Report on Colorado geoid comparisons

YM Wang, R Forsberg, L Sanchez, J Ågren and JL Huang

International Symposium on Gravity, Geoid and Height Systems 2 "GRAVITY FIELD OF THE EARTH"

Copenhagen, Denmark, Sep 17-21, 2018

Model contribution groups

- H Abdelmotaal, Minia University, Egypt
- M Filmer et al. University of Curtin, Australia
- **VN Grigoriadis et al.** Aristotle University of Thessaloniki, Greece
- **E NICACIO et al.** Universidade Federal do Paraná, Brazil
- J Agren, Lantmäteriet/KTH, Sweden
- B Erol et al. Istanbul Technical University, Turkey
- JL Huang et al. NRCan, Canada
- YM Wang et al. NGS, USA

Introduction

Objectives

a) How well do the geoid models agree?b) How do they compare with independent GPS/leveling data?

c) Geopotential numbers and their accuracies

• Participants: IHRS, IAG SC2.2, ICCTJSG 0.15 & JWG 2.2.2

 Additional groups will have their models ready for a later study.

Reference models recommended

- GOCO05S (n=2, 280) (Mayer-Gürr, T. et al, 2015)
 xGEOID17 RefB (n=2, 2190) (Wang, Y.M. et al, 2017)
- xGM16 (n=2, 719) (Pail, R. et. al, 2017)

Note: EIGEN6C4 (n=2, 2190) (Föster et al. 2014) was not suggested in IHRF_Basic_req_V0.3, but was used by one group

GRAV-D (MS05) + surface gravity





Geoid Height along GSVS17



Geoid Height Diff. along GSVS17



Geoid Height Diff. along GSVS17



NOAA's National Geodetic Survey Positioning America for the Future

www.ngs.noaa.gov

Geoid diff. (model – mean) 223 benchmarks, Unit in meters

	Α	В	С	D	Е	F	G	Н	
Mean	1.470	-0.148	0.202	0.911	-0.075	-0.466	-0.021	-0.802	
STD	0.221	0.056	0.014	0.043	0.036	0.024	0.023	0.202	
Min.	0.969	-0.317	-0.234	0.776	-0.135	-0.504	-0.080	-1.262	
Max.	1.943	-0.021	-0.172	1.008	-0.019	-0.392	0.058	-0.524	
Range	1.074	0.296	0.062	0.232	0.116	0.112	0.138	0.738	
STD values of NGS historical GPS/leveling data comparisons at 194 marks									
STD	0.361	0.082	0.051	0.071	0.078	0.051	0.053	0.206	

Height Anomaly Along GSVS17



GSVS17 Marks (West to East)

11

Elevation (m)

Elevation (m)

Height Anomaly Diff. (model-mean)



Height Anomaly Diff. (model-mean)



NOAA's National Geodetic Survey Positioning America for the Future

www.ngs.noaa.gov

Height anomaly diff. (model – mean) 223 benchmarks, Unit in meters

	Α	В	С	D	Е	F	G	н
Mean		-0.157	-0.163	0.944	-0.042	-0.429	-0.153	-0.467
STD		0.020	0.010	0.039	0.038	0.020	0.021	0.463
Min.		-0.206	-0.188	0.802	-0.103	-0.466	-0.198	-1.457
Max.		-0.117	-0.142	1.018	0.027	-0.388	-0.065	0.166
Range		0.089	0.046	0.216	0.130	0.078	0.133	1.623

Conclusions

- Geoid/height anomaly models from 8 groups are compared.
- The degree-zero is not applied consistently by different groups.
- The models agree within 3 cm to 10 cm in terms of standard deviation with respect to the mean, 2 models are treated as outliers.
- Models agree with the historical NGS GPS/leveling data in the range of 5 to 8 cm, excluding two outliers.

Conclusions (continued)

- The GRAV-D data was not included in few groups' models. It should be used in the final models.
- Need to pay attention to geoid differences at short wavelengths.
- Are corrections (e.g., atmospheric, geoidquasigeoid separation) applied consistently between groups?
- Models received are computed using the Stokes integral, the Least Squares Collection solutions are desired.

Future Work

- Cleanup the GRAV-D data and resample it into 1Hz; make it available to all groups.
- Provide the groups the mean profiles of geoid undulation and height anomaly.
- Standardize the procedure for degree-zero implementation on the geoid and geopotential numbers.
- Complete the study after the GSVS17 data becomes available (hopefully before IUGG 2019).