1. What are tornadoes? How do they originate? Why are they so destructive? Discuss.

Approach

Define about the tornadoes in the introduction part. Then highlight the origin and genesis of the tornadoes. In the end discuss why they are so destructive before conclusion.

Introduction

A tornado is a violently rotating column of air that extends from a thunderstorm to the ground. It is a vortex of rapidly moving air. A tornado forms when changes in wind speed and direction create a horizontal spinning effect within a storm cell. This effect is then tipped vertical by rising air moving up through the thunderclouds.

Body

Tornadoes is a localized cyclonic low pressure cell surrounded by a whirling cylinder of violent wind, characterized by a funnel cloud extending below a cumulonimbus cloud which predominantly occurs in North America.

Origination:

- Tornado formation typically needs the four ingredients: shear, lift, instability, and moisture.
- Wind shear is the most important factor that plays into the creation of tornadoes. When there is wind shear, sometimes these winds begin to roll into a horizontal column of air.
- Once you get a strong updraft of air being transported from the ground to the atmosphere, that column of air becomes vertical. That is when a storm usually develops in this scenario.
- As the storm develops, it turns into a supercell thunderstorm much of the time. These supercell thunderstorms are separate, discrete cells that are not part of a line of storms. Also, supercells are storms that rotate and spin. With both the vertical, rotating column of air and the supercell thunderstorm together, that may bring down a tornado from the storm cloud
- Tornadoes are most common in spring and least common in winter. Spring and fall experience peaks of activity as those are the seasons when stronger winds, wind shear, and atmospheric instability are present. Tornado occurrence is highly dependent on the time of day, because of solar heating.
- United States has the most violent tornadoes. At any moment there are approximately 1,800 thunderstorms in progress throughout the world.

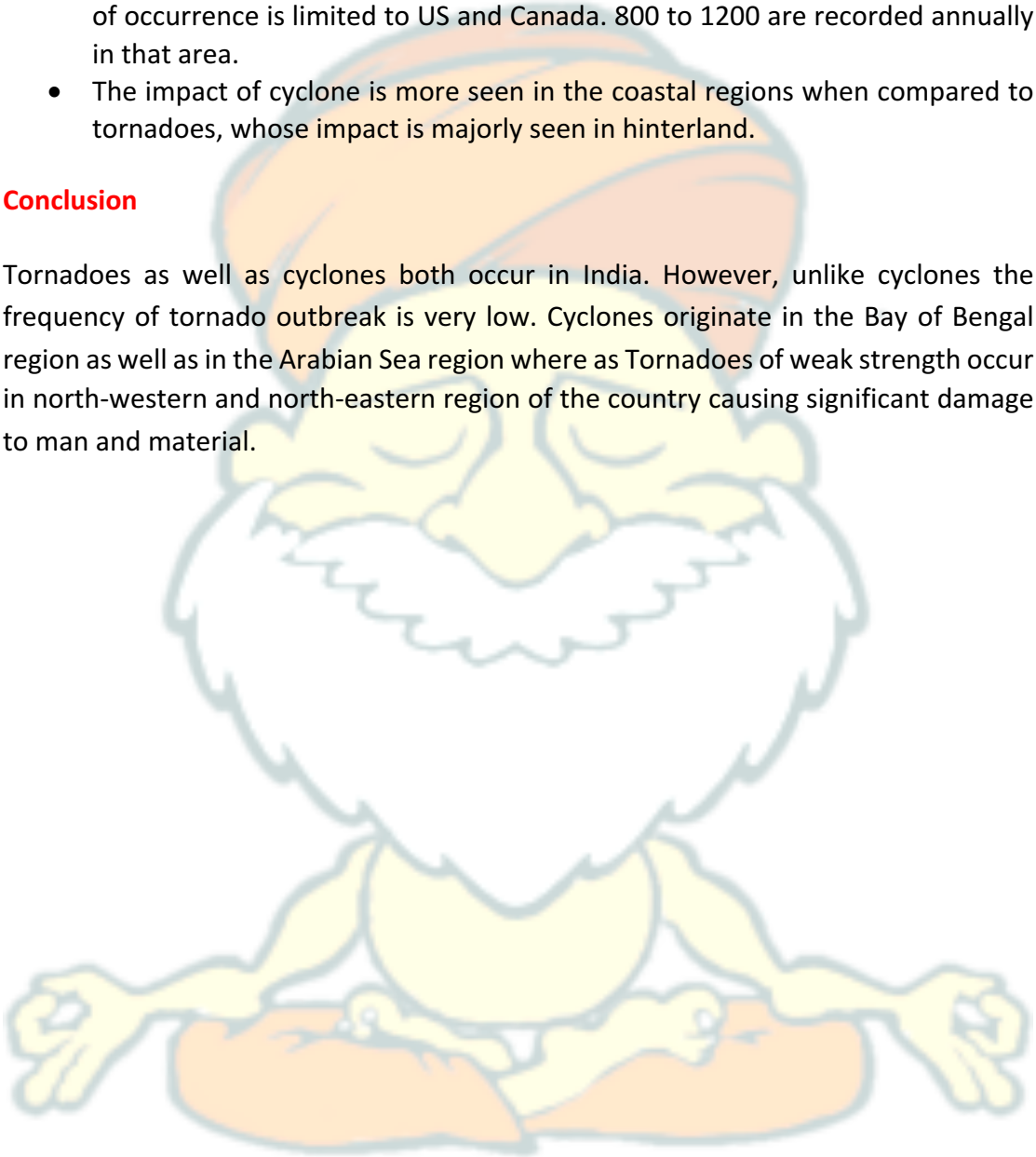
They are so destructive because:

- Strong winds: They are strong wind with low pressure centre which can travel up to 500 km per hour.

- Flying debris: Due to low pressure centre, it sucks in lot of dust and debris which travels causing extensive damage along path.
- Vertical Wind shear: Strong swirling updraft.
- Unpredictability: Due to its unpredictability, no precautions are taken leading to destructiveness.
- They are largely restricted on land but do occur over oceans in form of waterspouts. Due to their unique environmental conditions to be formed 90% of occurrence is limited to US and Canada. 800 to 1200 are recorded annually in that area.
- The impact of cyclone is more seen in the coastal regions when compared to tornadoes, whose impact is majorly seen in hinterland.

Conclusion

Tornadoes as well as cyclones both occur in India. However, unlike cyclones the frequency of tornado outbreak is very low. Cyclones originate in the Bay of Bengal region as well as in the Arabian Sea region where as Tornadoes of weak strength occur in north-western and north-eastern region of the country causing significant damage to man and material.



2. What is storm surge? What factors control the magnitude of a storm surge? Discuss

Approach

It expects students to write about storm surge. And simply write the factors controlling the magnitude of a storm surge with different variables.

Introduction

Storm Surge is an abnormal rise of sea level as the tropical cyclone crosses the coast. The storms produce strong winds that push the water into shore, which might lead to flooding. It is measured as the height of the water above the normal predicted astronomical tide. The surge is caused primarily by a storm's winds pushing water onshore.

Body

Factors that control the magnitude of Storm surge:

- Storm surge depends on intensity of the cyclone (Maximum winds and lowest pressure associated with it and Coastal bathymetry (shallower coastline generates surges of greater heights).
- However, as the storm moves closer to the shore, the water which is being pushed downwards by the wind cannot move any lower, so the water forces itself from the sides towards land, causing a storm surge wave.
- Strength and Size of the Storm: During a cyclone, the water level rises to form storm surges, where the strength and speed of the winds are the highest. Usually, the largest surges occur in the direction of where the wind is blowing. Due to the rotation of the earth, the surge occurs towards the right side of the cyclone in the northern hemisphere, and towards the left side in the southern hemisphere.
- Atmospheric Pressure: The force exerted by the atmospheric pressure is a smaller factor in the formation of a storm surge. Although low pressure also contributes to the surge, its influence is very small, i.e., around 5%.
- Bottom Conditions Near Shore: Another minor factor determining the strength of a surge is whether the coastal slope is steep or shallow, and rough or smooth. A shallow and smooth ocean floor near the coast can dramatically enhance the speed and power of the storm surge, while a steep climb with rough obstructions can slow and sometimes even stop a storm surge. A wider shore will have a higher surge than a narrower shore.
- Distance from Storm Centre to Shore: For a storm surge to achieve maximum potency, the distance between the eye of the storm and the shore should neither be too close nor too far. If the distance is less, the surge cannot gather enough velocity to gain power. However, if the storm is too far, the surge will lose its gathered energy by the time it reaches the shore.

- Tides: The gravitational force of the sun and moon cause low and high tides. If the storm surge occurs during a low tide, the intensity will be significantly reduced. However, a storm surge during high tide will cause a storm tide capable of heavy destruction.
- Freshwater: Usually, before a storm reaches land, most coastal areas receive heavy rainfall, causing water levels to rise. This is especially true in areas that have a river delta, causing bigger and stronger storm surges.
- Shape and Angle of Coast to the Storm: A shore with a convex shape will have a lower surge as compared to a concave shore. Also, if the storm is moving parallel to the shore, it will cause lower and weaker storm surges as compared to a storm moving perpendicular to the coast.
- Sea Waves: When waves break onto the beach, they may collect into pools, eventually making it easier for the surge to overcome the friction of the beach, and move even further inland.

Conclusion

It is one of many natural events storm tide inundates low lying coastal areas which have far reaching consequences apart from flooding. Hence, necessary precaution if taken will ensure the minimal loss of environment human life in the surrounding area. Innovations are needed to mitigate them and also utilize them for welfare of mankind.

3. Global warming is a reality, that is affecting the glacial landforms, flora & fauna across the globe. Do you agree? Substantiate with the help of suitable examples.

Approach

Simply describe define the global warming and glaciers. Then highlight the impact of changes in glaciers and how global warming is changing the glacial landscape, before conclusion try to give few suggestions to tackle situation.

Introduction

Global warming is the phenomenon of a gradual increase in the temperature near the earth's surface. This phenomenon has been observed over the past one or two centuries. This change has disturbed the climatic pattern of the earth.

Body

- Glaciers are ice blocks covering mountains or continental plains. They are not just that but they are environmental sanctuary. Due to global warming, there dynamics is changing leading to environmental disasters.

Changes in glaciers will lead to:

- Carbon dioxide and precipitation: Glaciers are store house of co2. Due to melting it is released leading to more winter precipitation.
- Sea level rise: Antarctic ice breaks can trigger land based ice off the continent. With land based ice entering, sea level will raise.
- Albedo value: They have 90% albedo value. Melting of them will increase greenhouse effect.
- Oceanic temperature: It changes oceanic temperature. Example Green land ice sheets and Artic Ocean melting.
- Ocean nutrient and mineral content: Changes the nutrient content of ocean floor and mineral reserves. Due to melting of Artic Ice, new gas reserves and other minerals are being explored. Canadian mineral deposits were exposed during melting.
- Atmospheric circulation: Ocean currents and air circulation will change.
- Landforms: Central Canada's glacial melting lead to undulating surface dotted with water bodies.
- Vegetation pattern: Due to Alaskan melting, extensive plant cover is building up even in Himalayas and Alps.

Global warming Changing glacial landforms:

- Human activities are at the root of this phenomenon. Specifically, since the industrial revolution, carbon dioxide and other greenhouse gas emissions have raised temperatures, even higher in the poles, and as a result, glaciers are rapidly melting, calving off into the sea and retreating on land.
- Between the years 1975 to 2000, an average of four billion tonnes of ice were being lost each year and between the years 2000 to 2016, glaciers melted

approximately twice as fast implying that Himalayan glaciers lost about 8 billion tonnes of ice each year on an average during this period.

- Glaciers depend on heavy precipitation to replenish ice on an annual basis, but, if monsoons are disrupted, ice is depleted. As the glaciers melt, rivers flood, with the flooding of rivers, people, crops and livestock get drowned and hydroelectric plants are disrupted.
- Rapid glacial melt in Antarctica and Greenland also influences ocean currents, as massive amounts of very cold glacial-melt water entering warmer ocean waters is slowing ocean currents. And as ice on land melts, sea levels will continue to rise.
- The glacial melt we are witnessing today in Antarctic and Greenland is changing the circulation of the Atlantic Ocean and has been linked to collapse of fisheries in the Gulf of Maine and more destructive storms and hurricanes around the planet.
- Glacial melting will also cause the extinction of numerous species, as glaciers are the natural habitat of a number of animals, both terrestrial and aquatic.
- Coastal communities will continue to face billion-dollar disaster recovery bills as flooding becomes more frequent and storms become more intense. People are not the only ones impacted. In the Arctic, as sea ice melts, wildlife like walrus are losing their home and polar bears are spending more time on land, causing higher rates of conflict between people and bears.

Glaciologists believe that, despite the massive ice loss, we do still have time to save the glaciers from their predicted disappearance. Here are some ideas and proposals for how we can help achieve this goal:

- Developing a comprehensive understanding of the status of Himalayan glaciers
- Promotion of research on Himalayan glaciers
- Glacier/ Source vulnerability assessment for the Hydropower plants
- Watershed management by energy utilities
- Integrated River Basin Management to rejuvenate water potential
- Assessment of glacial lake outburst flood (GLOF) potential

Conclusion

Humankind has become dependent on the burning of fossil fuels to support our way of life, but it increases global warming at an unnatural rate that led to meltimg of glaciers. To restore the glaciers we need to utilize alternative energy sources, increase our energy efficiency and decrease our individual carbon footprints.