Repeated absolute gravity measurements in the Fennoscandian postglacial rebound area: comparison of gravity change with observed vertical motion and with GIA models

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Absolute Gravity Team

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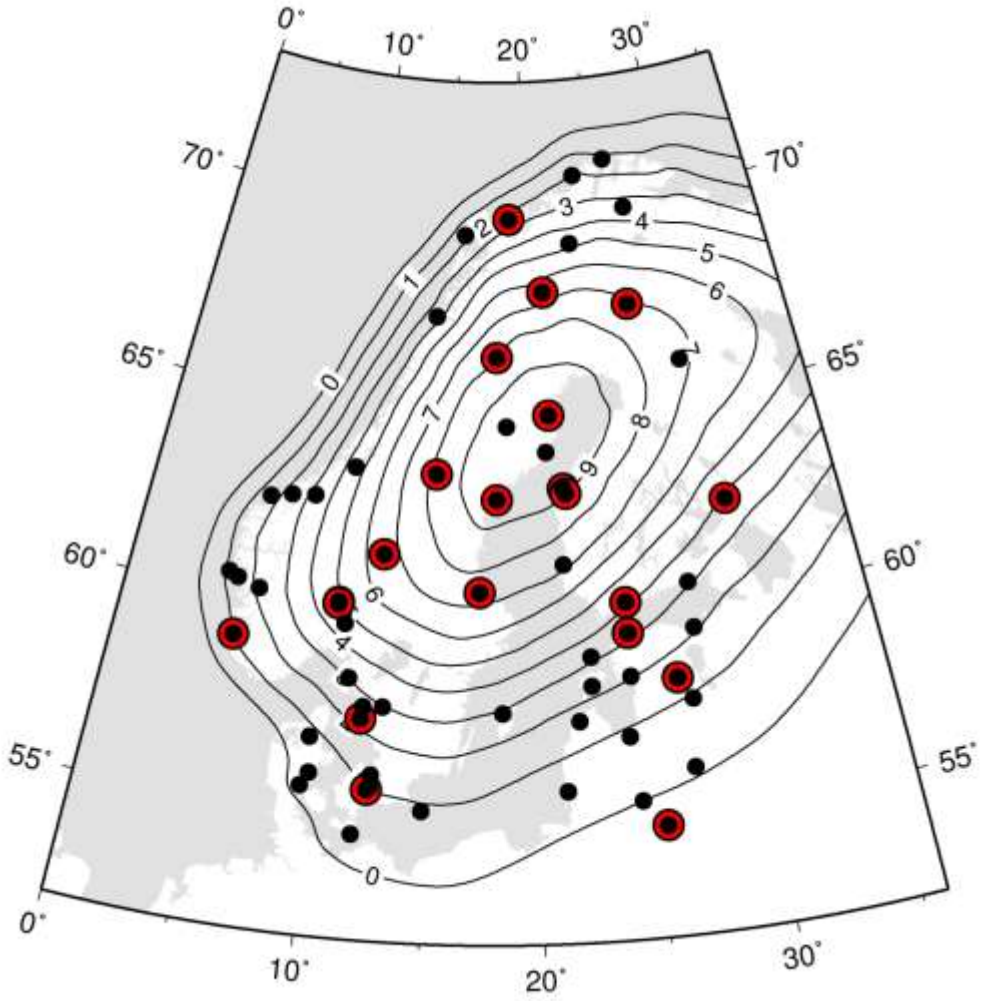
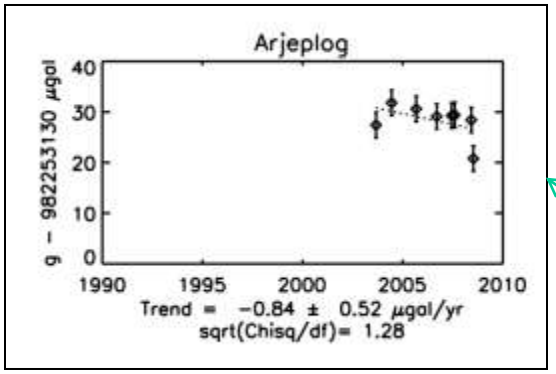
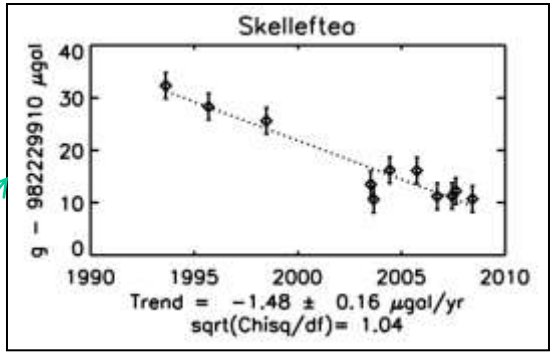


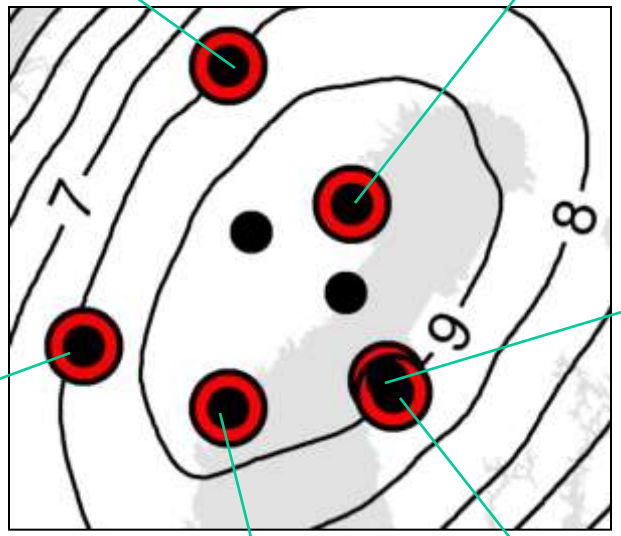
Absolute gravity stations

Red rim: enough repeats to determine a trend

Isolines: vertical velocity mm/yr relative to CM from the empirical velocity model NKG2005LU_ABS


Arjeplog
g − 982253130 μgal
Trend = −0.84 ± 0.52 μgal/yr
sqrt(Chisq/df)= 1.28


Skellefteå
g − 982229910 μgal
Trend = −1.48 ± 0.16 μgal/yr
sqrt(Chisq/df)= 1.04


7
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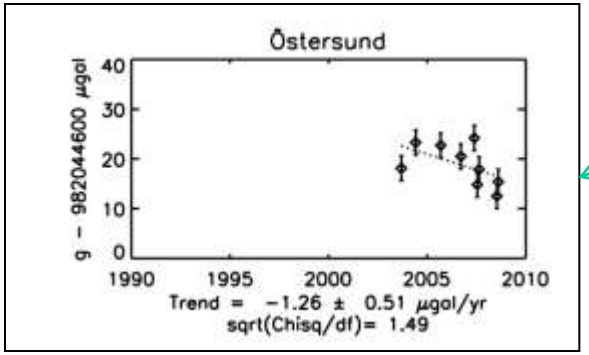
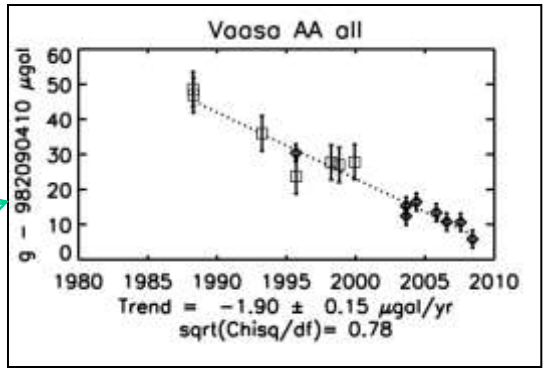
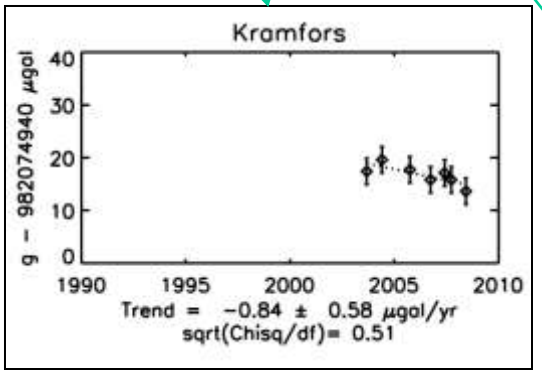
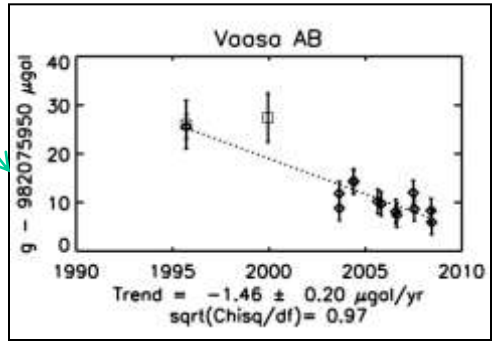

Östersund
g − 982044600 μgal
Trend = −1.26 ± 0.51 μgal/yr
sqrt(Chisq/df)= 1.49


Vaasa AA all
g − 982090410 μgal
Trend = −1.90 ± 0.15 μgal/yr
sqrt(Chisq/df)= 0.78


Kramfors
g − 982074940 μgal
Trend = −0.84 ± 0.58 μgal/yr
sqrt(Chisq/df)= 0.51


Vaasa AB
g − 982075950 μgal
Trend = −1.46 ± 0.20 μgal/yr
sqrt(Chisq/df)= 0.97

Samples

Things you can do with the data

- station-by-station comparison of g_dot and h_dot to agreements and inconsistencies
- multi-station comparison to find slope and intercept of g_dot vs. h_dot
- use an areally extensive set of g_dot values as a GIA modelling data set in its own right

Gravity and vertical rates used in the poster

1	2	3	4	5	6	7	8
Copenhagen_V	55.6869	12.4350	0.074	0.566	1.26	0.53	0.16
Joensuu	62.3912	30.0962	-0.865	0.493	4.50	0.19	3.31
Metsähovi	60.2175	24.3953	-0.775	0.100	5.21	0.23	4.05
Sodankylä	67.4209	26.3890	-1.182	0.206	8.53	0.31	7.29
Vaasa_AA	63.0847	21.6458	-1.898	0.148	9.28	0.19	8.09
Vaasa_AB	62.9612	21.7706	-1.462	0.197	9.28	0.19	8.09
Tromsö	69.6627	18.9396	-0.002	0.224	4.61	0.49	3.35
Stavanger	59.0175	5.5983	-0.329	0.172	2.19	0.51	1.05
Trysil_AB	61.4228	12.3814	-1.315	0.216	9.54	0.34	8.37
Trysil_AC	61.4228	12.3814	-1.077	0.126	9.54	0.34	8.37
Hönefoss_AB	60.1700	10.3800	-1.028	0.341			
Hönefoss_AC	60.1300	10.3550	-0.723	0.228			
Arjeplog	66.3180	18.1249	-0.842	0.523	9.11	0.24	7.88
Kiruna	67.8776	21.0602	-0.955	0.223	7.72	0.28	6.48
Mårtsbo	60.5951	17.2585	-1.139	0.180	8.86	0.15	7.69
Onsala	57.3953	11.9255	-0.589	0.090	4.05	0.31	2.93
Östersund	63.4428	14.8581	-1.257	0.506	9.55	0.17	8.35
Skellefteå	64.8792	21.0483	-1.478	0.156	10.95	0.18	9.74
Kramfors	62.8547	18.0961	-0.836	0.576			
Suurupi	59.4667	24.3833	-0.525	0.428	4.35	0.34	3.20
Vilnius	54.7217	25.3383	-0.306	0.409	0.77	0.34	-0.38
Toravere	58.2667	26.4667	-0.369	0.428			

4 gravity rate µgal/yr

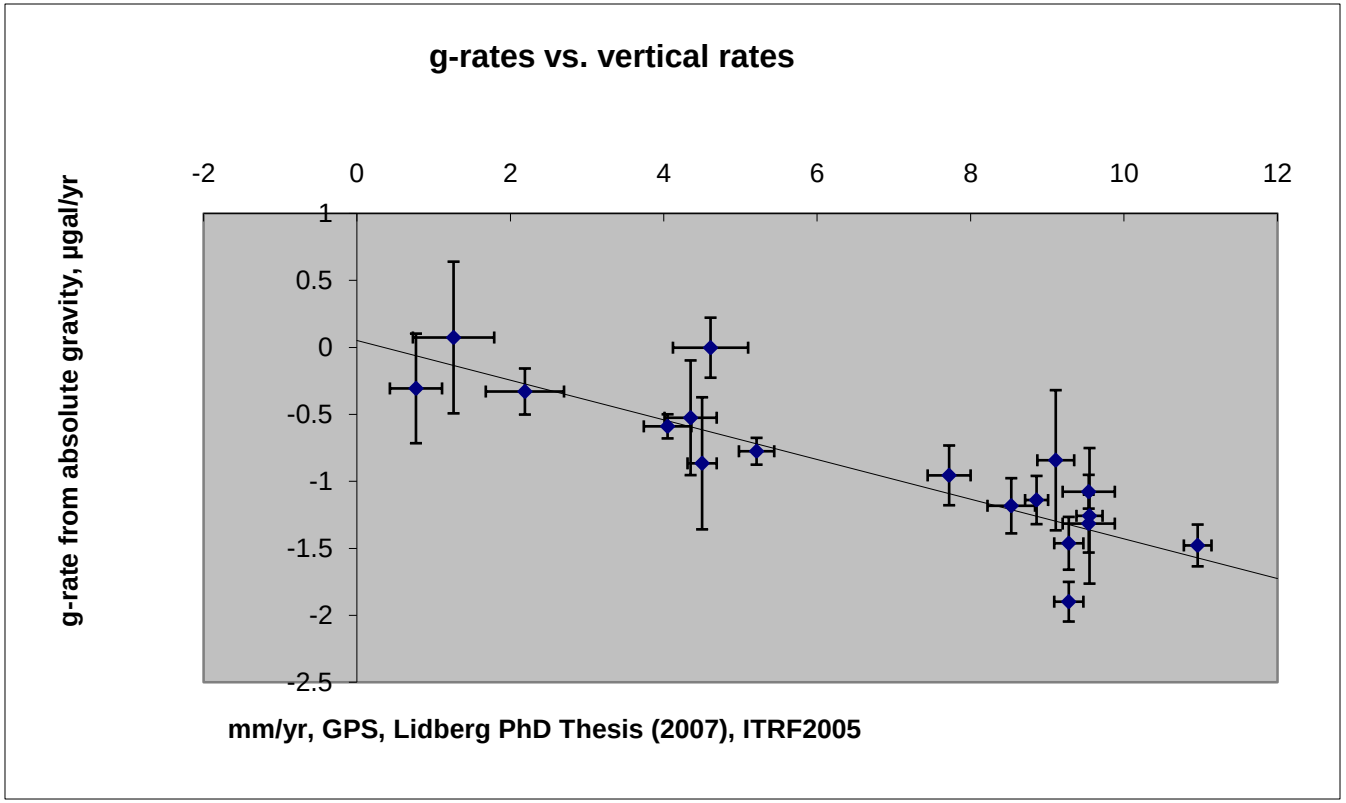
5 error 1-sigma

6 vertical rate mm/yr Martin Lidberg Ph.D. thesis ITRF2005

7 error 1-sigma

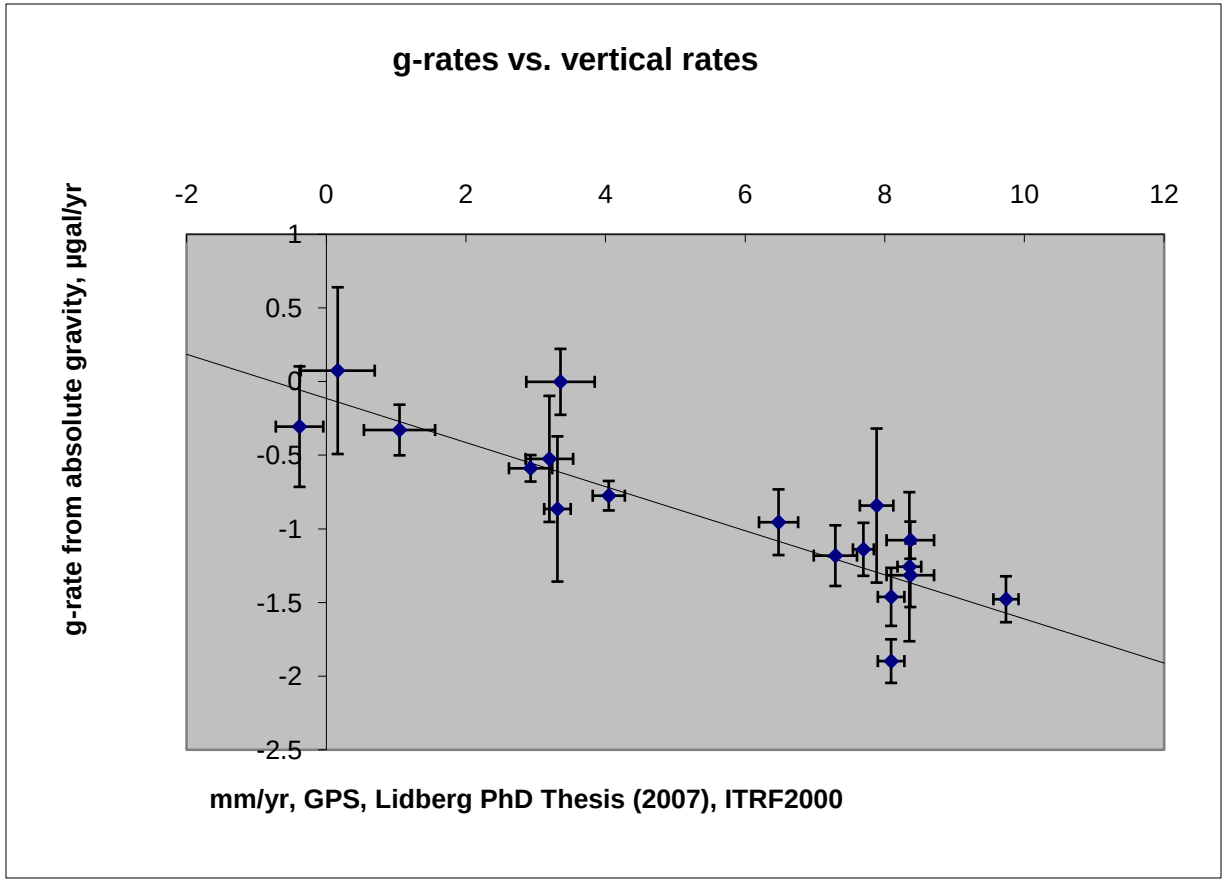
8 (6) transformed to ITRF2000 by JM

Fitting of linear relationship to g_dot vs. h_dot, part I



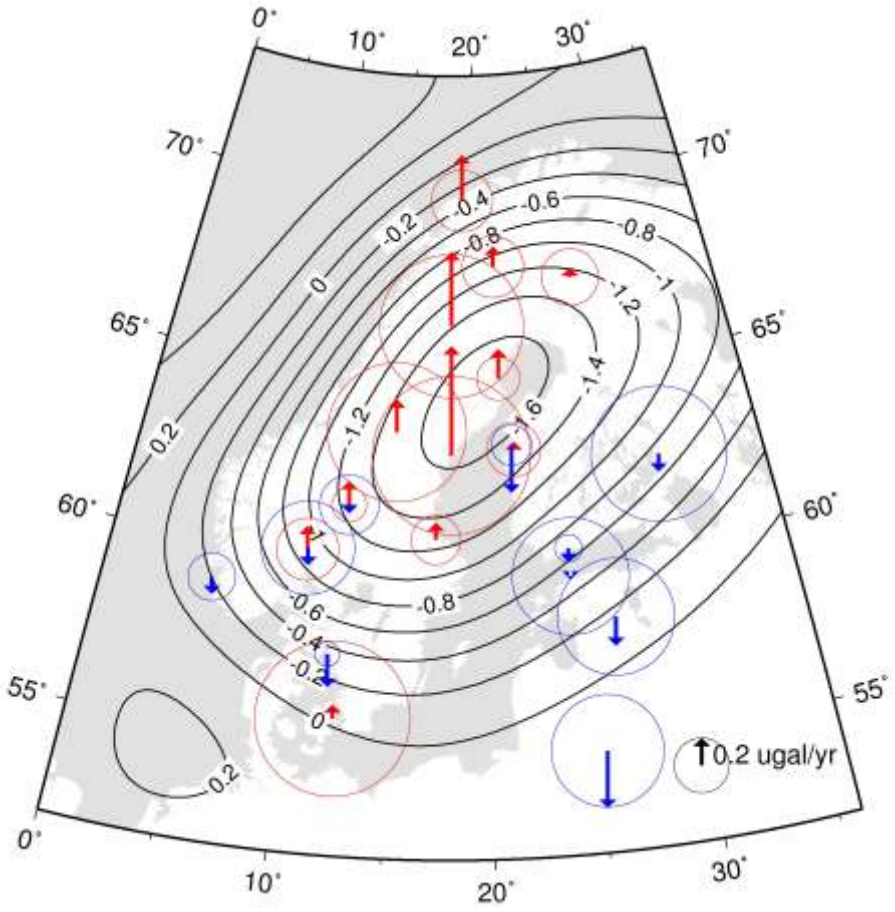
Slope –0.148 0.022 µgal/mm (1-sigma)
Intercept +0.05 0.16 µgal or +0.33 1.08 mm/yr
m.sq. = 1.85 (tail probability 0.02)

Fitting of linear relationship to g_dot vs. h_dot, part II



Slope –0.150 0.022 µgal/mm (1-sigma)
Intercept –0.11 0.16 µgal or –0.73 1.08 mm/yr
m.sq. = 1.87 (tail probability 0.02)

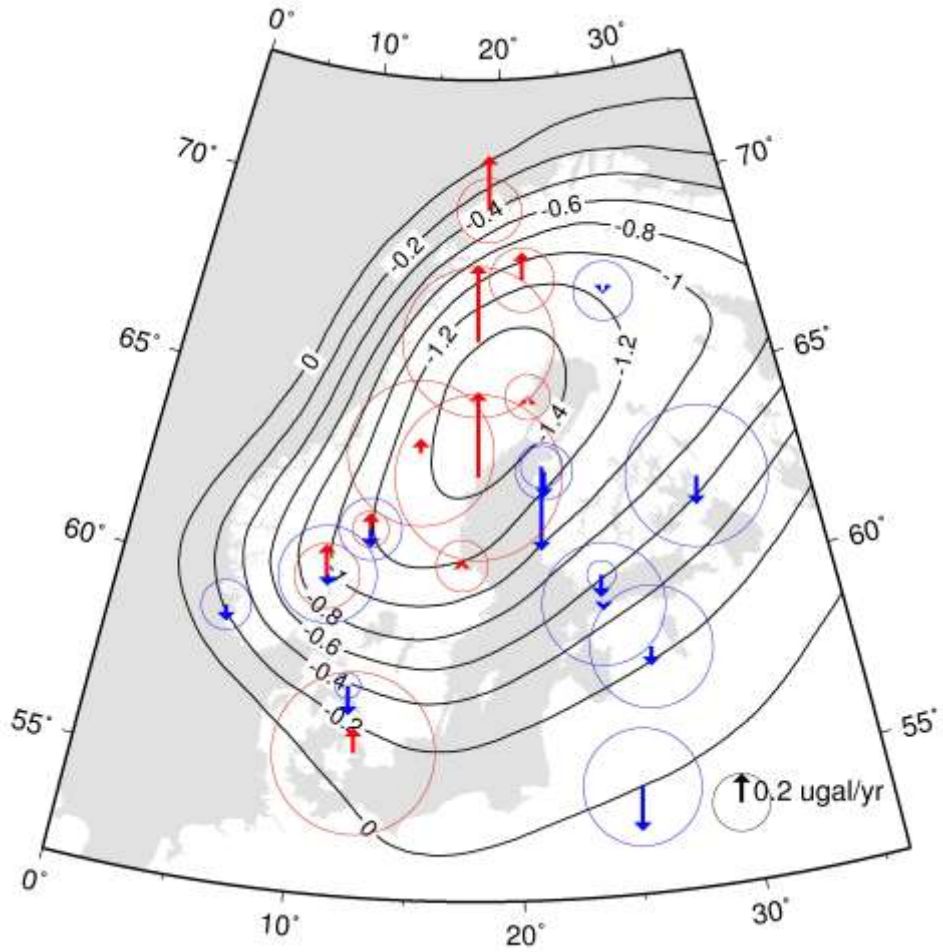
Tests of GIA models using g_dot data (I)



- g_dot predictions not always available
- multiply h_dot predictions by -0.154 µgal/mm
- see e.g., Wahr (1995), Peltier (2004)
- calculate weighted error-sum-of-squares and mean square

Map: expected g_rate from the GIA model by Milne (2001,2004)

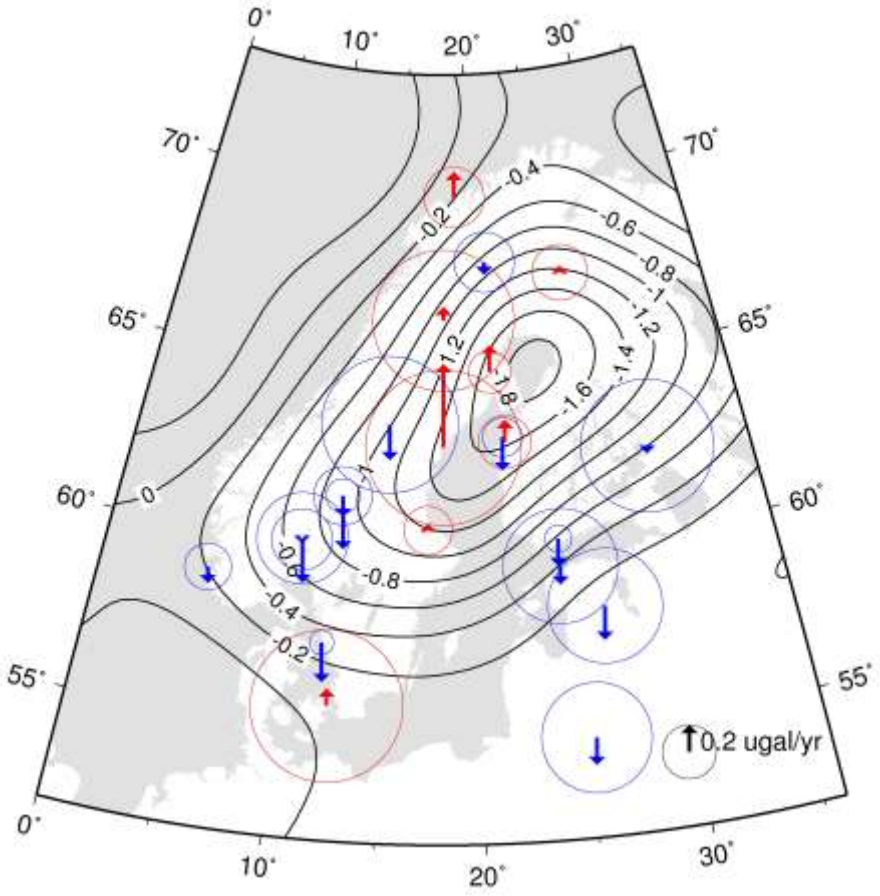
Tests of GIA models using g_dot data (II)



- Lambeck et al. (1998) map gave PGR relative to MSL (1992-1991). Transformed to PGR relative to the Earth's center of mass before multiplying with -0.154 µgal/mm

Map: expected g_rate from the GIA model by Lambeck et al. (1998)

Tests of GIA models using g_dot data (III)



- Mean squares:
- Milne 1.21
- Lambeck 1.52
- ICE-5G(VM2) 1.34

- In each case, removing the two stations with biggest misfit brings the mean square below 1.0

- i.e., no strong discrimination based on the totality of data

Map: expected g_rate from the GIA model ICE-5G (VM2) by Peltier (2004)