



# IGS QUALITY OF SERVICE

The International GNSS Service (IGS) provides the highest quality GNSS data, products, and services in support of the terrestrial reference frame; Earth observations and research; Positioning, Navigation, and Timing (PNT); and other applications that benefit the scientific community and society.



The IGS operates a global network of Global Navigation Satellite System (GNSS) ground stations, data centers, and data analysis centers to provide data and derived data products that are essential for Earth science research; multi-disciplinary positioning, navigation, and timing (PNT) applications; and education.

The foundation of the IGS is a global network of over 400 permanent, continuously operating, geodetic quality stations tracking GPS, GLONASS, Galileo, BeiDou, QZSS, and SBAS.

Station data is archived at IGS Global Data Centers and four Regional Data Centers. Analysis Centers regularly process the data and contribute products to the Analysis Center coordinator, who produces the official IGS combined products.

The Central Bureau is responsible for day-to-day management of the IGS, following policies set by the IGS International Governing Board.

The IGS reference frame coordinator determines tracking site coordinates and velocities in the International Terrestrial Reference Frame (ITRF), and organizes the IGS contribution to ITRF.

## Products

- GNSS satellite ephemerides
- Earth rotation parameters
- Global tracking station coordinates and velocities
- Satellite and tracking station clock information
- Zenith tropospheric path delay estimates
- Global ionospheric maps

These products support Earth science analyses and other efforts, such as: Improving and extending the International Terrestrial Reference Frame (ITRF) maintained by the International Earth Rotation and Reference Systems Service (IERS); monitoring deformation of the Earth; monitoring Earth rotation; monitoring the troposphere and ionosphere; determining orbits of scientific satellites; and other diverse applications.

## Organizational Values

- Advocacy of an open data policy, with data and products readily available,
- Welcome contributions from and participation with all organizations,
- Effective reliability through redundancy of IGS components,
- Technical evolution through "friendly competition",
- Dedicated engagement with policy entities to raise mutual awareness of IGS and geodesy in general.

The IGS is a component of the  
**Global Geodetic Observing System**  
<http://www.ggos.org>



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## IGS Quality of Service

The IGS continuously monitors the accuracy of its products through intercomparison of results between Analysis Centers. IGS strives to deliver its products on a highly available basis as shown below. Due to the volunteer nature of IGS, availability of products is not guaranteed.

GPS Satellite Ephemerides / Satellite and Station Clocks		Sample Interval	Accuracy	Latency	Continuity	Availability
Broadcast (for comparison)	Orbits	1s	~100 cm	real time	Continuous	99.99%
	Sat. Clocks		~5 ns RMS; ~2.5 ns Sdev			
Ultra-Rapid (predicted half)	Orbits	15 min	~5 cm	predicted	4x daily, at 03, 09, 15, 21 UTC	95%
	Sat. Clocks		~3 ns RMS; ~1.5 Sdev			
Ultra-Rapid (observed half)	Orbits	15 min	~3 cm	3-9 hours	4x daily, at 03, 09, 15, 21 UTC	95%
	Sat. Clocks		~150 ps RMS; ~50 ps Sdev			
Rapid	Orbits	15 min	~2.5 cm	17-41 hours	daily, at 17 UTC	95%
	Sat. & Stn. Clocks	5 min	~75 ps RMS; ~25 ps Sdev			
Final	Orbits	15 min	~2 cm	12-18 days	weekly, every Thursday	99%
	Sat. & Stn. Clocks	Sat: 30 s; Stn.: 5 min	75 ps RMS; 20 ps Sdev			
Real-time	Orbits	5-60 s	~5 cm	25 seconds	Continuous	95%
	Sat. Clocks	5 s	300 ps RMS; 120 ps Sdev			

**Note 1:** Orbit accuracies are 1D mean RMS values over the three XYZ geocentric components. IGS accuracy limits, except for predicted orbits, are based on comparisons with independent laser ranging results and discontinuities between consecutive days. The precision is better.

**Note 2:** The accuracy (neglecting any contributions from internal instrumental delays, which must be calibrated separately) of all clocks is expressed relative to the IGS timescale, which is linearly aligned to GPS time in one-day segments. The standard deviation (Sdev) values are computed by removing a separate bias for each satellite and station clock, whereas this is not done for the RMS values.

**Note 3:** Availability :percentage of time that accuracy and continuity of service meet stated specification.

GLONASS Satellite Ephemerides	Sample Interval	Accuracy	Latency	Continuity	Availability
Final	15 min	~3 cm	12-18 days	weekly, every Thursday	99%

Geocentric Coordinates of IGS Tracking Stations (over 250 Sites)		Sample Interval	Accuracy	Latency	Continuity	Availability
Final Positions	Horizontal	weekly	3 mm	11-17 days	weekly, every Wednesday	99%
	Vertical		6 mm			
Final Velocities	Horizontal	weekly	2 mm/yr	11-17 days	weekly, every Wednesday	99%
	Vertical		3 mm/yr			

Earth Rotation Parameters		Sample Interval	Accuracy	Latency	Continuity	Availability
Ultra-Rapid (predicted half)	Polar Motion	daily integrations at 00, 06, 12, 18 UTC	~200 $\mu$ s	real time	4x daily, at 03, 09, 15, 21 UTC	99%
	Polar Motion Rate		~300 $\mu$ s/day			
	Length-of-day		~50 $\mu$ s			
Ultra-Rapid (observed half)	Polar Motion	daily integrations at 00, 06, 12, 18 UTC	~50 $\mu$ s	3-9 hours	4x daily, at 03, 09, 15, 21 UTC	99%
	Polar Motion Rate		~250 $\mu$ s/day			
	Length-of-day		~10 $\mu$ s			
Rapid	Polar Motion	daily integrations at 12 UTC	~40 $\mu$ s	17-41 hours	daily at 17 UTC	99%
	Polar Motion Rate		~200 $\mu$ s/day			
	Length-of-day		~10 $\mu$ s			
Final	Polar Motion	daily integrations at 12 UTC	0.03 mas	~11-17 days	weekly, every Wednesday	99%
	Polar Motion Rate		~150 $\mu$ s/day			
	Length-of-day		0.01 ms			

**Note 1:** 100  $\mu$ s = 3.1 mm of equatorial rotation; 10  $\mu$ s = 4.6 mm of equatorial rotation.

**Note 2:** The IGS uses VLBI results from IERS Bulletin A to partially calibrate for LOD biases over 21-day sliding window, but residual time-correlated LOD errors remain.

Atmospheric Parameters	Sample Interval	Accuracy	Latency	Continuity	Availability
IGS Final Tropospheric Delay: zenith path delay (ZPD) plus north, east gradients	5 min	~4 mm for ZPD	~3 weeks	daily	99%
Ionosphere TEC Grid	2 hours; 5 deg (Lon.) x 2.5 deg (Lat.)	2-8 TECU	~11 days	weekly	99%
Rapid ionosphere TEC Grid	2 hours; 5 deg (Lon.) x 2.5 deg (Lat.)	2-9 TECU	<24 hours	daily	95%