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EVALUATION OF THE ACCURACY AND PERFORMANCE OF GPS ANTENNAS (ESPECIALLY FOR HEIGHT POSITIONING)

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1- Introduction

- GPS Heightening
- Earth's atmospheric layers (ionosphere, troposphere)
- The antenna type and characteristics are important factors

Investigates the accuracy of GPS heightening by using the Ashtech different antennas

EXPERIMENTAL SETUP

- Three special apparatus were prepared for this purpose. The three devices are 20 cm long and marked with every millimeter piece.
- Samandira site (Project area) in Istanbul.
- GPS measurements lasted two days(2 May 2012(7:00-13:00 h) - 3 May 2012(11:00-16:00 h))
- Static measurements

Project area and GPS network

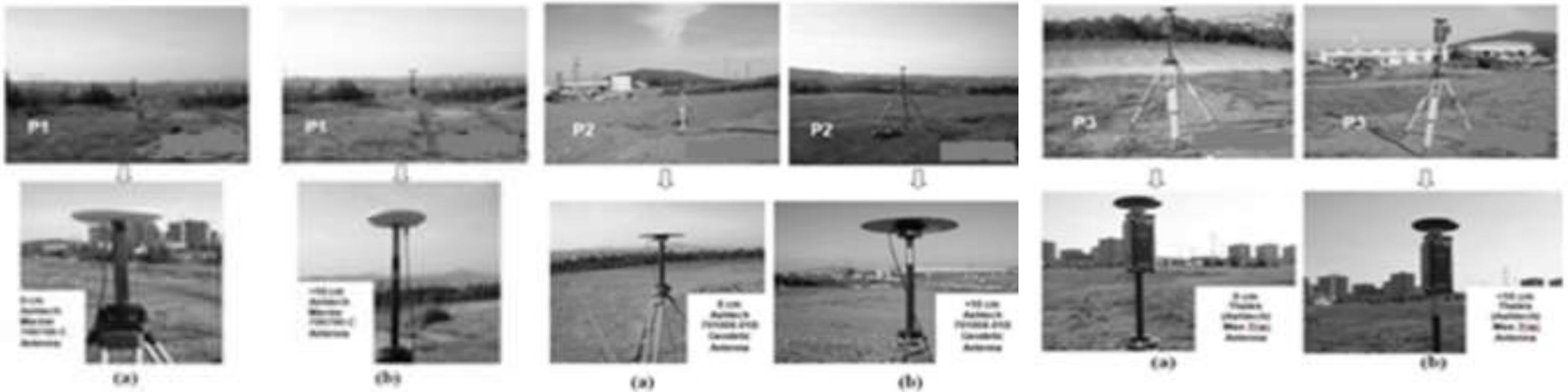
- 1 Thales (Ashtech) Z Max, 2 Ashtech Z Surveyor measuring instruments, (**1 Ashtech 701008-01B geodetic antenna, 1 Ashtech Marine 700700-C antenna and 1 Thales (Ashtech) Mac-Trac antenna were used**)
- The special device for all three receivers was set to firstly 0 cm and then 10 cm

EXPERIMENTAL SETUP

Ashtech Marine 700700-C antenna

Ashtech 701008-01B geodetic antenna

Thales (Ashtech) Z Max Mac-Trac antenna



Point I (P1) and the special apparatus were set to 0, 10 cm on 2, 3 May 2012

Point II (P2) and the special apparatus were set 0, 10 cm in 2, 3 May 2012

Point III (P3) and the special apparatus were set 0, 10 cm in 2, 3 May 2012

- Canadian Spatial Reference System-Precise Point Positioning (CSRS-PPP) web-based online PPP service

RESULTS AND ANALYSES

2 MAY 2012 (0 cm)

	Antenna Type	φ_{ITRF} (dms)	λ_{ITRF} (dms)	h (m)
P1	Ashtech Marine 700700-C	40º 58' 09".9930	29º 13' 4".0112	204.847
P2	Ashtech 701008-01B	40º 58' 11".2235	29º 13' 4".9892	204.352
P3	Ashtech Max-Trac	40º 58' 12".4562	29º 13' 5".9426	202.980

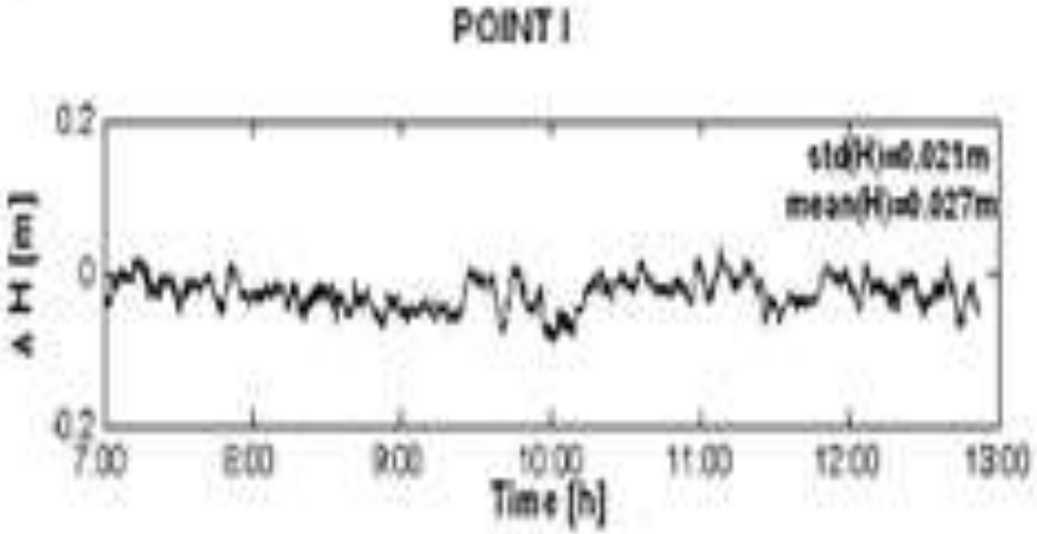
3 MAY 2012 (+10 cm)

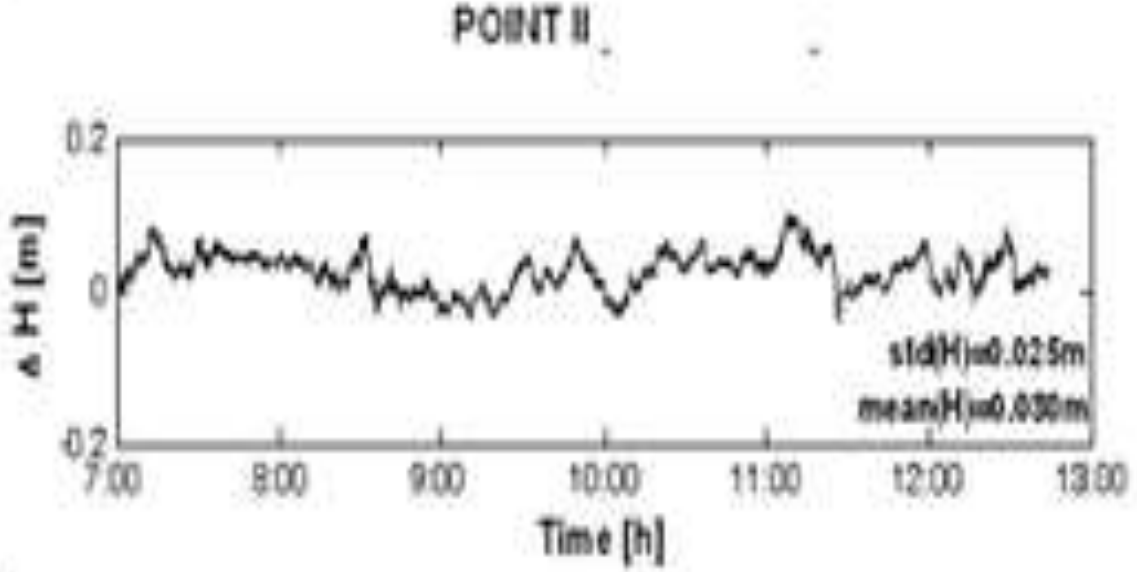
	Antenna Type	φ_{ITRF} (dms)	λ_{ITRF} (dms)	h (m)
P1	Ashtech Marine 700700-C	40º 58' 09".9924	29º 13' 4".0112	204.902
P2	Ashtech 701008-01B	40º 58' 11".2240	29º 13' 4".9912	204.459
P3	Ashtech Max-Trac	40º 58' 12".4563	29º 13' 5".9421	203.088

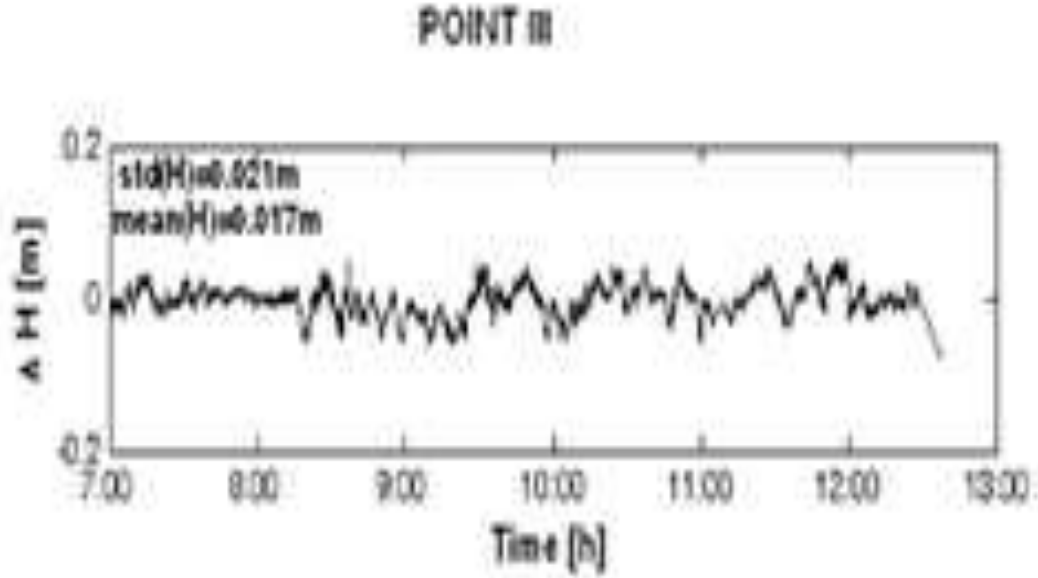
RESULTS AND ANALYSES

2 May 2012 (0 cm)				
Point	**h_{GPS} (m)**	**Δh_{GPS} (m)**	**$\Delta h_{Leveling}$ (m)**	**Difference (cm)**
P1	204.847	Δh_{12} = 0.495	Δh_{12} = 0.551	± 5.6
P2	204.352	Δh_{23}= 1.372	Δh_{23}= 1.361	± 1.1
P3	202.980	Δh_{13}= 1.867	Δh_{13}= 1.882	± 1.5
3 May 2012 (+10 cm)				
Point	**h_{GPS} (m)**	**Δh_{GPS} (m)**	**$\Delta h_{Leveling}$ (m)**	**Difference (cm)**
P1	204.902	Δh_{12} = 0.443	Δh_{12} = 0.551	± 10.8
P2	204.459	Δh_{23}= 1.371	Δh_{23}= 1.361	± 1.0
P3	203.088	Δh_{13}= 1.814	Δh_{13}= 1.882	± 6.8

RESULTS AND ANALYSES

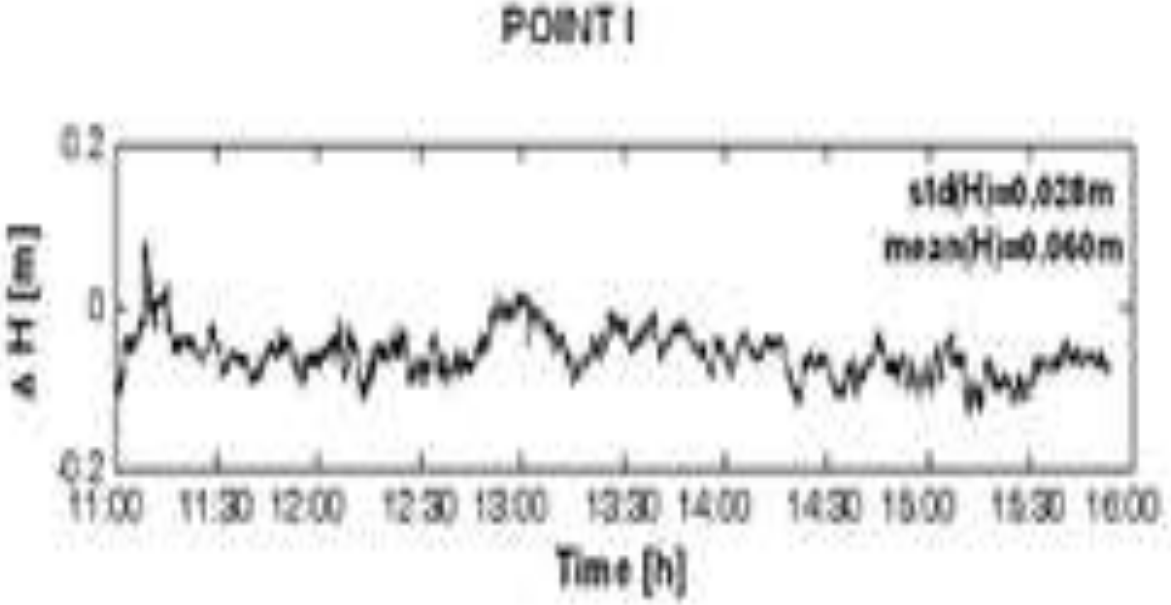


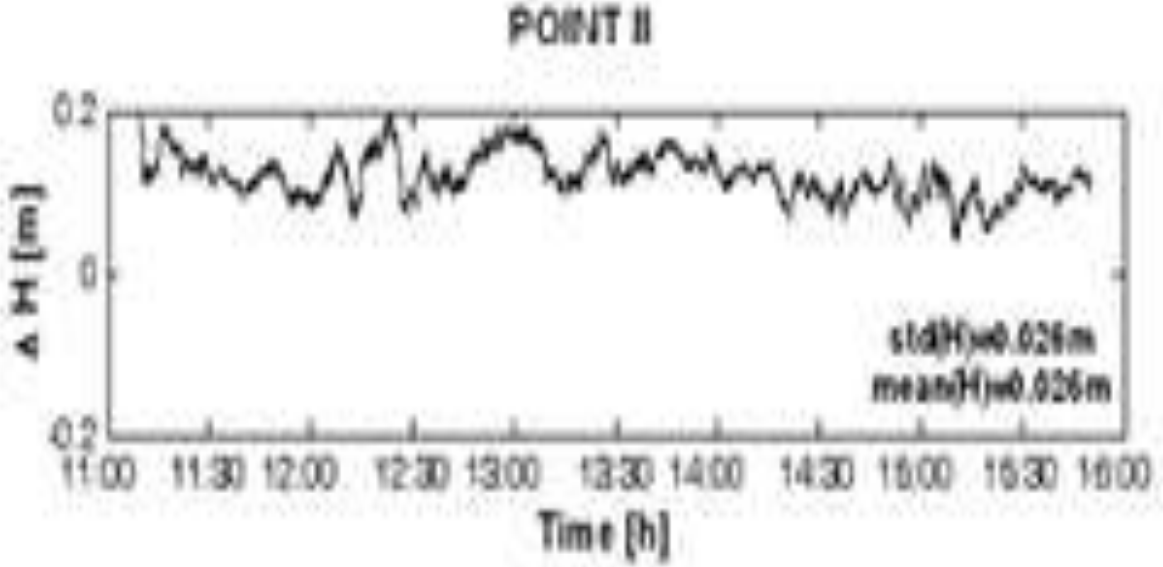


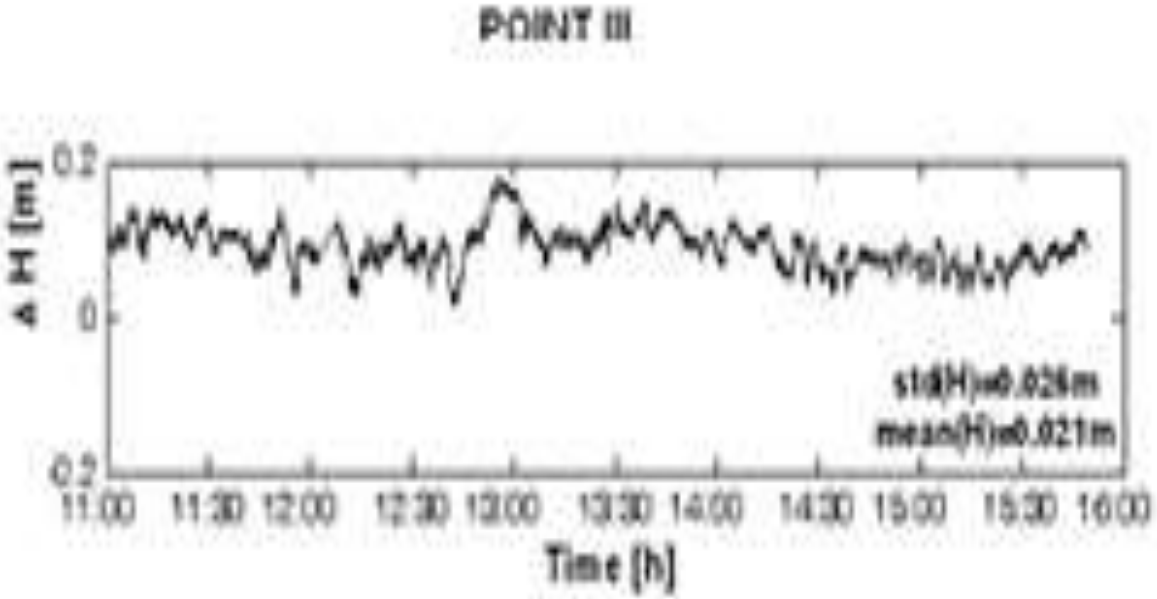


2 MAY 2012

RESULTS AND ANALYSES







3 MAY 2012

CONCLUSIONS

Numerous external errors can affect GPS accuracy. Fault sources include excessive multipath, carrier phase shifts, spatial decay over long baselines, insufficient signal strength, and poor field techniques. These factors are part of the GPS positioning. Fortunately, new and technological GPS receivers and antennas (Ashtech Z Max) and appropriate field training can be removed from most of the mistakes associated with these types of events. This study has been shown that the accuracy of determining the height values by using GPS is significantly influenced especially in the Ashtech Marine 700700-C antenna when satellite signals are distorted and reflected. Faults can be ± 6 cm in the vertical position average value. These effects were shown to be completely dependent on the performance of the receivers used in GPS antennas and GPS surveys.

THANKS FOR YOUR ATTENTION