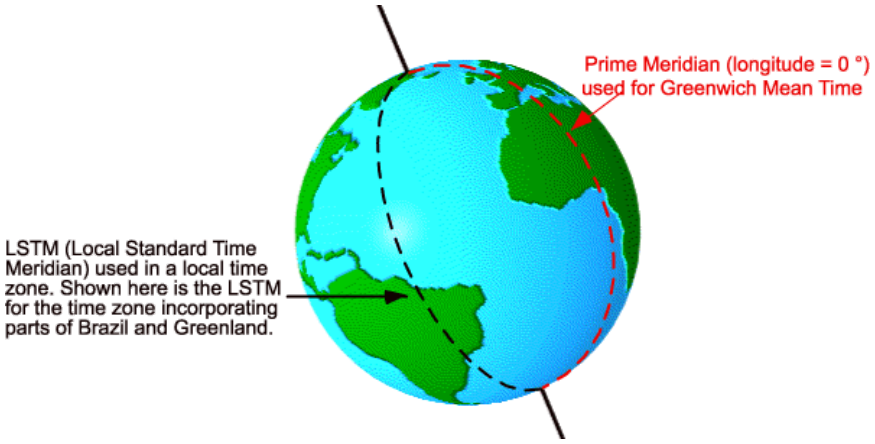
# Solar Time

## Local Solar Time (LST) and Local Time (LT)

Twelve noon local solar time (LST) is defined as when the sun is highest in the sky. Local time (LT) usually varies from LST because of the eccentricity of the Earth's orbit, and because of human adjustments such as time zones and daylight saving.

## Local Standard Time Meridian (LSTM)

The Local Standard Time Meridian (LSTM) is a reference meridian used for a particular time zone and is similar to the Prime Meridian, which is used for Greenwich Mean Time. The LSTM is illustrated below.




The (LSTM) is calculated according to the equation:

$$LSTM = 15° \cdot \Delta T_{GMT}$$

where $\Delta T_{GMT}$ is the difference of the Local Time (LT) from Greenwich Mean Time (GMT) in hours. 15°= 360°/24 hours.

## Equation of Time (EoT)

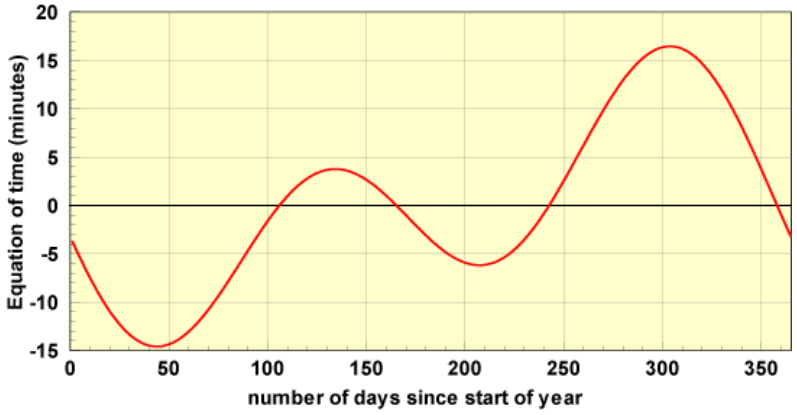
The equation of time (EoT) (in minutes) is an empirical equation that corrects for the eccentricity of the Earth's orbit and the Earth's axial tilt.

$$EoT = 9.87\sin(2B) - 7.53\cos(B) - 1.5\sin(B)$$

where

$$B = \frac{360}{365}(d - 81)$$

in degrees and $d$ is the number of days since the start of the year. The time correction EoT is plotted in the figure below.




## Time Correction Factor (TC)

The net Time Correction Factor (in minutes) accounts for the variation of the Local Solar Time (LST) within a given time zone due to the longitude variations within the time zone and also incorporates the EoT above.

$$TC = 4(Longitude - LSTM) + EoT$$

The factor of 4 minutes comes from the fact that the Earth rotates 1° every 4 minutes.

## Local Solar Time (LST)

The Local Solar Time (LST) can be found by using the previous two corrections to adjust the local time (LT).

$$LST = LT + \frac{TC}{60}$$

## Hour Angle (HRA)

The Hour Angle converts the local solar time (LST) into the number of degrees which the sun moves across the sky. By definition, the Hour Angle is 0° at solar noon. Since the Earth rotates 15° per hour, each hour away from solar noon corresponds to an angular motion of the sun in the sky of 15°. In the morning the hour angle is negative, in the afternoon the hour angle is positive.

$$HRA = 15°(LST - 12)$$

‹ Motion of the Sun  Declination Angle ›

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