1. How do India's annual precipitation patterns and associated variations bring in conditions of floods and droughts? Analyse.

Introduction:

Weather conditions in India are greatly influenced by the El Niño Southern Oscillation (ENSO) that causes widespread floods and droughts almost at intervals. The frequency, intensity, and impacts of such extreme events vary dramatically with geographical location over the Indian subcontinent. Thus, addressing the inter-annual variability in precipitation patterns becomes an important concern over India.

Body:

South west summer monsoon, spreading from June to September is a grand period of rainfall in India as monsoonal torrents supply about 80% of India's annual rainfall. The distribution of rainfall varies temporally as per an annual cycle of seasons. The meteorologists recognise four seasons:

Cold Weather Season:

- Little rainfall in some parts of India.
- Some weak temperate cyclones from the Mediterranean Sea cause rainfall in north-western India, which are called Western Disturbances.

Hot weather season

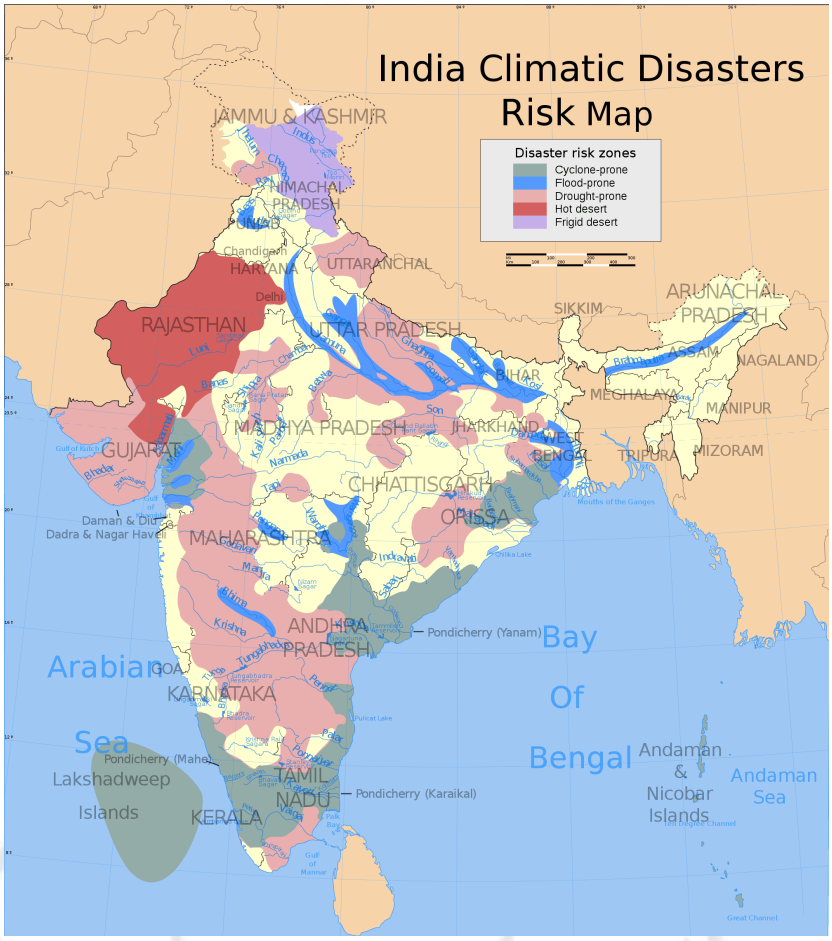
- A sudden contact between dry and moist air masses gives rise to local storms which are associated with torrential rains.

Southwest Monsoon season

- Over 80% of the annual rainfall is received in the four rainy months of June to September.
- The monsoon may burst in the first week of June in the coastal areas of Kerala, Karnataka, Goa and Maharashtra while in the interior parts of the country; it may be delayed to the first week of July.
- Monsoonal rainfall is largely governed by relief or topography and rainfall has a declining trend with increasing distance from the sea.

Retreating Monsoon

- By the end of September, the monsoon becomes weak in response to the southward march of the sun.
- The weather is dry in north India but is associated with rain in the eastern part of the Peninsula.



Floods in India:

Nearly 40 million hectares of India's land is prone to floods. Usually during La-Nina years, occurrence of floods is as follows:

- **Through heavy precipitation**: Heavy rainfall over natural bank of rivers, of about 15 cm or more in a single day exceeds the carrying capacity of rivers causes a flood in that region. Such effect can be seen in the West Coast region of the Western Ghats, Assam and sub-Himalayan West Bengal and Indo-Gangetic plains.
- **Floods through cyclonic rainfall**: Flood after cyclone is a very common phenomenon in the eastern coast of Tamil Nadu, Andhra Pradesh, Odisha and West Bengal.
- **Cloudbursts**: Quite regular in the Himalayan region during monsoons as well.
- **Strong NE monsoons**: In November and December 2015, the annual North-East monsoon generated heavy rainfall in south India causing floods along the Coromandel Coast in Tamil Nadu, Andhra Pradesh and Pondicherry. Chennai and surrounding area were hardly hit by these floods.
- **Western disturbance in winter**: Showers the Gangetic plain and causes heavy snowfall in Himalayas. Excessive precipitation due to this disturbance can cause crop damage, landslides, floods and avalanches.

Droughts in India:
More than 44 per cent of India's areas were under various degrees of drought conditions (abnormally dry to exceptionally dry) as of June 10, 2019 Drought Early Warning System (DEWS).

- **Deficit in SW-monsoon rains**: Felt to a large extent especially in areas that have large rain variability-leeward side of Western Ghats (Marathwada and Vidarbha) and North-west extremities of the country.
- **Untimely delay in monsoons:** The sluggish pace of the south west monsoon has compounded the severe dry spell. Most of these are in Andhra Pradesh, Kerala, Madhya Pradesh, Maharashtra, Chhattisgarh, and the north eastern states. Only four sub-divisions in Karnataka, Gujarat, and Lakshadweep have witnessed 'normal' rainfall.

Way Forward:

Dealing with floods and droughts in India, is a complex situation, given the numerous unpredictable factors associated with it.

Flood mitigation strategies:
- Planting of the tree and mangrove belts along river banks and coastlines.
- Planned settlement growth.
- Shared flood warning mechanisms.
- Recharge and rejuvenation of wetlands.
- Identification and assessment of flood-prone areas.

Drought mitigation:
- Adoption of micro-irrigation techniques
- Stringent application of water harvesting measures not only at the individual level but at community and village level too.
- Seechwal model can be implemented especially in acute water deficit areas. This model is currently being extended along the banks of the Ganga
- Wastewater recycling facilities in urban and industrial centres to allow for non-drinking uses.
- Agricultural practices should focus on more crop, per drop.
- Agro-climatic basis for crop selection.

Conclusion:
As India is poised to turn into a major power in the world, vagaries of the rainfall patterns is one of the most important challenge we have to face. Effective and committed solutions, policies and implementation by all stakeholders are the only way to strengthen our ability to deal with it.

2. Water, wind and ice create wonderful physiographic landforms that have become major tourist attractions. Can you mention some of these landforms with suitable examples?

Introduction

Geomorphology is the study of landforms, their processes, form and sediments at the surface of the Earth. Study includes looking at landscapes to work out how the earth surface processes, such as air, water and ice, can mould the landscape.

Body

Landforms created by water:

- **Cliff:** An erosional landform, produced by wave action, which is either at the seaward edge of the coast or at the landward side of a wave-cut platform and which denotes the inner limit of the beach erosion.
  Example: White cliffs of Dover, England and Torres Del Paine, Chile.
- **Sea caves:** The primary process involved is erosion. Sea caves are found throughout the world, actively forming along present coastlines and as relict sea caves on former coastlines.
  Example: Fingal's Cave, Staffa, Scotland and apostle island caves, Wisconsin, USA
- **Sea arches:** A sea arch is a natural opening eroded out of a cliff face by marine processes
  Example: Azure window, Malta and Cathedral Cove in New Zealand.
- **Blowhole:** When sea caves grow towards the land and upwards creating a vertical shaft that exposed on the surface, it results in a blowhole.
  Example: Nakelele Point in Hawaii and Hummanaya Blowhole in Srilanka.
- **Peneplain:** It is a low-relief plain formed by protracted erosion.
  Example: Sub-Cambrian peneplain in southern Sweden and drowned peneplain at Belcher Islands, Hudson Bay, Canada.
- **Barrier islands:** A barrier island is a sandbar that has grown to become an island. It is long and generally straight and narrow and parallel to the mainland shore.
  Example: The Mississippi-Alabama barrier islands and Hatteras Island, North Carolina.
- **Beach cusp:** It is a formation of sand, gravel or other beach material in the form of an arc. The cusp is the point of the arc on each side, directed toward the ocean.
  Example: Islands of Thailand
- **Fjord:** A long, narrow inlet with steep sides or cliffs, created by glacial activity
  Example: Geirangerfjord is located in south western Norway and Faroe Island in Scotland.

Landforms created by wind:

- **Barchan:** Dunes form where there isn't very much sand and the wind blows in one direction. These dunes are also called crescent dunes.
  Example: Inland desert regions such as Turkistan

- **Inselberg:** It is an isolated rock hill, knob, ridge, or small mountain that rises abruptly from a gently sloping or virtually level surrounding plain.
  Example: Mount Monadnock in New Hampshire, United States.
- **Yardangs:** It is formed in environments where water is scarce and the prevailing winds are strong, uni-directional, and carry an abrasive sediment load.
  Example: Xiniang Yardang, China

Landforms created by Ice:

- **Cirque:** It is an amphitheatre-like valley formed by glacial erosion.
  Example: Circo de Gredos in Spain and Cirque de Garvanie in France.
- **Horn:** A horn results when glaciers erode three or more arêtes, usually forming a sharp-edged peak.
  Example: Flinsch Peak in Glacier National Park, Montana
- **Drumlin**: Drumlins and drumlin clusters are glacial landforms composed primarily of glacial till.
  Example: Drowned drumlin in Clew Bay, Ireland
- **Hanging valley:** A hanging valley is elevated above another valley, with one end open to the valley below. There may be a cliff or steep formation where they meet.
  Example: Hanging Valleys of Yosemite National Park, California, USA and Birdman Woman Falls, Glacier National Park, Montana, USA

Conclusion

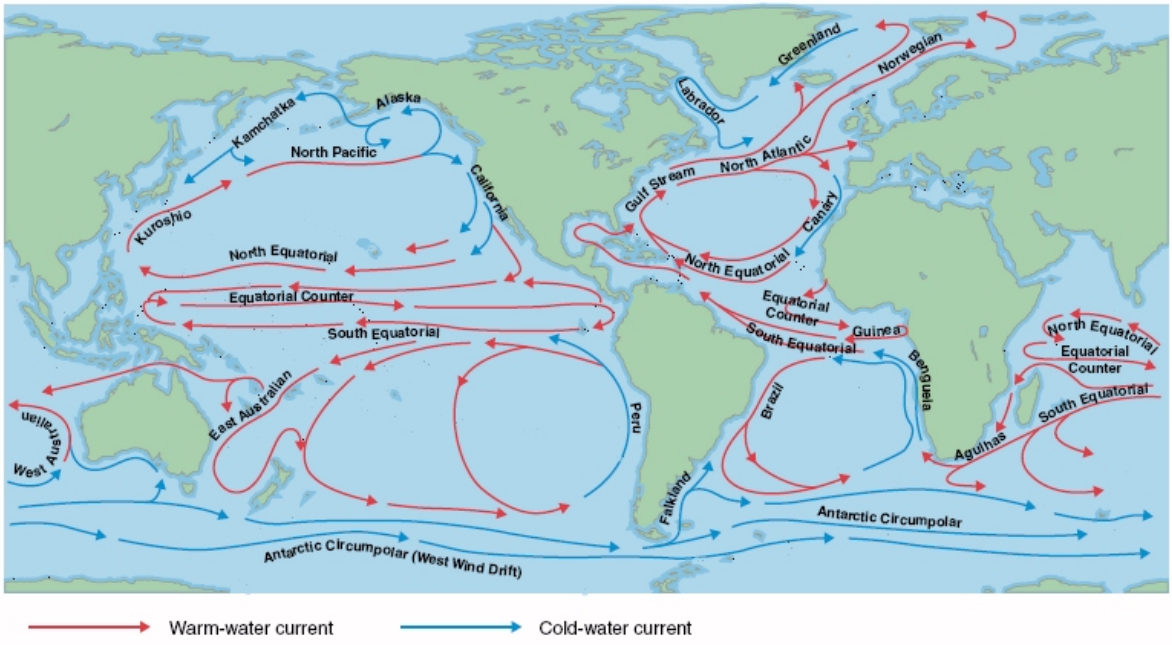
A tourist landscape can be described as constructed through a large number of symbolic and material transformations of an original physical and/or socioeconomic landscape in order to serve the interests of tourists and the tourist industry

3. Ocean currents have far reaching impacts on the coastal economy. Do you agree? With the help of suitable examples, examine the ways in which ocean currents affects coastal economy.

Introduction

Ocean currents are body of water mass with a slightly different thermophysical characteristic viz temperature, density and salinity from the surrounding water body. They move in a well-defined path like a river in the ocean and is influenced by the direction of wind and the coastal features.

Body



Ocean currents have far reaching impacts on the coastal economy. Ocean currents affects coastal economy in many ways such as

Agriculture

- Ocean currents influence the climate of the coastal regions and, in many cases, well beyond the coast. Such influence, characterized mostly by temperature, precipitation and cloud cover, and consequently the length of the growing season, determines the type of agriculture and hence many other economic activities of the region.

Fishing industry

- The most effective, reliable, and productive areas for industrial fishing are located where the cold ocean currents (carrying oxygen) meet warm ocean currents rich in nutrients.
- In East Asia meeting of the warm Kuroshio and the cold Oyashio current provides ideal conditions for rich fishing grounds in Japan. However, navigation becomes difficult due to thick fog.

Energy from Ocean Currents

- The massive oceanic surface currents are untapped reservoirs of renewable energy, probably the largest on the planet. Even if only a small portion of ocean currents energy can be harnessed, the potential of “hydro” energy that is embedded in ocean currents is remarkable.
- A key concern is how the turbines could affect local marine ecosystems. The turbines would be located at depths of about 100 meters, in areas of fast-moving water. In many zones, the main animals to worry about would be large marine mammals, like whales and dolphins

El Niño and La Niña

- The terms of El Niño and La Niña are frequently used when the weather patterns of the Pacific Ocean are discussed. Both of these contrasting patterns appear irregularly every few years, but they bring the likely weather patterns of sometimes extreme rains or the absence of rains, respectively.
- The consequences of El Niño may be substantial on weather of all countries with Eastern Pacific seashores, and consequently on the economy (fishing and agriculture) and health (epidemic diseases).

Ports

- The warm current is also responsible natural maintenance of ports . Eg - warm gulf current play an effective role in melting the ice in north European nation ports during winter.

Climate

- Ocean currents act as global conveyor belts which transfer heat from one part of the earth to another. They regulate the coastal climate thereby indirectly regulating the vegetation, fauna and the lifestyles of the people.

Others

- Ocean currents affect the shipping industry, commercial and recreational fishing, and recreational navigation for boats.
- They play a role in the distribution of pollution, such as oil spills. Oil and fuel tends to remain on the surface of the ocean, so knowing the current helps determine where such pollution might travel.

Conclusion

Ocean currents do indeed play a significant role ushering in the necessary weather changes, which at the same time, dictate the ways in which physiography, livelihoods and coastal economy of the world are impacted.

4. What are different types of deserts? How do deserts get formed? Examine the factors associated with dessert formation.

Introduction

Desert is a type of biome characterised by extreme temperatures and extremely low amount of precipitation (25 cm or less in a year). It is a major type of ecosystem that supports a community of distinctive plants and animals. Around 30 percent of total landmass on earth constitutes of desert.

Body

Different Types of Desert:

General Desert Classification:

- Hot and Dry Deserts- Mostly located near Tropic of Cancer or Tropic of Capricorn, the extreme temperatures reach around 100 degree Fahrenheit or

above. They get plenty of rainfall only for short duration of time. The soil is coarse-textured, shallow, rocky and gravely with no subsurface water. Examples- Sahara Desert, Thar Desert etc

- Cold Deserts- Generally found in temperate regions at higher altitude. They have hot summer and extremely chilled winter (temperature may reach up to -40C). Precipitation occurs in the form of snow, the humidity remains low throughout the year. Examples- Atacama Desert(Peru), Gobi Desert etc.

- Semiarid Deserts- Summers are generally long and dry, winters normally bring little rainfall. Normally the temperatures do not cross 45-50 degree Celsius. Examples- Nearctic realm (North America, Newfoundland, Greenland, Russia, Europe and northern Asia).

- Coastal Deserts- They have cool winters and moderately long and warm summers. The average summer temperatures are in the range 10-25 degree Celsius, winter temperatures are around 5 degree or below Celsius. Average rainfall of around 10-15 cm. Example- Namib Desert, Atacama Desert(Chile) etc

Formation of Deserts:

Deserts are formed by weathering processes as large variations in temperature between day and night put strains on the rocks which consequently break in pieces. Although rain seldom occurs in deserts, there are occasional downpours that can result in flash floods. Rain falling on hot rocks can cause them to shatter and the resulting fragments and rubble strewn over the desert floor are further eroded by the wind. This picks up particles of sand and dust and wafts them aloft in sand or dust storms. Wind-blown sand grains striking any solid object in their path can abrade the surface. Rocks are smoothed down, and the wind sorts sand into uniform deposits. The grains end up as level sheets of sand or are piled high in billowing sand dunes.

Factors associated with desert formation:

- Wind Pattern- Offshore trade winds carry least moisture, thereby minimising the precipitation. This is mostly seen in tropical regions with latitudes ranging from 15 to 30 degree.
- Presence of cold current- Will enhance the high pressure along the western coast of continents thereby pushing the region into extreme state of dryness. Example- Namib due to benguela current.
- Rain shadow effect- presence of mountain can cause least precipitation on leeward side. Example- Thar desert due to Aravalli ranges.
- Sand property- Sand cannot retain high temperature, therefore cannot maintain low pressure and they exhibit permanent high pressure character. This minimizes the rainfall in the region.

- Vegetation- Poor vegetation would aid the weathering process and erosion, this then accelerates formation of deserts.
- Anthropogenic factors- deforestation, excessive use of fertilizers, climate change due to human actions (burning fossil fuels, pollution etc) have resulted in changing precipitation pattern.

Conclusion

Natural causes for desert formation have been from times immemorial, it is the anthropogenic causes which are cause of concern. The plan of action to combat desertification needs to be in line with the UN convention to combat desertification (UNCCD).

5. How do local winds affect the socio-economic conditions of a region? Illustrate with the help of examples.

Introduction:

There are several winds which develop in response of the local terrain. They are generated through temporary creation of regions with relative high and low pressure. They are known as the local winds. They have a significant impact in the socio-economic conditions of a place and psychology of the society. Broadly they can be categorised on the basis of periodicity. There can be periodic winds and non-periodic winds.

Body:

Some of the local winds across the world and how they affect socio-economic conditions of region:

- Blizzard: It is intensely cold fast blowing wind accompanied by snow, blows in north America.
- Buran: it blows in central Asia and Siberia. It is a strong cold north easterly wind which reduces the temperature up to -30o
- Chili: it is a hot dry wind which blows from the Sahara Desert towards the Mediterranean Sea through Tunisia.
- Gibli: it blows from the Sahara Desert towards Mediterranean Sea through Libya. It is an extremely hot local wind. It blows during the summer season. It may last for 3-5 days. This wind has extreme effects. Due to heat the government declares the holiday. Because of this the shade temperature reaches up to 60o sometimes the tyres of the car melt and stick to the road. Even the dry grass catches fire. People shelter themselves in the basements.
- Haboob: it is an intense dust storm blowing across the world. It brings huge dust stroms in the area they pass by, Eye and respiratory system protection is advisable for anyone who must be outside during a haboob.

- Karaburn: it blows from March to May and leads to hazy weather. It is also responsible for deposition of loess in Huwang Ho valley.
- Khamsin: hot wind blows in Egypt for about 50 days. On its forward side, the centre brings warm, dry air northward out of the desert, carrying large amounts of dust and sand; on its rear side, it brings cool air southward from the Mediterranean.
- Loo: it blows in summer season in India in northern plains. It is a hot dry wind and raises the temperature. Loo follows a three-day cycle. It starts blowing at 9am in the morning till 5 in evening. On its third day, it is accompanied by a storm in the evening called Aandhi and causes little shower taking the temperature down.
- Mistra: it blows in Rhone valley of france. It a cold wind blowing during winters. It has adverse effects on orchards.
- Berg: It blows in South Africa. It blows mainly in winter due to anticyclone effects in the interiors, causing uncomfortable weather for people and damage to crops
- Chinook (snow or ice eater): it blows in USA and Canada between December and march. It descends on the leeward side of the mountain. It is warm and dry and causes the snow to melt which provides water for agriculture. It has a soothing effect on weather and society.

Conclusion:

Locals winds have both positive and negative effects on the socio-economic conditions of the region. With help of technology available, we can reduce the negative part by taking up preventive and mitigative measures.