Global Wind Belts

Dana Desonie, Ph.D.

AUTHOR
Dana Desonie, Ph.D.

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CHAPTER 1 Global Wind Belts

- Identify and define global winds.
- Explain how atmospheric circulation creates global winds, and how global winds influence climate.

Why were winds so important to the early explorers?

When Columbus sailed the ocean blue, and for centuries before and after, ocean travel depended on the wind. Mariners knew how to get where they were going and at what time of the year based on experience with the winds. Winds were named for their usefulness to sailors, such as the trade winds that facilitated commerce between people on opposite shores.

Global Wind Belts

Global winds blow in belts encircling the planet. Notice that the locations of these wind belts correlate with the atmospheric circulation cells. Air blowing at the base of the circulation cells, from high pressure to low pressure, creates the global wind belts.

The global wind belts are enormous and the winds are relatively steady (**Figure** 1.1).

The Global Winds

Let's look at the global wind belts in the Northern Hemisphere.

- In the Hadley cell air should move north to south, but it is deflected to the right by Coriolis. So the air blows from northeast to the southwest. This belt is the trade winds, so called because at the time of sailing ships they were good for trade.

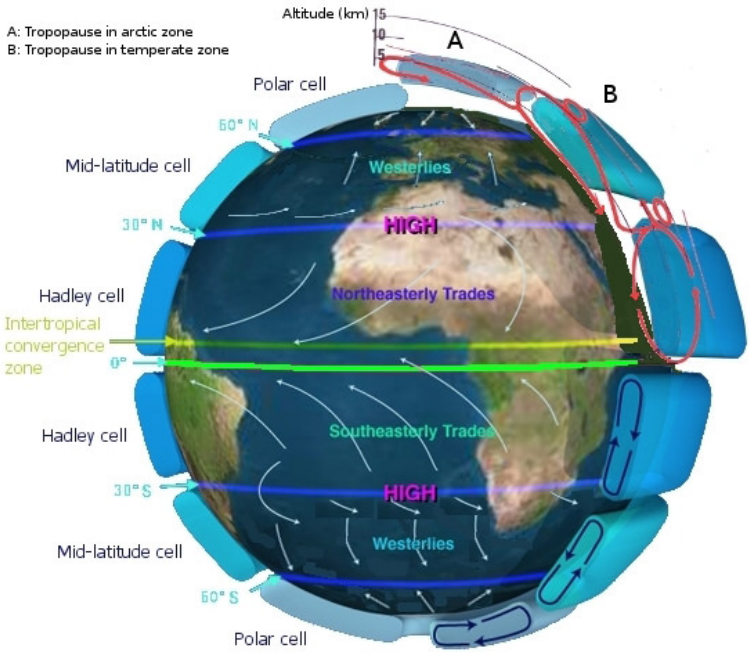
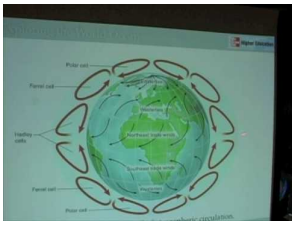


FIGURE 1.1

The major wind belts and the directions that they blow.

- In the Ferrel cell air should move south to north, but the winds actually blow from the southwest. This belt is the westerly winds or westerlies.
- In the Polar cell, the winds travel from the northeast and are called the polar easterlies.

The wind belts are named for the directions from which the winds come. The westerly winds, for example, blow from west to east. These names hold for the winds in the wind belts of the Southern Hemisphere as well.



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Global Winds and Precipitation

The high and low pressure areas created by the six atmospheric circulation cells also determine in a general way the amount of precipitation a region receives. Rain is common in low pressure regions due to rising air. Air sinking in high pressure areas causes evaporation; these regions are usually dry. These features have a great deal of influence on climate.

Polar Front

The **polar front** is the junction between the Ferrell and Polar cells. At this low pressure zone, relatively warm, moist air of the Ferrell Cell runs into relatively cold, dry air of the Polar cell. The weather where these two meet is extremely variable, typical of much of North America and Europe.

Jet Stream

The polar **jet stream** is found high up in the atmosphere where the two cells come together. A jet stream is a fast-flowing river of air at the boundary between the troposphere and the stratosphere. Jet streams form where there is a large temperature difference between two air masses. This explains why the polar jet stream is the world's most powerful (**Figure** 1.2).

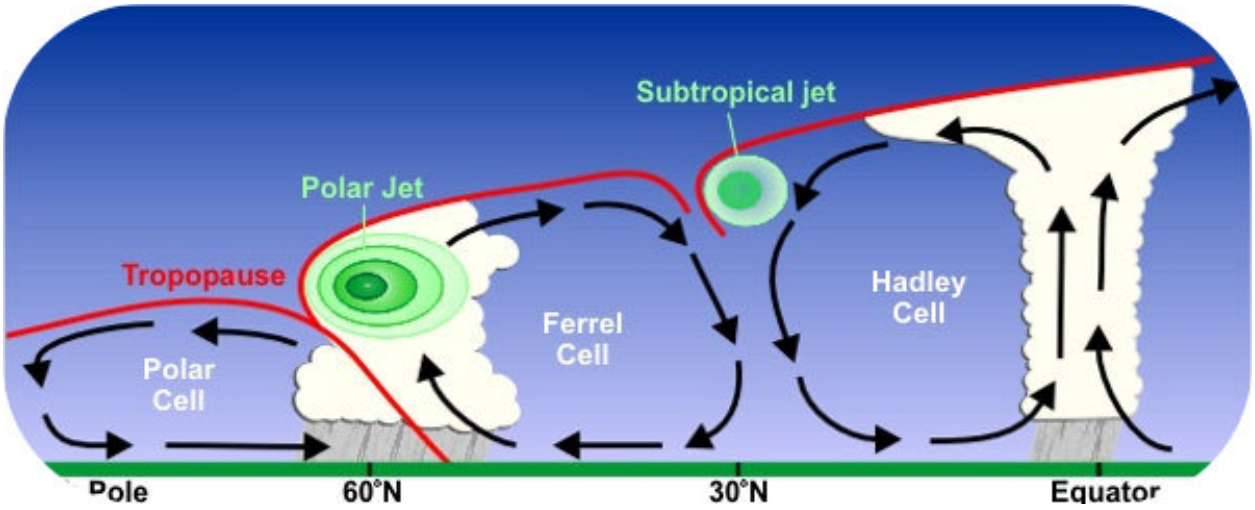
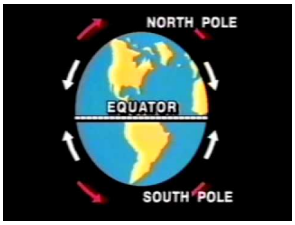


FIGURE 1.2

A cross section of the atmosphere with major circulation cells and jet streams. The polar jet stream is the site of extremely turbulent weather.

Jet streams move seasonally just as the angle of the Sun in the sky moves north and south. The polar jet stream, known as "the jet stream," moves south in the winter and north in the summer between about 30°N and 50° to 75°N.



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Summary

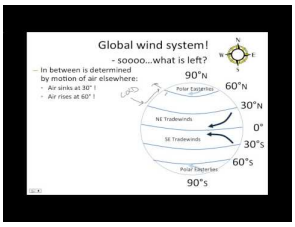
- Global winds blow from high to low pressure at the base of the atmospheric circulation cells.
- The winds at the bases of the cells have names: the Hadley cell is the trade winds, the Ferrel Cell is the westerlies, and the polar cell is the polar easterlies.
- Where two cells meet, weather can be extreme, particularly at the polar front.

Review

1. What is a jet stream? What is "the" jet stream?
2. Why does a flight across the United States from San Francisco to New York City takes less time than the reverse trip?
3. Where on a circulation cell is there typically precipitation and where is there typically evaporation?

Explore More

Use this resource to answer the questions that follow.



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1. What would wind at the surface do if Earth did not rotate?
2. At what latitudes are the three convection cells in the Northern and three in the Southern Hemisphere?
3. How are winds named?
4. What happens at the equator?
5. What creates the Trade Winds?
6. What happens to the air that sinks at the poles? What are the winds created?
7. Which winds are created as air moves from 30 to 60 degrees? Which way do those winds move in the northern and southern hemisphere?
8. What is the name of the zone at the equator? Is this a high or low pressure zone? Is there a lot of precipitation?
9. What is the name of the zone at 30-degrees? Is this a high or low pressure zone? Is there a lot of precipitation?
10. Why does the air that is sinking at 30-degrees north and south create deserts?
11. Which two air masses clash at the polar front?

References

1. Courtesy of NASA. Map of global wind belts . Public Domain
2. Courtesy of National Weather Service. Diagram of a jet stream . Public Domain