ICGEM

ICGEM - International Centre for Global Earth Models

Elmas Sinem Ince, Franz Barthelmes, Sven Reißland
Helmholtz Centre Potsdam GFZ German Research Centre for Geosciences

SERVICES OF ICGEM

- Collecting and archiving of all existing global gravity field models (GGMs)
- Making GGMs available on the web in a standardized format
- Providing DOI number to the model coefficients
- Web-interface to calculate gravity functionals from the spherical harmonic coefficients on freely selectable grid
- Visualization tool of the static and temporal models
- Visualization of surface spherical harmonics as tutorial
- Evaluation of the models in spectral domain and w.r.t. GNSS/levelling derived geoid
- Theory, discussion forum and Frequently Asked Questions

GRAVITY FIELD MODELS

LIST OF STATIC GRAVITY FIELD MODELS

| Nr	Model	Year	Degree	Data	References	Download	Calculate	Show	DOI
165	IGGT_R1	2017	240	G(GOCE)	Lu, B. et al 2017	gfc zip	Calculate	Show	✓
164	IfE_GOCE05s	2017	250	S(GOCE)	Wu, H. et al 2017	gfc zip	Calculate	Show	✓
163	GO_CONS_GCF_2_SPW_R5	2017	330	S(GOCE)	Gatti, A. et al. 2016	gfc zip	Calculate	Show	✓
162	GAO2012	2012	360	A, G, S(GOCE), S(GRACE)	Demianov, G. et al, 2012	gfc zip	Calculate	Show	✓
161	XGM2016	2017	719	A, G, S(GOCO05s)	Pail, R. et al, 2017	gfc zip	Calculate	Show	✓
160	Tongji-Grace02s	2017	180	S(Grace)	Chen, Q. et al, 2016	gfc zip	Calculate	Show	✓
159	NULP-02s	2017	250	S(Goce)	A.N. Marchenko et al, 2016	gfc zip	Calculate	Show	✓
158	HUST-Grace2016s	2016	160	S(Grace)	Zhou, H. et al, 2016	gfc zip	Calculate	Show	✓
157	ITU_GRACE16	2016	180	S(Grace)	Akyilmaz, O. et al, 2016	gfc zip	Calculate	Show	✓
156	ITU_GGC16	2016	280	S(Goce), S(Grace)	Akyilmaz, O. et al, 2016	gfc zip	Calculate	Show	✓
155	EIGEN-6S4 (v2)	2016	300	S(Goce), S(Grace), S(Lageos)	Förste, C. and Bruinsma, S.L., 2016	gfc zip	Calculate	Show	✓
154	GOCO05c	2016	720	(see model), A, G, S	Fecher, T. et al, 2016	gfc zip	Calculate	Show	✓
...									
8	GEM2	1972	22	G, S	Lerch, F.J. et al, 1972	gfc zip	Calculate	Show	
7	GEM1	1972	22	S	Lerch, F.J. et al, 1972	gfc zip	Calculate	Show	
6	KOCH71	1971	11	G, S	Koch, Karl-Rudolf and Witte, Bertold U., 1971	gfc zip	Calculate	Show	
5	KOCH70	1970	8	G, S	Koch, Karl-Rudolf and Morrison, Foster, 1970	gfc zip	Calculate	Show	
4	SE2	1969	22	G, S	Gaposchkin, E.M. Lambeck, K., 1970	gfc zip	Calculate	Show	
3	OSU68	1968	14	G, S	Rapp, Richard H., 1968	gfc zip	Calculate	Show	
2	WGS66	1966	24	G	WGS Committee, 1966	gfc zip	Calculate	Show	
1	SE1	1966	15	S	Lundquist, C.A. et al, 1966	gfc zip	Calculate	Show	

EVALUATION

COMPARISON IN SPECTRAL DOMAIN
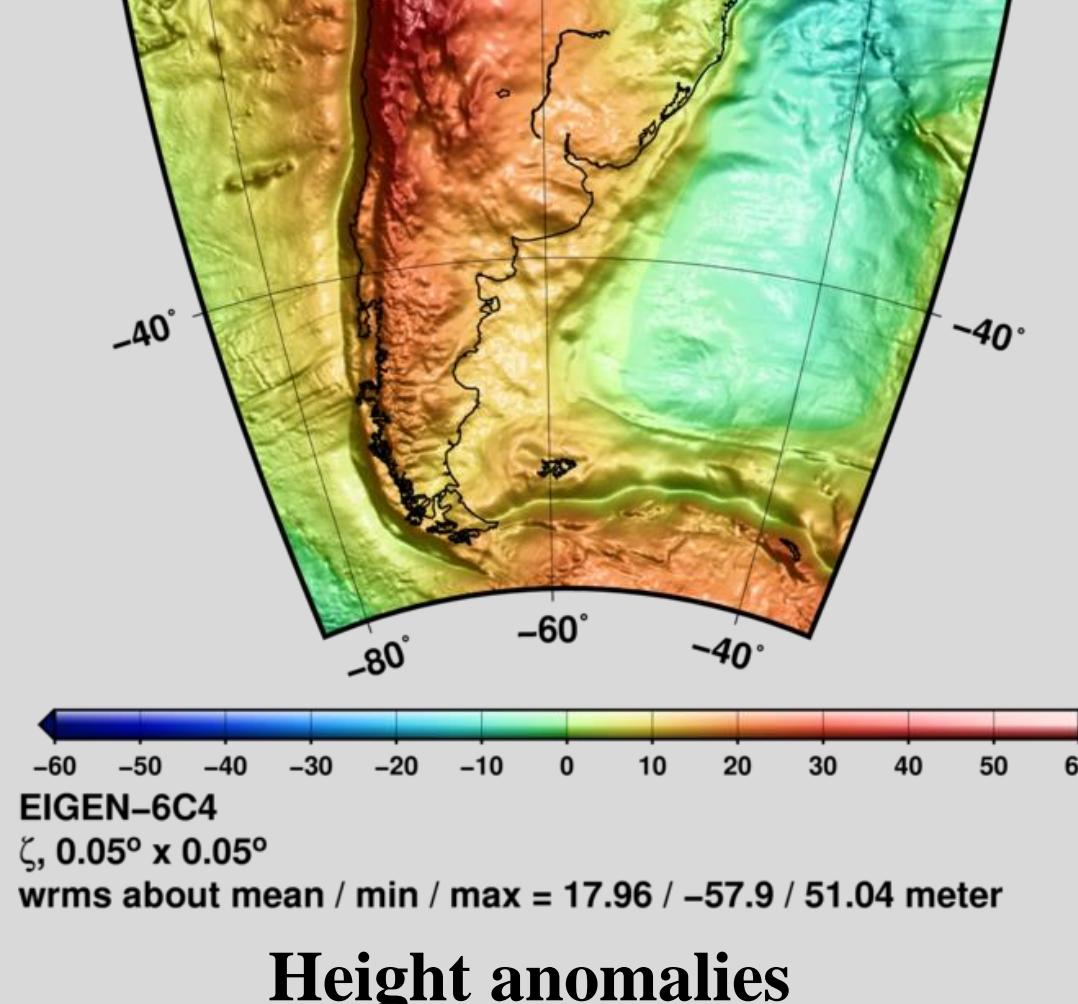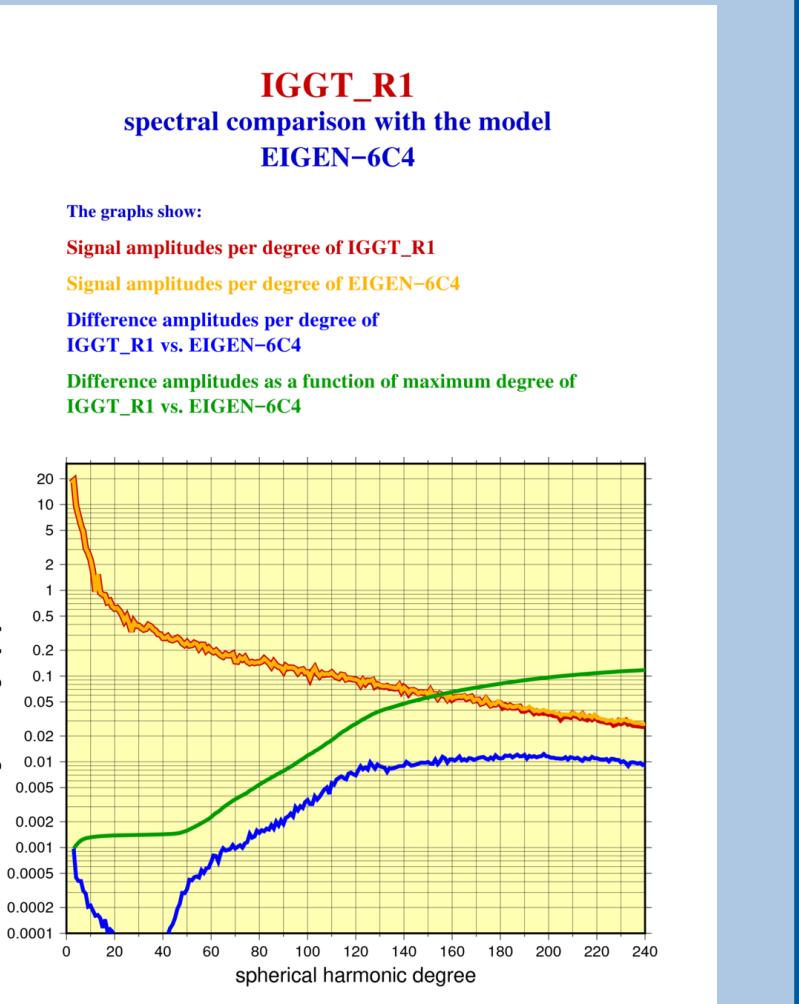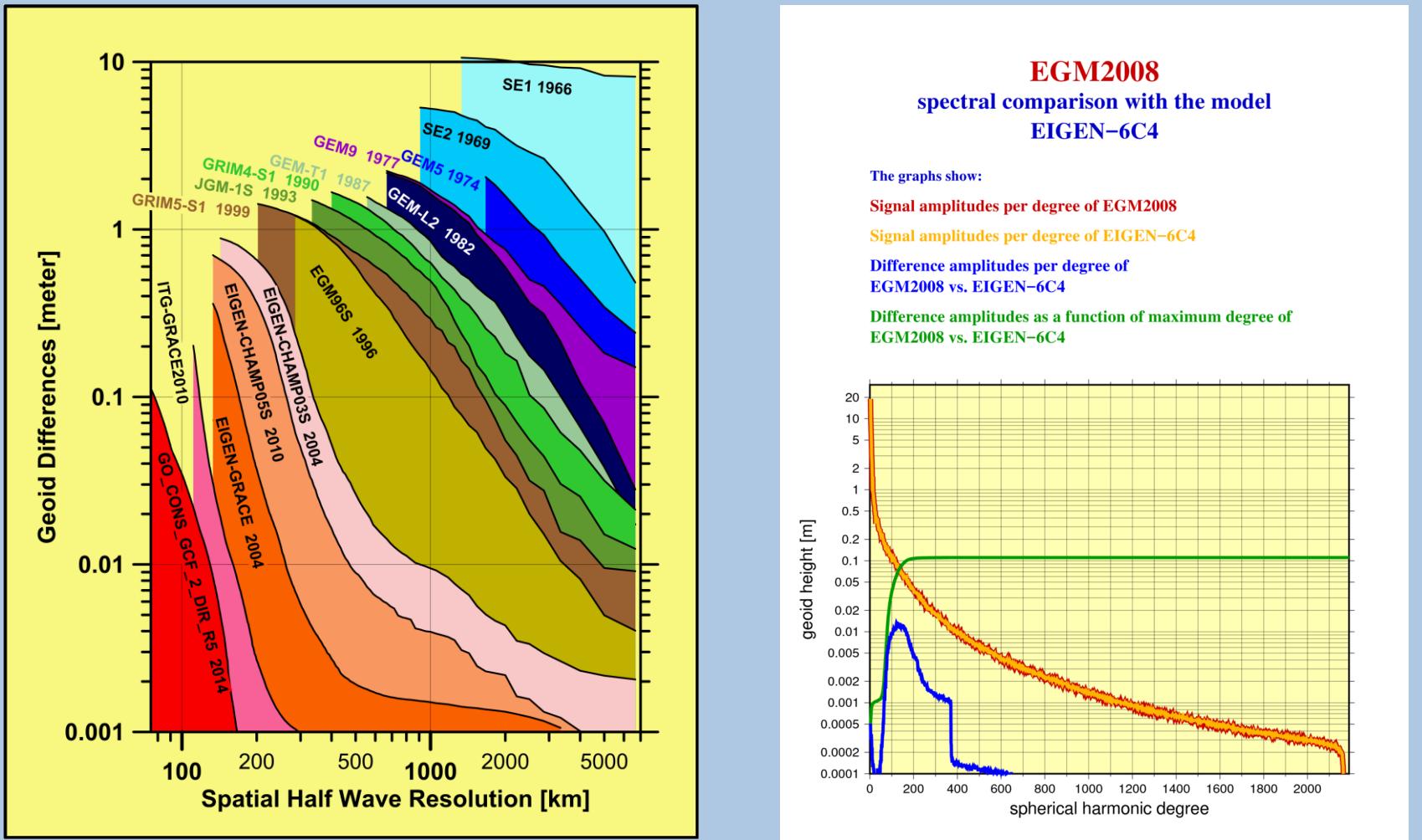
COMPARISON W.R.T GNSS/LEVELING DERIVED GEOID

#### Root mean square (rms) about mean of GPS / levelling minus gravity field model derived geoid heights [m]

Nr	Model	Nmax	Australia (201 points)	Brazil (1112 points)	Canada (2691 points)	Europe (1047 points)	Japan (816 points)	USA (6169 points)	All (12036 points)
165	IGGT_R1	240	0.317 m	0.513 m	0.348 m	0.387 m	0.483 m	0.412 m	0.4111 m
164	IfE_GOCE05s	250	0.337 m	0.512 m	0.329 m	0.385 m	0.48 m	0.414 m	0.4081 m
163	GO_CONS_GCF_2_SPW_R5	330	0.33 m	0.511 m	0.299 m	0.346 m	0.442 m	0.396 m	0.3873 m
162	GAO2012	360	0.293 m	0.531 m	0.309 m	0.453 m	0.759 m	0.366 m	0.4177 m
161	XGM2016	719	0.218 m	0.44 m	0.151 m	0.14 m	0.125 m	0.263 m	0.2489 m
160	Tongji-Grace02s	180	0.452 m	0.605 m	0.478 m	0.596 m	0.669 m	0.53 m	0.5417 m
159	NULP-02s	250	0.351 m	0.512 m	0.375 m	0.413 m	0.508 m	0.427 m	0.4284 m
158	HUST-Grace2016s	160	0.489 m	0.658 m	0.594 m	0.69 m	0.837 m	0.596 m	0.6273 m
157	ITU_GRACE16	180	1.778 m	6.645 m	1.591 m	1.307 m	0.976 m	2.741 m	2.9603 m
157	ITU_GRACE16 (upto130)	130	0.515 m	0.747 m	0.676 m	0.871 m	1.093 m	0.692 m	0.7419 m
156	ITU_GGC16	280	0.335 m	0.505 m	0.31 m	0.343 m	0.45 m	0.398 m	0.39 m
155	EIGEN-6S4 (v2)	300	0.327 m	0.507 m	0.298 m	0.345 m	0.447 m	0.405 m	0.3915 m
154	GOCO05c	720	0.221 m	0.445 m	0.154 m	0.138 m	0.217 m	0.262 m	0.2541 m

CALCULATION SERVICE

EIGEN–6C4
N, 0.5° x 0.5°
wrms about mean / min / max = 30.59 / −106.3 / 85.34 meter

Geoid heights

EIGEN–6C4
ζ, 0.05° x 0.05°
wrms about mean / min / max = 17.96 / −57.9 / 51.04 meter

Height anomalies

EIGEN–6C4
δg_SA, 0.02° x 0.02°
wrms about mean / min / max = 78 / −385.8 / 693.1 mgal

Gravity disturbances


EGM2008
Δg_B, 0.01° x 0.01°
wrms about mean / min / max = 81.27 / −253.9 / 322.5 mgal
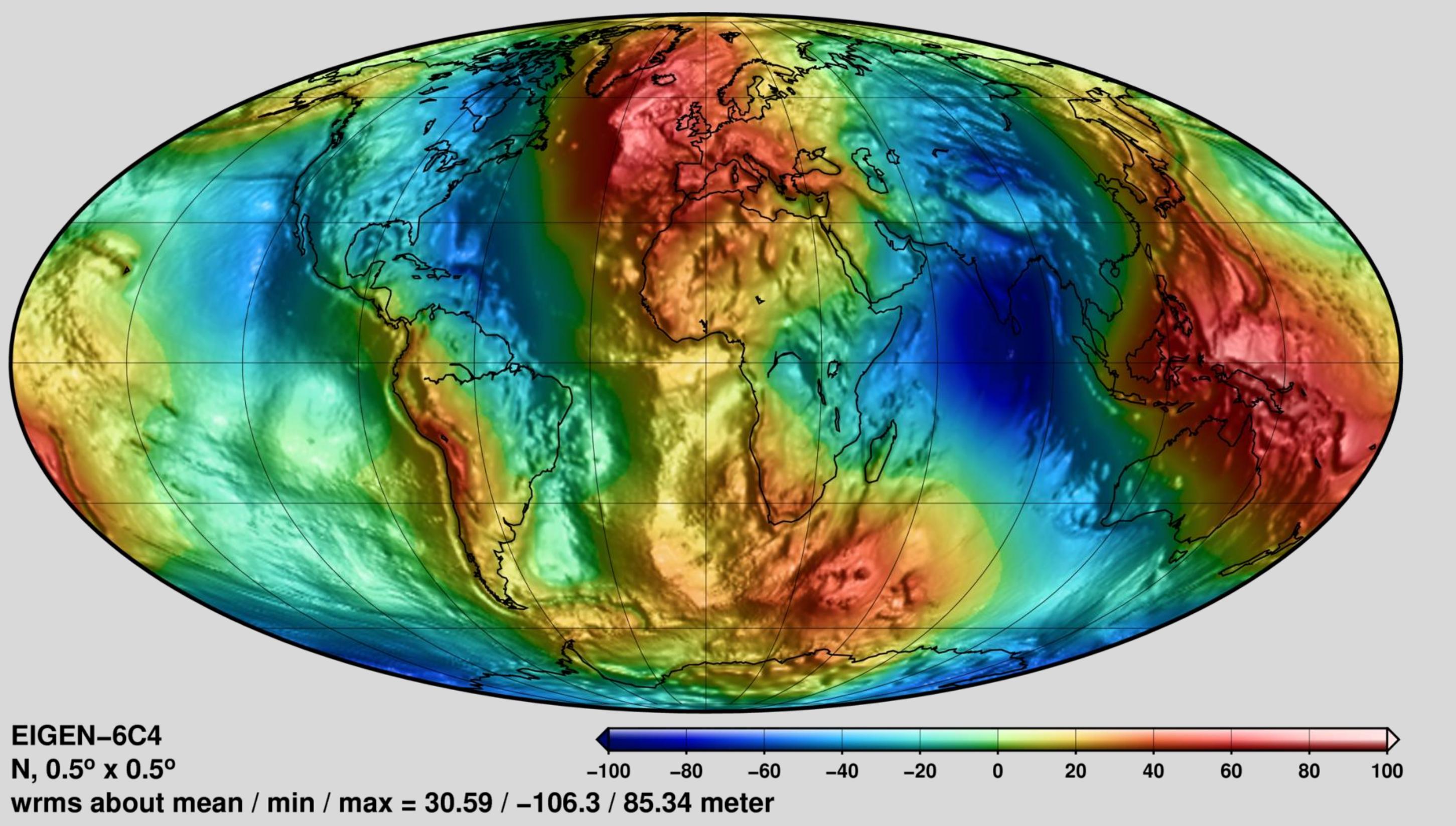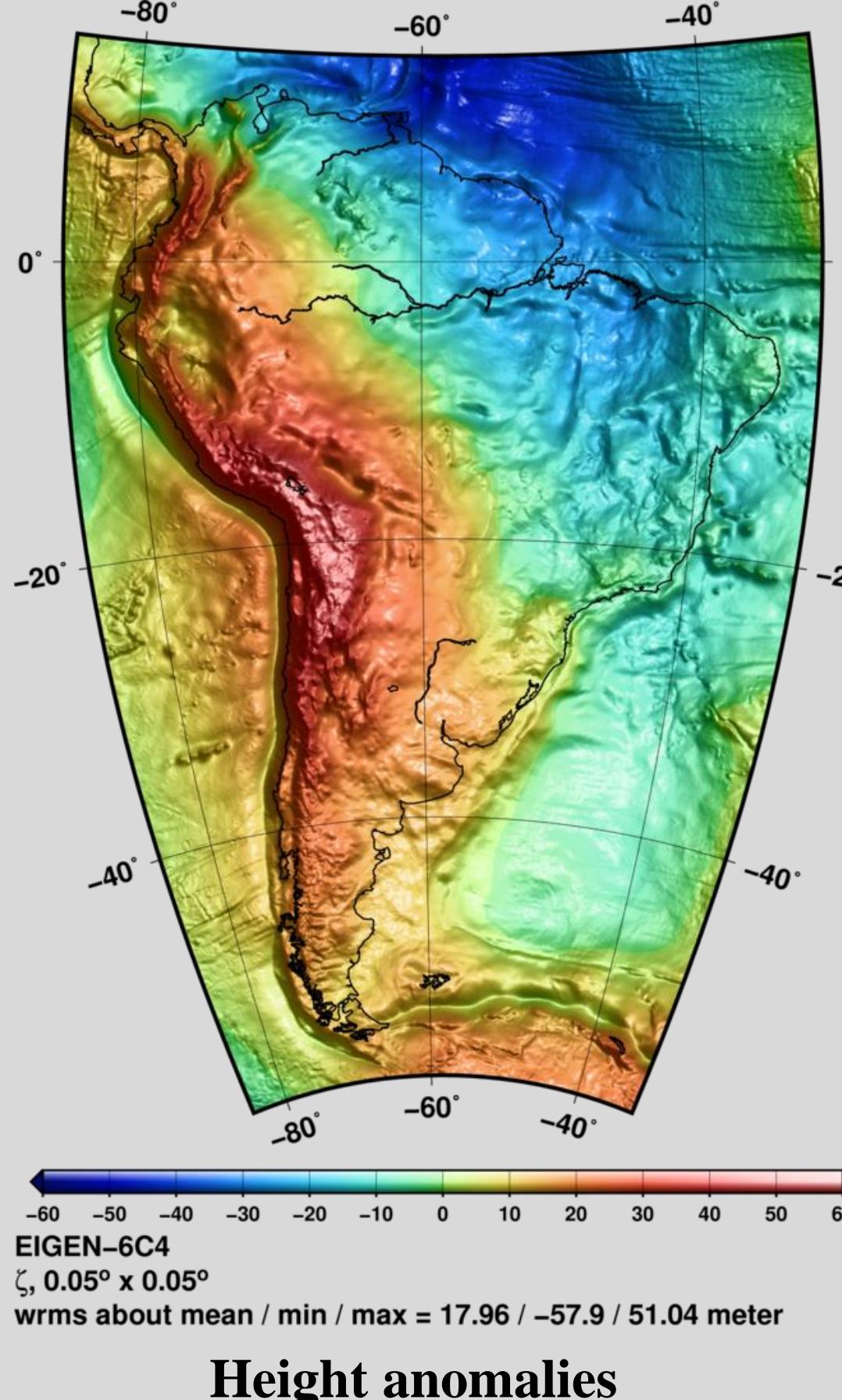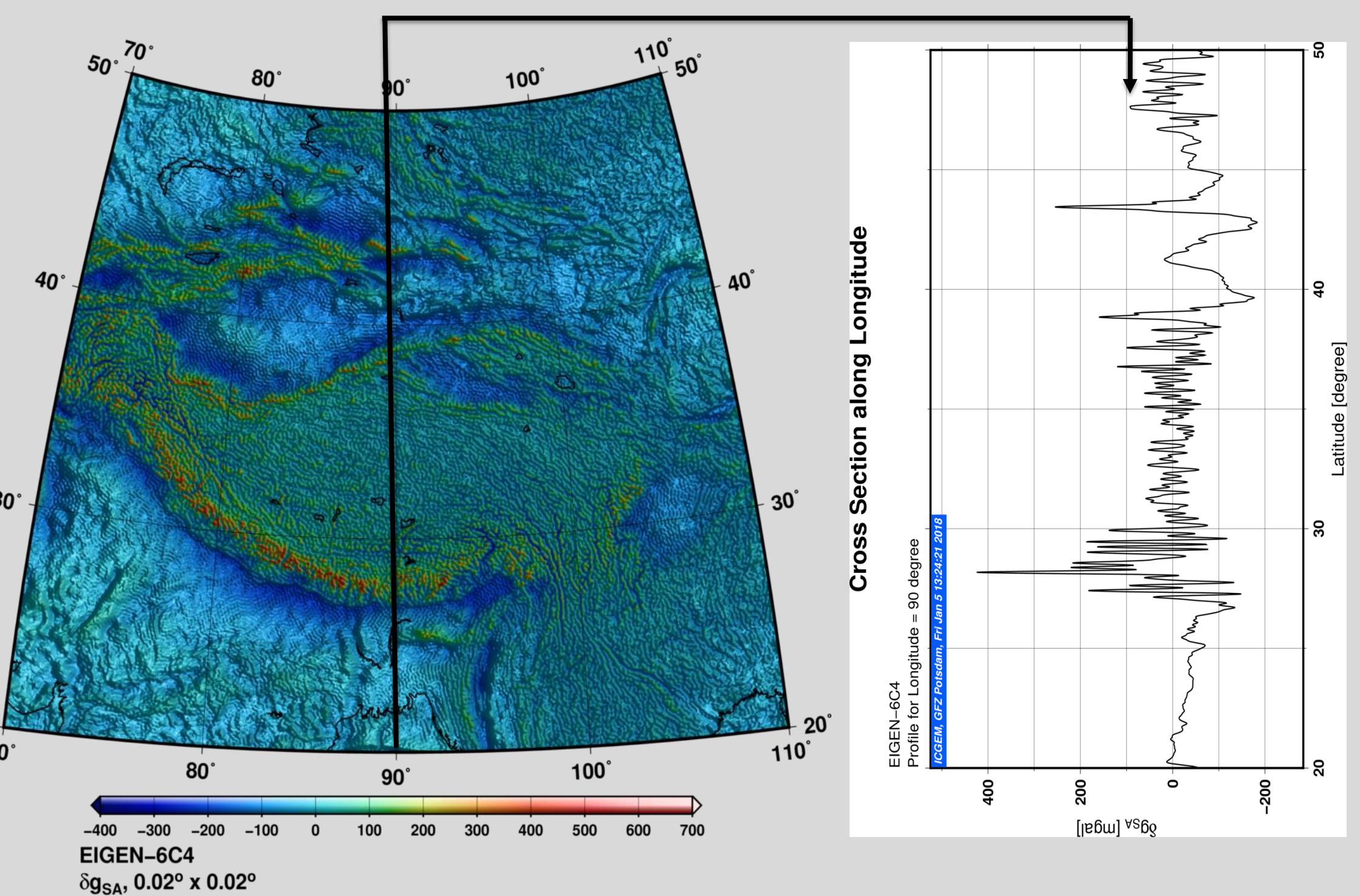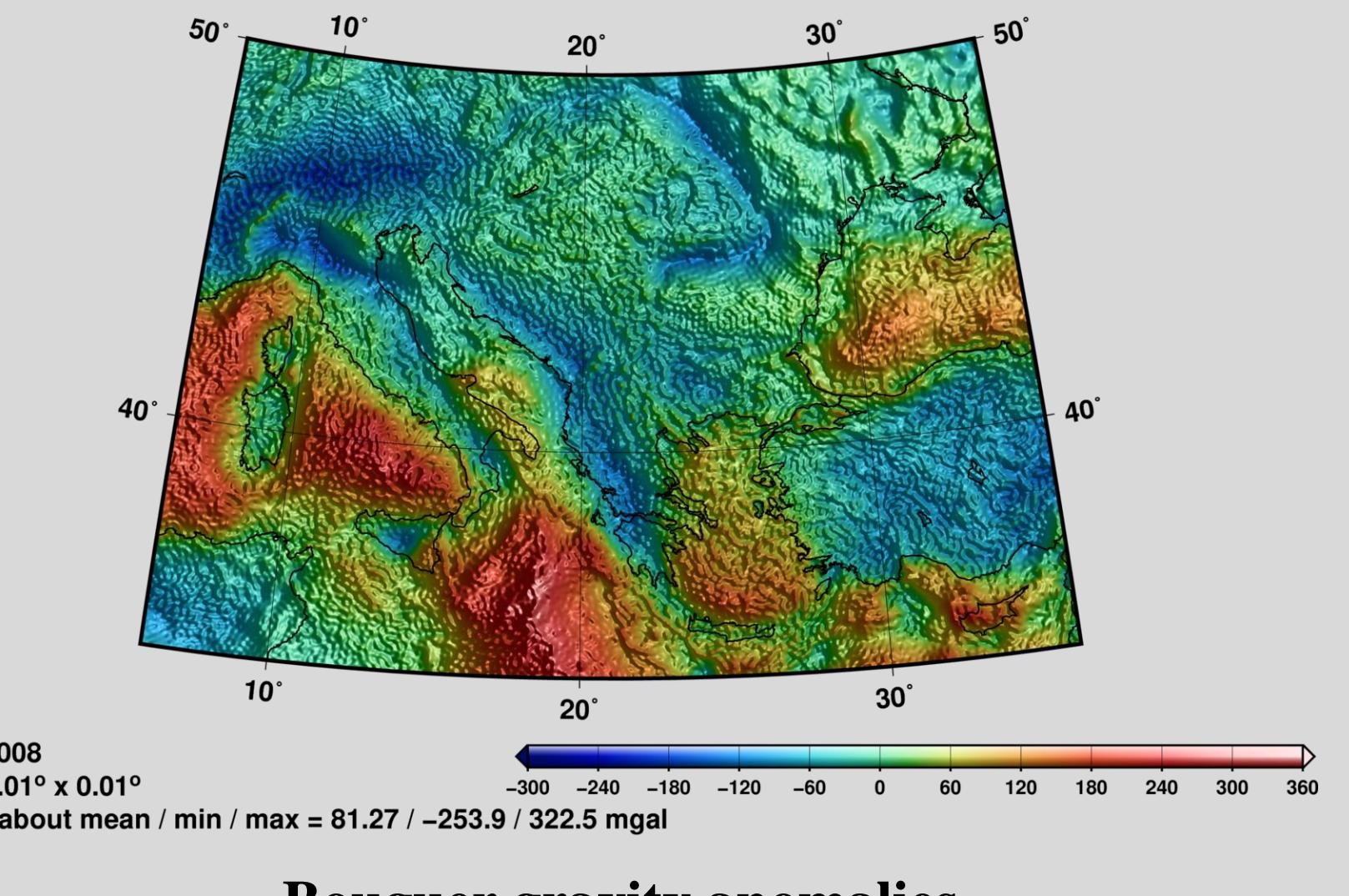
Bouguer gravity anomalies

Functionals Available
- Height anomaly, height anomaly on the ellipsoid
- Geoid height
- Gravity anomaly classical, molodensky, spherically approximated, Bouguer
- Gravity disturbance on the Earth surface, on geoid, spherically approximated
- Gravity on the Earth surface, on/above the ellipsoid
- Gravitational field potential on/above ellipsoid
- Second derivative of the disturbance potential
- Equivalent water height (water column)

3D VISUALISATION

STATIC GRAVITY FIELD MODELS

Geoid undulations · Gravity anomalies · Model differences
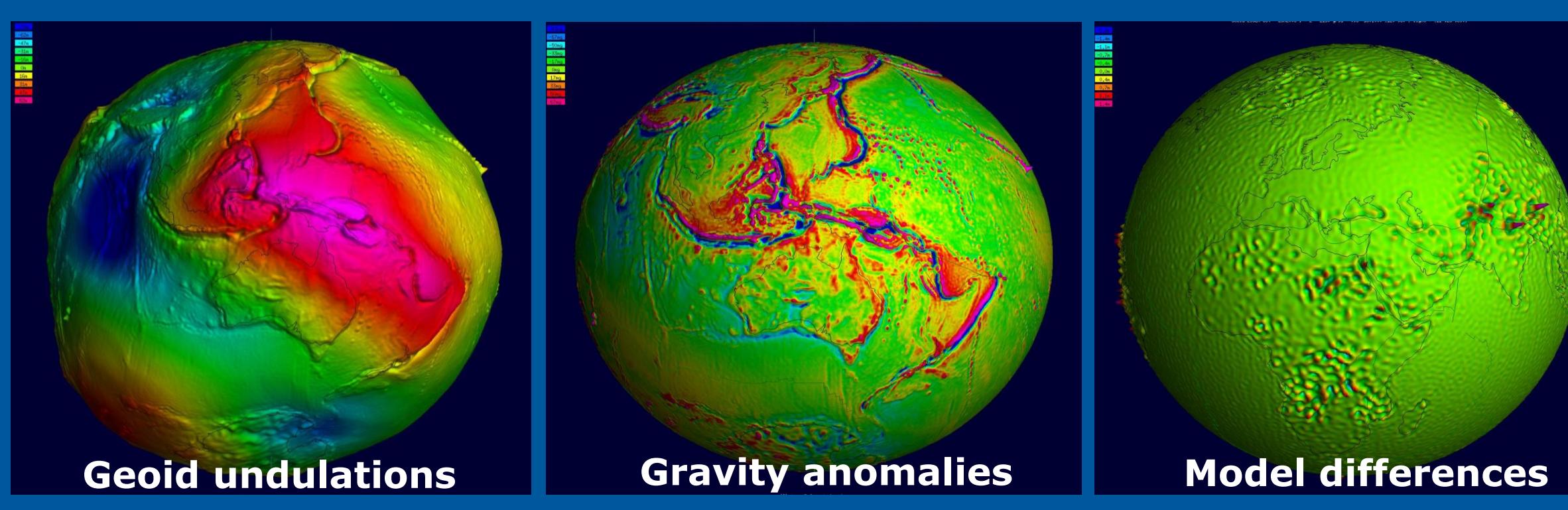
TEMPORAL GRAVITY FIELD MODELS

Equivalent water height · Trend
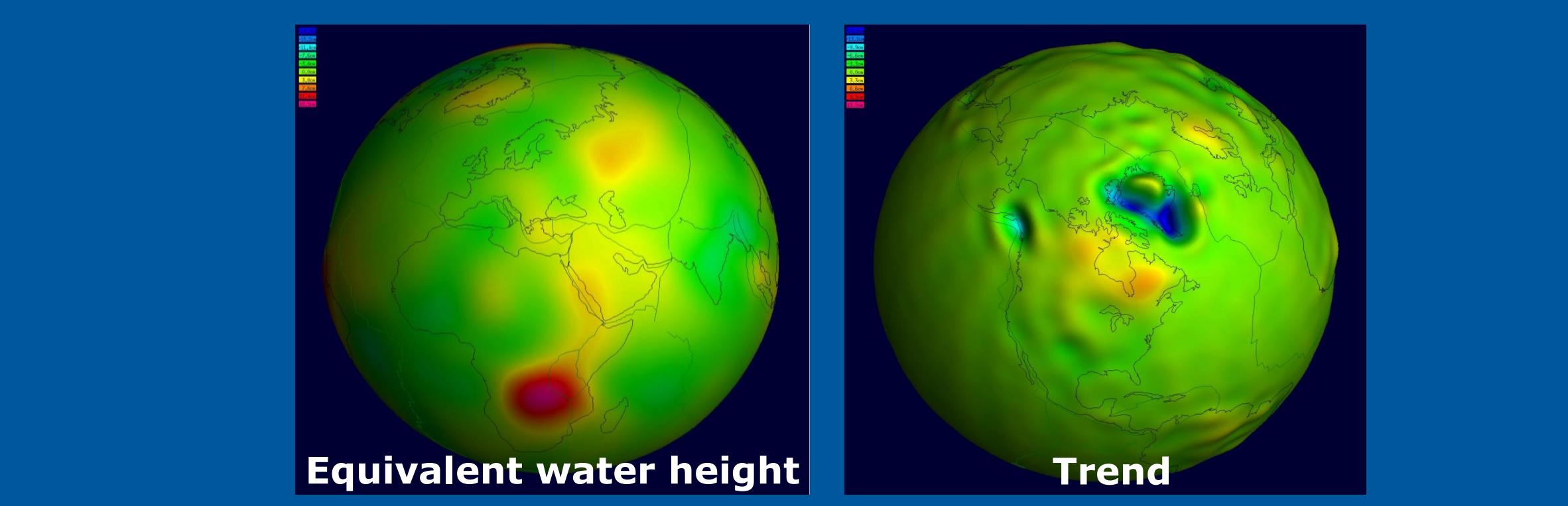
SPHERICAL HARMONICS TUTORIAL

l=9, m=0 · l=9, m=4 · l=9, m=9

OTHER CELESTIAL BODIES

Moon · Venus · Mars

REFERENCES

http://icgem.gfz-potsdam.de/str-0902-revised.pdf
http://icgem.gfz-potsdam.de/GlobalModelsICGEM.pdf
https://iag.dgfi.tum.de/fileadmin/IAG-docs/Travaux2017/28_ICGEM_2015-2017.pdf