary and secondary sources of data.  Online research.  Constructing, interpreting, analyzing and drawing conclusions about a range of graphical and statistical techniques.  Using a range of maps to identify glacial features/processes.  Opportunity to apply systems theory to identify the inputs, processes and outputs operating in glacial landscapes. | Students will be able to identify glaciers as open systems in glaciated landscapes.  Students will be able to identify the different elements of a glacial system, including:   * Inputs * Components/stores * Transfers/flows * Outputs   Students will understand the role of ablation and accumulation in glacial budgets and how this relates to glacial advance and retreat.  Students will understand that most glaciers have experienced patterns of advance and retreat in the past linked to the Pleistocene glaciations (with an illustrative example).  Students will understand and be able to assess the role of a range of processes associated with glaciers. Including:   * Weathering * frost action, nivation * Ice movement * Internal deformation, rotational, compressional, extensional and basal sliding * Erosion * Plucking, abrasion * Transport * Deposition.   Students will understand and be able to assess the role of fluvioglacial processes. Including:   * Meltwater * Erosion * Transport * Deposition.   Students will be able to describe and explain periglacial features and processes, including:   * Permafrost * Active layer * Mass movement. | Q&A/paired discussion to identify what is meant by a glacial system and budget – can they identify the elements of a glacial budget?  Students draw an annotated diagram of a glacier system and plot line graphs to show understanding of glacial budget.  Following the above, use models online to understand the idea of ablation and accumulation, and how they relate to advance and retreat – opportunity for peer assessment of levels marked exam question to show understanding.  Study a glacier, or glaciers, that have good evidence of advance and retreat. Create sketch maps of various snout positions (one that has *recently* advanced and one that has *recently* retreated) and add annotation to suggest reasons for the advance and retreat. On a larger scale, and longer time scale, annotate an outline map of Europe to show the extent of ice cover during and since the last glacial maximum ca. 18,000 years ago.  Paired research of warm and cold based glaciers, then share findings.  Approach to glacial, fluvioglacial and periglacial processes may vary depending on prior knowledge as some may have done this well-rehearsed material at GCSE. For each process listed, students should use a range of resources (textbooks, VLE, internet, video, etc) to produce a revision card/sheet including:   * Definition * Description of the process * Explanation of how the process shapes the landscape, or operates * Annotated diagram where appropriate   These could be shared between groups, or a display of the best created, or some may produce electronic resources to share via VLE. | Information and diagrams of [glaciers as systems and glacial budgets](http://www.physicalgeography.net/fundamentals/10ae.html)  [Introduction to Glacier Mass Balance with diagrams](http://www.antarcticglaciers.org/modern-glaciers/introduction-glacier-mass-balance/)  [Information and animated diagrams of glaciers](https://ees.as.uky.edu/sites/default/files/elearning/module13swf.swf)  World Meteorological Organization information on [retreating glacier Mer de Glace](http://globalcryospherewatch.org/cryonet/sitepage.php?surveyid=46)  [Effect of climate change on the Mont Blanc glacier](http://www.bloomberg.com/news/features/2015-09-25/climate-change-on-mont-blanc-the-vanishing-mer-de-glace)  [Photography of retreating modern glaciers](http://home.onemain.com/~home_range/doc_phot/1_case2.htm)  [Information on an advancing glacier: Hubbard Glacier, Alaska](http://pubs.usgs.gov/fs/fs-001-03/fs-001.03.pdf)  [NASA Earth Observatory aerial images of Hubbard Glacier](http://earthobservatory.nasa.gov/IOTD/view.php?id=85900)  Quite sophisticated [exploration of ‘warm and cold based glaciers’,](http://www.antarcticglaciers.org/modern-glaciers/glacial-processes/) using Antarctic examples  [Summary of classification of glaciers](http://geomorphology.org.uk/sites/default/files/intro_to_glaciers.pdf) with warm and cold based at the end, including clear temperature profiles  [Detailed presentation on processes of glacial erosion](https://web.viu.ca/earle/geol305/Processes%20of%20Glacial%20Erosion.pdf)  Summary of [processes in glacial environments](http://geomorphology.org.uk/edu-resources/processes-glacial-environments)    [Overview of glacial transport and deposition](https://www4.uwsp.edu/geo/faculty/lemke/geol370/lectures/08_transport_deposition.html)  [Detailed information on ice movement and glacier flow](http://geomorphology.org.uk/sites/default/files/ice_movement.pdf)  National Snow and Ice Data Center: [Why do glaciers move?](https://nsidc.org/cryosphere/glaciers/questions/move.html) (and much more about glaciers!)  [Background to fluvioglacial processes](https://www4.uwsp.edu/geo/faculty/lemke/geol370/lectures/06_meltwater_landforms.htm)  [Periglacial processes and landforms](http://www.physicalgeography.net/fundamentals/10ag.html)  [Short video on periglaciation](https://www.youtube.com/watch?v=RijScDMVQzQ) |
| **Week 4-5**  **Glaciated landscape development**  This content must include study of a variety of landscapes from beyond the United Kingdom (UK) but may also include UK examples.   * Origin and development of glaciated landscapes. * Erosional and depositional landforms: corries, arêtes, glacial troughs, hanging valleys, truncated spurs, roches moutonnées. Characteristic glaciated landscapes. * Origin and development of landforms and landscapes of glacial deposition: drumlins, erratics, moraines, till plains. Characteristic glaciated landscapes. * Fluvioglacial landforms of erosion and deposition: meltwater channels, kames, eskers, outwash plains. Characteristic fluvioglacial landscapes. * Periglacial landforms: patterned ground, ice wedges, pingos, blockfields, solifluction lobes, terracettes, thermokarst. Characteristic periglacial landscapes. * The relationship between process, time, landforms and landscapes in glaciated settings: characteristic glaciated and periglacial landscapes. | Use of key subject specific and technical terminology.  Develop knowledge and understanding of a range of related landforms that combine to form distinctive landscapes:   * Glaciated * Fluvioglacial * Periglacial   To identify connections and interrelationships between different aspects of geography.  Opportunity to conduct fieldwork to investigate glacial landforms and landscapes in the field.  Opportunity to present and analyse geographical data employing a variety of graphical techniques and descriptive statistics (see skills checklist).  Opportunity to apply systems theory to identify the inputs, processes and outputs operating in glacial landscapes.  To understand how processes operate over a range of timescales to create ever changing but distinctive landscapes.  Opportunity to construct arguments and explanations about the formation of glacial landforms and landscapes, coming to valid conclusions. | Students will revisit the idea of distinctive glaciated landscapes resulting from a combination of related landforms.  Students will be able to describe the characteristics and analyse the factors and processes in the development of landforms and characteristic landscapes of glacial erosion, including:   * Corries * Arêtes * Glacial troughs * Hanging valleys * Truncated spurs * Roches moutonnées.   Students will be able to describe the characteristics and analyse the factors and processes in the development of landforms and characteristic landscapes of glacial deposition, including:   * Drumlins * Erratics * Moraines * Till plains.   Students will be able to describe the characteristics and analyse the factors and processes in the development of landforms and characteristic landscapes of fluvioglacial erosion and deposition, including:   * Meltwater channels * Kames * Eskers * Outwash plains.   Students will be able to describe the characteristics and analyse the factors and processes in the development of periglacial landforms and characteristic periglacial landscapes, including:   * Patterned ground * Ice wedges * Pingos * Blockfields * Solifluction lobes, terracettes * Thermokarst.   Students will explore the relationship between process, time, landforms and landscapes in these cold environments. | Q&A/discussion to define “landforms” and “landscapes”  Q&A to establish that landscapes that are currently glaciated may once have been fluvial landscapes with different characteristics. Opportunity to draw a diagram of a *model* upland fluvial landscape compared to a *model* glaciated valley landscape (animations included may help).  Landforms are well rehearsed material with a wide range of resources available – opportunity for research task.  For each glacial erosional and depositional landform, fluvioglacial landform and periglacial landform listed in the specification use a range of resources to produce a revision card/sheet (or electronic resource), including:   * Annotated sketch/ diagram showing its characteristics * A flow diagram giving a sequenced explanation of formation – explaining processes in their development * Factors affecting their formation * Reference to inputs, processes and outputs within the landscape system it is a part * A named illustrative example (not developed case study) from a local UK area and one from beyond the UK * A summary of the timescales involved in the formation of the landforms.   To conclude each section of the landforms part of the specification identify an area dominated by each of the following and describe/assess how the individual landforms have combined to form the distinctive landscape:   * Characteristic landscape of glacial erosion * Characteristic landscape of glacial deposition * Characteristic fluvioglacial landscape   (There is an opportunity to investigate landforms/ landscapes in the field).  Opportunity to assess learning with a range of exam style questions. | [Animations of *model* landscapes being modified from fluvial to glaciated features](http://www.nature.com/nature/journal/v493/n7431/fig_tab/nature11786_SV4.html)  [Short video on glacial and periglacial landscape evolution](https://www.youtube.com/watch?v=U7IC-L2fq2o)  [Short video on glacial erosion](https://www.youtube.com/watch?v=D5uDaEpJHjE)  National Snow and Ice Data Center: [How do glaciers affect land?](https://nsidc.org/cryosphere/glaciers/questions/land.html) (mostly erosional)  [Details and diagrams showing the formation of corries](http://www.coolgeography.co.uk/A-level/AQA/Year%2012/Cold%20environs/Glacial%20Landforms/Landforms.htm)  RGS lesson ideas on [glaciation and geological timescales](http://www.rgs.org/OurWork/Schools/Teaching+resources/Key+Stage+3+resources/Glaciation+and+geological+timescales/How+glaciers+shape+the+land+and+what+they+leave+behind.htm)  Video on [landforms formed by glacial erosion,](https://www.youtube.com/watch?v=pDAjVbSLfoM) using images mainly from New Zealand  [Features of glacial deposition and depositional landforms](http://www.geography-site.co.uk/pages/physical/glaciers/deposit.html)  [Overview of the depositional features of glaciers](http://elearning.stkc.go.th/lms/html/earth_science/LOcanada3/307/1_en.htm)  [Interactive revision exercise on defining features of glacial deposition](http://www.brainrush.com/lesson/geo-formation-of-features-of-glacial-deposition)  [Short video on glacial depiction features](https://www.youtube.com/watch?v=lJ1Uj_Tr3Rg)  [Short video on kame and esker formation](https://www.youtube.com/watch?v=CVAPWfyoxK4)  Field Studies Council [ideas for fluvioglacial fieldwork](https://www.geography-fieldwork.org/ice/fluvioglacial.aspx)  Overview of [the glacial and fluvioglacial deposition in the Boyne Valley, Ireland](http://www.geocases1.co.uk/printable/Glacial%20and%20fluvoglacial%20deposits%20in%20the%20Boyne%20Valley%20Ireland.htm)  [Short video about outwash features](https://www.youtube.com/watch?v=RtZenG3dtj8)  [Notes on periglacial processes and features](http://uregina.ca/~sauchyn/geog323/periglacial.html)  [Periglacial features with examples from Antarctica](http://www.antarcticglaciers.org/glacial-geology/glacial-landforms/antarctic-periglacial-environments/)  [Brief video about pingos in Alaska national parks](https://www.youtube.com/watch?v=4_mVhXYc7W4)  [Video about permafrost patterns on the ground](https://www.youtube.com/watch?v=4j_n7QMKDYc)  [Presentation on periglacial features of Svalbard](http://www.uio.no/studier/emner/matnat/geofag/GEG2130/h10/undervisningsmateriale/20101117%20HHC%20GEG2130%20Svalbard%20Landforms.pdf) |
| **Week 5**  **Human impacts on cold environments**   * Concept of environmental fragility. Human impacts on fragile cold environments over time and at a variety of scales. Recent and prospective impact of climate change. Management of cold environments at present and in alternative possible futures. | Use of key subject specific and technical terminology – like “fragile environment”.  Possible opportunity to conduct fieldwork to investigate the impacts of people on cold environments and assess management approaches.  Online research.  Handling primary and secondary sources of information.  To use a range of GIS including climate change models and remotely sensed data.  Construct and interpret a range of graphical and statistical techniques. | Students will understand and be able to analyse the concept of “environmental fragility”.  Students will be able to categorise the impacts of humans in cold environments. These may include:   * Global warming * Pollution * Development of infrastructure * Economic activity * Introduction of alien/invasive species.   Students will understand that the way different groups of people have used/interacted with different cold environments has different levels of impact, in the context of:   * Different times – historically, present, future * Different cold environments * Different scales – local, regional, national, international.   Students will understand current and future issues relating to natural and enhanced climate change. In terms of:   * Causes – Natural Vs Human * Impacts – Observable, predicted and now occurring, predicted future change.   Students will understand that just as there are a variety of cold environments there is variety in the way they are managed. (Possible link here to the idea of ‘Global Commons’ and students could assess the present management of Antarctica).  Students will understand there are alternative viewpoints about future management strategies for cold environments; Antarctica could serve as an illustrative example. | Q&A/group discussion to establish understanding of “environmental fragility” and “fragile environments”.  Opportunity to research the human impacts in cold environments, followed by exercise to categorise such impacts.  Opportunity for a group research and presentation exercise. Each individual/ group has to research human impacts for a particular time and scale. Individuals report back. Impacts for different times and scales are collated.  Opportunity to practice extended prose exam questions to assess the changing nature of human impacts over time.  Q&A/discussion to assess understanding of the natural Vs human enhanced climate change.  Opportunity to research current observable impacts of climate change in cold environments, followed by research into predicted future impacts. Findings could be shared using a display or electronic presentation shared via a VLE.  For a chosen cold environment (possibly Antarctica) students to study resources about current and future management strategies. Followed by an exercise to assess the success or otherwise of such strategies.  Opportunity for Q&A/group discussion/role play/debate about the views of different stakeholders involved in the future management of cold environments.  Opportunity to use a range of styles and tariffs of exam style questions to assess learning. | [Collection of NASA resources relating to climate change](http://climate.nasa.gov/)  [Information on human use of cold environments](http://www.acegeography.com/human-uses.html)  [Overview of human impacts on Antarctica](http://www.coolantarctica.com/Antarctica%20fact%20file/science/human_impact_on_antarctica.php)  [Impacts of climate change in Antarctica](http://discoveringantarctica.org.uk/challenges/sustainability/impacts-of-climate-change/)  [Climate change and issues of sustainability in Antarctica](http://old.discoveringantarctica.org.uk/alevel_teachers_sustainability.html)  [Traditional uses of the Arctic with some lesson resources](http://www.econedlink.org/teacher-lesson/795/Traditional-Economies-Inuit)  [Impacts of climate change on levels of sea ice in the Arctic](http://www.climatehotmap.org/global-warming-effects/sea-ice.html)  [Climate change in the Arctic](https://nsidc.org/cryosphere/arctic-meteorology/climate_change.html)  [‘Managing for the Future’ report](http://www.afsc.noaa.gov/publications/misc_pdf/iamreport.pdf) on climate change in the Arctic  UNESCO report on [climate change and sustainable development in the Arctic](http://unesdoc.unesco.org/images/0018/001863/186364e.pdf)  [Why climate change affects the Arctic and Antarctic differently](http://www.livescience.com/40125-climate-change-affecting-arctic-antarctic-differently.html)  Antarctic and Southern Ocean Coalition [information on climate change and the Antarctic](http://www.asoc.org/advocacy/climate-change-and-the-antarctic)  [Information on the ‘future of Antarctica’](http://discoveringantarctica.org.uk/challenges/sustainability/future-of-antarctica/)  [Information on the future sustainability of Antarctica](http://discoveringantarctica.org.uk/challenges/sustainability/) |
| **Week 6**  **Case studies**  **Case study 1**  Case study(ies) of glaciated environment(s) at a local scale to illustrate and analyse fundamental glacial processes, their landscape outcomes as set out above and engage with field data. | Collect, analyse and interpret a range of qualitative and quantitative data from a range of primary and secondary sources.  Present, analyse, draw conclusions and evaluate those findings using a range of geographical techniques (see skills checklist). | Students could either study a local glacial landscape in the UK, or one beyond the UK, through the use of secondary data sources – including online digital mapping, secondary data, local authority websites and text book resources - or engage first hand or complete fieldwork to collect primary data, or a combination of both.  The aims of such work are to:   * Illustrate how the glacial landscape is distinctive and is the unique combination of the processes and environmental characteristics that created it at a local scale.   If students complete a fieldwork investigation they will be able to follow through a complete geographical investigation and route to enquiry. | An opportunity to create a “virtual fieldwork investigation” and provide students with a range of data relating to a local glaciated environment for students to investigate and address the themes of the enquiry.  Or, an opportunity for students to conduct a short fieldwork enquiry of a local glaciated environment to investigate the main themes of the specification. Students could write up a mini-fieldwork enquiry to act as a case study of a local glaciated environment.  (This could feed into the completion of coursework for the Non-examination assessment element of the specification). | Many of the accompanying textbooks will have illustrative examples of possible glacial fieldwork opportunities. Other guidance may be found below:  Ideas from the FSC on [fieldwork relating to glaciers](http://www.geography-fieldwork.org/ice/glacial.aspx)  Ideas from the FSC on [fieldwork relating to fluvioglacial processes](https://www.geography-fieldwork.org/ice/fluvioglacial.aspx)  RGS example of [fieldwork and research project on glaciers](http://www.rgs.org/OurWork/Schools/School+Members+Area/Ask+the+experts/Glaciation.htm)  [Opportunities for fieldwork at the Lake District National Park](https://www.rgs.org/OurWork/Schools/Fieldwork+and+local+learning/Planning+your+fieldtrip/Fieldwork+locations/Lake+District/Lake+District.htm)  [Guidance on planning a glacial fieldwork investigation](http://www.antarcticglaciers.org/students-3/geography-a-level-2/a-level-geography-fieldwork-investigation/) |
| **Case study 2**  Case study of a contrasting glaciated landscape from beyond the UK to illustrate and analyse how it presents challenges and opportunities for human occupation and development and evaluate human responses of resilience, mitigation and adaptation. | Collect, analyse and interpret a range of qualitative and quantitative data from a range of primary and secondary sources; this could include discursive/creative material when looking at the experiences of people in place. | (This example is based on an investigation of the Sápmi region of tundra in northern Europe)  Students will be able to describe, analyse and evaluate a range of themes relating to how the human population of the Sápmi region interacts with their tundra (periglacial) landscape, including:   * An understanding of the glacial/periglacial processes that combined to create this unique glaciated landscape * The challenges and risks of living in the Sápmi region * The opportunities offered by living in the Sápmi region * The human response to the challenges of the Sápmi region. Including strategies aimed at resilience, mitigation and adaptation.   The potential for possible sustainable development in the future for the people of the Sápmi region. | Opportunity for individual, paired or group research task, using a range of textual, digital or audiovisual resources. Findings could be shared in traditional classroom approaches or shared through a VLE on a blog for example.  For a more active learning approach students could research from the point of view of different stakeholders. Feedback could then take the form of a debate/roleplay or construction of SWOT analysis in groups etc. | [Introduction to the Sápmi region and people](http://www.visitsweden.com/sweden/Things-to-do/Culture-heritage--arts/Sapmi-and-the-Sami/)  [Factsheet about the Sápmi people in Sweden](http://www.samenland.nl/lap_sami_si.html)  [Information on reindeer herding and forestry in Northern Sweden](http://www.oloft.com/casestudy.html)  [Information on the lands of the Sápmi](http://www.sacredland.org/index.html@p=91.html)  [BBC news article on Lapland’s reindeer](http://news.bbc.co.uk/1/hi/world/europe/629818.stm)  [United Nations information on the Sápmi in Norway and Finland](http://www.unric.org/en/indigenous-people/27307-the-sami-of-northern-europe--one-people-four-countries)  [Slideshow images of the Sápmi people through time](https://www.youtube.com/watch?v=B2WpJHzbbpc)  [54 minute UN documentary video on the Sápmi](https://www.youtube.com/watch?v=ehLFBkGh_B4)  [Shorter documentary video on the Sápmi](https://www.youtube.com/watch?v=4oawzU5l7qk) |

**Quantitative and qualitative skills**

Students must engage with a range of quantitative and relevant qualitative skills, within the theme landscape systems. These should include observation skills, measurement and geospatial mapping skills and data manipulation and statistical skills applied to field measurements.

**Making connections**

Students must consider connections across the themes within the theme of glacial systems and landscapes, connections between this and other themes in the specification and connections with novel geographical themes beyond the specification.