

Lecture 4.4:

Gravity from GOCE satellite gradiometry With Examples from The Kingdom of Saudi Arabia



Gravity gradients, in TRF.

941087922 -6456035.1 -1563104.2 6392.5
-1365.8849 -1362.0342 2727.9411 18.1141
0.0040 0.0035 0.0070 0.0075

941087923 -6456331.5 -1561756.1 14087.0
-1365.9165 -1362.0471 2727.9686 18.1458
0.0040 0.0035 0.0070 0.0075

941087924 -6456618.8 -1560405.9 21781.5
-1365.9237 -1362.0673 2727.9805 18.1679
0.0040 0.0035 0.0070 0.0075

CHECK: LAPLACE=0.0



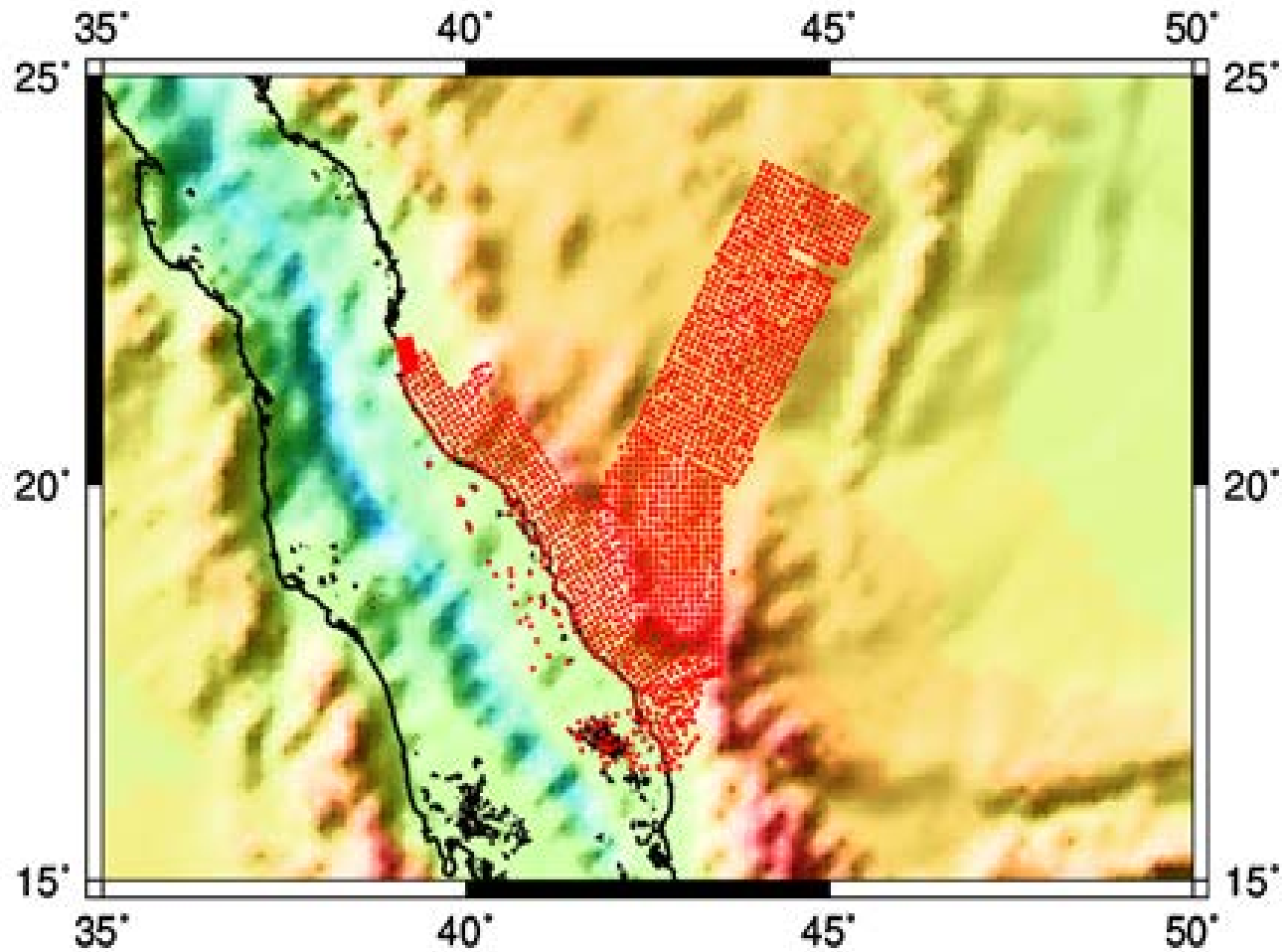
Spherical harmonic coefficients:

Degree i , Order j , C_{ij} , S_{ij} , error-estimates:

0	0	0.100000000000e+01	0.000000000000e+00	0.0000e+00	0.0000e+00
1	0	0.000000000000e+00	0.000000000000e+00	0.0000e+00	0.0000e+00
2	0	-.484165338480e-03	0.000000000000e+00	0.1424e-11	0.0000e+00
3	0	0.957242874798e-06	0.000000000000e+00	0.1211e-11	0.0000e+00
4	0	0.540018997487e-06	0.000000000000e+00	0.4591e-12	0.0000e+00
5	0	0.685985807456e-07	0.000000000000e+00	0.3259e-12	0.0000e+00
6	0	-.150015349955e-06	0.000000000000e+00	0.2660e-12	0.0000e+00
7	0	0.905048877701e-07	0.000000000000e+00	0.2301e-12	0.0000e+00
8	0	0.494966103941e-07	0.000000000000e+00	0.2076e-12	0.0000e+00
9	0	0.279965544344e-07	0.000000000000e+00	0.1924e-12	0.0000e+00
10	0	0.533427131066e-07	0.000000000000e+00	0.1822e-12	0.0000e+00
11	0	-.507527543333e-07	0.000000000000e+00	0.1750e-12	0.0000e+00



Free-air gravity available: faaksa.txt



KSA Workshop, Nov., 2013, (CCT, RF)

Prediction of faaksa.txt from Trr (mgal)

NUMBER: 2196

OBSERVATIONS	PREDICTIONS	DIFFERENCE	ERROR ESTIMATES
MEAND	20.01	25.33	-5.32
ST.DEVI.	37.19	18.93	35.31
MAX	237.29	67.90	192.58
MIN	-80.16	-12.61	-114.84

ODISTRIBUTION OF DIFFERENCES, UNITS: 5.000000

20 28 38 39 67 95 131 147 172 171 171 148 135 107 116 131 95 53 27 6 5 294

-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 OUTSIDE



Computation and comparison with DIR R3 (mgal)

NUMBER: 2196

	OBSERVATIONS	PREDICTIONS	DIFFERENCE
MEAND	20.01	22.92	-2.90
ST.DEVI.	37.19	23.58	33.89
MAX	237.29	86.47	183.85
MIN	-80.16	-25.69	-111.91

ODISTRIBUTION OF DIFFERENCES, UNITS: 10.000000

14	21	37	45	55	56	72	107	218	354	356	244	179	232	127	30	9	7			
4	5	3	21																	
-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10

OUTSIDE



Computation and comparison with EGM2008 (mgal)

NUMBER: 2196

	OBSERVATIONS	PREDICTIONS	DIFFERENCE
MEAND	20.01	24.09	-4.07
ST.DEVI.	37.19	35.63	13.36
MAX	237.29	219.45	62.21
MIN	-80.16	-75.44	-83.58

ODISTRIBUTION OF DIFFERENCES, UNITS: 5.000000

7	10	12	19	23	51	97	179	398	433	345	243	193	90	43	13	10	5	3		
1	1	20																		
-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10

OUTSIDE



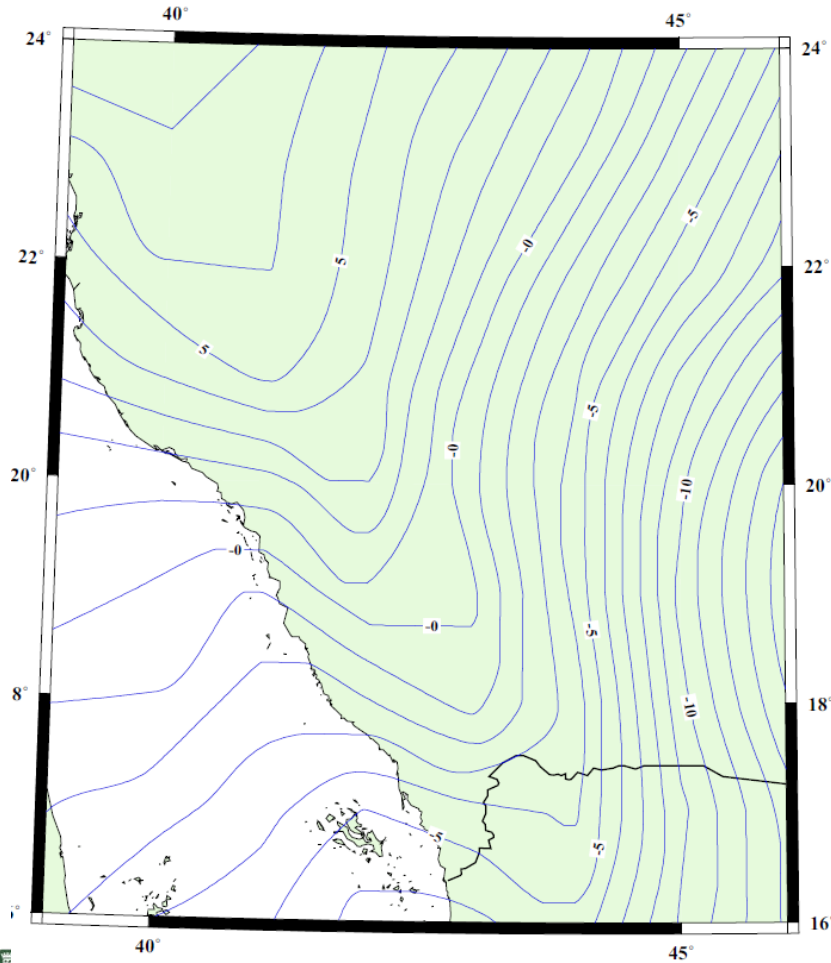
Local geoid (height anomaly) computation.

- (1) Use free-air gravity minus EGM2008,
<http://cct.gfy.ku.dk/riyadh/faaksa-egm08.dat>
- (2) Use local DTM:
http://cct.gfy.ku.dk/riyadh/srtm30_15253550.gri
- (3) Create reference grid using TCGRID called srtm5.gri
- (4) Use TC to subtract residual topographic effects to obtain
faaksa-egm08-tc5.dat
- (5) Estimate empirical covariance function using EMPCOV
- (6) Fit the 4 first empirical values to an analytic model using
COVFIT http://cct.gfy.ku.dk/riyadh/covfit_dg-egm085_720.out
- (7) Use GEOCOL to predict (reduced) height anomalies and errors
- (8) Add back the residual topographic effects using TC.

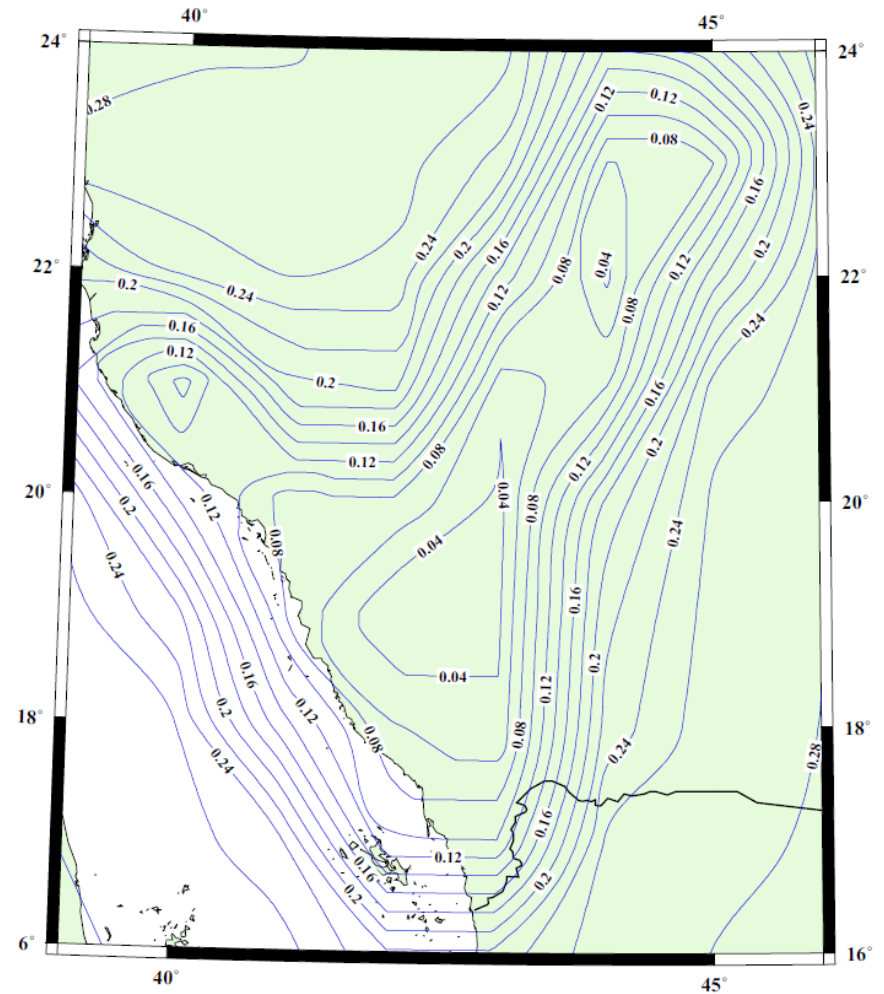


Local geoid (height anomaly) result.

ha predicted from dg+tc (m).



ha prediction error estimate (m).



Conclusion (preliminary)

Height anomalies with error of 0.03 m easily obtained if sufficient gravity.

If no gravity available use GOCE T_{zz}

Use EGM2008 contingently
with the first 240 coefficients substituted by a
GOCE model !

