


GPS Equipment and Accuracy

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Overview

- How Does GPS Work
- Correction Types/Services
- Accuracy vs. Repeatability?
- Reliability?
- Correction costs
- Purchase Considerations



How does GPS work...

- Satellite radio signals
 - L1
 - L2
 - L2C (limited)
 - L5C (limited)
- New signals provide improved
 - Precision
 - Availability

Understanding GPS Classes

Levels of Correction

- Sub-meter
- Decimeter
- Centimeter (RTK)

Number Required

- GPS: 4 satellites
- RTK: 5 satellites

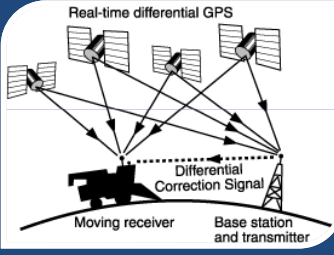


Image courtesy of University of Kentucky

Sources of GPS Correction

Type	Broadcast Method	Examples
WAAS	Satellite	---
Single Frequency	Satellite	John Deere SF1 OmniStar XP
Dual Frequency	Satellite	John Deere SF2 OmniStar XP
RTK	Radio or Cellular	Several

Correction Service	Pass-to-Pass Accuracy	Potential Range of Drift
WAAS	± 6 to 13 inches	± 4.7 ft
Sub-meter	± 6 to 13 inches	± 2.3 ft
Decimeter	± 2 to 4 inches	± 1.7 ft
RTK	± 1 inch	± 1 inch

Selection of GPS Accuracy
Pass-to-Pass vs. Long-Term

GPS Selection vs. Operation

- Sub-meter
 - Scouting
 - Yield mapping
 - Soil sampling
 - Variable-rate
- Decimeter* and RTK
 - Planting
 - Strip-tillage
 - Auto-swath
 - Controlled traffic

Accuracy vs. Reliability

- Accuracy (relative): measured in distance and has long been the standard metric for analyzing the performance of GPS systems.
- Reliability measures the up-time of a GPS system. Combination of:
 - Satellite availability
 - Correction service availability.

GPS

5 Operating Satellites, 2 Blocked by Trees

9 Operating Satellites, 2 Blocked by Trees

More Satellites


=

More Operational Time

<h3>GPS Solution</h3> <ul style="list-style-type: none"> • Best Case: 8 - 9 Satellites • Near Trees: 5 - 6 Satellites • May lose correction or ability of receiver provide a position (down-time) 	<h3>GNSS Solution (GPS+GLONASS)</h3> <ul style="list-style-type: none"> • Best Case: 14 - 15 Satellites • Near Trees: 8 - 10 Satellites • Improved reliability (continues to work!)
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Example GNSS Receivers "GPS + GLONASS"

- John Deere SF3000
- AgLeader GPS 2500
- Trimble AgGPS 442
- Raven Phoenix 300
- Topcon AGI-3



Comments:

- Must have GNSS correction!
- Increased options in the future.

GPS Correction Costs (non-RTK)

- **WAAS:** Free
- **Single Frequency:**
 - OmniStar XP - \$800/yr
 - OmniStar G2 - \$800/yr (GNSS)
 - John Deere SF1 - Free
- **Dual Frequency:**
 - John Deere SF2 - \$800/yr
 - OmniStar HP - \$1500/yr

Example RTK Correction Costs

RTK fees:

- Trimble VRS: \$1500/yr
- CORS in TN: \$300/yr
- Earl Dudley: \$1000/yr
- John Deere: \$2000/yr

***May require cellular data plan + modem**

GPS Purchase Considerations

- **Required accuracy** for your operation
 - Sub-meter vs. RTK
 - Pass-to-pass vs. long-term
 - Purchase vs. free correction service
- **Source of GPS correction**
- Suggest **GNSS receivers** on future purchases
- Is the receiver **easily upgradeable** as new firmware versions are released?

Thank-You

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