



GO TO THE MOUNTAIN

The 1998 Winter Olympics have introduced the world to a new city: Nagano, Japan.

After viewing the heavy snowfall around Nagano during the Olympic events, it probably will surprise many to learn that the city of 300,000 is located at a more southerly latitude than San Francisco, Calif., Washington, D.C., or even Athens, Greece.

Nagano is located on Japan's largest island, Honshu (haun-SHOE). The city's site is in a north-south valley in the heart of Japan's highest volcanic mountains. These mountains are the backbone of the four main Japanese islands, having formed as the Pacific geologic plate is subducted beneath the Eurasian plate.

The Japanese Alps, a volcanic mountain chain, continues to be active, creating hot springs, smoking volcanoes and frequent earthquakes. On either side of Nagano's Shinano River valley, mountains rise to elevations over 7,500 feet (2,288 m.).

Elevation is a dominant climatic control at any latitude, but in Nagano's (NAG-ah-NO) low latitude other variables also influence its winter climate to bring such abundant snowfall.

Temperatures decline with increasing elevation on the average of about 3.5 F per 1,000 feet (6.5 C per 1,000 m.). This is called the normal lapse rate, for it is just an average mostly useful in making quick calculations of temperatures at different elevations. For example, an easy rule of

thumb is to assume that, all else being equal, temperatures on a mountain 7,000 feet (2,135 m.) will be about 24.5 F colder than at sea level.

There is, however, another cooling factor which affects mountain climates, called the dry and wet adiabatic lapse rates. When air is forced to rise over a mountain range, it cools at the dry adiabatic rate of 5.5 F. per 1,000 feet (10 C. per 1,000 m.). This rate of cooling is much higher than the normal lapse rate. In the same example of a 7,000-foot mountain given above, if the air is forced over the mountain, temperatures at the top could be as much as 38.5 F. (24 C.) colder than at sea level.

Air must be cooled for condensation to occur. Air being forced over our hypothetical mountain range may be cooled to the dew point, or the point at which a cloud begins forming. At this point, the droplets of water and ice become visible as a cloud.

As the air continues to rise, moisture continues to condense into the cloud, with precipitation beginning to fall. But the rate of cooling drops from 5.5 F to about 3.2 F per 1,000 feet, because the process of condensation releases some heat.

Although this may sound complicated,

precipitation.

A few other of the world's ski resorts are as close to the equator as Nagano's latitude of 36.42 N, although Nagano's location is the farthest equatorward the Winter Olympics have ever been held. In fact, Nagano is located farther south than Barcelona, Spain, the site of the 1992 Summer Olympics.

Other low latitude ski resorts include Taos, N.M. (36.25 N), located near the southern tip of the Rocky Mountains and known for its wonderful skiing; Boone, N.C. (36.2 N), known as the center of skiing in the southern Appalachians; and even Australia's Snowy Mountains (36.17) containing that country's only ski resort area.

What makes all of these resort areas possible is elevation. At such latitudes, elevations above 5,000 feet (1,542 m.) are essential for temperatures low enough to hold snow through the winter months. Siting ski slopes away from the sun's exposure also is essential (north in the northern hemisphere and south in the southern hemisphere).

Nagano has one additional advantage over most other ski areas of similar latitude. A wintertime, cold Siberian high pressure area lies to the northeast, and the

Kuroshi ocean current bathes Japan in warm water.

Cold, dry Siberian winds sweep across the Sea of Japan, squeezing the warmer air over the ocean against the Japanese Alps and forcing it over the mountains. These northwest winds blow up the Shinano valley, creating an orographic effect to

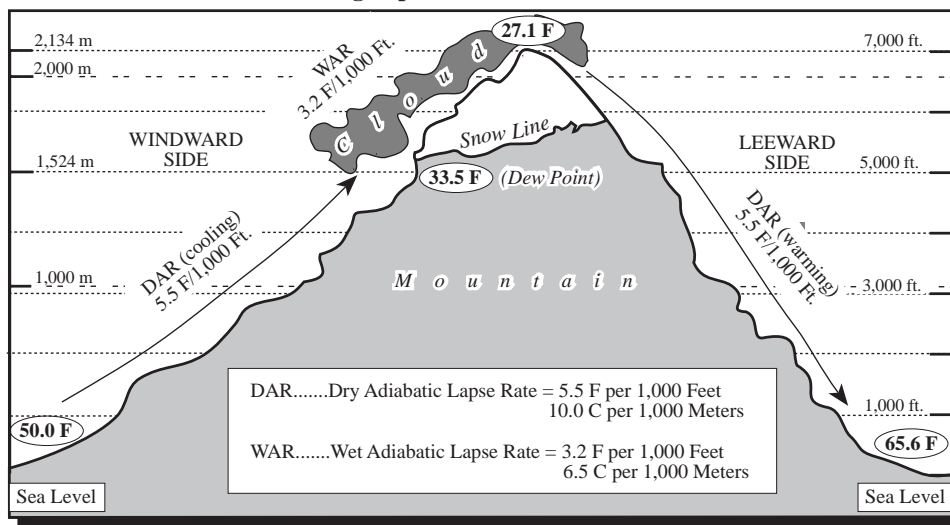
bring four or more feet (1.3 m) of annual snowfall to Nagano's resort area.

Such conditions create a perfect low latitude, high elevation winter wonderland for winter sports.

And that is Geography in the News, February 19, 1998.

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The Orographic Effect on a Mountain



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these are the scientific processes that create the uniqueness of mountain climates worldwide. Sudden rain and snow storms, heavy precipitation, high winds and cold temperatures are products of mountain geography.

This process, whereby condensation forms and precipitation occurs as air is pushed up mountain slopes, is called the orographic process. Most of the world's mountains experience some orographic