“How to Collect the Best GPS Data Under Tree Canopy”

Timber Measurement Society

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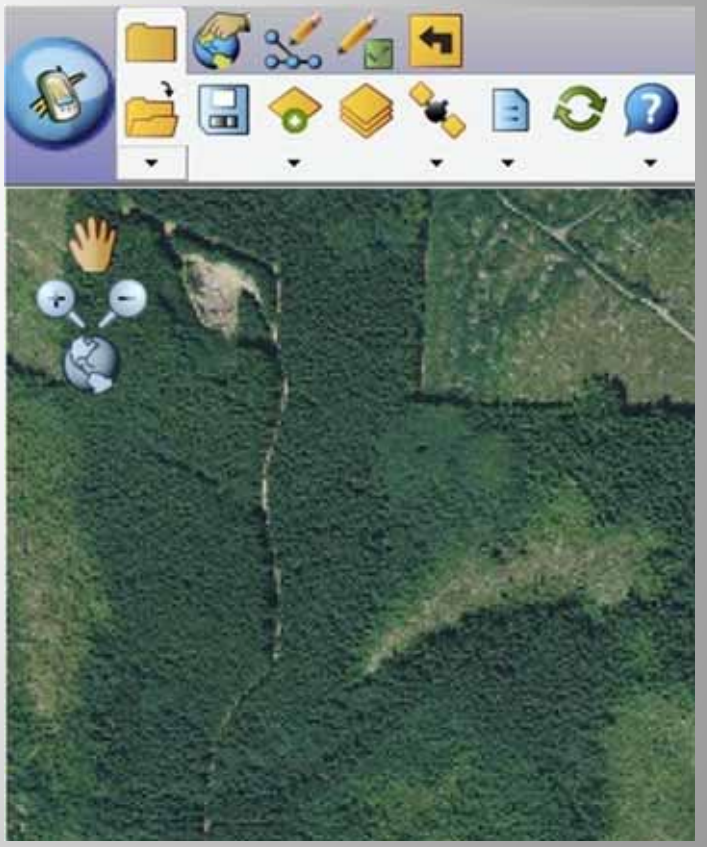


Presentation Outline

1. **GPS – What we do**
2. **Equipment/GNSS**
3. **Accuracy fundamentals**
4. **The Future of GPS**
5. **Discuss GPS units With US and GLONASS satellites**

What We Do With GPS

- Navigate
  - To known points
  - Find areas to work in

- Collect data
  - Points, Lines, Polygons
- Interface with other Mapping Software
  - Example: ArcGIS, ArcView, MapInfo, AutoCAD

GPS Units

- Consumer Grade
  - 2 to 5 meter accuracy
  - $99.00 to $500.00

- Resource Grade
  - Sub-meter or 1-3 meter accuracy
  - $2,000.00 to $8,000.00

- Survey Grade
  - Centimeter accuracy
  - $7,000 to $45,000

•Factors Affecting Accuracy

- # Of visible satellites
- Multipath (Signal bouncing off objects)
- Distance: rover to base (for real time or Post Pro.)
- PDOP (position dilution of precision)
- Signal Strength
- Satellite elevation
- Occupation time
- Differential correction (WAAS, Post Processing)

PDOP

- Position Dilution Of Precision
  - A unit-less measure of satellite geometry
  - Lower numbers better
  - Perfect PDOP is 1
    - 1 satellite overhead and 3 more equally spread just over the horizon

Number of Satellites

Over 20 GPS and GLONASS satellites available at any one time

Multipath

- Signals bounce off objects and then they hit the GPS antenna.
  - Water
  - Tree Boles
  - Foliage
  - Buildings
- Manufacturers try to mitigate this in software

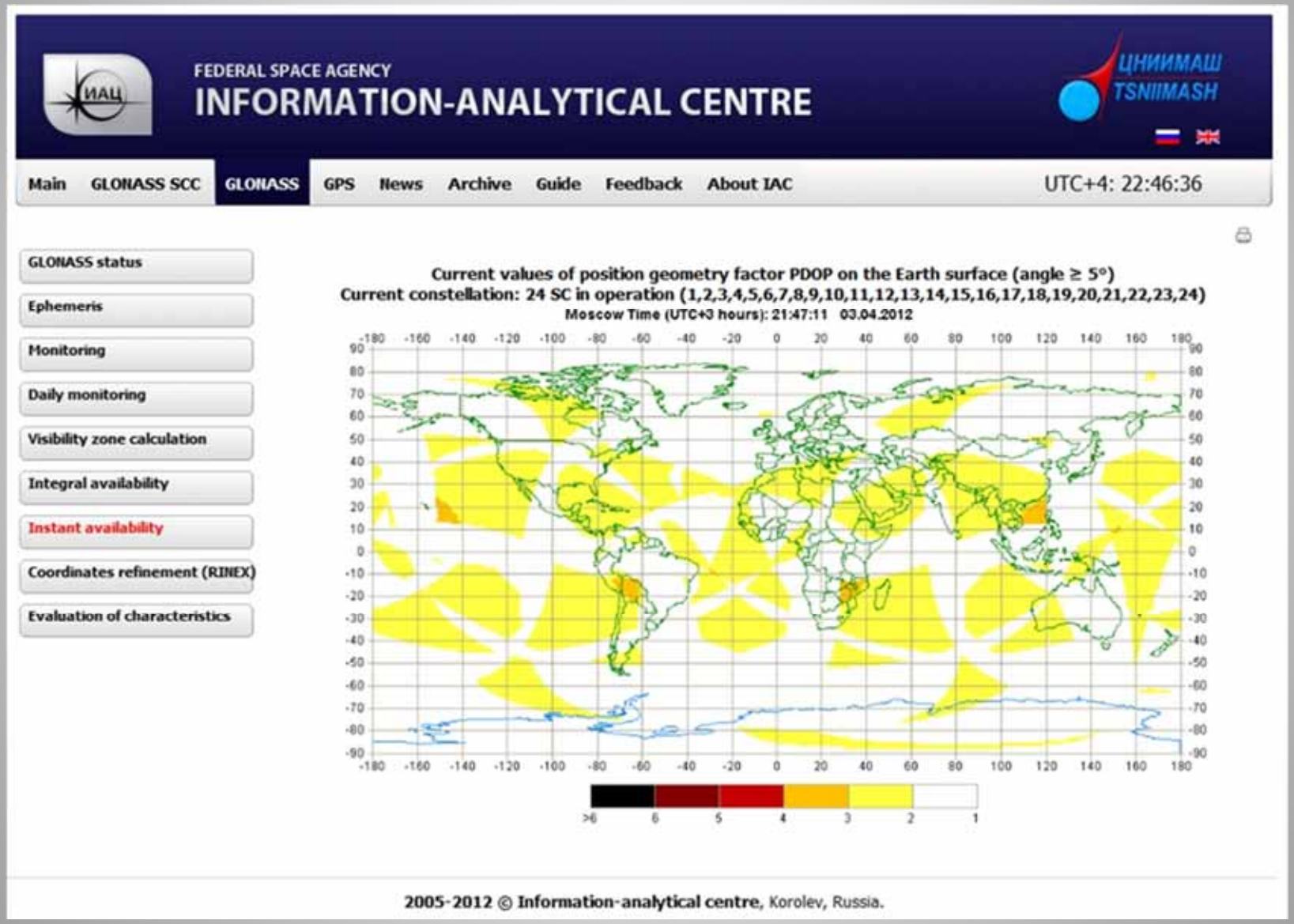
Improving GPS Accuracy With Averaging

- Higher occupation time = better accuracy
- 180 readings on property corners
- 20 to 60 readings under tree canopy
- Garmin GLO – 10/second
- **Use point averaging; It works!**

Field Antenna Options:

- Put antenna on hard hat or soft hat
- Keep it above obstructions
- Shield antenna lead from brush
- Use an external antenna

What Is GLONASS? What Parts of the World Does it Cover?



Why use GLONASS?

1. It simply works better under tree canopy to track US and Russian satellites
2. Lower PDOP
3. Better Accuracy
4. No More Waiting to get Satellites

GPS Units that Track GLONASS

- Ashtech MobileMapper 120
- Trimble GeoExplorer6000
- Topcon GRS-1
- Garmin GLO
- Apple iPhone 5

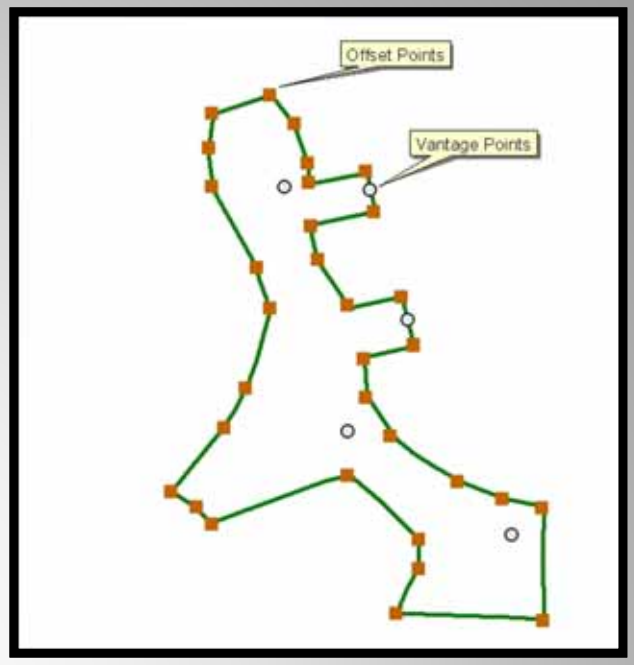
Use Good Protocol Over Points

Other Factors

- Use a range pole when feasible
  - Elevates antenna
  - More precise over the point
- Be Patient
- If elevation is important, enter antenna height/adjustment from HAE to MSL
- Keep using GPS & track your results
- Use GPS offsets

GPS Offsets

- LaserGIS



Maximizing GPS Accuracy

- Before going to the field:
  - Pick best GPS unit (with WAAS, with GLONASS)
  - Update the almanac
- In the Field:
  - Let GPS track in open sky for 2 to 5 minutes
  - Let GPS track during the entire session
  - Keep antenna in good position (above your body)
  - Watch your PDOP values (Wait a few seconds)
  - Pick points with best satellite visibility
  - Use point and vertex averaging
  - Keep GPS unit over the point

The Future of GPS

- Two Satellite Constellations available NOW
  - GPS (United States – 31) started 1978
  - GLONASS (Russian – 24) started 1982
- Two Sat. Constellations available SOON
  - Galileo (European – 24) in two years or less
  - Compass (Chinese – 24) in three years
- Stronger signals from the new satellites
- New signal will be open source
  - Consumer GPS units will be sub-meter

Conclusion:

- GLONASS Significantly improves Accuracy
- Time waiting for satellite signals under dense tree canopy is minimal
- “Difficult” GPS areas aren’t so difficult anymore
- You ain’t seen nothing yet!

Thanks!

For all your GPS Work, May your:

- **PDOPS be low**
- **Satellites be High in the Sky**