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Hydrology and fluvial processes pdf

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HYDROLOGY AND GEOMORFOLOGY River Buzzer! It refers really only to water on the land of the planet and how the landscape forms! This topic is divided into 4 sections the drainage basin system The rains discharge reports within the drainage basins Processes of the river channels and earth shapes Click on the link below to download a checklist for revision Of this topic 1. The drainage basin system The hydrological cycle before being able to concentrate on the drainage basin system you need to make sure you understand the hydrological cycle. The hydrological cycle is the continuous movement of water on the earth between the atmosphere (air), lithosphere (red) and the biosphere (crying and animals). A powered by the sun the hydrological cycle is a closed system there are no gains or losses from outside the system (nothing is added or taken away) the same water has been cycling around the water cycle for millions of years! It is possible to divide parts of the hydrological cycle in ... Flows / transfers = Water movement from a store to the other store = where the water is kept see if you can select the flows / transfers and shops in the diagram above . The drainage basin system A drainage basin is the total area of land drained from a river and its tributaries. The rivers begin at their source normally on the plateau and end up to their mouth in the sea / an ocean or a lake. They flow through a drainage basin that has a higher ground on the side, known as a spartial. All the water falling into a single drainage basin will flow through smaller rivers known as tributaries and eventually end up in the main river flowing towards the mouth. Where on the river as a tributary one unites another river this is known as a confluence. The drainage system shows how the water moves around a single drainage basin. It is an open system. This means that the water moves through its borders in and other drainage basins, the atmosphere, the oceans and the seas. You must be able to define each of the terms that are displayed on the above diagram. Inputs to the drainage basin system = precipitation outings = evapotranspiration, Runoff, river channel that takes water at the sea Stores = river channels, lakes, vegetation (through the interception.) soil moisture, earth water. Components of the drainage basin and their relationships between them. If a part of the drainage system changes, it can affect everyone else. Read the information below to find out how and some other information on each part. Precipitation Precipitation can vary in its total quantity, intensity, type, distribution and variability. Precipitation has a relationship with all the other elements within the drainage basin, and if you can change one of the variables above (for example the quantity of precipitation) this will change other pieces of the drainage basin. Interception Interception refers to water captured and stored by vegetation. There are three main parts to it. 1) Loss-water interception that is maintained by the plant surfaces and the water is subsequently evaporated or absorbed by the implant 2) falling water that falls through the gaps in the vegetation or drops from leaves, twigs or drums 3) STEMFLOW- L ' Water that deceives along twigs and branches and finally the main interception trunk varies depending on the type of vegetation. It is less from herbs than from wood. In agricultural land, interception rates depend on the density of the planted crops. Evaporation This is the process in which liquid or solid is transformed into gas. The factors that influence the rates and the quantity of evaporation are ... Evapotranspiration (EVT) & Potential Evapotranspiration (PEVT) Breathable is the process through water vapor escapes from a living plant. Combined processes of evaporation and breathing are often called Evapotranspiration. In some very arid areas of globe evaporation can explain 100% of water loss from rainfall in a drainage system. Potential Potentials the loss of water that would occur if there was an unlimited supply of water in an area. For example in Egypt the actual evapotranspiration rates are less than 250mm per year, but this is only because there is less than 250mm rainfall per year. However, if there was much more rainfall in Egypt, the high temperatures in Egypt would guarantee a rate of evaporation of 2000mm per year! Thus Egypt has a potential evapotranspiration rate of 2000mm. Infiltration Infiltration is the process through which water is immersed or absorbed by the soil. The infiltration capacity is the maximum rate to which rain can be absorbed by a soil in a given condition Once a precipitation period begins, infiltration occurs in the ground, and the infiltration capacity will gradually reduce until the soil is completely saturated and can no longer absorb water. At this point the flow of land/surface will increase. The following table shows how the various factors affect infiltration and surface leakage rates There are two main types of ground flow/surface Run out ground water ground water refers to subsurface water (contains 96.5% of all fresh water on earth. The underground waters come from rainfall on earth. It infiltrates into the ground and then drains slowly down into the rock. The permanently saturated area inside the rock is known as the Pharaoh area. The upper level of this area is called the water table. The amount of underground water in the ground and therefore the water table varies. The drainage and refill systems of underground waters are dynamic and the water is continuously slowing down gradient from charging areas for exhaust areas. The charging refers to the filling of water in the pores where the water was dried or extracted (treated) by human activities. Most underground waters are located a few hundred meters from the surface. However, it was found at depth of 4 km! In large kite systems, tens or even hundreds of years can pass the water through this underground part of the hydrological cycle. How does the charging take place? -Infiltration of precipitation (rainfall/snow-melt), -seepage through the banks and beds of rivers, lakes or canals. -Leakage from adjacent eagles and rocks What is the name of a specific area where the discharge of underground waters occurs? -The aquifer fills until the water reaches the surface of the soil, where it flows from the ground as springs. Water can also cross river beds providing the basic flow of rivers How else did underground water supplies change? -Groundwater leakage in a nearby aquifer -Artificial abstraction, for example Confined Underground Water wells and Aquifer Eagles is only the name for an underground rock that stores underground waters in it. Some eagles are often confined (slammed into a rock layer) overlapping waterproof layers (aquiclude), or partially confined by layers of low permeability (an aquitard). Two separate features of rocks control how effective they are like eagles: Porosity is a measure of how much a volume of rocks is open space (pores). This space can be between cereals or inside cracks or rock cavities. (porous or not porous) Permeability is a measure of the ease with which water can move through a porous rock (ability to transmit water) (permeable or waterproof) Some key ideas about porosity and permeability of the rocks If a rock has few porosities as water can not be stored or transferred through it Examples of low porosity rock is crystalline igneous and glacial rock up If pores in a rockbut are strictly packed water transfer is very slow, but the water seal is still possible An example of a rock that has pores so it is porous but it is waterproof because they are strictly packed is clay If the pores are interconnected with large gaps between them, the rock/soil can be porous and permeable, for example sandstone. Rocksmake the best eagles are both porous and permeable so what can flow in them. They often need to be above a layer of waterproof rock, so water is not lost from the base of the eagle. Based on what we have learned, you should be able to answer the following question Using examples, explain how geology can define if a rock is an effective aquifer (8m) Porosity and permeability of the rock below ground decides if it will be an effective aquifer High porosity and permeability rocks with many pores and large gaps among the pores allow water to transfer well into them to make a good example of rock Low porosity rocks do not make good eagles like water can not pass through them An example of this type of rock is glacial until some rocks have high porosity but are waterproof and therefore not act as a good eagle An example of this type of rock is clay 2) reports of rain discharge inside the drain basins Hydrographs and river regimes A river regime is the annual variation of a river flow (its discharge). The discharge is the volume of water that passes along the channel of a river during a certain period of time. The regime of a river can be shown on an annual hydrograph. It plots the change of drainage of the river for a year in cubic meters (cumec). The character of a river regime is influenced by many factors, but the most important factor is the climate. If we look at the river regimes of three climatic zones, we will see 3 very different regimes. Mediterranean Polar (Arctic) A river regime is known as a simple regime if it is based on a river with only one peak in the year. A river regime is known as a complex regime if it is based on a river with lots of tributaries flowing through a variety of climates and environments. Flood hydrographs A flood storm hydrograph is only used to track the discharge of a river during a single storm event. An example of flood hydrographs is shown below. The bar chart shows the amount of precipitation in mm during a storm. The chart of the line is used to track the river discharge which obviously grows bigger after the rain fell. The basic flow refers to the amount of water in the river to begin with, and the storm flow is the additional water in the river after the storm. Generally, flood hydrographs show an increasing limb, where the discharge rises as more rainwater reaches the river, followed by a falling limb, where the discharge of the river reduces as water infiltration from the river bank and in the ground as flow Look at the flood hydrograph below and try to answer the questions below. Then scroll down to check the answers. Questions What is the river discharge at point W, X, Y and Z? W = 3 cumecs X = 27 cumecs Y = 34 cumecs Z = 9 cumecs 2) Approximately how much did the rainfall fall during the entire storm period? 3 + 29+ 49+ 10 = 91mm 3) How long was the delay for this storm event? From 16.00 first day to about 01.40 the second day = 23 hours 40 mins 4) What time and in what day was the most likely river flooding? Responses 1) What is the river discharge at point W, X, Y and Z? W = 3 cumecs X = 27 cumecs Y = 34 cumecs Z = 9 cumecs 2) Approximately how much did the rainfall fall during the entire storm period? 3 + 29+ 49+ 10 = 91mm 3) How long was the delay for this storm event? From 16.00 first day to about 01.40 the second day = 23 hours 40 mins 4) What time and in what day was the most likely river flood? At the discharge peak at 01.40 on the second day What factors can affect the form of a hydrograph? 3) Processes and forms of land of the river canals and their variables Rivers and streams are bodies of water flowing into open channels. Rivers get water and material as input fromof land, precipitation and flow of underground water and erosion The rivers then transfer this water and material along the sea (flow) The rivers give up water and material for the sea/land as an exit. The shape of the river channel is constantly adapted to changes in water and material inputs, so that it can transfer water and material downstream. This constant balance adjustment we callbalance, seven variables of the river channel are involved in this constant regulation, each variable can change as it moves along a river course. 1) 2) 3) 4) 5) 6) 7) each variable is connected to the others, so if you change, others can also, see if you can answer the questions below, then scroll down to check your answers. 1) how can the depth of the channel change if the download increases? 2) how could speed change if the gradient changes? 3)If the width and depth of the channel increase then what will happen in the transversal area? 1) How can the depth of the channel change if the download increases? the channel will become deeper as the download increases (to some extent) 2) how could the speed change if the gradient changes? If the slope is steeper = higher speed if the gradient is more delicate = lower speed 3) If the width and depth of the channel increase then what will happen in the transversal area? If the width and depth increase then so will be transversal area efficiency of the channel and the energy of the river an energy of the river is used to erode its beds and banks and transport material downstream More energy has = more work can do however, some of its energies must be used to overcome friction, so it is not always efficient. two key ideas related to energy and river efficiency. Hydraulic ray manning radius hydraulic efficiency of a river channel = a measurement of the capacity of a river channel to move water and sediment. depends on the friction that the water rises against which is shown by the hydraulic ray of the river this is the proportion of water in a channel that is in contact with the beds and banks the answers The higher the hydraulic ray the more efficient the river and the faster it will flow with more energy the equation of manning (an engineer) has worked that the water in the channels has different energy and efficiency depending on the rough way the channel friction is the provocativeness of the channel the equation is as follows: velocity= hydraulic radius x gradient/ roughness (n) a high value indicates a rough bed (you do not need to be aware of what it is!) erotic processes just like at igcse, you need to know the main types of erosion occurring in a river during its course. erosion is influenced by flow types: laminar flow = horizontal movement of water parallel to the river bed (very rare) turbulent flow = a series of eddies (swirls) both vertical and horizontal in the direction of the valley (more common) the turbulent flow causes the greater erosion - the horizontal turbulent flow is known has the helidal flow and is associated with the hydraulic action as water roll against the beds and banks that weaken them. this can expand the channel - vertical turbulence is associated with pot holes in the channel bed where vertical abrasion occurs as grinding rocks in the bed, this can deepen the channel. transport processes the load of a river is transported downstream in 4 ways. 1) suspension (solid load) = fine clay particles and sand are transported inside the water even to low discharges. 2) jumping (high load)= sand, gravel and small stones are bounced along the river bed by water flow 3) traction (drawn load) = boulders and pebbles are rolled along the river bed at times of high discharge 4) solution (sink load) = some minerals dissolve in water as calcium carbonate. this requires very littleHJULSTROM curve - The capacity of a stream refers to the greater quantity of debris that a flow can transport - the competence refers to the diameter of the larger particle that can be transported - the critical erosion speed is the lowest speed to which The grains of a given size can be -The relationship between these variables is shown by means of the hjulstrom curve the hjulstrom curve that is? Show which speed you need to collect (enter) and erode material, transport it, or deposit it. Show this for -Clay, SILT, SAND, Pebbles and Boulders Important things to note most of the time, larger particles like boulders, need a greater speed for them to be collected because of their large size however, l 'Exception to this rule is clay and silt, as even if the particles are very small, the particles tend to stay together, making them difficult to collect. Higher speeds are needed to collect (input) that only for transport. When the speed descends below a certain level (rotation speed), the particles are deposited Landforms and canal types found along a river course A river canal can be straight, meanders or intertwined. But what do these terms mean? A straight channel is very rare, but it's exactly as it looks! The river is straight along its course! A derivation channel is common and occurs where the river moves from side to side when describing meandering or straight channels it is possible to use the term sinuosity, which is an indication of how it is behaving a channel. It is measured by looking at how long the channel is compared to the length of the valley through which it runs. For example, a sinuosity figure greater than 1.5 means that the channel is meandering, while a sinuosity figure lower than 1.5 means that it is fairly straight. More than 4.4. It means a river has a high sinuosity, and means a lot. A braided channel is a canal that is divided by islands or bar. They occur when a river does not have the ability to carry its load into a single channel. As a river travels along its course, the shape of the canal and the forms of land that are created by a change in the river. Some forms of land are caused by erosion, some for deposition, some a mixture of both! The following earth forms are known as forms of earth erosion à € "as they are created mainly through the erosion process 1) waterfalls and gorges 2) Means à € " because the meander of the river? Stage 1: helical flow (cork screwing movement) means that a river tends to alternate between fast and slow water flow. This then creates riffles and pools such as fast water erodes and slow water deposits are shallow water areas / pools are deeper water areas 2: a theory is that the river meander when water It swings from side to side to avoid riffles and to scroll through the pools it means that the fastest water line (Thalweg) moves from side to side. Stage 3: Over time, as water is faster through the pools (as there is less friction in deeper water), erodes the banks and beds where the pools are this makes the biggest meanders since L ' water is more slow in riffles (friction in low water) there is deposition as the river flows of energy and descends what I carry Stage 5: since water continues to run fast around the outer curve of a meander , it took more and makes it deeper (a pool) this leads to a river cliff à € "the internal curve is more slow and then the deposition occurs and a tilt or tip bar is created look at the clip Above to make a final check that is understood on the meanders. MEANSERS / 403.TMLHTTP: //www.bbc.co.uk/learningzone/clips/rivers-meanders/403.html 3) Arco Lakes OX C-shaped lakes called OX Bow Lakes form when the meanders continually eroded. The following earth forms are known as forms of depository land à € " as they are created mainly through the deposition process. Deposition occurs when a river slows down and loses its energy, then lowers the load. In the upper course of a river deposition it could occur behind large boulders in water Slack in the middle course, the deposition increases when the speed of the river is reduced à € " such as to the inner curve of a meander or when he enters a lake or Behind a dam. In the lower course, the deposition can occur when the river enters a standing body Water like the sea and slows down. The forms of land depositional are created everywhere that the alluvium (river material) is deposited on earth or sea. There are 7 main terrestrial forms created by the deposition along the river course. 1) This point bar occurs on the inner curve of a meander when the deposition accumulates on slope slide and breaks through the water surface to form a gravel bank. 2) Flood chapel these are formed when the river breaks out of their banks and floods on a regular basis. Flight material deposits away from the river creating plain land sections around the river. 3) Levees The coarse material is deposited near the canal during repeated floods, building a bank on both sides of a river. The finest material travels further on the flood plain 4) Alluvium Flooding fans (material in a river) fell from the river when it loses momentum while entering a wide and flat valley after leaving a narrow mountain channel. This happens as water speed, slope and speed reduces while water enters a wide non-conflicting channel, so it is deposited. It is the terrestrial equivalent (earth) of a delta. 5) Delta these forms where the river flows into a body standing of water like a sea, and deposits it loaded. The river needs to bring a large volume of sediments. Deposition is increased if the water is salty because the salt causes clay particles to attack together (flocculated). a) Delta dell'Arcuate This form of delta is made where the deposition occurs in a fan form, found in areas where along the shore drift occurs to cut the edges of the earth shape b) the foot of the Delta bird This form of delta is made where the river leads a lot of this silt that can be brought for a very long distance in the sea that makes it long and thin. c) The cusp delta This form of delta is made where the deposition occurs at a point as a tooth. It occurs as two opposite currents hit deposits on both sides. 4) The men's impact for the exam is necessary to know how human beings have influenced the river basin changing particular processes, shops and human impact channels on à € " precipitation, evaporation and evapotranspiration Precipitation: à € on Cloud seeding introduces Silver iodid, solid carbon dioxide (dry ice) or ammonium nitrate in the air to encourage water drops to form. - Mixed Results but in Australia and the United States increased precipitation of 10-30% - in urban areas precipitation can be increased by 10% due to extra pollutants in the evaporation in the evaporation air and evapotranspiration-DAMS increased evaporation-and.g. The assuming dam loses a third of water by evaporation - can be reduced by plastic coatings on chemical tanks or chemical sprays on water - urbanization reduces evaporation due to less vegetation the human impact on - interception, infiltration and Reduced soil water - urbanization creates waterproof surfaces with compacted soil - this reduces infiltration roots, so increases the flow of land o pompando acqua in profondi pozzi o pozzi (Questo è usato in Israele) Mini Case studio del mare Aral -Il mare aral ha cominciato a ridursi negli anni '60 when l'acqua è stata pre dai fumi Syr Darya and Amu Darya - Dal 1994 la costa è caduta di 16m, surface è decreased di 50,% volume ridotto del 75% -I livelli di ricchezze erano increases Positivi - Controlla le inondazioni e siccità -Aiuta a irrigare la terra e coltivare le colture -Produce HEP - Migliora la navigazione e la ricreazione e il turismo Negativi -Tuttavia, ci sono Perdite d'acqua da evaporazione -La vendita è avvenuta -Vedida da serbatoio haqua Nubians dis dis dis discarico ridotto Pieno scarico è when il canale di un fiume si riempie completely, in mode che qualsiasi più risultati dell'acqua traboccare le banche Su banca di scarico pieno è when il livello di acqua nel canale sopra le rive and teases un'alluvione. Alcuni termini chiave relativi all'inondazione L'intervallo di ricorrenza si riferisce alla regolarità di un'alluvione di una data dimensione Le piccole inondazioni sono predicted per versi regolarmente Grandi inondazioni si veranno meno spesso Un'alluvione flash è un'alluvione in cui il tempo di ritardo è eccezionalmente brief. A slow increase in the inondazione in cui il tempo di ritardo è più lungo cause naturali di inondazioni Tipi di precipitazioni: L'inondazione is generally causata of precipitazioni pesanti. If cade come snow allora l'acqua viene immagazzinata sulla surface finché non si scioglie. When it is verno scioglimenti di ghiaccio the snow, questo può anche portare a inondazioni. Vegetazione: If sulla surface c'è una vegetation limitata, non c'è nulla da intercettare. Ciò provoca una maggiore decomposizione superficiale. Climate: If il clima è molto secco, l'acqua non sar in grado di penetrare nel terra. Question probes a maggiore escape. Analogously, if time is stato molto umido and il terra è impiantato qualsiasi acqua in eccesso si esaurirà diretably nel fiume. Type of roccia Se la roccia è permeabile e porosa allora l'acqua si filtra o si terra qui per un po ', rallentando il tempo di ritardo al fiume. Se la roccia è impermeabile, l'acqua non sarà in grado di infiltrarsi in un cresce flusso di terra al fiume. Cause ume/intensificazione delle inondazioni Urbanizzazione: Concrete and asphalt sleep impermeabili and la corsa fuori accade molto più veloce, in mode che il fiume non può gestire la quantità di acqua che riceve. Sistemi di drenaggio: I tubi sotterranei trasportano l'acqua directly nel fiume riducendo il tempo di ritardo. Deforestazione: La rimozione degli alberi means che non c'è nulla per intercettare l'acqua piovana. Ciò means an increase of the surface of scarico. It increases anche la quantità di sedimenti che il fiume porta con se nel fiume. Dighe: Le dighe sono utili in how controllano la quantità di acqua che è in grado di scorrere verso il basso during i periodi di alta precipitazione. Tuttavia il process di creazione di dighe means che grandi aree di terra devono essere inondate per creare il serbatoio dietro la dige. Anche rilasciando acqua attraverso una tale a monte, può causare inondazione a valle. Studio di caso di inondazione del Pakistan Alla fine di luglio 2010, forti piogge monsoniche hanno causato gli Indus and altri fiumi circuscstanti a scoppiare le loro banche nel nord-ovest del Pakistan. Il peggior fiume inondazione dal 1920 continuò per tutta l'estate, che colpisce 17 milioni di persone. Interi villaggi sono stati distrutti, milioni di persone sono state spostate e 1.600 persone sono rimaste death. Guard il follower water clip perYou are an idea of the measurement and intensity of floods The following table provides a brief summary of the causes and effects of flood flood solutions there are three main solutions to reduce the impacts of floods 1) Flood forecast - Forecasts and warning 2) Prepare persons for flooding 3) Prevention and improvement of floods 1) Prediction - Equipment of meteorological satellites to predict high rain rain amounts - Facing of rainfall and snow amounts - Using river gauges to study levels Of the river over time and in the map of computer flood models - Human infrastructure information and what would be more at risk. 2) Prepare people for floods - loss of adjustment of flood sharing (eg disaster help and insurance) - The removal of settlements from Parains Flood 3) prevention and improvement of floods There are two types of flood protection methods acting to prevent or improve floods. Hard Engineering = Defense schemes that stop natural rivers. Soft engineering = involves the use of the natural environment surrounding a river, and the schemes often work with the natural processes of the river. Look at the following table and try to decide that I am soft engineering and that are difficult engineering methods that you are a great percentage of the world experiments dry or arid conditions. These conditions can lead to security, which may have serious impacts on people and the environment. Some key questions about slacità are considered below. 1) What is the sorry? Sicità is defined as a long dry period of time that leads to extreme dryness. The absolute security is a period of at least 15 days with less than 0.2 mm of rain 2) what causes you? The lack of rains can be caused by several factors: À € à,~ "global atmospheric circulation leads to descending air on sub-tropical areas and therefore a lack of rain (clouds are formed) À € à,~ " a distance Area from the sea can limit the amount of water transported by the wind À € à,~ "Some places are influenced by the effects of the shadow of rain. It is here that the air passes to the mountains, and the rain is released, but l'air has therefore lost all its moisture while reaching the opposite side of the mountains if you are not sure of the causes above - check the atmosphere and the meteorological section! 3) Where do you experience your slacità in the world? 4) Which shots of impact do you have your sicity in areas? MedC Mini case of study: European s released 2003, one in 2003 all Central Europe, suffered a summer of sanctà coupled with a heat wave of abnormally high temperatures à , À, À, France - 30,000 died in the wave D The heat, collected from 30% of the previous year, the electricity couldn grid; T cope with the application has increased for air conditioning and refrigerators. Portugal - worst forest fires for 30 years, temperatures reached 43 degrees in Lisbon, 1300 deaths. Throughout Europe there were reports of the worst harvests since World War II and some countries have had to import food for the first time in decades. Throughout the EU, the production of grain has decreased by 10 million tons (10%) mini case studies study: Ethiopia Driughts of 2003 in 2003, parts of southern Ethiopia have experienced the longest sanctà anyone has ever known. They suffered the sixth rainy season in 3 years, leading to 20 million people desperate for help. 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