


National Geodetic Survey Positioning America for the Future [geodesy.noaa.gov](http://geodesy.noaa.gov)



## Rigorous Geodetic Positioning in the Americas

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## Online Positioning User Service - OPUS

- Web-based GPS Positioning Tool – [www.ngs.noaa.gov/OPUS](http://www.ngs.noaa.gov/OPUS)
- Simplified Web Interface
  - RINEX File or Native GPS Receiver File
  - Antenna Type – IGS Naming Convention
  - Antenna Height
  - Email Address
- Processing / Adjustment Performed on NGS Servers
- Solution Report via Email – ASCII file, XML
- Free Service

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## OPUS Web Interface

### OPUS: Online Positioning User Service

National Geodetic Survey

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**tools:OPUS Menu**

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**Upload your Data File**

Tie your GPS observation to the National Spatial Reference System.  
[what is OPUS?] [FAQs]

\*Email address - your solution will be sent here.

\*Data file of dual-frequency GPS observations. [sample]

Antenna type - choosing wrong may degrade your accuracy.

0.0 meters above your mark.  
Antenna height of your Antenna's Reference Point.

Options to customize your solution.

Upload to RAPID-STATIC for data > 15 min. < 2 hrs.  
Upload to STATIC for data > 2 hrs. < 48 hrs.  
process your solution.

\* required fields  
We may use your data for internal evaluations of OPUS use, accuracy, or related research.

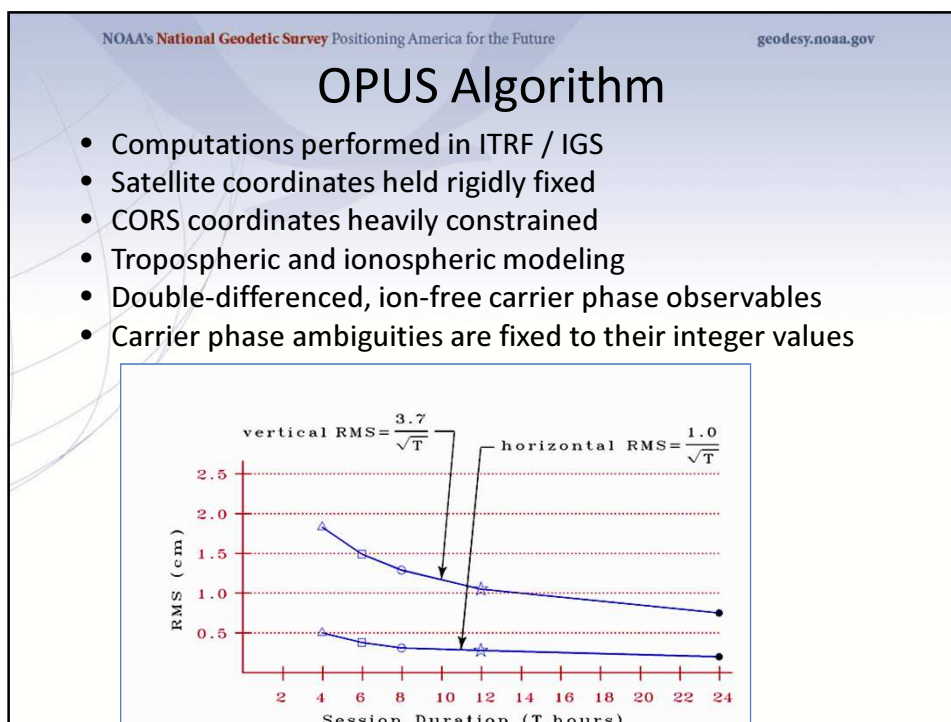
Sample Solutions

Station	Antenna	Height	Time	Accuracy
12345678	Trimble	1.5	2012-05-12 10:00	0.02
87654321	Trimble	1.5	2012-05-12 10:05	0.02

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## How Does OPUS Work

- Prepare and quality control submitted data
- Estimate an approximate position for the rover
- Compute distance to many nearby CORS
- Select the five best CORS based upon:
  - Being closest to the user's site
  - Having common satellite visibility
  - Having more than 80% of the possible data available
  - Having low multipath
- Complete single-baseline processing to all five CORS
- Select the best three solutions
- Solution Report via Email



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**FILE: brft2370.12o OP1348760626205 \*\* Fortaleza in Brazil**

1008 NOTE: Antenna offsets supplied by the user were zero. Coordinates  
 1008 returned will be for the antenna reference point (ARP).  
 1008

**NGS OPUS SOLUTION REPORT**  
 =====

All computed coordinate accuracies are listed as peak-to-peak values.  
 For additional information: <http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy>

USER: <a href="mailto:rick.foote@noaa.gov">rick.foote@noaa.gov</a>	DATE: September 27, 2012
RINEX FILE: brft2370.12o	TIME: 15:48:21 UTC

SOFTWARE: page5 1106.16 <a href="#">master53.pl</a> 082112	START: 2012/08/24 00:00:00
EPHEMERIS: igs17025.eph [precise]	STOP: 2012/08/25 00:00:00
NAV FILE: brdc2370.12n	OBS USED: <b>45659 / 46216</b> : 99%
ANT NAME: LEIAX1202 NONE	# FIXED AMB: 125/162 : 77%
ARP HEIGHT: 0.00	OVERALL RMS: 0.017(m)

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**REF FRAME: IGS08 (EPOCH:2012.6463)**

X: 4985393.477(m) 0.011(m)  
 Y: -3954993.421(m) 0.023(m)  
 Z: -428426.608(m) 0.010(m)

LAT: -3 52 38.80531 0.009(m)  
 E LON: 321 34 28.06472 0.023(m)  
 W LON: 38 25 31.93528 0.023(m)  
 EL HGT: 21.627(m) 0.007(m)

**UTM COORDINATES - UTM (Zone 24)**

Northing (Y) [meters] 9571397.538  
 Easting (X) [meters] 563779.005  
 Convergence [degrees] -0.03884794  
 Point Scale 0.99965035  
 Combined Factor 0.99964695

**BASE STATIONS USED**

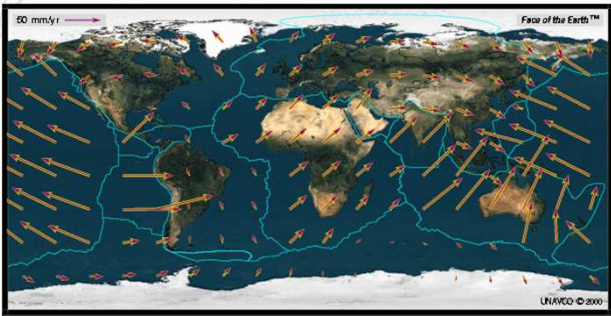
PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DH8854	PMB1 PARAMARIBO CORS ARP			2136143.0
DH8856	SRZN ZANDERIJ CORS ARP			2121939.7
CHPI				2187099.5



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## Transform Coordinates – SIRGAS2000

- Two Step Approach
  - A. Determine velocities of the plate where the point is located.



- B. Transform coordinates from IGS08 to ITRF2000, epoch 2000.4 (SIRGAS2000)

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## Velocities - Plate Motion Calculator

[http://www.unavco.org/community\\_science/science-support/crustal\\_motion/dxdt/model.html](http://www.unavco.org/community_science/science-support/crustal_motion/dxdt/model.html)

Enter coordinates and (optionally) other selections:

<b>Latitude:</b>	<input type="text"/> degrees North <input type="text"/> minutes North <input type="text"/> seconds North E.g. enter the latitude as -56.25 degrees or -56 degrees 15 minutes for 56 degrees 15 minutes South.	<b>Model</b>
<b>Longitude:</b>	<input type="text"/> degrees East <input type="text"/> minutes East <input type="text"/> seconds East E.g. enter the longitude as -102.5 degrees or -102 degrees 30 minutes for 102 degrees 30 minutes West.	GEODVEL 2010
<b>Height:</b>	<input type="text"/> height (meters) optional WGS-84 height of geographic coordinate (default = 0 meters)	MORVEL 2010
<b>XYZ:</b>	... or enter the position in WGS-84 XYZ coordinates: <input type="text"/> 4985393.477 X (meters) <input type="text"/> -3954993.421 Y (meters) <input type="text"/> -428426.608 Z (meters)	APKIM2005-DGFI
		APKIM2005-IGN
		GSRM v1.2
		CGPS 2004
		REVEL 2000
		ITRF2000
		HS3-NUVEL 1A
		APKIM2000.0
		HS2-NUVEL 1A
		NUVEL 1A
		NUVEL 1

Model	Latitude	Longitude	Speed mm/yr	Azimuth (cw from N)	N Vel. mm/yr	E Vel. mm/yr	Plate (reference)	Site Name
GEODVEL 2010	3° 52' 38.81" S -3.877446°	38° 25' 31.94" W -38.425538°	12.65	340.93°	11.96	-4.13	SA(NNR)	
MORVEL 2010	3° 52' 38.81" S -3.877446°	38° 25' 31.94" W -38.425538°	11.67	337.57°	10.79	-4.45	SA(NNR)	
APKIM2005-DGFI	3° 52' 38.81" S -3.877446°	38° 25' 31.94" W -38.425538°	12.58	343.21°	12.05	-3.64	SA(NNR)	
APKIM2005-IGN	3° 52' 38.81" S -3.877446°	38° 25' 31.94" W -38.425538°	13.58	345.75°	13.17	-3.34	SA(NNR)	
GSRM v1.2	3° 52' 38.81" S -3.877446°	38° 25' 31.94" W -38.425538°	12.73	344.35°	12.26	-3.43	SA(NNR)	
CGPS 2004	3° 52' 38.81" S -3.877446°	38° 25' 31.94" W -38.425538°	11.97	338.37°	11.12	-4.41	SA(NNR)	
REVEL 2000	3° 52' 38.81" S -3.877446°	38° 25' 31.94" W -38.425538°	11.81	333.68°	10.58	-5.24	SA(NNR)	
ITRF2000 (AS&B [2002])	3° 52' 38.81" S -3.877446°	38° 25' 31.94" W -38.425538°	12.54	338.11°	11.64	-4.68	SA(NNR)	
HS3-NUVEL1A	3° 52' 38.81" S -3.877446°	38° 25' 31.94" W -38.425538°	12.90	334.86°	11.68	-5.48	SA(NNR)	
APKIM2000.0	3° 52' 38.81" S -3.877446°	38° 25' 31.94" W -38.425538°	10.30	338.30°	9.57	-3.81	SA(NNR)	
ITRF2000 (D&A [2001])	3° 52' 38.81" S -3.877446°	38° 25' 31.94" W -38.425538°	12.79	340.86°	12.08	-4.19	SA(NNR)	
HS2-NUVEL1A	3° 52' 38.81" S -3.877446°	38° 25' 31.94" W -38.425538°	13.12	335.16°	11.91	-5.51	SA(NNR)	
NUVEL 1A	3° 52' 38.81" S -3.877446°	38° 25' 31.94" W -38.425538°	12.91	334.87°	11.68	-5.48	SA(NNR)	
NUVEL 1	3° 52' 38.81" S -3.877446°	38° 25' 31.94" W -38.425538°	13.31	334.81°	12.04	-5.66	SA(NNR)	

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## Modeled vs. Computed Velocities

**Modeled -- NUVEL 1A**

N Vel. (mm/yr) = 11.68                      E Vel. (mm/yr) = -5.48

**Modeled -- ITRF2000 (AS&B)**

N Vel. (mm/yr) = 11.64                      E Vel. (mm/yr) = -4.68

**Computed -- IGS Multi-year solution**

N Vel. (mm/yr) = 12.30                      E Vel. (mm/yr) = -4.70

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## Transform Coordinates – IGS08 to SIRGAS2000

[http://www.ngs.noaa.gov/TOOLS/Htdp/Htdp\\_transform.html](http://www.ngs.noaa.gov/TOOLS/Htdp/Htdp_transform.html)

Input Reference Frame: IGS08  
 Output Reference Frame: ITRF2000  
 Starting Epoch: 2012.6463  
 Ending Epoch: 2000.4

X: 4985393.477 Y: -3954993.421 Z: -428426.608  
 N Vel. (mm/yr) = 11.68 E Vel. (mm/yr) = -5.48  
 Up Vel. (mm/yr) = 0.00

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## HTDP OUTPUT – SIRGAS2000

\*\* Using modeled velocities: NUVEL 1A  
 HTDP (version 3.2.3) OUTPUT

TRANSFORMING POSITIONS FROM ITRF2008 or IGS08 (EPOCH = 08-24-2012 (2012.647))  
 TO ITRF2000 or IGS00/IGb00 (EPOCH = 05-26-2000 (2000.400))

	INPUT COORDINATES	OUTPUT COORDINATES	INPUT VELOCITY
<b>BRFT</b>			
LATITUDE	3 52 38.80531 S	3 52 38.81033 S	11.68 mm/yr north
LONGITUDE	38 25 31.93528 W	38 25 31.93318 W	-5.48 mm/yr east
ELLIP. HT.	21.627	21.636 m	0.00 mm/yr up
X	4985393.477	4985393.516 m	-2.79 mm/yr
Y	-3954993.421	-3954993.369 m	-4.78 mm/yr
Z	-428426.608	-428426.763 m	11.65 mm/yr

The slide features a background with a light blue and yellow gradient. On the left side, there is a stylized graphic of a globe's grid lines. At the top left, the text "NOAA's National Geodetic Survey Positioning America for the Future" is displayed. At the top right, the website "geodesy.noaa.gov" is listed.

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# Thank You

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