New Vertical Datum for the Dead Sea Works, Israel 2008

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RESEARCH PROJECT for the Survey of Israel

Supported in part by the Dead Sea Works, Israel
Satellite view: Middle East

Satellite view: Israel
Satellite view: Dead Sea

FIG Working Week, Eilat, May 3-4-5-6-7-8, 2009...
Geoid for Israel

Geoid from LEVELING and GPS – or from GRAVITY.

**LEVELING in Israel:**
- MSL not accurate
- Tie to the Net is tenuous
- Observations over 50+ years
- No proper Orthometric Correction
- Not all loops included
- No simultaneous Adjustment
  (Hierarchic forcing of 2nd degree into 1st)

**GPS (for Elevations) in Israel:**
- Not same epochs as leveling (obviously)
- Short-period observations

**GRAVITY:**
- UNB Geoid Program Suite
  (modified Stokes-Helmert procedure)
- [EGM2008]

FIG Working Week, Eilat, May 3-4-5 6-7-8, 2009  
TS SC/Sharmi: Dead Sea
Leveling and Gravity - 1

Leveling and Gravity - 2

\[ b - a = dH_{\infty} \]

\[ b - a = dZ_{rt} = ??? \]
Orthometric Correction

Correction for non-parallelism of the Verticals:

**Normal** - Ellipsoidal gravity field; effect only in N-S direction
- size from -0.1 to +0.7 mm per leveling line (2-3 km) in the Project.

**Gravimetric** - Actual gravity field; in any direction; usually much bigger
- size from -7.2 to +8.3 mm per leveling line (2-3 km),
- where 2nd deg. tolerance is $\Delta h_{corr}$, or 6-7 mm per line;
- the cumulative Change in Elevations was (from 0 to) +43 mm (SOI higher; Project heights based on one point only);
- Undulations Changed from -77 to +120 mm (Project higher).

ROAD 3 - OPEN H from P1 - going north

<table>
<thead>
<tr>
<th>Point</th>
<th>also</th>
<th>SOI (m)</th>
<th>phi</th>
<th>lambda</th>
<th>norm.corr.</th>
<th>H w.norr.corr.</th>
<th>Y</th>
<th>app.</th>
<th>X (m)</th>
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<tbody>
<tr>
<td>P6</td>
<td>3358MPI</td>
<td>-386.946</td>
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<table>
<thead>
<tr>
<th>Point</th>
<th>g (mgal)</th>
<th>h wgs84 (m)</th>
<th>$\Delta Z$ (m)</th>
<th>ort.corr. (mm)</th>
<th>H ortho (m)</th>
<th>N 2008 (mm)</th>
<th>N ILUM1.2 (mm)</th>
<th>precision</th>
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<td>16.473</td>
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<td>0.040</td>
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Undulations, N (DSW Datum2008)
Challenges for the Dead Sea

Lowering Sea Level
- Seashore moves East; beaches get farther from hotels
- DSW needs to channel water from North basin to evaporation ponds
- DSW needs to elevate dykes and excavate salt from ponds
- Hotel beaches need dyke protection, from elevated ponds

Settlement and Sinkholes
- Caused by sweet water dissolving salt layers, and salt water eroding silt layers
- Hotels are settling; damage forecast
- Sinkholes limit operations; dangerous even to pedestrians
THANK YOU.

SHALOM!