1. Differentiate between cyclones and tornadoes? In terms of occurrence, do you find a difference between the global distribution of cyclones and tornadoes? Examine.

Approach

It expects students to compare between cyclones and tornadoes. Give the detailed account of occurrence of these phenomena in various geographical areas.

Introduction

Tornadoes have historically occurred in the Bay of Bengal region mostly it's uncommon in India but recently tornado hit West Bengal's Hooghly district ahead of Cyclone Yaas. The weather phenomenon occurred in the Bengal shows Tropical cyclones and tornadoes are atmospheric vortices, they have little in common. Both are strong, spiralling storms that can be very destructive.

Body

Cyclones:

- Tropical cyclones are violent storms that originate over oceans, in tropical areas and move over to coastal areas bringing about large scale destruction caused by violent winds very heavy rainfall and storm surges.
- A cyclone consists of a low-pressure area with high pressure all around.
- They have large diameters.

Tornadoes

- A tornado is a violent storm comprised of extremely strong winds spiralling around a central point in a funnel-shaped cloud.
- It is formed when a funnel-like column of cold air sinks down from a story cloud.
- They have a relatively smaller diameter.

Difference between Genesis of cyclones and tornadoes:

- Tropical cyclones are generated in regions of near zero horizontal temperature gradient. Tropical cyclones require very low values of tropospheric vertical shear in order to form and grow.
- Tornadoes are produced in regions of large temperature gradient. Tornadoes require substantial vertical shear of the horizontal winds (i.e. change of wind speed and/or direction with height) to provide ideal conditions for tornado genesis.
- Cyclones diameter of the circulating system can vary between 150km to 250km in diameter. The system moves slowly about 300-500km per day.
- Tornadoes are generally narrow in diameter compared with other storms, so their destruction is confined to a narrow path.
- Tornadoes often occur in groups. Tornado strength is measured on the Fujita scale. Tropical cyclones are purely an oceanic phenomena - they die out over-land due to a loss of a moisture source.

- Tornadoes are primarily over-land phenomena as solar heating of the land surface usually contributes toward the development of the thunderstorm that spawns the vortex and over-water tornadoes called as water sprout.
- Lastly, tropical cyclones have a lifetime that is measured in days. While tornadoes typically last on the scale of minutes.

Difference between global distribution of cyclone and tornadoes:

- Tornadoes occur in many parts of the world, including Australia, Europe, Africa, Asia, and South America. Even New Zealand reports about 20 tornadoes each year. Two of the highest concentrations of tornadoes outside the U.S. are Argentina and Bangladesh.
- Almost 90 percent of these storms form within 20° north or south of the Equator. Only two tropical ocean basins do not support tropical cyclones, because they lack waters that are sufficiently warm. The Peru Current in the eastern South Pacific and the Benguela Current in the South Atlantic carry cool water Equatorward from higher latitudes and so deter tropical cyclone development.
- Tornadoes occur most often in association with thunderstorms during the spring and summer in the mid-latitudes of both the Northern and Southern Hemispheres.
- Tornadoes have been reported on all continents except Antarctica. The United Kingdom has the most tornadoes per land size, most of them weak. On average, about 33 tornadoes are reported annually there. In absolute numbers, the United States has the most tornadoes by far (more than 1,000 per year have been reported every year since 1990).

In terms of Impact:

- Tornadoes tends to be more destructive than cyclone for the reasons.
- Speed of tornadoes are typically high than cyclone.
- As tornadoes originate and propagate over land, the destruction level on ground is high.
- As the size of tornado is small, the destruction intensity is higher.
- The impact of cyclone is more seen in the coastal regions when compared to tornadoes, whose impact is majorly seen in hinterland.

Conclusion

These violent storms are the manifestation of the atmosphere's adjustments to varying energy distribution. The potential and heat energies are converted into kinetic energy in these storms and the restless atmosphere again returns to its stable state.

2. Why do some regions in the oceans have greater density of fishes than the others? Do ocean currents play a role in this phenomenon? Explain with the help of suitable examples.

Approach

Try to explain phenomenon of the major fishing grounds/zones and explain whether ocean current has any role in this phenomenon with help of suitable examples.

Introduction

The major fishing zones of the world are along the coastal areas where cold ocean currents flow because cold ocean currents are nutrient rich which support higher populations of phytoplankton,zooplankton,krill and Fishes. Moreover Fishing is industry is more dominant in middle latitudes because there in a single catch there is high probability of getting fishes of the same species.

Body

Major fishing zones of the world are:

- Northwest pacific region- areas near Japan.
- Northwest Atlantic- areas near Canada.
- Southern Atlantic and northern Antarctica.

Factors that govern density of fishes :

- Shallow continental shelf- these are the regions of high productivity. The water here is nutrient rich and sunlight is available in abundance. New found-land coast
- Coastal upwelling – these areas bring nutrient rich waters from a depth. It provides plenty of oxygen for fishes to survive. Example Peru coast.
- Water temperature- most organisms avoid extreme temperatures and thus thus major fishing zones are confined to tropics.
- Mixing of ocean currents- these areas have very high biological productivity, because plankton growth is encouraged by mixing of warm and cold water.
- Commercial fishing requires large ships- multiple varieties of fishes caught, separated, processed for packing on the ship itself, high-tech equipment to scan fishing waters for optimal location and so on.Such vessels and technology require massive capital investment available in Europe, America but not much in Asia.

Ocean currents play a major role in this phenomenon because mixing of these currents creates high fishing zones. Some of these areas are:

- Mixing of Labrador current and gulf stream- Canada: This region is blessed with the convergence of the Gulf Stream and the Labrador Current that enhance the fishing productivity. The Cod, Halibut, tuna, squid, flounder, redfish, and salmon; herring and mackerel are famous fishes caught here.
- The South East Pacific: It stretches from Pacific Coast of South America that includes Panama to Cape Horn. The northward flowing Peru Current provides

an ideal environment for the anchovy culture because it is associated with a coastal upwelling of nutrient rich colder water laden with plankton on which the anchovy feeds.

- Mixing of Kuroshio and oyashio- areas near Japan.
- Mixing of gulf stream in Arctic waters- Areas near Norway and Britain.

However recently even exploitation of the areas determine the density and richness of fishes. So areas which are traditionally blessed with rich fishes are now facing depletion due to overfishing. So human exploitation is another major factor which decides why few areas are rich in fish density

Conclusion

Though density of fishes is determined by nature but development of fisheries industry is governed by Human technology. This is the reason why most of the major fishing areas are in Northern Hemisphere. However over exploitation of these areas had resulted in depletion of fish resources and countries such as Japan are migrating even to Antarctic ocean in search of new fishing grounds.

3. What do you understand by 'salt budget'? Examine the factors that affect the salinity of oceans.

Approach

It expects students to elaborate upon concept of salt budget along with factors influencing the salinity of oceans across the globe. It expects students to draw relevant map or diagram.

Introduction

It involves all the processes through which salt moves from the ocean into the lithosphere, to a certain extent into the atmosphere, and back into the oceans. Moving water, including groundwater, leaches minerals from the rocks through the process of surface erosion.

Body

Salt budget: Salt budget is movement of salt content from oceans to lithosphere to certain extent in atmosphere and back into the oceans. It can be also called as salt cycle. It deals with the extraction and addition of salt content.
Salt budget:

- Submarine volcanism at mid oceanic ridge brings salt content into the ocean.
- Some of the salts in the ocean waters accumulate at the ocean bottom through the process of sedimentation turning into mineralized rocks. Over a period of millions of years, some of these rocks get raised above the ocean surface due to plate tectonics. This brings the salt content to the lithosphere in the form of minerals.
- Salt from the oceans also gets sprayed into the atmosphere due to the action of wind. This salt returns to the lithosphere mixed with precipitation. However, this constitutes a tiny fraction of salt moving from the land to the sea and vice versa.
- Moving water, including groundwater, leaches minerals from the rocks through the process of surface erosion. The mineral-laced water joins the rivers and streams which finally reach the oceans. These minerals add to the salinity levels of the ocean waters.
- Factors affecting salinity of oceans:
- The degree of concentration of the salt solution in oceans does vary in different areas expressed as salinity either as percentage or in parts per thousand. The average salinity of oceans is 35.2 parts of salt in 1000 parts of water.
- But in Baltic due to dilution by fresh water of rivers and melted ice it decreases to 7 parts per thousand. However in Red sea due to high evaporation and comparatively fewer rivers to bring fresh water, the average salinity increases to 39 parts per thousand.

Ocean salinity is dependent upon several factors and it keeps varying with the place and time of measurement. The main determinants of ocean salinity include,

- Evaporation: In general, salinity is higher at places with high rates of evaporation. The tropical seas such as the Red Sea, Persian Gulf have the highest rates of evaporation. Consequently, the waters of these seas close to the Tropic of Cancer have some of the highest rates of ocean salinity.
- Temperature: Temperature and ocean salinity share a direct relationship. In general, regions with high temperatures are also the regions with high salinity.
- Precipitation: Precipitation and salinity share an inverse relationship. In general, regions with higher levels of precipitation have lower levels of salinity. This is the reason why though the equatorial region is as hot as the sub-tropics; it records lower salinity than the sub-tropics since the former receives heavy precipitation in a day.
- Ocean Currents: They play an important role in the spatial distribution of dissolved salts in ocean waters. For instance, Gulf Stream in the North Atlantic Ocean increases the salinity of ocean waters along the western margins of the Atlantic Ocean. The North Atlantic Drift, on the other hand, increases the salinity of waters in the North Sea.
- The influx of Fresh Water: Salinity is relatively lower in areas where major rivers meet the oceans. For instance, at the mouths of rivers such as Amazon, Congo, Ganges the ocean surface salinity is found to be lower than the average surface salinity. Similarly, in the Polar Regions, when the glaciers melt during the summers, there is an influx of fresh water into the surrounding ocean which reduces the surface salinity.
- Inflow of high salinity wa-ter from the Arabian Sea into the Bay of Bengal is signif-icant and occurs after the mature phase of the southwest monsoon. Freshwater transport out of the Bay of Bengal is southward throughout the year along the eastern bound-ary of the Indian Ocean.
- Low salinity water transport into the Arabian Sea occurs in the Somali Current during the southwest monsoon, closing a clockwise path of water mass transport. Only a small fraction of low salinity water is ad-vected into the eastern Arabian Sea from the Bay of Bengal.

Conclusion

Oceans, seas and coastal areas form an integrated and essential component of the Earth's ecosystem and are critical to sustainable development. They cover more than two-thirds of the earth's surface and contain 97% of the planet's water. Salt budget needs to be studied as it's integral nutrient in the ocean and it can contribute to poverty eradication by creating sustainable livelihoods and decent work.