

1. What do you understand by cryosphere. Discuss how it affects the earth's climate.

(250 words)

Answer:

Background:-

- With nearly 70% of Earth's fresh water stored in glaciers and ice caps, more than a billion people around the world rely on the cryosphere as a source of drinking water.

Cryosphere:-

- There are places on Earth that are so cold that water is frozen solid. These areas of snow or ice, which are subject to temperatures below 32°F for at least part of the year, compose the cryosphere.
- Ice and snow on land are one part of the cryosphere. This includes the largest parts of the cryosphere, the continental ice sheets found in Greenland and Antarctica, as well as ice caps, glaciers, and areas of snow and permafrost. When continental ice flows out from land and to the sea surface, we get shelf ice.
- The other part of the cryosphere is ice that is found in water. This includes frozen parts of the ocean, such as waters surrounding Antarctica and the Arctic. It also includes frozen rivers and lakes, which mainly occur in polar areas.

Affects earth climate:-

• **Regulating temperature:-**

- The components of the cryosphere play an important role in the Earth's climate. Snow and ice reflect heat from the sun, helping to regulate our planet's temperature.
- Ice cores drilled from ice sheets and glaciers provide annual records of temperature, precipitation, atmospheric composition, volcanic activity, and wind patterns going back more than 800,000 years. Today, scientists also use satellites to observe the cryosphere and monitor changes. Using these data, they are able to make predictions about what the cryosphere and Earth's climate might look like many years from now.

• **Albedo:**

- Snow and ice have high albedo. They reflect much of the insolation, which helps in cooling of the earth. Thus, presence or absence of snow and ice affects the heating and cooling of Earth's surface. This influences the entire planet's energy balance.

• **Feedback Loop:**

- Melting ice reduces the reflective surface. And, the ocean and land are darker in color, they absorb more solar radiation, and then release the heat to the atmosphere. This causes more warming and so more ice melts. This is known as a feedback loop.
- The cryosphere is an integral part of the global climate system with important linkages and feedbacks generated through its influence on surface energy and

moisture fluxes clouds, precipitation, hydrology atmospheric and oceanic circulation.

- **Storage of Carbon:**

- The permafrost of the polar region has trapped tonnes of carbon inside its soil. If 'feedback loop' aggravates, this carbon will be released in form of methane- a powerful greenhouse gas- which will catalyze the global warming.
- At polar regions, sea-water is converted into sea ice. As a result, surrounding water gets saltier. Saltier water has higher density, it sinks and initiates thermohaline circulation patterns across the oceans of the world. These Ocean currents act like a conveyor belt, transporting warm water from the equator toward the poles and cold water from the poles back to the tropics. Thus, currents regulate global climate. Some of these currents affect rain and drought situation via El-Nino La-Nina effect.
- Melting of cryosphere affects the volume of water in oceans. Any changes in the water cycle, affects global energy/ heat budget, and thereby global climate.
- **Conclusion:-**
 - With the rampant climate change, changes in cryosphere need to be studied further and the initiative by ministry of earth sciences towards understanding the cryosphere process is the step in the right direction.

PRACTICE QUESTIONS

Answer the following Questions

1. Discuss how dust storms are formed? Examine the impact of climate change in formation of dust storms? (250 words)
2. The post of the Governor, by constitutional design, acts as a check upon both federalism and popular democracy. Critically comment. (250 words)