GEOID18: Last U.S. Hybrid Geoid Prior to NAPGD2022

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Paper 9933
OUTLINE

• GEOID12 – lessons learned
• Hybrid Geoid modeling primer
• GPS on BM 18 planning and collection
• Expected changes in GEOID18
• Summary
Differences Between GEODI12A and GEOID12
Differences Between GEOID12B and GEOID12A

- GPS on BM used in GEOID12A and GEOID12B
- Updated heights for GEOID12B (D11788 and D11789)
- BM removed from GEOID12B, no adjusted heights based on leveling (DH3639 and DH3640)
- BM that refer to local tide gauges, not PRVD02, Removed from GEOID12B (D11783, D11784, D11785, D11786 and D11787)
Hybrid Geoid Modeling Primer

- Start with a gravimetric geoid (USGG2012)
- Use control data to fit to local datums
- Appropriate versions of NAD 83
- Respective local Vertical Datum (if one exists)
- Use LSC to determine correlated signal
- For complex areas (e.g., CONUS), use MMLSC
- Apply grid of correlated signal to USGG2012
- Results in GEOID12 with high frequency nature from USGG2012 but fit to local control
Conversion Surface: From Gravimetric to Hybrid Geoids

**Gravimetric Geoid** systematic misfit to BM’s but best fits “true” heights

**Hybrid Geoid** “converted” to fit local BM’s, so best fits NAVD 88 heights

**Conversion Surface** model of systematic misfit derived from BM’s in IDB
OPUS-Shared Solutions
Sample plot showing regions to be targeted for collection.
Example point where suspect control data was revisited.

PID HD0371
Location of Control Data (GPS on BM) used in GEOID18

[Map showing the location of control data with different markers for new marks, included, and excluded in GEOID12B.]
Control data (GPS on BM) used in making GEODI18

<table>
<thead>
<tr>
<th>GPS on BM</th>
<th>Available</th>
<th>Flagged as bad fit</th>
<th>Used in Model</th>
<th>Number since GEOID12B</th>
<th>Used since GEOID12B</th>
</tr>
</thead>
<tbody>
<tr>
<td>NGS IDB:</td>
<td>30,128</td>
<td>1,987 (6.6%)</td>
<td>28,141</td>
<td>6,610</td>
<td>6,324</td>
</tr>
<tr>
<td>OPUS Share: 2+ Obs.</td>
<td>3,313</td>
<td>288 (8.7%)</td>
<td>3,025</td>
<td>3,009</td>
<td>2,748</td>
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<tr>
<td>OPUS Share: 1 Obs.</td>
<td>2,349</td>
<td>-</td>
<td>211</td>
<td>2,141</td>
<td>186</td>
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<tr>
<td>Canada</td>
<td>579</td>
<td>14</td>
<td>565</td>
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</tr>
<tr>
<td>Mexico</td>
<td>247</td>
<td>41</td>
<td>206</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Total:</td>
<td>36,616</td>
<td>2,330</td>
<td><strong>32,148</strong></td>
<td>11,760</td>
<td>9,258</td>
</tr>
</tbody>
</table>
Differences Between GEODI18 and GEOID12B
Summary

• Generation of GEOID12/A/B resulted lessons learned
• A much more careful analysis followed
  – Analysis of the leveling in comparison to neighbors
  – Analysis of residual values at GPS on BM
• A campaign followed on that targeting areas of deficiency
• Resulting model is much improved and strengthened
• This is the last hybrid model before NAPGD2022 will replace it
• The GPS on BM data collected here will go into follow on vertical datum conversion tool
Questions?

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