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Mini Review

Factors Influencing the Climate on a Global Scale

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ABSTRACT

Earth is a dynamic globe, undergoing ongoing change as a result of both internal and external factors. Magma currents within our planet move the plates that make up the continental crust, forminsg mountains and valleys in the process. These valleys could become lakes, seas, and oceans in the future. The largest force affecting Earth on the surface is sunlight. The sun gives life its energy and controls our planet's weather and climate by creating temperature gradients in the atmosphere and oceans.

Keywords: Earth; Climate; Ocean currents; Evaporation; Circulation; Surface winds

INTRODUCTION

Earth receives both light and heat from the sun's rays, and locations that receive more exposure warm more. This is especially true in the tropics, where the amount of incident sunshine varies less seasonally. Tropical air that is moist warms, gets less dense, and rises. However, when air rises through the atmosphere, it cools. Clouds arise as water molecules condense, and rain falls as a result. Warm air rising from the surface of the Earth pushes the air mass away from the equator, and as it travels poleward, it releases its moisture as precipitation.

This cycle of evaporation, condensation, and precipitation would transfer water and air along a north-south axis from the equator to the poles if the Earth did not spin on its axis. This, on the other hand, does not occur. The rotation of the Earth creates three circulation belts. The air masses sink as they travel from the tropics to locations around 30° north and south latitude. After George Hadley, who first characterised it, this belt of air circulation is known as a Hadley cell. In temperate latitudes (between 30° and 60° latitude) and towards the poles (between 60° and 90° latitude), two additional belts of circulating air exist.

At 30° latitude, the sinking air mass causes two phenomena: It helps to create arid climates and regulates air circulation north and south of the tropics. Because the descending dry air drains moisture from the soil, dry, even desert-like conditions are common at 30° north and south latitude. Cool air is taken from adjacent locations to fill the hole when warm air rises in the tropics. The trade winds that blow in subtropical areas are created as a result of this. However, some of the air from the Hadley cell is dragged away from the equator and toward the poles. The winds that characterise weather patterns in temperate zones are created by this air mass.

The Coriolis force deflects air back to Earth's surface under the effect of the Earth's rotation, shifting the flow to the right of its initial direction in the northern hemisphere and to the left of its initial trajectory in the southern hemisphere. The easterly trade winds are formed when winds travelling toward the equator are deflected to the west (easterly winds blow from east to west). The Coriolis effect deflects winds toward the east in temperate zones where they blow toward the poles, with prevailing westerlies (winds blowing from west to east) conveying most weather patterns in these temperate regions.

LITERATURE REVIEW

Ocean currents

The oceans are similarly affected by the Earth's rotation, with currents flowing within ocean basins. Surface winds, the rotation of the Earth, and salinity differences all contribute to ocean currents.

Warm surface waters in tropical oceans and seas are blown east to west by trade winds. Warm water accumulates near the west coasts of continents, creating a temperature gradient across the ocean surface. The western Pacific is about 8°C warmer than the eastern Pacific under typical conditions, and this difference helps to generate clouds and precipitation in Australia, Indonesia, and parts of Africa. El Nino is a weather phenomenon that occurs when this temperature gradient is disrupted [1].

An upwelling occurs as water moves away from Peru's and Ecuador's coasts, drawing cold water from below to fill the void. In the Atlantic and Indian Oceans, similar conditions can be found on the west coasts of continents. These areas are the principal source of mixing between the warmer surface waters and the colder deep

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waters, which are normally kept apart. The very high biological productivity of these regions' coastal waters is due to the upwelling of nutrient-rich water.

The rotation of the Earth causes surface currents in the oceans, much as it does the prevailing winds. Surface waters near the equator flow from east to west due to the effect of the trade winds. Water is deflected away from the equator by the Coriolis force, much as it is in the atmosphere (northward in the Northern Hemisphere, southward in the Southern Hemisphere). The Coriolis Effect causes rotating convection in the oceans, with currents flowing in a clockwise direction in the Northern Hemisphere and counter-clockwise in the Southern Hemisphere [2]. The water cools and sinks as it approaches the poles. Cold-water surface currents travel back toward the equator along the west coasts of continents due to prevailing winds in northern and southern latitudes.

When surface waters reach the northern waters of the North Atlantic, they freeze. The freezing process eliminates water molecules from the ocean but not salt. As a result, the salinity of ocean waters has increased. With higher salinity and lower temperature, the water has a higher density water is densest at 4°C and descends to the ocean floor [3]. This process creates a massive, slow-moving deep-water "conveyor belt" that transfers water from Antarctica to the Indian, Pacific, and Atlantic oceans.

Global climate

By transferring heat and moisture, the combination of oceanic and atmospheric circulation drives global climate. Throughout the year, areas in the tropics remain warm and damp. Seasonal shifts in temperate zones are driven by variations in solar input. These seasons can bring about significant temperature fluctuations in the Northern Hemisphere, where land masses are more concentrated [4]. Seasonal cycles in the Southern Hemisphere revolve around the presence and absence of precipitation rather than dramatic temperature swings because huge land masses are closer to the equator and the bulk of the Earth's surface is covered with water [5].

Global climate patterns are dynamic, changing over time in response to solar radiation, greenhouse gas concentrations in the atmosphere, and other climatic forcing factors. Cycles in solar energy reaching the poles are one of the more predictable of these shifts.

The gravitational attraction of other planets in our solar system causes Earth's elliptical orbit around the sun to alter. The planet's orbit evolves from almost circular to elongate over a 100,000-year cycle, moving it further away from its energy source [6]. The tilt of the Earth in relation to its orbit varies throughout a 41,000-year cycle, from 21.5° to 24.5° we are currently in the middle of this cycle, at 23.5°. Finally, the Earth's axis (north-south orientation) shifts with time [7]. This 23,000-year precession of the equinoxes shifts the planet's orientation in relation to its orbital location. When the three Milankovitch cycles reinforce one another, solar input is altered, and oceanic and atmospheric circulation patterns are influenced. This can result in cooling and glaciation on a regular basis [8].

Periods of cooling can be accelerated by albedo, which occurs when snow and ice reflect incident sunlight and heat, further cooling the globe. As a result, glaciers and polar ice caps continue to grow even when incident sunlight levels are low. The surface level of oceans declines as more water freezes, causing changes in oceanic circulation patterns. Furthermore, plate tectonics can modify the flow of water by shifting continental land masses, changing ocean currents and circulation patterns [9].

Rapid melting events can occur as Earth's precession and tilt increase polar exposure to sunlight. Soils melt and previously frozen vegetation disintegrate once free of the grasp of ice, releasing carbon dioxide and methane gas two well-known greenhouse gases into the sky. Carbon dioxide and methane levels in the atmosphere contribute to global warming, and both gases are thought to have had a role in past rapid warming events.

Biogeography

Plant and animal distribution now reflects past changes in global climatic conditions as well as the placement of land masses. The quantity of area available for terrestrial organisms to live decreased during cold periods, when much of the land was covered in snow and ice, increasing competition for resources. Organisms migrated to fill newly-available places as the ice melted during warming periods, and many species thrived in the new environment. Organisms created adaptations over time that allowed them to better exploit their changing circumstances. Some of these adaptations have survived into present times [10].

Large land masses shifted under the influence of magma currents beneath the crust as climatic conditions changed. Mountain ranges were formed by continental collisions, while spreading rifts generated seas, both of which served as barriers to organismal dispersal, limiting organisms' capacity to migrate. Organisms evolved features that best adapted them to the natural conditions of their continent and region when they were restricted to smaller places.

Today, scientists distinguish six biogeographic regions in which animals exhibit characteristics unique to that region: Nearctic, Palearctic, Neotropical, Ethiopian, Oriental, and Australian. Animals with more distinct features can be found in realms where dispersal barriers have existed for longer periods of time. The marsupial mammals of the Australian Region, which has a long history of isolation from other continents, are one of the clearest instances of this.

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