
GPS -

*

-

-

- پردیس دانشکده‌های فنی - دانشگاه تهران

(// // //)

GPS

-

() GPS

-

()

()

()

- GPS -

:

(GALILEO GLONASS GPS) GNSS

[]

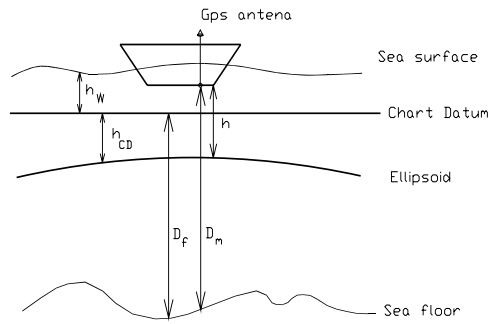
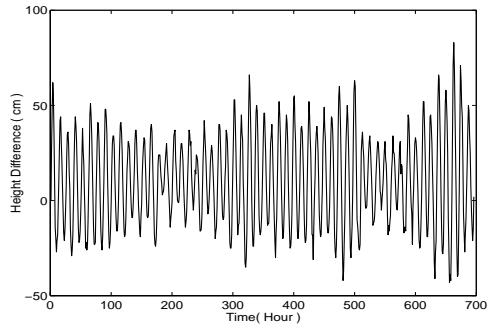
()

GPS

GPS

()

()



GPS

$$\nabla\Delta\Phi = \nabla\Delta\rho + \nabla\Delta d\rho + \lambda\nabla\Delta N + \nabla\Delta d_{trop} - \nabla\Delta d_{ion} + \varepsilon_\Phi$$

$$D_f = D_m - (h - h_{CD})$$

()

h

$D_m ()$

h_{CD} GPS

()

h_w

)

$D_f ($

()

C/A

[]

L_2 L_1

GPS

IHO

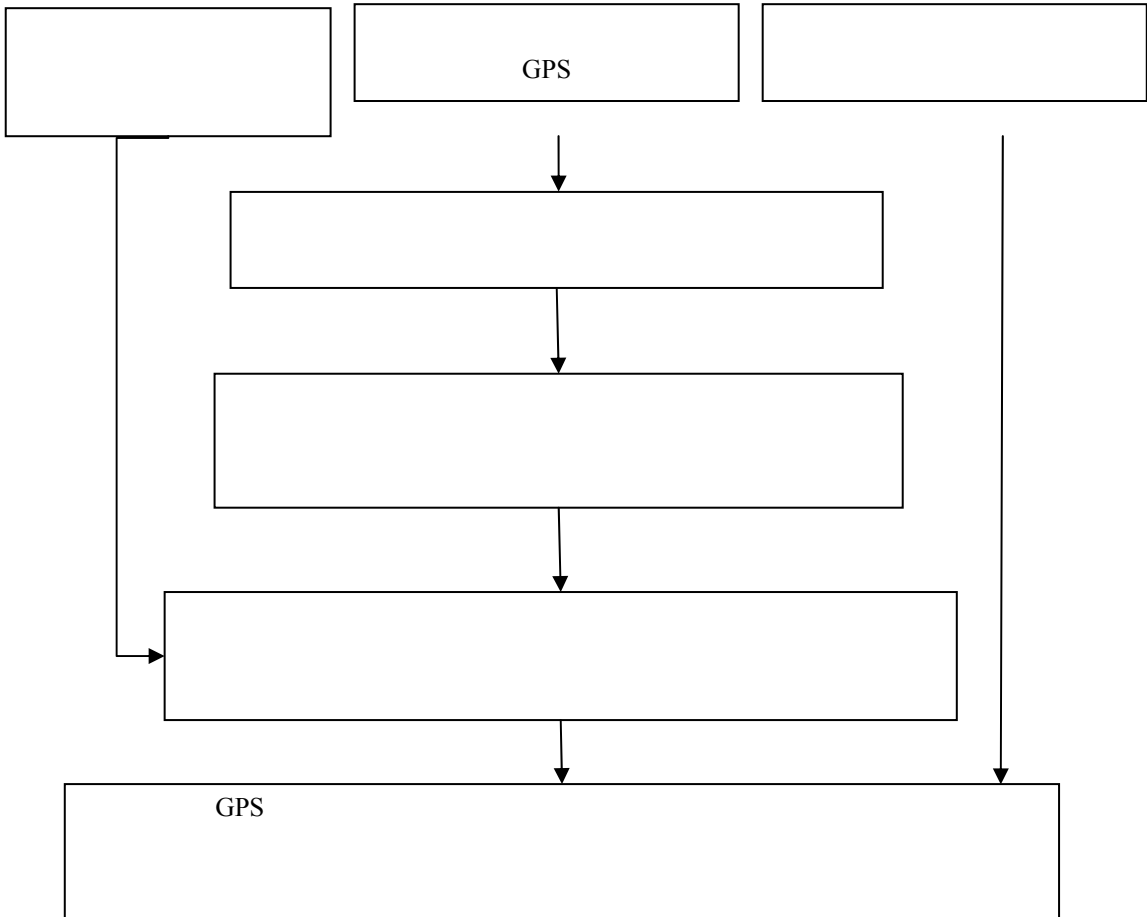
()

()

[]

$$\nabla\Delta\Phi = \nabla\Delta\rho + \lambda \cdot \nabla\Delta N + \varepsilon$$

()



GPS

:

$$\min_{a,b} \|y - Aa - Bb\|_{Q_y}^2, \quad a \in \mathbb{Z}^n, b \in \mathbb{R}^p$$

$$y = [\dots] \quad (1)$$

(2)

$$y = Aa + Bb + e$$

(3)

Q_y

y

$a \in \mathbb{R}^n$

$b \in \mathbb{Z}^p$

$b \in \mathbb{Z}^p$ (Rover)

\hat{b}

\hat{a}

A (

$B \quad m \times n$

$e \quad m \times p$

Q_a

$$y = [\dots]$$

$$\min_{a,b} \|y - Aa - Bb\|_{Q_y}^2, \quad a \in \mathbb{R}^n, b \in \mathbb{R}^p$$

(4)

(5)

$$\nabla \Delta N$$

:

[]

[]

$\min_a \|\hat{a} - a\|_{Q_a} = \min_a (\hat{a} - a) Q_a^{-1} (\hat{a} - a), a \in \mathbb{Z}^n$

Rover ()

³LAMBDA

[] a

OTF :

b a

[]

$b = \hat{b} - Q_{\hat{a}\hat{a}} Q_{\hat{a}}^{-1} (\hat{a} - a)$ ()

$Q_b = Q_{\hat{b}|a} = Q_{\hat{b}} - Q_{\hat{b}\hat{a}} Q_{\hat{a}}^{-1} Q_{\hat{a}\hat{b}}$ ()

⁴OTF

L₁

()

()

[]

$h_{CD} = a_0 - 1.1(A_{m_2} + A_{s_2} + A_{k_1} + A_{o_1})$ ()

GPS

()

(L₃)

Hopfield

[]

()

$\nabla \Delta \left[\frac{f_1 \phi_1 - f_2 \phi_2}{f_1^2 - f_2^2} \right] = \frac{\nabla \Delta \rho}{C} + \nabla \Delta N_{ion} + \varepsilon$ ()

$N_{ion} = f_1 N_1 - f_2 N_2 / f_1^2 - f_2^2$

[]

[]

()

$$h(\varphi, \lambda, t) = U_0(\varphi, \lambda) + \sum_{i=1}^n \{U_i(\varphi, \lambda) \cdot \cos(2\pi f_i t) + V_i(\varphi, \lambda) \cdot \sin(2\pi f_i t)\} \quad ()$$

()

$$h(\varphi, \lambda, t) \quad ()$$

n t (φ, λ)

()

f_i

$$U_i(\varphi, \lambda), V_i(\varphi, \lambda), U_0(\varphi, \lambda)$$

IHO

Bi-Linear

()

[]

$$\begin{aligned} U_0(\varphi, \lambda) &= a_0^0 + a_1^0\varphi + a_2^0\lambda + a_3^0\varphi\lambda \\ U_i(\varphi, \lambda) &= a_0^i + a_1^i\varphi + a_2^i\lambda + a_3^i\varphi\lambda \quad (i = 1, 2, \dots, n) \\ V_i(\varphi, \lambda) &= b_0^i + b_1^i\varphi + b_2^i\lambda + b_3^i\varphi\lambda \end{aligned}$$

()

GPS

$$a_k^0, a_k^i, b_k^i \quad ()$$

(φ, λ)

[]

$$h_{CD}(\varphi, \lambda) = U_0(\varphi, \lambda) - \left[\sum_{i=1}^4 \sqrt{U_i(\varphi, \lambda)^2 + V_i(\varphi, \lambda)^2} \right] \quad ()$$

GPS

$$U_0(\varphi, \lambda) \quad ()$$

$$U_i(\varphi, \lambda), V_i(\varphi, \lambda)$$

() ()

$$h_{CD}(\varphi, \lambda)$$

[]

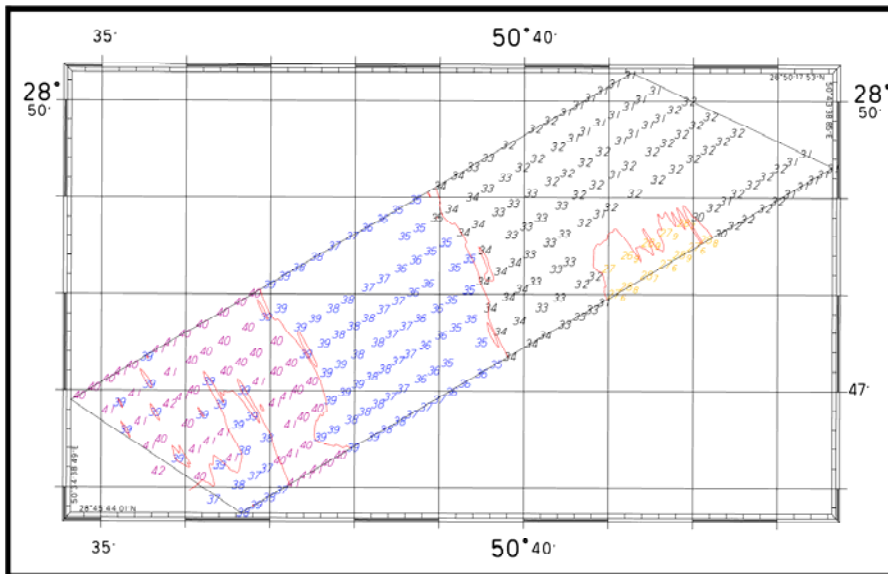
GPS

GPS

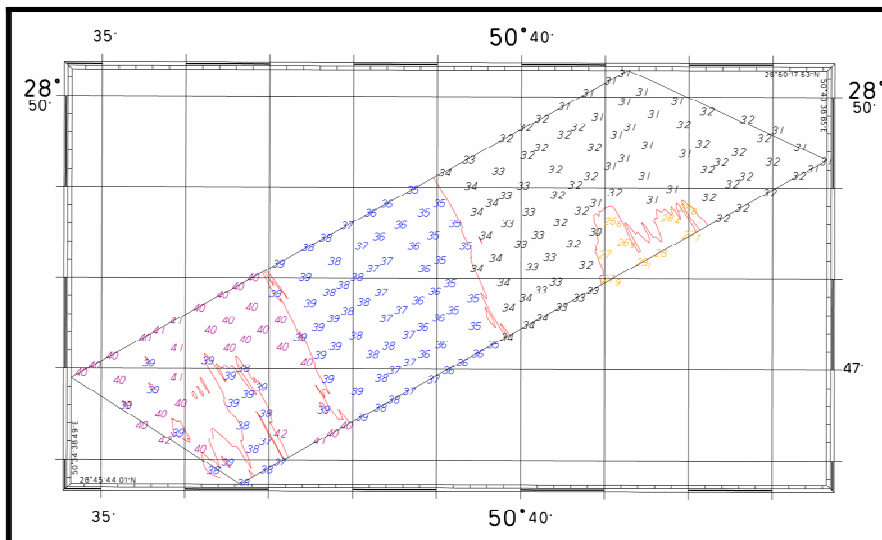
ERS

JASON1

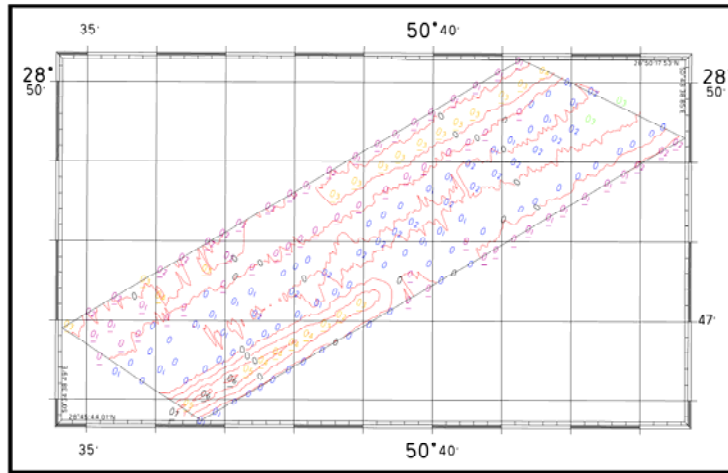
GPS



() :



() :



.(IHO

)

:

- 1- Ardalan AA, and Hashemi H (2007) A new global ocean tide analysis and computation of Mean Sea Level model based on orthonormal base functions using 11 years of Topex/Poseidon satellite altimetry observations. Journal of Faculty of Engineering, (in Persian).
- 2 - Hafmann, Wellenhof, B., Lichtenegger, H., and Collins J. (1992). *Global positioning system theory and practice*. Springer Verlag Wien.
- 3 - Teunissen, P. J. G. (1995). "The least-squares ambiguity decorrelation adjustment: A method for fast GPS integer ambiguity estimation." *Journal of Geodesy*, Vol.70, No. 1-2, PP. 65-82.
- 4 - Teunissen, P. J. G., de Jonge, P. J., and Tiberius, C. C. J. M. (1994). *On the spectrum of the GPS DD-Ambiguities*. *Proceedings of ION GPS-94, 7th International Technical Meeting of the Satellite Division of the Institute of Navigation*, Salt Lake City, UT, September 20-23, PP. 115-124.
- 5 - Jonge, P. and Tiberius, C. (1996). *The LAMBDA method for integer ambiguity estimation: implementation aspects*. <http://www.geo.tudelft.nl/mgp/lambda/lila.html>.
- 6 - *The Hydrographer of the navy. Admiralty manual of Hydrographic surveying*, Volume 2, Chapter 2, Tide and Tidal Stream. Crown, 1969.
- 7 - Golub, G. H. and van Loan, C. F. (1989). *Matrix computations*. Second edition. The Johns Hopkins University Press, Baltimore, Maryland, USA.
- 8 - Teunissen, P. J. G. (1993). *Least-squares estimation of the integer GPS ambiguities*. *Invited paper, Section IV Theory and Methodology, IAG General Meeting, Beijing, China, August*, also in Delft Geodetic computing Centre LGR Series, No. 6, PP.16.
- 9 - Teunissen, P. J. G., de Jonge, P. J. and Tiberius, C. C. J. M. *The Volume of the GPS Ambiguity Search Space and its Relevance for Integer Ambiguity Resolution*. *Paper to be presented at ION GPS-96, 9th International Technical Meeting of the Satellite Division of the Institute of Navigation, Kansas City, Missouri, Sept. 17-20*.
- 10 - DAAC, P. O. (1993). *"PO.DAAC Merged Geophysical Data Record Users Handbook"* JPL D-11007, November 1996.

- 1 - International Hydrography Organization (IHO)
- 2 - Integer Least Square
- 3 - Least-squares Ambiguity Decorrelation Adjustment (LAMBDA)
- 4 - On The Fly (OTF)
- 5 - Draught