

## Hurricane force

## Weather data facts and figures

### Atmospheric pressure

Atmospheric pressure is measured using a barometer, in units of millibars (mb), hectoPascals (hPa), or centimetres or inches of mercury. Variations in atmospheric pressure can affect the weather as air flows from regions of high pressure to those with low pressure. Atmospheric pressure also depends on altitude as the higher you are above sea level the less air is above you pressing down. Pressures from weather stations are usually adjusted so they give figures for sea level.

On a weather chart, lines joining places with equal sea-level pressures are called isobars. Weather charts showing isobars indicate anticyclones (areas of high pressure) and depressions (areas of low pressure). More information is available from

<http://www.bbc.co.uk/weather/features/weatherbasics/airpressure.shtml> This page also has links to high pressure and low pressure.

[http://en.wikipedia.org/wiki/Atmosphere\\_\(unit\)](http://en.wikipedia.org/wiki/Atmosphere_(unit))

[www.globe.gov/trr-ppt/pressure.ppt](http://www.globe.gov/trr-ppt/pressure.ppt) has a PowerPoint presentation to download about barometric pressure.

The National Physical Laboratory has an on-line barograph

<http://resource.npl.co.uk/pressure/pressure.html>

### Units of pressure

**Pascal** SI unit of pressure = 1 Newton per sq metre      **1 HectoPascal (hPa)** = 100 Pascals

**1 Newton** = Force needed to give an mass of 1 kg an acceleration of  $1 \text{ ms}^{-2}$

**Bar** – unit of pressure =  $10^5$  Pascal = 0.987 atmospheres (average atmospheric pressure at sea level).

Typical atmospheric pressure at sea level ranges from 970-1040 millibars

**millibar (mb)** = one thousandth of a bar or 100 Pascal's equivalent to 1 HectoPascal

[http://kids.earth.nasa.gov/archive/air\\_pressure/](http://kids.earth.nasa.gov/archive/air_pressure/)

### Humidity

<http://www.bbc.co.uk/weather/features/weatherbasics/humidity.shtml>

Humidity can be measured in several ways, but **relative humidity** is the most common. In order to understand relative humidity, it is helpful to first understand absolute humidity.

**Absolute humidity** is the mass of water vapour divided by the mass of dry air in a volume of air at a given temperature. The hotter the air is, the more **water** it can hold..

**Relative humidity** is the ratio of the current absolute humidity to the highest possible absolute humidity. It is expressed as a percentage. A reading of 100 percent relative humidity means that the air is totally saturated with water vapour and cannot hold any more, making rain likely. Relative humidity near the ground does not have to be 100% for rain to fall.

Humans are very sensitive to humidity. If the air is at 100-percent relative humidity, sweat will not evaporate into the air. As a result, we feel much hotter when the relative humidity is high. If the air temperature is 24 degrees Celsius with a relative humidity of 0%, the air temperature feels more like 21 degrees C whereas with 100% relative humidity it would feel more like 27 degrees C.

### Wind

A wind is named for the direction from which it blows. A wind blowing from southeast to northwest is a southeast wind. The direction from which wind blows is called windward. The direction toward which it blows is leeward. An object is upwind from a person when it is between the person and the source of the wind. The person is downwind from the object. Wind direction is shown by a weather vane.

Wind speed can vary greatly. Near the earth's surface, it is measured by an instrument called an anemometer. In the upper atmosphere, wind speed is determined by tracking a balloon.

Wind speed is measured in **knots (nautical miles per hour)**, statute (land) **miles per hour**, or in **metres or feet per second**.

**The Beaufort scale** is based on a system devised by Admiral Sir Francis Beaufort in 1806. The scale uses numbers from 0 to 12 for wind speed—the higher the number the greater the speed.

[http://en.wikipedia.org/wiki/Beaufort\\_scale](http://en.wikipedia.org/wiki/Beaufort_scale)

**The Torro scale** is an extension of the Beaufort scale for tornadoes and hurricanes.  $T_0$  is equivalent to force 8 on the Beaufort scale,  $T_1$  is equivalent to force 10,  $T_2$  to force 12 and so on.

[http://en.wikipedia.org/wiki/TORRO\\_scale](http://en.wikipedia.org/wiki/TORRO_scale)

**The World Meteorological Organization has adopted the knot as the international unit for measuring wind speed.** <http://science.howstuffworks.com/wind-info.htm>

### Further information for converting wind speeds into different forms.

**For all these conversions a suitable degree of accuracy can be agreed by discussion.**

1 hour = 60minutes: 1 minute = 60 seconds

1 mile = 1760 yards: 1 yard = 3 feet; 1 foot = 12inches

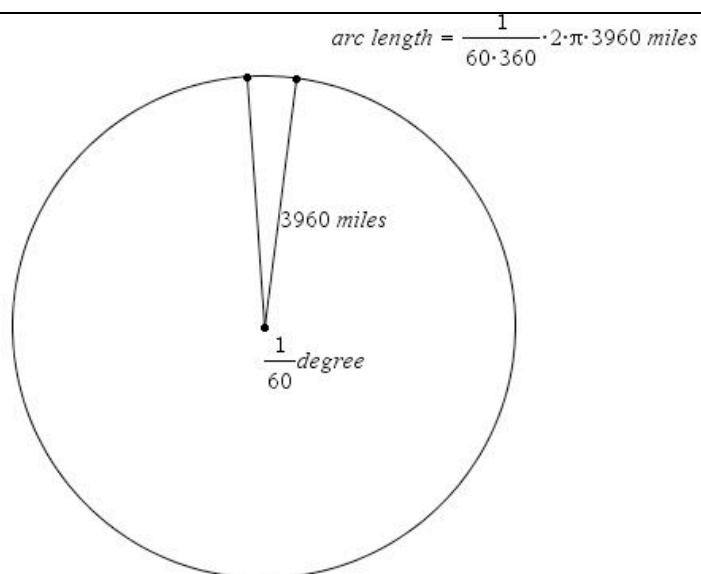
1 mile is approximately 1609.34metres (In athletics a metric mile is taken as 1600metres)

How would you convert one mile to metres if the only fact that you knew was that one inch is approximately 2.54cm?

**1 nautical mile is approximately 1852 metres or 6076 feet or 1.15 miles or use the facts below.**

One nautical mile makes an angle of one minute (60 minutes = 1 degree) at the centre of the earth.

You can estimate how long a nautical mile is if you know the radius of the earth (3963 miles or 6378 km)



### Solar radiation

Outside the earth's atmosphere, solar radiation has an intensity of approximately 1370 watts/metre<sup>2</sup>. This is the value at the top of the atmosphere and is called the Solar Constant.

On the surface of the earth on a clear day, at noon, the direct radiation from the sun will be approximately 1000 watts/metre<sup>2</sup> in many places. The energy from the sun can be captured using solar panels. The availability of

energy is affected by the location and factors such as latitude, height above sea level, season, and time of day. The biggest factors affecting the available energy in a particular location are cloud cover and other weather conditions.

### Units

The **watt** (symbol: **W**) is a unit of power in the International System of Units (SI). One watt is equivalent to 1 joule (J) of energy per second. For mechanical energy, one watt is the rate at which work is done when an object is moved at a speed of one metre per second against a force of one Newton.

$$1\text{W} = 1\text{Js}^{-1} = 1\text{kgm}^2\text{s}^{-3} = 1\text{Nms}^{-1}.$$

For electrical energy: Work is done at a rate of one watt when one ampere flows through a potential difference of one volt.

Solar radiation is measure in watts per square metre  $\text{W/m}^2$ .

### Ultra violet index

The **UV index** is an international standard measurement of how strong the ultraviolet (UV) radiation from the sun is at a particular place on a particular day. Its purpose is to help people to effectively protect themselves from UV light. Excessive exposure causes sunburns, eye damage, skin aging, and skin cancer. Public-health organizations recommend that people protect themselves when the UV index is 3 or higher.

The UV index is a linear scale. An index of 0 corresponds to zero UV radiation such as at night. An index of 10 corresponds roughly to mid-day sun and a clear sky. Indices greater than 11 are quite common in the southern hemisphere where the Ozone layer is depleted. The numbers are related to the amount of UV radiation reaching the surface of the earth, measured in  $\text{W/m}^2$ , but the relationship is not simple and cannot be expressed in physical units. The UV index is however designed to give a good indication of likely skin damage.

### General information from

<http://science.howstuffworks.com/meteorological-terms-channel.htm>

[http://www.metoffice.gov.uk/education/teachers/indepth\\_understanding.html](http://www.metoffice.gov.uk/education/teachers/indepth_understanding.html)

<http://www.metoffice.gov.uk/education/index.html>

**Weather for sailors:** This web site shows a world map which can display a variety of weather observations such as barometric pressure. <http://www.sailwx.info/index.html>