Scientific applications of GNSS: Could Galileo Really Make a Difference?

P. Willis\textsuperscript{(1,2)}, Y.E. Bar-Sever\textsuperscript{(2)}, S.C. Wu\textsuperscript{(2)}

(1) Institut Geographique National, France
(2) Jet Propulsion Laboratory, Caltech, USA
SUMMARY

- Potential scientific interests of Galileo
- Simulations at JPL: GPS+Galileo
  - Precise orbit determinations with GNSS
- Others applications
  - Reference Frames issues
  - Atmospheric sciences
- Conclusions
GPS+Galileo POD simulations

- Objectives:
  - POD of a highly elliptical satellite (VSOP)
- Simulations hypothesis
  - simulated data GPS+Galileo on-board the satellite
  - Different tests with noise measurements
  - Different estimation strategy/ reduced dynamics
VSOP2 Orbit Error Using GPS+Galileo Pseudorange (10cm) and Carrier Phase (5mm) from 188 Stations
GPS-Like Pseudorange (10cm) and Carrier Phase (5mm) from 30 Stations
Reduced Dynamic (50nm/sec^2); 1e-13 Clocks; All Sites Adjusted (5mm)
VSOP2 Orbit Error Using GPS+Galileo Pseudorange (10cm) and Carrier Phase (5mm) from 188 Stations
Accelerometer (1nm/sec**2); 1e-13 Clocks: All Sites Adjusted (5mm)

Nice, April 2004

EGU 2004
VSOP2 Orbit Error Using GPS+Galileo Pseudorange (10cm) and Carrier Phase (5mm) from 188 Stations
GPS-Like Pseudorange (10cm) and Carrier Phase (5mm) from 30 Stations
Reduced Dynamic (50nm/sec**2): 1e-13 Clocks: All Sites Adjusted (5mm)

Nice, April 2004

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The IGS tracking network
http://igsorb.jpl.nasa.gov/images/world_clean.jpg

Nice, April 2004  EGU 2004
Reference frames

• GPS-only solutions
  – Advantages
    • Current precision: 2 mm H, 6 mm V
  – Weaknesses
    • Remaining issues: radomes effects, antenna patterns calibration, systematic errors with other techniques (SLR, VLBI, DORIS).
Atmospheric sciences

• Applications
  – Using permanent tracking network (for Wet Zenith Delays)
  – Using LEO satellites (for tomography)

• Present weaknesses
  – Integrity
  – Accuracy
Wet zenith delay estimates from GPS and WVR data using Kalman filter/smoother

Bias = 0.004, STD = 0.006

Days since July 1, 1999

Meters

Nice, April 2004
CONCLUSIONS

- GPS is already a powerful tool for sciences
  - Precise orbit determination
  - Reference frame
  - Atmospheric sciences
- Galileo can still provide valuable information
  - More satellites