

# Nautical Astronomy

NAVIGATIONAL ALGORITHMS

© Andrés Ruiz, 2014

San Sebastián – Donostia

43° 19'N 002°W

<http://sites.google.com/site/navigationalalgorithms/>

# Abstract

Take the sextant and shoot the Sun or the North Star. Practice with it using the old methods of astronomical navigation, and let this app do the calculations for you!.

16:03

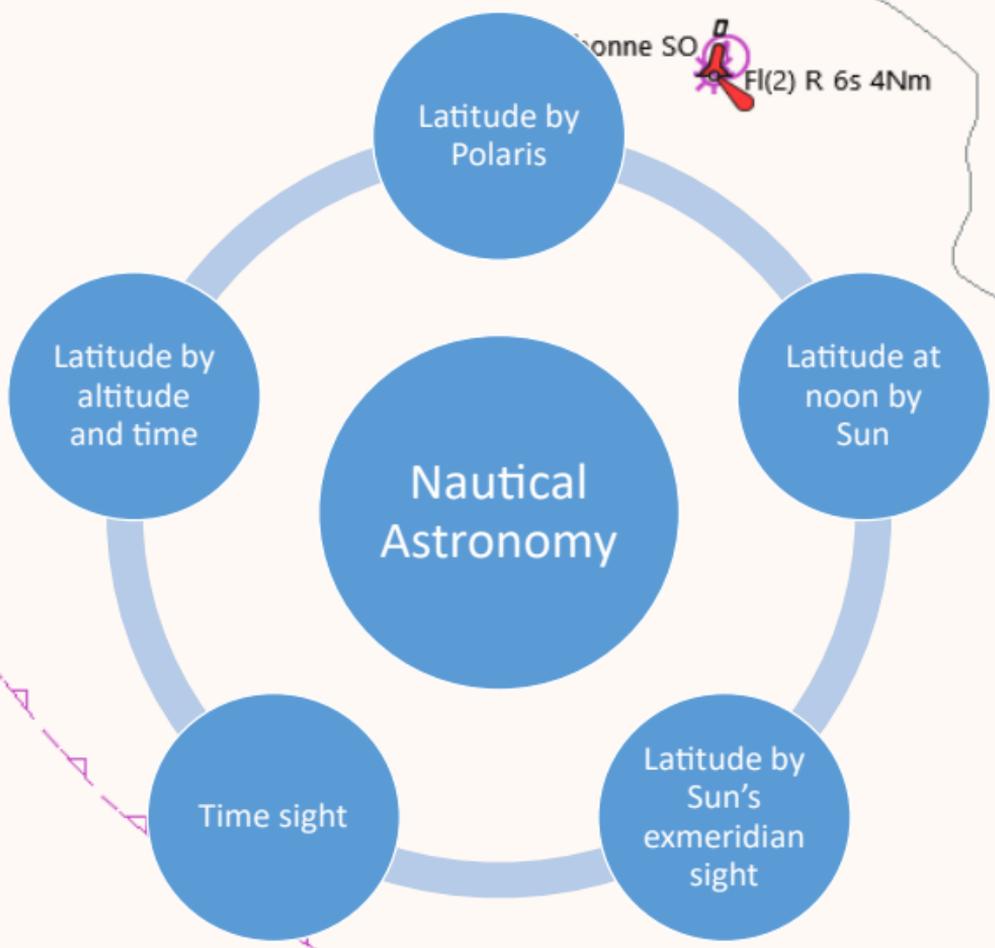
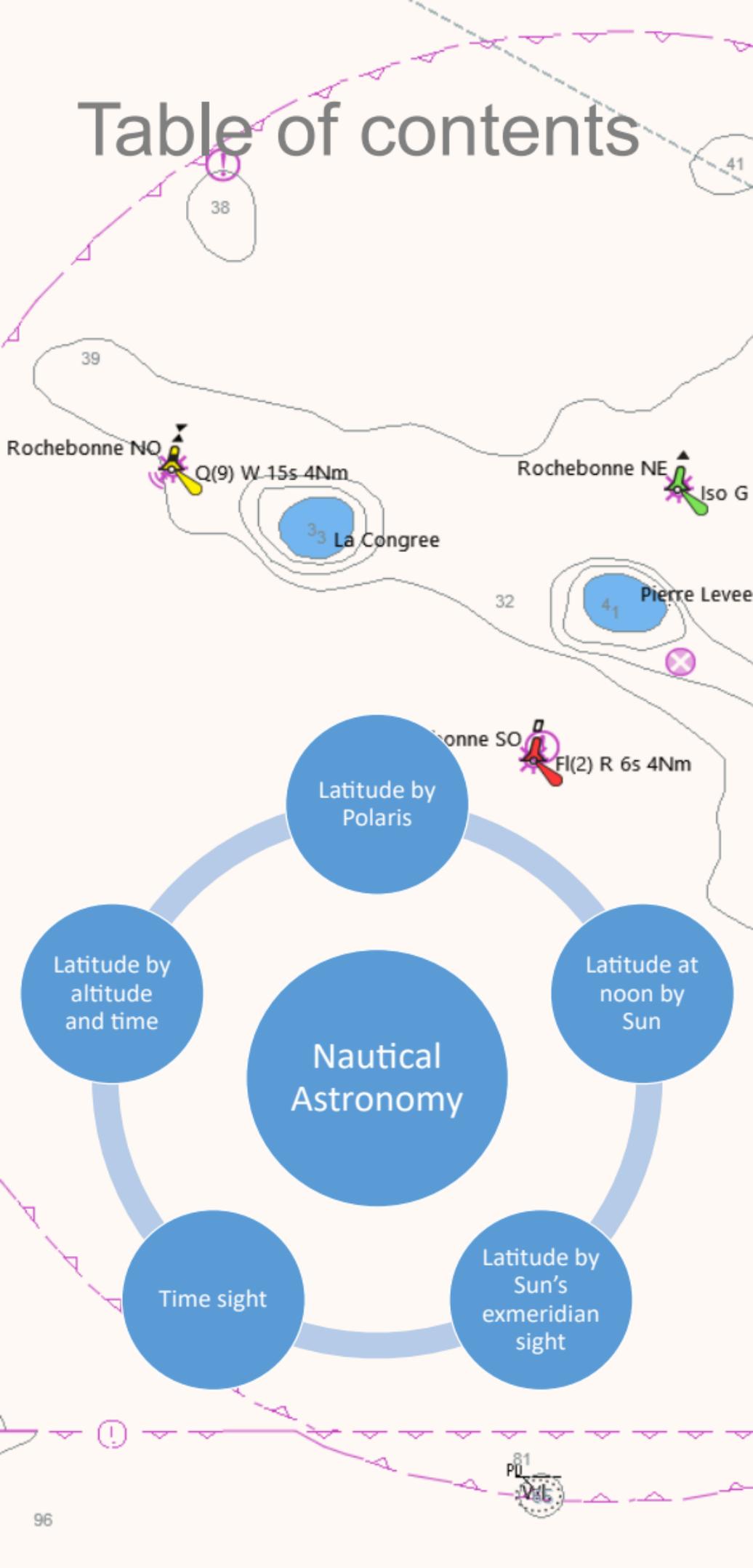
**Nautical Astronomy**

Date	22/08/2012
UT1	18:45:33
DR Latitude	38° 00,0' N
DR longitude	008° 35,2' E
Altitude Hs	37° 35,2'
Limb	center
Reference	Sea horizon
h eye (m)	2.5 m
IC (')	0.0'
Pressure (hPa)	1010.0 hPa
Temperature (°C)	10.0 °C
Latitude by Polaris	

**CALCULATE**

Polaris  
Dec = 89° 18,8'  
GHA = 210° 47,3'  
Ho = 37° 31,2'  
p = 90°-dec = 00° 41,2'  
LHA = 219° 22,5'  
Bo = 38° 03,1' N  
Zn = 0,5°

# Table of contents



# Latitude by Polaris

22/08/2012

18:45:33 UT1

Geocentric equatorial coordinates

## **Polaris**

Dec = 89.313590 = 89° 18.8'

GHA = 210.787763 = 210° 47.3'

DR

Be = 38.051667 = 38° 0.0'

Le = 8.586667 = 8° 35.2'

Altitude

Hs = 37.5872 ° = 37° 35.2'

ie = 0.0000 '

heas = 2.5000 m

T = 10.0000 °C

P = 1010.0000 hPa

Hoi = 37.5872 °

dip = 0.0464 °

Ha = 37.5408 ° = 37° 32.4'

R = 0.0211 °

OB = 0.00000000 °

HP = 0.0000 °

PA = 0.00000000 °

SD = 0.0000 °

Aug = 0.00000000 °

SDag = 0.000000 '

Ho = 37.519739 = 37° 31.2'

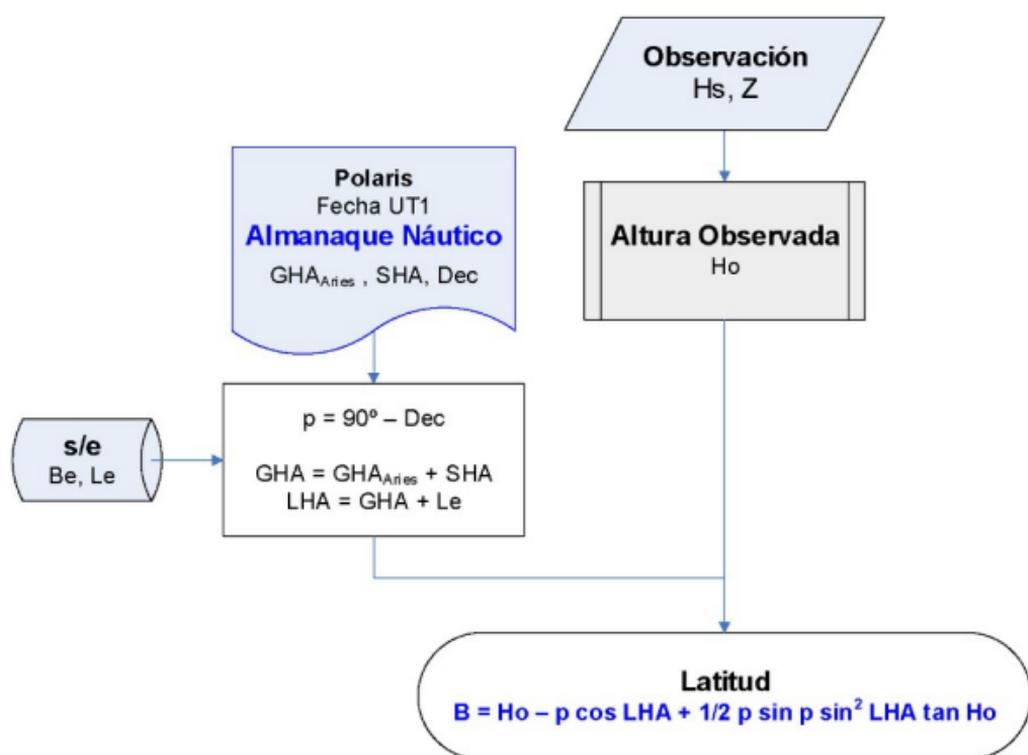
Latitude by Polaris

B = 38° 3.1'

Zn = 0.5°

# Algorithm

## Latitud por la altura de la estrella Polar



# Latitude at noon by Sun

21/08/2012

11:28:42 UT1 - Meridian passage  
Geocentric equatorial coordinates

## Sun

Dec = 11.886463 = 11° 53.2'

GHA = 351.416045 = 351° 25.0'

DR

Be = 38.0 = 38° 0'

Le = 8.586667 = 8° 35.2'

Altitude - max/min

Hs = 63.841688 = 63° 50.5'

ie = 0.0000 '

heas = 0.0000 m

T = 10.0000 °C

P = 1010.0000 hPa

Hoi = 63.8417 °

dip = 0.0000 °

Ha = 63.8417 ° = 63° 50.5'

R = 0.0080 °

OB = -0.00000841 °

HP = 0.0024 °

PA = 0.00105620 °

SD = 0.0000 °

Aug = 0.00000000 °

SDag = 0.000000 '

Ho = 63.834788 = 63° 50.1'

Upper transit

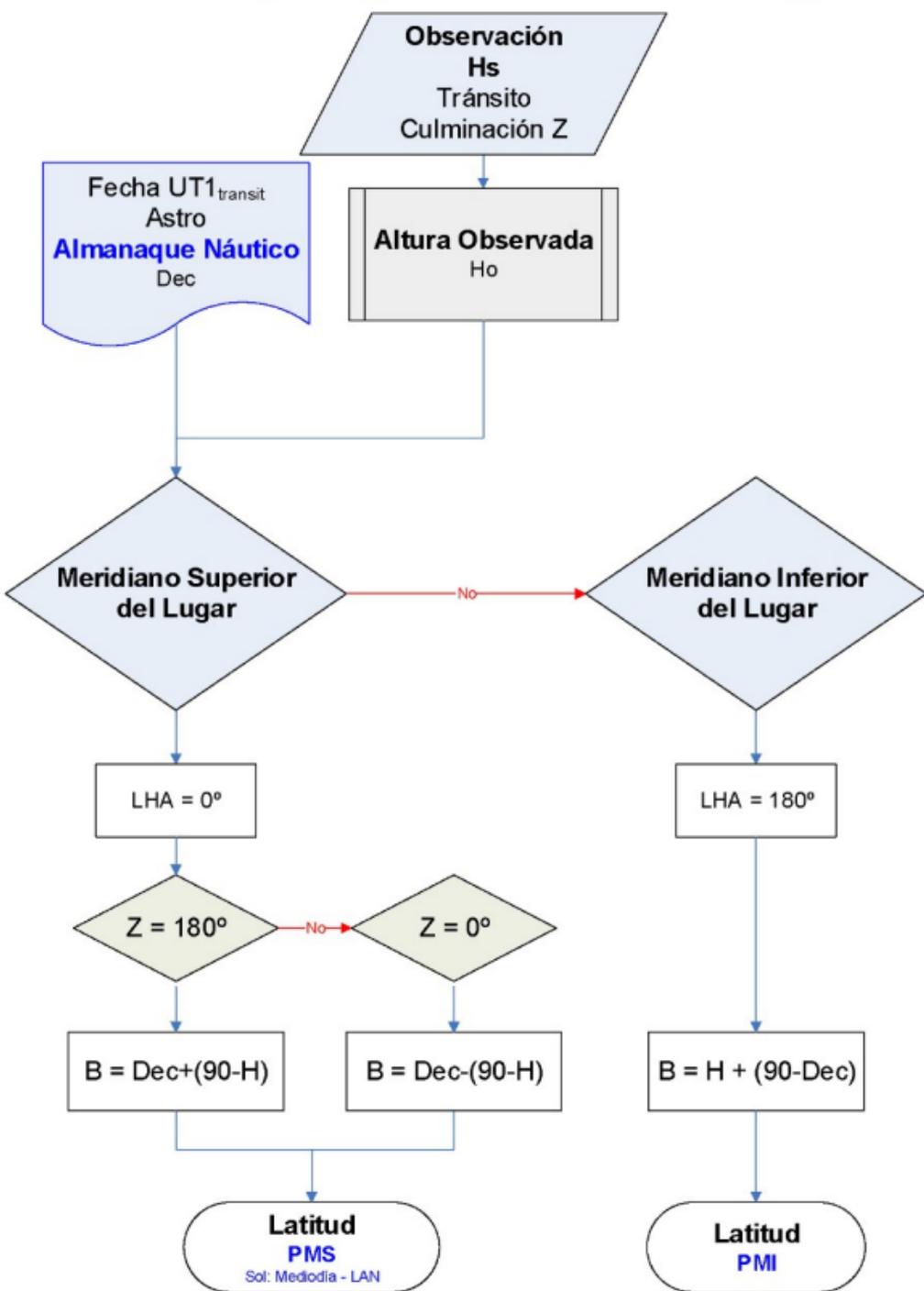
Culmination = S

Latitude at meridian passage

B = 38.051675 = 38° 3.1'

# Algorithm

## Latitud al paso por el meridiano del lugar



# Latitude by Sun's exmeridian sight

21/08/2012

11:39:20 UT1

Geocentric equatorial coordinates

## Sun

Dec = 11.883989 = 11° 53.0'

GHA = 354.074840 = 354° 4.5'

DR

Be = 38.051667 = 38° 0.0'

Le = 8.586667 = 8° 35.2'

Altitude

Hs = 63.731667 = 63° 43.9'

ie = 0.0000 '

heas = 0.0000 m

T = 10.0000 °C

P = 1010.0000 hPa

Hoi = 63.7317 °

dip = 0.0000 °

Ha = 63.7317 ° = 63° 43.9'

R = 0.0080 °

OB = -0.00000837 °

HP = 0.0024 °

PA = 0.00106040 °

SD = 0.0000 °

Aug = 0.00000000 °

SDag = 0.000000 '

Ho = 63.724732 = 63° 43.5'

Upper transit

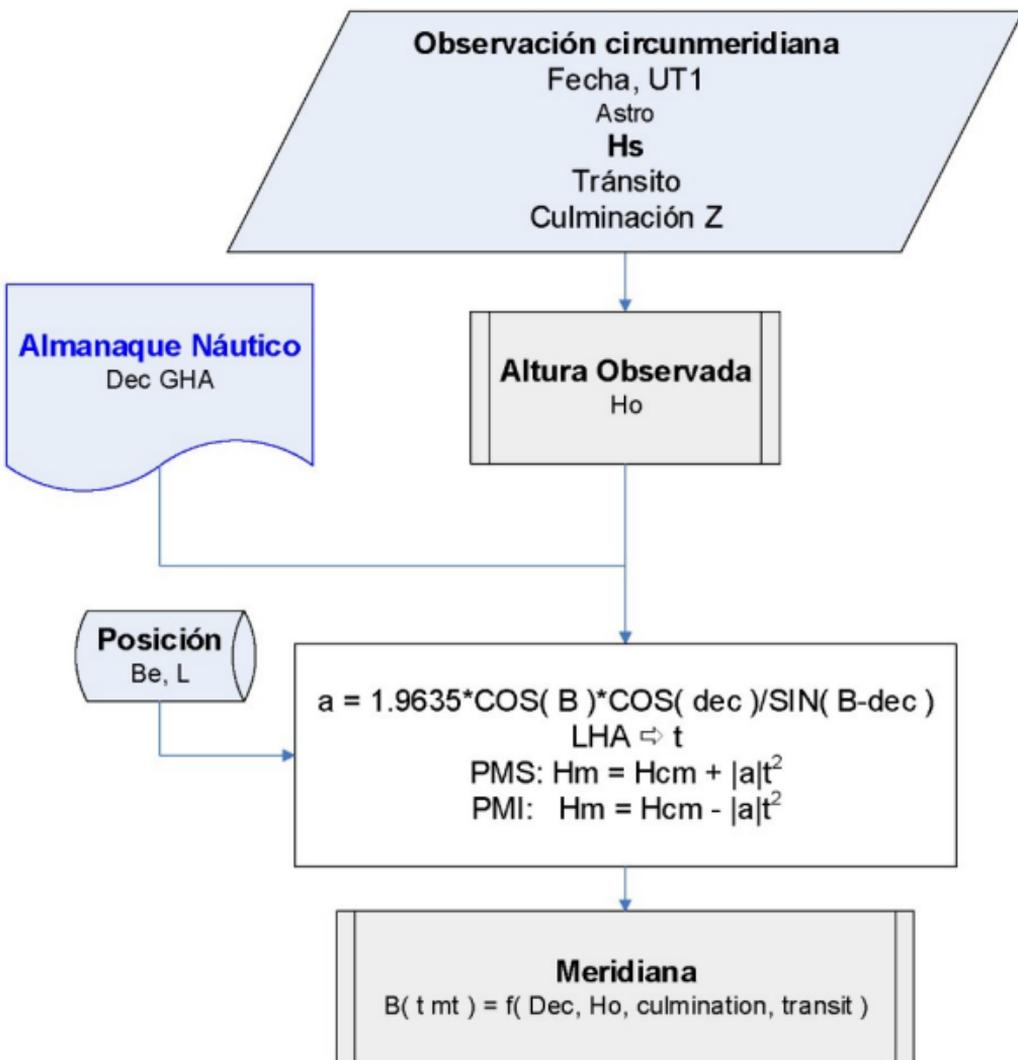
Culmination = S

Latitude by Ex-meridian sight

B = 38.051243 = 38° 3.1'

# Algorithm

## Latitud por altura circunmeridiana



# Time sight

Altitude sight:

15/04/2013

14:18:56

Assumed Position

42° 00.0' N

070° 00.0' W

## Sun

Hs = 45° 22.80' = 45.3800 °

Limb = lower

Ref = Sea Horizon

heye = 10.5 m

IC = 0 '

P = 1010 hPa

T = 10 °C

Ho = 45° 32.2'

Geocentric equatorial coordinates

GHA = 34° 44.7'

Dec = 09° 57.5' N

Time Sight

LHA = 324° 46.9'

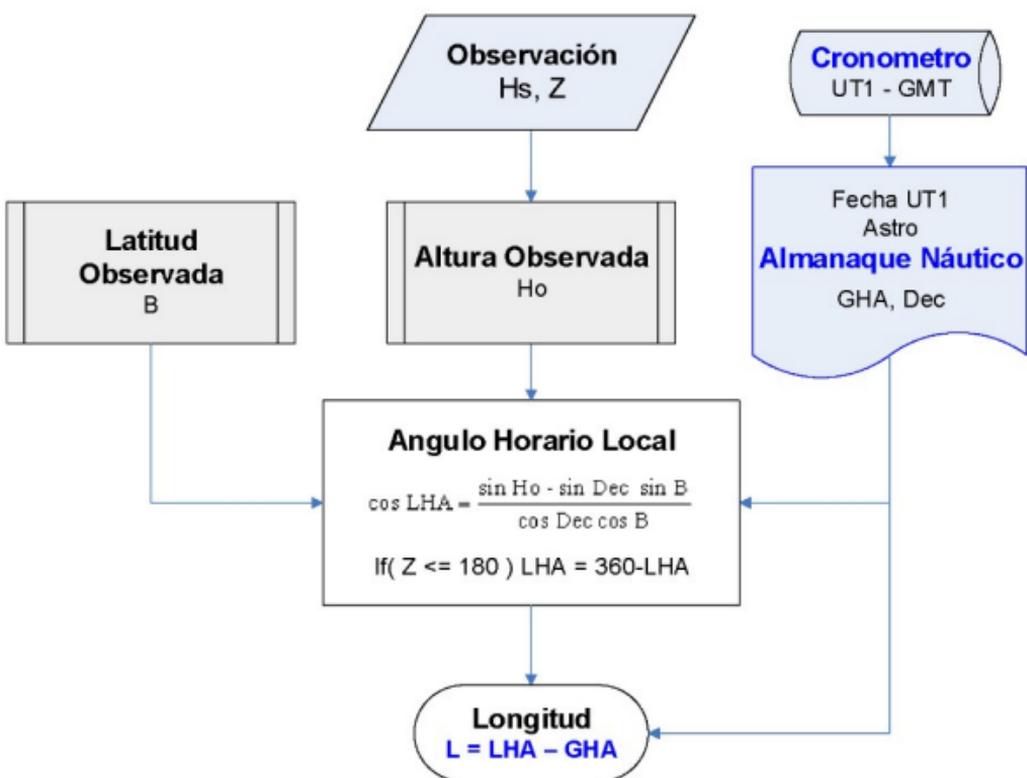
LAT = 09:39:08

L = -69.96218700562287

**L = 069° 57.7' W**

# Algorithm

## Longitud – Time Sight



# Latitude by altitude and time

29/07/2014

10:44:25 UT1

Be =  $43^{\circ} 19.0'$

Le =  $-2^{\circ} 0.0'$

NAUTICAL ALMANAC

## Sun

GHA =  $339^{\circ} 28.9'$

Dec =  $18^{\circ} 42.4'$

SD = 15.752326 '

HP = 0.144354 '

CORRECCION DE LA ALTURA - ALTITUDE CORRECTION

Limb: lower

Ref: Sea Horizon

Hs =  $58.7313^{\circ} = 58^{\circ} 43.9'$

ie = 0.0000 '

heas = 2.5000 m

T = 10.0000  $^{\circ}\text{C}$

P = 1010.0000 hPa

Ho =  $58.9388 = 58^{\circ} 56.3'$

Latitude by altitude and time

B =  $43^{\circ} 19.0'$  N

# Algorithm

## Latitud by altitude and time

