Plate Boundary Observatory GPS Update

Greg Anderson
PBO Data Products Manager

CORS Users Forum, Long Beach, CA
13 September 2005
Topics

• What is the Plate Boundary Observatory?
• PBO GPS equipment
• Network operations/construction status
• Data management status/real-time progress
• Mt. St. Helens response
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Tom Herring, MIT
What is PBO?

• Geodetic component of EarthScope, installed and operated by UNAVCO and funded by the National Science Foundation.

• Install & run large network to study:
  – Earthquake processes & seismic hazards
  – Magmatic processes & volcanic hazards
  – Active deformation & tectonics
  – Continental geodynamics
PBO GPS Network

875 new stations  209 existing stations
100 survey-mode receivers
Topics

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- Mt. St. Helens response

Tom Herring, MIT
CGPS Equipment

- Trimble NetRS receivers and choke-ring antennas
- SCIGN-type deep- and shallow-drilled monuments
- Solar/wind DC power, AC where possible
- CDMA, VSAT, radio deliver IP-based data comms
Survey-mode GPS Equipment

Topcon GB-1000 w/Tech 2000 mast
28 in 2005, another 72 in 2006
Available to researchers via proposal process
Topics

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- Network operations/construction status
- Data management status/real-time progress
- Mt. St. Helens response
Network Progress: 31 Aug 2005

<table>
<thead>
<tr>
<th>Activity</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final station locations identified</td>
<td>498</td>
</tr>
<tr>
<td>Permits submitted</td>
<td>419</td>
</tr>
<tr>
<td>Permits accepted</td>
<td>247</td>
</tr>
<tr>
<td>Monuments installed</td>
<td>211</td>
</tr>
<tr>
<td>Data available</td>
<td>182</td>
</tr>
<tr>
<td>Operating as expected</td>
<td>122</td>
</tr>
<tr>
<td>Routine archiving</td>
<td>105</td>
</tr>
</tbody>
</table>
• What is the Plate Boundary Observatory?
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• Network operations/construction status
• Data management status/real-time progress
• Mt. St. Helens response
GPS Data Management Overview

• Data Status
  – 182 of 211 stations have returned data
  – 105 stations archived routinely
  – Others lack comms or have various problems
  – Data for Jan 2004-Sep 2005 available via GPS archives

• Data Analysis
  – 2 Analysis Centers (CWU, UCB) & 1 GPS AC Coordinator (MIT)
  – Data products: position & velocity solutions, time series, etc.
  – All of 2004 and July 2005 forward have been processed
  – RMS ~1.5 mm horizontal, 4 mm vertical
  – Archived at GPS Archives at UNAVCO Facility and IRIS DMC
  – Products available from Archives by end of September 2005

• Data Management
  – Data Management web site: http://pboweb.unavco.org/data
  – Special data request tool available on PBO web site
PBO Routine GPS Data Products

Level 0 (at least daily)
- 15-sec BINEX, routine download
- 5-sps BINEX, triggered download
- Survey-mode BINEX files

Level 1 (automated QC @ PBO HQ)
- 15-sec, 5-sps, survey-mode BINEX

Level 2 (1-, 15-day and 1-yr latencies)
- Individual AC position solution (CWU and UCB)
- Individual AC processing input and output files (CWU and UCB)
- Combined position & velocity solutions & time series (MIT)
- Combined baseline time series (MIT)
- Coseismic offsets (MIT)

Archived at UNAVCO Facility, IRIS DMC
Level 0/1 data available now
Level 2 data by end of September 2005
Routine GPS Data Flow

NetRS CGPS Receiver

- Boulder RAID (1-yr buffer)
  - Download and initial QC
  - Distribute Level 0/1 data
  - Mirror with Socorro DCC

- Boulder POD (Primary DB)

  Boulder DCC
  - Daily mirroring

  Socorro DCC (Alternate DCC, can sub for Boulder)

  Socorro RAID (Backup buffer)

  Socorro POD (Backup DB)

  Analysis Centers (UCB, CWU)
  Level 2a Products

  Analysis Center Coordinator (MIT)
  Level 2b products

  UNAVCO Facility (Archive, Deliver)

  IRIS DMC (Archive, Deliver)

Data Product Type

- Level 0
- Level 1
- Level 2b
- Level 2a
Archived Data Volume (as of 8/31)

- PBO GPS Network
- PBO Nucleus Network
- Total GPS Data

Data volume archived (GB):

- Jun 2004: 1 iPod shuffle
- Sep 2004: 1 iPod mini
- Apr 2005: 1 iPod
Real-time GPS Plans

- RTK feeds
  - Landowners have access from NetRS
  - RTCM (v2.1, 2.2, 2.3), CMR, CMR+, RT17
  - Can grant to 3rd parties
  - Approximately 25 stations w/feeds as of 8/31/2005
  - Includes local surveyors, utilities, etc.

- IP-based data flow
  - Possibly using NTrip software (see Weber talk)
  - 2005: Test w/5 southern CA stations (w/SOPAC)
  - 2006: Test with about a dozen stations
  - 2007-2008: expand to selected other stations
Real-time GPS Plans

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High-rate RT GPS Data Flow

NetRS CGPS Receiver → Boulder DCC
- Download
- Convert to RTCM

Boulder DCC → Boulder RAID (1-yr buffer)
Boulder DCC → Boulder POD (Primary DB)

Boulder DCC → Socorro DCC (Alternate DCC, can sub for Boulder)

Socorro DCC → Socorro RAID (Backup buffer)
Socorro DCC → Socorro POD (Backup DB)

binex.earthscope.org
- 1-sps BINEX

rtcm.earthscope.org
- 1-sps RTCM

Socket connection Each station has own IP port number
Special Data Request Tool

http://pboweb.unavco.org/shared/scripts/datarerequests

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**DATA REQUESTS**

Use the following form to request data from the Plate Boundary Observatory (PBO).

<table>
<thead>
<tr>
<th>Name (First and Last):</th>
<th>Daffy Duck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email Address:</td>
<td><a href="mailto:d.duck@disney.com">d.duck@disney.com</a></td>
</tr>
<tr>
<td>Telephone:</td>
<td>888-555-1212</td>
</tr>
<tr>
<td>Role:</td>
<td>Project Principal Investigator</td>
</tr>
<tr>
<td>Institution:</td>
<td>Disneyland</td>
</tr>
<tr>
<td>Data you are Requesting:</td>
<td>Quack!</td>
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<tr>
<td>Source of Funding:</td>
<td>Secret gold reserves</td>
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<tr>
<td>Data Start Date:</td>
<td>2005-10-02</td>
</tr>
<tr>
<td>Data End Date:</td>
<td>2005-10-08</td>
</tr>
</tbody>
</table>

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Mount Saint Helens
Volcanic Crisis Response
October 2004

Photo by Mike Poland
Mt. St. Helens Response

- Stations recon’ed Aug 2004
- Installations planned Summer 2005
- Magmatic systems committee recommended rapid response to Sept 23rd 2005 increased seismic activity and steam/ash eruptions
- Installed stations:
  - 2 in far field
  - 5 on flanks in 2 days
  - 2 more on flanks Feb 2005
- 9 more GPS planned
- 4 strain + 4 tilt planned
- Hourly data from 8 stations
Model (preliminary) - Point pressure source, depth 13.3 km, equivalent volume change 26 M m^3 per yr, 16 M m^3 for 7.25 months. Surface loading by new dome not corrected.
Summary

• PBO is geodetic component of EarthScope project
• Network Operations Status
  – 875 new CGPS stations over next 5 years
  – 211 new stations are installed
• Data Management Status
  – Data Management web site: http://pboweb.unavco.org/data
  – 182 of 211 stations have returned data
  – Data for Jan 2004-Sep 2005 available via GPS archives
  – Special data requests: http://pboweb.unavco.org/shared/scripts/datarequests
• Data Analysis
  – Analysis Centers (CWU, UCB) and AC Coordinator (MIT)
  – Data products: position and velocity solutions, time series, etc.
  – Available from Archives by Sept 2005
• Real-Time Data Progress & Plans
  – RTK feeds now available to landowners, about 25 active
  – 5 stations have IP-based real-time feeds as test
  – Will be expanding, making data available from Boulder in 2006
  – Possibly using NTrip software
For more information...

http://pboweb.unavco.org  www.earthscope.org