

Year 2003

Article of the month May

At what time is the sun due south (north)?

The answer is often, "at twelve o'clock".

That is correct when we mean XII hours apparent solar time, but here, we want something else.

In order properly to orient a sundial, it is necessary to know the north-south direction, and it is good fun to find that direction using the sun and a good watch.

The question now becomes:

What time does our watch read when the sun is due south (north)?

And that will rarely be twelve o'clock exactly.

There are differences between the time as shown by our watch, and that as shown by the sun.

These have two causes.

- The world is artificially divided into time zones, each keeping one civil time over its entire area, while each specific longitude has its own apparent solar time (longitude correction).
- And although our watch is ultimately regulated to the sun, its motion is quite constant, while that of the real sun is not (Equation of Time).

The first difference is constant (for a specific location), the second varies from day to day (but is the same in every location).

Longitude correction

Civil time in a time zone is based on a certain standard longitude, or standard meridian.

For The Netherlands for example it is -15 degrees (*east, or negative*), for Washington DC it is +75 degrees (*west, positive*) and for Sydney, Australia, it is -150 degrees. (*east, negative*).

Now look up the longitude of the planned sundial location, and calculate the difference LC between the local meridian LM and the standard meridian SM:

$LC = LM - SM$ (*in degrees*).

The longitude correction in minutes of time is 4 times LC just found.

If LC is positive, the location is to the west of the standard meridian.

If negative, it is east of it.

On average, the sun will be in the south (north) at twelve o'clock plus the longitude correction (in minutes, and considering the sign).

Examples:

Location	LM	SM	LC in gr.	LC in min.	east or west	sun south on average
Utrecht, Netherlands	-5	-15	10	40	west	12:40
USA, Washington DC	77	75	2	8	west	12:08
Australia, Sydney	-151	-150	-1	-4	oost	11:56

When summer time, or daylight saving time, is in force, one hour should be added, e.g. Utrecht has the sun in the south at 12:40 standard time, or 13:40 summer time (DST).

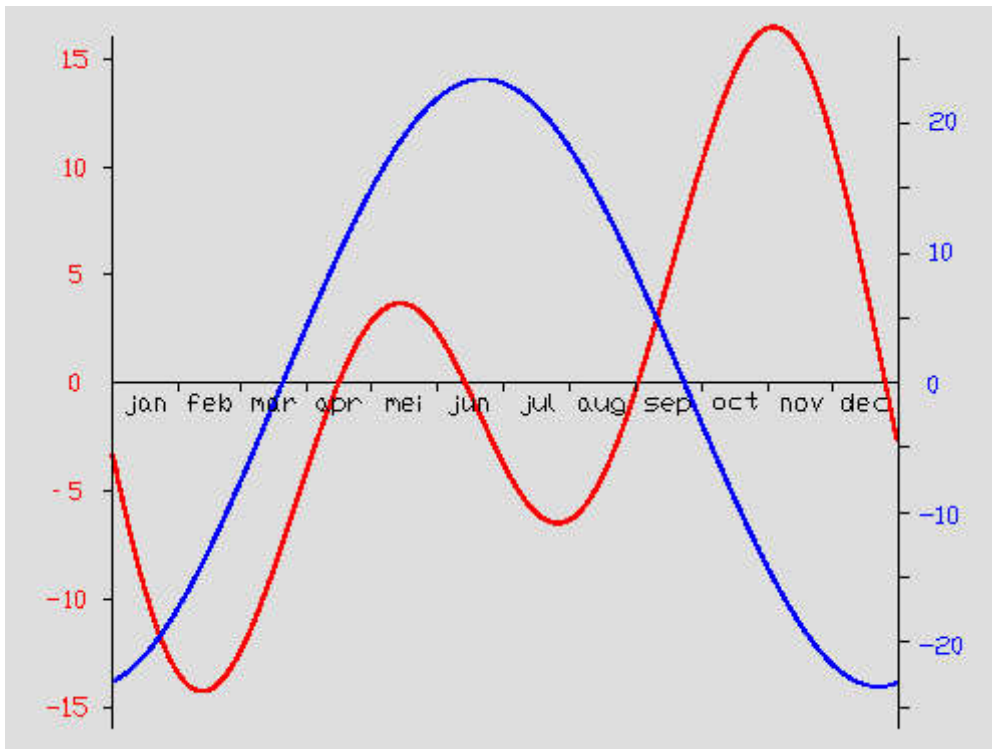
This average time is fixed for each location; it does not change over time.

Equation of Time

The inconstant motion of the apparent sun has two causes:

- The axis of the earth is slanted with respect to the earth's orbital plane.
- The earth moves around the sun in an ellipse, not a circle.

The graph below shows, in red, the equation of time in minutes.
(The blue line is for the declination of the sun.)



Or you may download [a table](#) of mean values for the period 2000-2099.
12kB

Sources published elsewhere, such as De Koepel's "Sterrengids", are even more accurate.

The value for the Equation of Time should be subtracted *) from the average time calculated above, and so for every day the time at which the sun is in the south (north) can be calculated.
Take care of the sign.

To sum up:

The sun is due south (north) at: **12:00 + longitude correction - equation of time.**

Remarks:

Outside of the tropical zones the midday sun is due south in the Northern Hemisphere, but in the Southern Hemisphere the midday sun is due the north.

Within the tropical zones, the midday sun is due north part of the year, due south in the remainder.

Fer de Vries.

*) This is the astronomical convention, where a positive EoT means that the sundial is fast, so that the sun is due south earlier - hence the subtraction. Some authors use the opposite convention. In any case, one should always find the sun slow in February (due south later than the average) and fast in November (due south earlier).

English translation: RH