



NATURAL HAZARDS MAP OF THE CIRCUM-PACIFIC REGION PACIFIC BASIN SHEET

THIS MAP IS A CONTRIBUTION TO THE
INTERNATIONAL DECADE FOR
NATURAL DISASTER REDUCTION (IDNDR)

CIRCUM-PACIFIC MAP PROJECT
The Circum-Pacific Map Project (CPMP) is a cooperative international effort to show the resources of mineral and energy resources to such phenomena as geology, seismology, and volcanology. The project is one of the activities of the Circum-Pacific Council for Energy and Mineral Resources. For each CPMP map series, six overlapping maps cover the Pacific Basin as a whole at a scale of 1:10 million, and a seventh map covers the entire region at a scale of 1:17 million. All are plotted on the Lambert azimuthal equal-area projection.

The Natural Hazards Map is a special sheet on the 1:17-million base prepared in cooperation with the U.S. National Oceanic and Atmospheric Administration. It also includes data from the Geographic, Plate-Tectonic, and Geodynamic Maps of the regular series of the Circum-Pacific Map Project.

Contributors for this map are Maurice J. Terman, U.S. Geological Survey, and Milton Lockwood, Curtis Mason, and Irving Petrock, National Oceanic and Atmospheric Administration.

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MAP PRODUCTION BY U.S. GEOLOGICAL SURVEY
Cartography by Frank J. Sidlas, Jr.
SCALE: 1:11,000,000
Lambert Azimuthal Equal-Area Projection
(Map center point: Equator, 180°W)

- EXPLANATION**
- WEATHER HAZARDS**
- TORNADOES**
Frequency of tornadoes—Triangles indicate general regions where tornadoes occur, and are especially dense, indicate the average period in years between occurrences of a given size. The width of the arrow indicates the approximate probability of having at least one tropical storm within a given 5-degree square in any given year. The greatest width represents a 10% probability, and the least a 10% probability. The preferred tracks are based on storm for the following periods: western North Pacific (1953-1966); eastern North Pacific (1967-1986); southwest Pacific and Australia (1986-1988); North Atlantic (1989-1990).
- WINTER-TIME WAVE HEIGHTS**
Percent frequency of heights equal to or greater than 4 meters (13 feet)—Waves are equal on the basis of the higher of the sea or the swell when both are present. If the heights are equal, the wave with the longer period is selected. Most of the observations were collected by ships of opportunity from the various maritime nations. The winter season is defined as the ice limits below.
- ICE LIMITS**
Derived from weekly analysis, 1973 through 1982.
Maximum ice edge during winter—December, January, February in the northern hemisphere, and June, July, August in the southern hemisphere.
Maximum ice edge during summer—June, July, August in the northern hemisphere, and December, January, February in the southern hemisphere.
Probability of winter-time superstructure icing—Exceeding of sea spray or precipitation on marine structure can build up rapidly and increase the height of a ship's center of gravity to become a serious threat, especially to smaller craft. In general, the greater the wind speed and the lower the air temperature, the greater the potential for superstructure icing. Indices are based on ship-of-opportunity observations used at the National Climatic Data Center (NCDC) using the following relationship function for the critical wind speed necessary to produce superstructure icing for a given temperature. The equation is based on T. Sorensen's relationship published in 1962:
 $V = 10 \sqrt{10 - T}$
when $T =$ wind speed in knots
 $T =$ temperature in °C
 $V =$ compound critical wind speed (knots)
 $A =$ wind speed (knots)
 $B = .0113$
- TROPICAL STORMS**
Preferred tracks for tropical storms (wind speeds equal to or greater than 34 knots). The width of the arrow indicates the approximate probability of having at least one tropical storm within a given 5-degree square in any given year. The greatest width represents a 10% probability, and the least a 10% probability. The preferred tracks are based on storm for the following periods: western North Pacific (1953-1966); eastern North Pacific (1967-1986); southwest Pacific and Australia (1986-1988); North Atlantic (1989-1990).

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- WINTER-TIME WAVE HEIGHTS**
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