

Ocean in Motion 6: How does the Ocean Change Weather and Climate?

A. Overview

1. The Ocean in Motion -- Weather and Climate

In this program we will tie together ideas from previous lectures on ocean circulation. The students will also learn about the similarities and interactions between the atmosphere and the ocean.

2. Contents of Packet

Your packet contains the following activities:

- I. A Sea of Words

B. Program Preparation

1. Focus Points

0The oceans and the atmosphere are closely linked

1. the sun heats the atmosphere as well as the oceans
2. water evaporates from the ocean into the atmosphere
 - a. forms clouds and precipitation
 - b. movement of any fluid (gas or liquid) due to heating creates convective currents

0Weather and climate are two different things.

1. Winds
 - a. Uneven heating and cooling of the atmosphere creates wind
 - b. Global ocean surface current patterns are similar to global surface wind patterns
 - c. wind patterns are analogous to ocean currents

2. Four seasons

0Atmospheric motion

1. weather and air moves from high to low pressure areas
2. the earth's rotation also influences air and weather patterns
3. Atmospheric winds move surface ocean currents.

C. Showtime

1. Broadcast Topics

This broadcast will link into discussions on ocean and atmospheric circulation, wind patterns, and how climate and weather are two different things.

a. Brief Review

We know the modern reason for studying ocean circulation is because it is a major part of our climate. We talked about how the sun provides heat energy to the world, and how the ocean currents circulate because the water temperatures and densities vary. To measure the circulation, we use various instruments. Some are remote-like satellites. Some are in the water (in-situ) - like current meters or tracers, such as visible dyes, or invisible chemicals. Ocean water contains many substances dissolved in it, including gases from the atmosphere. Carbon dioxide (CO₂), which is a major greenhouse gas, can be 'stored' in the water in this way. Another gas that can be dissolved in the water is CFCs, which are used as an invisible tracer.

Follow-up activity: A Sea of words.

b. The Atmosphere

The atmosphere is the thin layer of gases that surround the earth. It is what we commonly call air. In the same way that the sun heats the ocean which creates currents, it also heats the atmosphere which creates winds. Air moves from warm areas, or 'high' pressure, to cold areas, or 'low' pressure. Maps of ocean circulation are very similar to maps of atmospheric circulation. We associate high pressure with warm, dry, sunny weather. Low pressure is associated with cold, wet, cloudy weather. Atmospheric circulation also depends on the rotation of the earth, and convective currents. Convective currents are formed when warm air rises and cold air sinks. Weather and climate are different. Weather is the local state of the atmosphere over a short time. Fog, rain, snow, and sunshine are examples of weather. Climate is the general condition of the atmosphere around the globe. Global warming, or El Nino are climatic conditions.

c. Physical Ocean-Atmosphere Interactions

The oceans affect the atmosphere and vice versa. On a large scale, the atmosphere affects ocean circulation through wind-driven circulation. Oceans store heat better than the atmosphere, so in some areas, the air is being heated from above by the sun, and also from below by the ocean. This creates a bigger high pressure than usual, which makes the winds stronger. Warm water is evaporated from the ocean into the atmosphere. Usually, the air is warm in these regions, so the moisture rises with the rising warm air. It condenses and forms clouds. When a lot of moisture has condensed, we get precipitation (rainfall).

The ocean and atmosphere also interact on a smaller scale. Near the coasts, water from the ocean evaporates and forms clouds. The clouds are blown over land by sea breezes (Fig. 2a).

Precipitation occurs and the liquid water that falls on the land runs back into the ocean. This is called the water cycle. Oceans store heat better than land, so at night the oceans are warmer than the land. Warm air rises and cold air sinks, so at night there is a land breeze (Fig. 2b). A monsoon is a larger version of the sea and land breezes. In the summer, the land is heated and the air above it rises. Cool air from the sea blows on-shore to replace the rising air - like a sea-breeze. Heavy clouds and precipitation are associated with these monsoonal winds. During winter the reverse is true.

D. Activities.

I. A Sea of Words

Materials:

- Copies of Figure 1
- pencils

Objective: Familiarize students with the vocabulary of an oceanographer

Method: Find the hidden words. Read the remaining letters from top to bottom, left to right.

There is a hidden message. What is it?