Geographic Implications of Recent Jet Stream Developments[1]

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One of the most interesting meteorological discoveries of the past decade has been the jet stream. The knowledge that strong, river-like currents flow through the oceans has been known for centuries; but a swift river of air flowing with great persistence through the atmosphere remained unnoticed until very recently. Within the past ten years, scientists from many countries have become extremely interested in this air-river that has come to be called the "jet stream." It is a narrow, meandering, ever-present band of strong westerly winds high above the earth in middle latitudes. It offers many new hopes and poses many new problems to air travel, and promises one of the most important advances in the science of weather forecasting during the twentieth century.

The jet stream is of varying size but usually 25 to 50 miles wide and about one mile deep. Winds of diminishing velocities extend outward hundreds of miles from the core. The jet stream has daily and seasonal fluctuations, usually meandering between the 25th and 45th parallels of latitude and between 30,000 and 40,000 feet above sea level. Its lowest latitudes and highest altitudes are reached in winter, while in summer the situation is reversed.

The speed of the jet stream, like its location, is subjected to daily and seasonal variations. The winds are strongest where the north-south temperature contrasts are greatest. This condition is intensified in the winter season and implies strongest wind velocities during the season when the stream is flowing at low latitutdes. The swiftest jets of the world, therefore, occur over southeastern United States and over central and southern China during the winter months when polar continental airmasses meet head-on with the much warmer tropical circulations. Velocities in the jet have been measured at 300 miles per hour and winds up to 450 miles per hour have been reported, but velocities are usually less than half this amount.

Probably the most important application of jet stream information will be in the science of weather forecasting. The jet stream has been related to polar front activity, including temperature, pressure, and rain fall distribution. As the jet increases in intensity, the Coriolis force (deflection by the earth's rotation) pushes the stream equatorward. This leads to a pressure gradient that causes tropical air to move poleward above and below the jet but at considerable distance above the earth. To balance this flow at upper levels, there is an equatorward movement of air at the surface, the leading edge of which is recognized as the polar (cold) front.

The jet stream has already proved very important to air travel. Because of turbulence on the fringes of the stream it can be dangerous to unskilled pilots, and the head-wind obstacle, when flying against it, is of serious consequence. It offers great advantages, however, when use can be made of the amazing tailwinds to speed a plane toward its destination.

In the event of another global war, the jet stream may serve as an important weapon. During World War II, the Japanese released balloons in the jet stream which carried delay-action fire bombs to American shores. The effectiveness of this attack is not public knowledge, but many bombs did reach the continent, some as far inland as Montana. Asiatic powers are in a strategic position to utilize the jet stream in the event of war with the United States. The industrial heart of this country is favorably located, however, to render such use of the jet stream less effective.

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