

The Compass

The compass, an essential navigational aid. Learn all about Variation, Deviation, True and Magnetic bearings and how to convert from one to the other.

The compass

The Earth has a magnetic field which is roughly aligned with the north and south poles. A magnet allowed to rotate freely will align itself with these magnetic poles. The modern magnetic compass actually consists of several parallel magnets mounted to a compass card. This assembly pivots around a jeweled bearing and is usually built within a fluid filled container designed to dampen it's movement. These instruments give us the ability to accurately and consistently steer our boat on a desired course.



Compass Error

Anything that affects our compass reading, that is, anything that alters it from the direction of true north, is called compass error. We need to understand what forces will do this so that we can correct these errors and derive our actual heading. There are two different types of compass error:

- Variation
- Deviation

Variation

The magnetic poles correspond closely with the actual geographical poles. but not quite close enough. The north magnetic pole is located at approximately 78.9°N latitude and 103.8°W , over 600 miles from the geological north pole. And whilst your compass doesn't point exactly towards the north magnetic pole, it does point to a location near to it.

The problem that's created here is that a compass will point to a direction other than true north, the difference between the two depends on where on the Earth the compass is. This error is called Variation, and it's the angular difference between true north and magnetic north. This variation varies depending where you are in the world but in the UK it is

about 7° West. This means that the North the compass is indicating is 7° West of True North.

Clearly if our chart suggests we travel true North i.e., 0° then we must steer using our compass a course of 7° to compensate for the difference.

An area's local variation can be found within the Compass Rose of your nautical chart. It changes a very slight amount every year due to the slow migration of the Earth's magnetic poles so check the year that your chart was printed and note the annual increase or decrease in variation.

Variation only affects devices that rely on the Earth's magnetic field to work. Gyroscopic compasses, radio direction finders, and global positioning instruments are not effected by variation.

As previously mentioned variation changes through time and location. It can also be affected by other factors:

- **Secular** which is due to the movement of the poles,
- **Solar** which is slight but caused as the sun moves around the Earth
- **Lunar** which is very small due to the Moon but larger effect than the sun,
- **Magnetic Storms** which are caused when the Sun sends out plasma during Solar flare which interferes with the Earth's magnetic field.
- **Coastal Irregularities** such as the presence of large amounts of magnetic material can distort the **magnetic isogonic lines** (these are lines showing positions of equal magnetic variation over the earth's surface).

Deviation

Another force that acts upon your compass to create error is deviation. Deviation is the influence of the immediate environment upon your compass. Being a magnet, your compass will be attracted to (or repelled by) iron bearing metal and other magnets (including magnetic fields created by flowing electricity). Unlike variation, deviation is not

constant, it's different in every boat, and it's even different within the same boat, depending on which direction she's heading. Deviation is measured by the angular difference between the magnetic heading and the compass heading.

The navigator should know what the deviation is on his vessel. While it is beyond the scope of this tutorial to describe the process, most quality compasses can be adjusted to eliminate most, if not all deviation error. What deviation remains can be found and documented on a Deviation Card. This card or graph will list the deviation for various compass courses and is referred to by the navigator when compass courses need to be corrected.

Don't forget about everyday objects that you take on and off your boat particularly cylinders.

T=True
Var = Variation
M = Magnetic
Dev = Deviation
C = Compass
Error relationships

