FIG WORKING WEEK 2023
28 May - 1 June 2023 Orlando Florida USA
Protecting Our World, Conquering New Frontiers

An Entire Spectrum Modernization of the U.S. Geoid Model

---- From data collection to modeling and customer services

Xiaopeng LI, Ryan HARDY, Kevin AHLGREN, Yan Ming WANG, and Jordan KRCMARIC, U.S.A.

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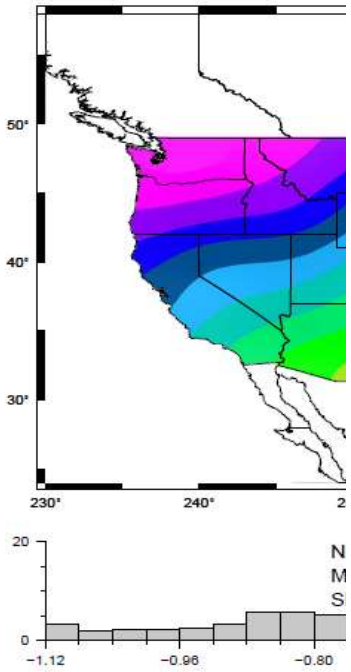
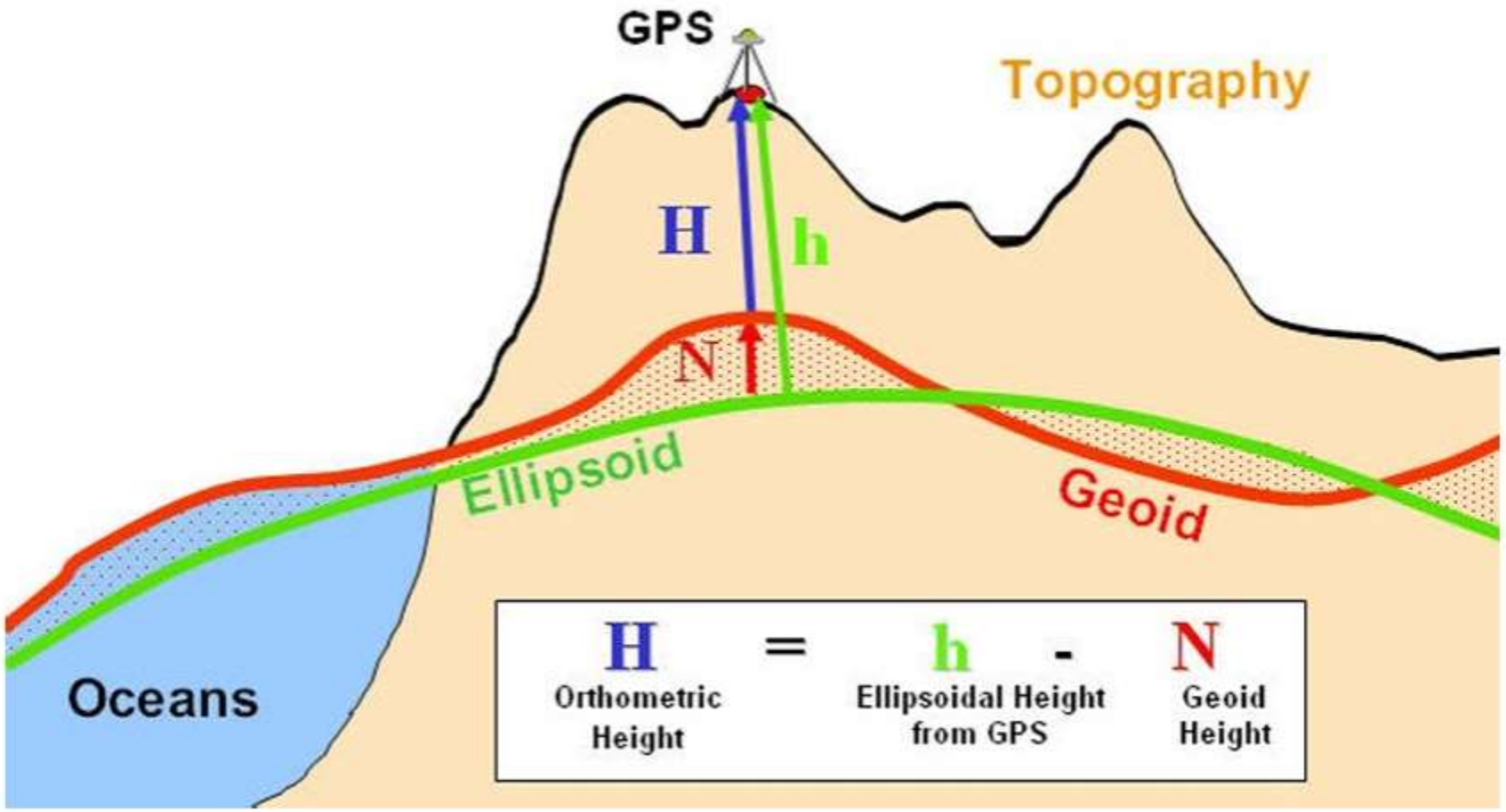
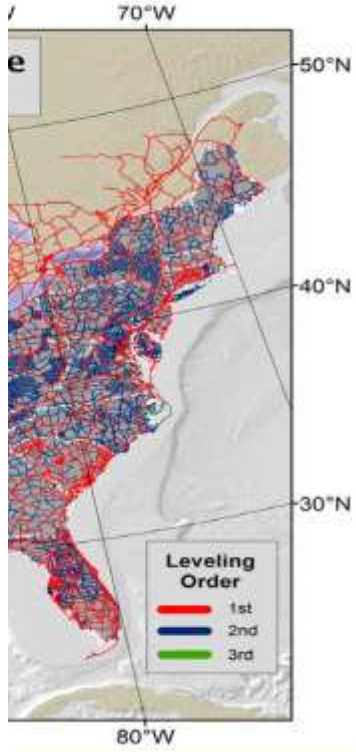
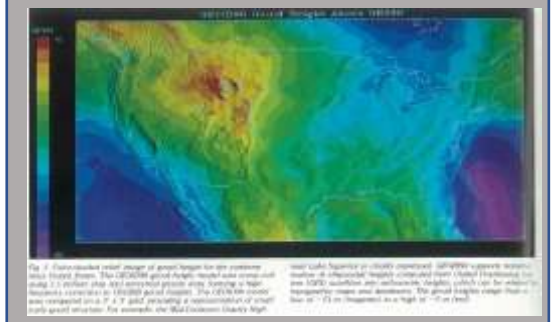

50°
40°
30°
230°
240°
20
0
−1.12
−0.98
−0.80


GPS
Topography
H
h
N
Ellipsoid
Geoid
Oceans
H = h - N
Orthometric Height
Ellipsoidal Height from GPS
Geoid Height

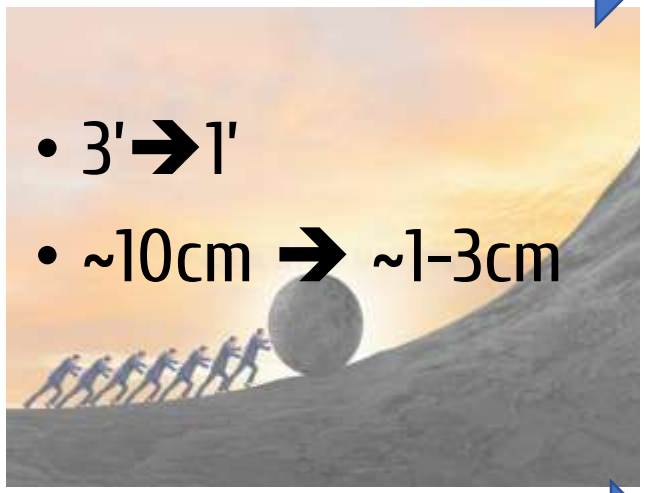

70°W
50°N
40°N
30°N
80°W
Leveling Order
1st
2nd
3rd

NGS geoid models

Geoid90

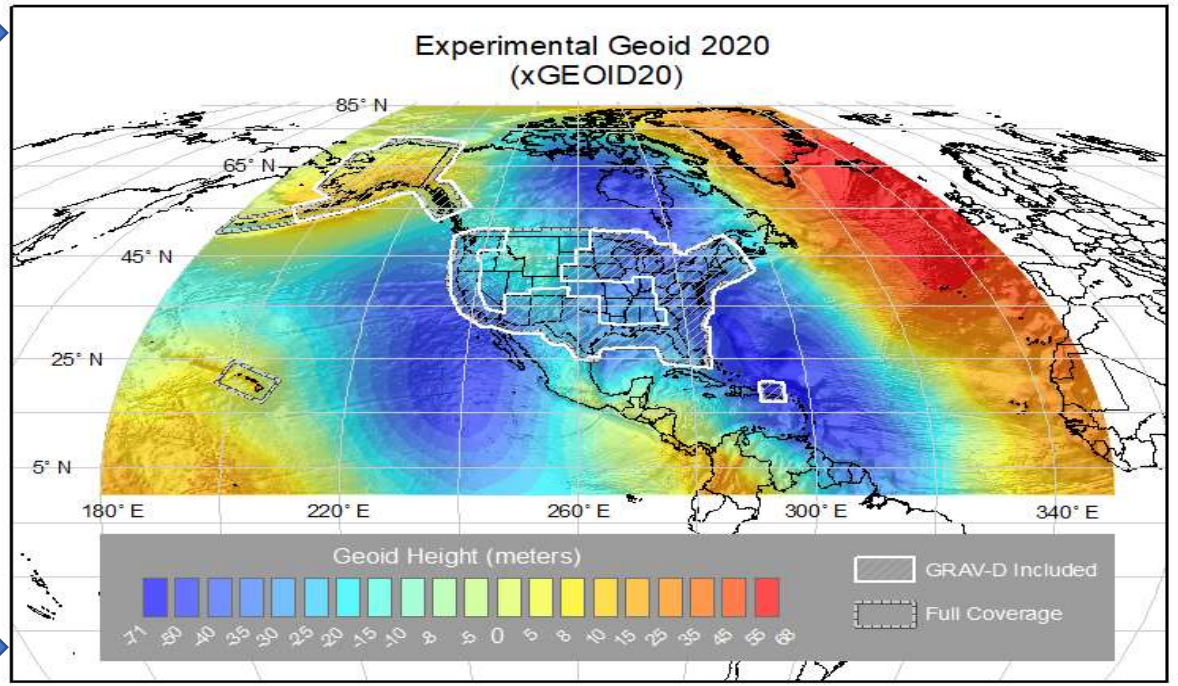


Culture Heritage



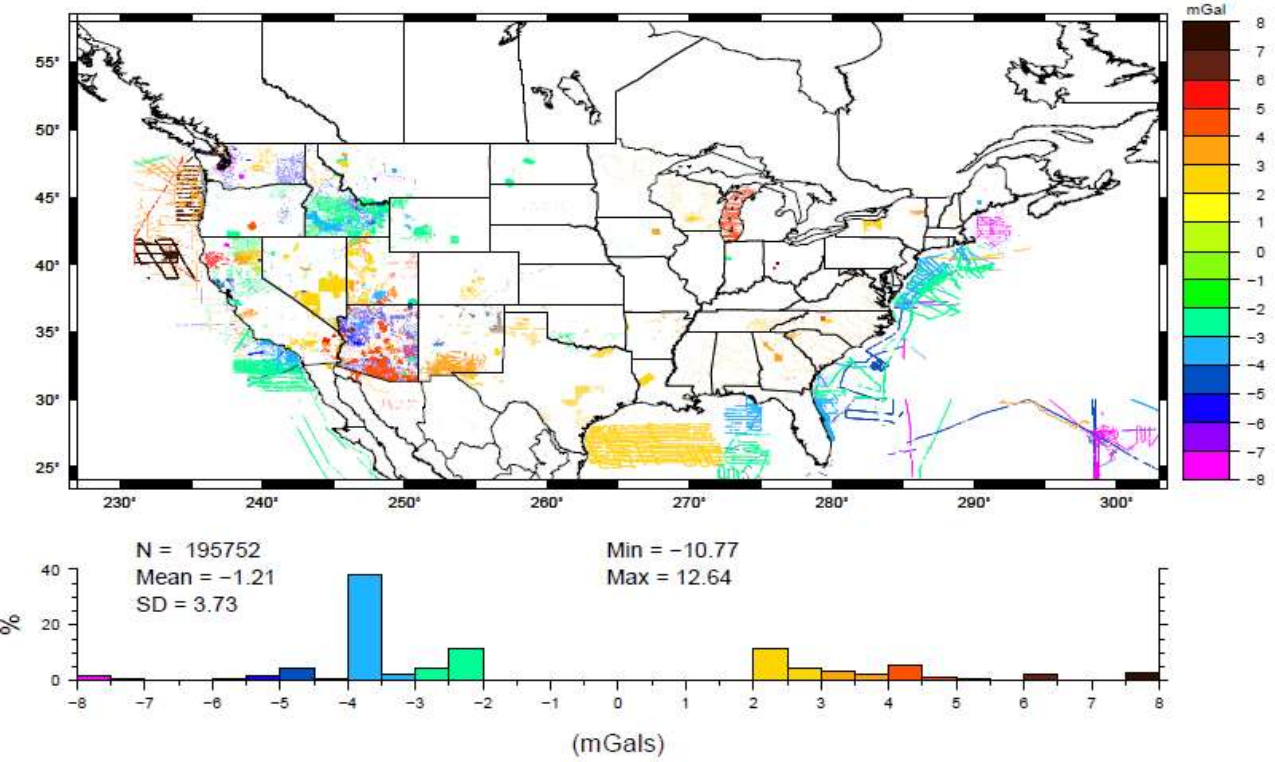
Team work

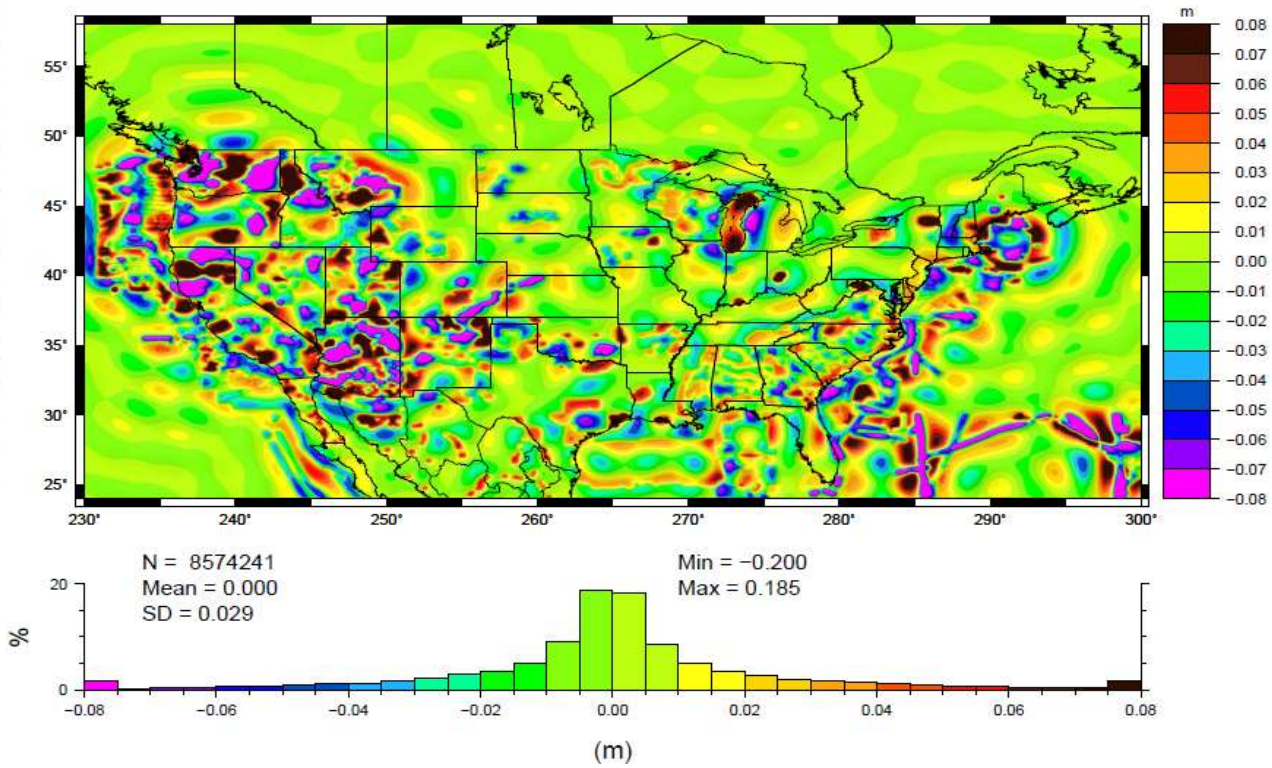
xGEOID20



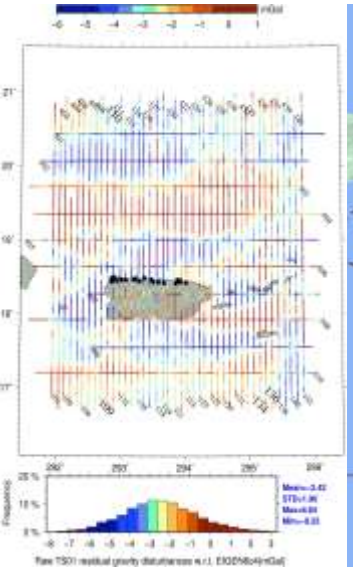
North American-Pacific Geopotential Datum of 2022 (NAPGD2022)

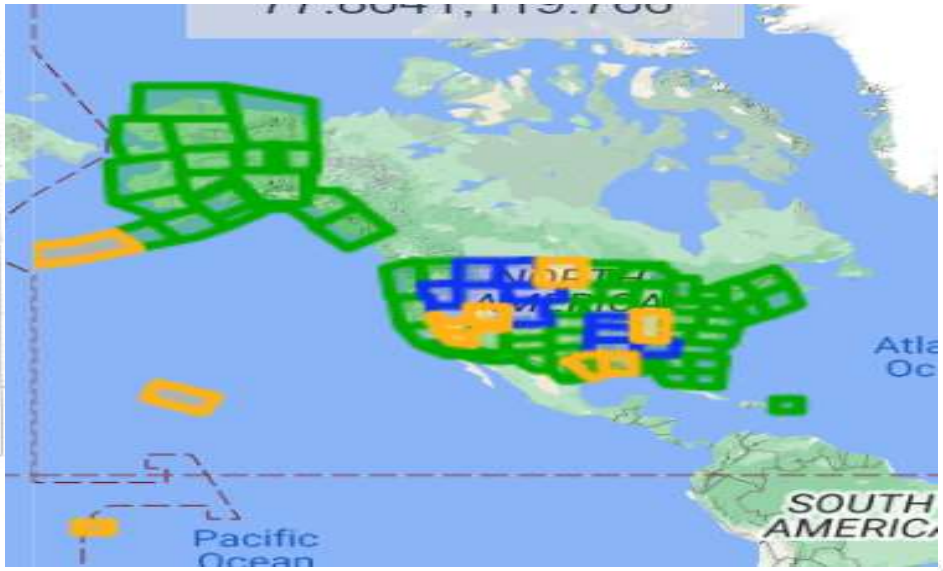
NGS surface gravity biases and their effects on geoid models

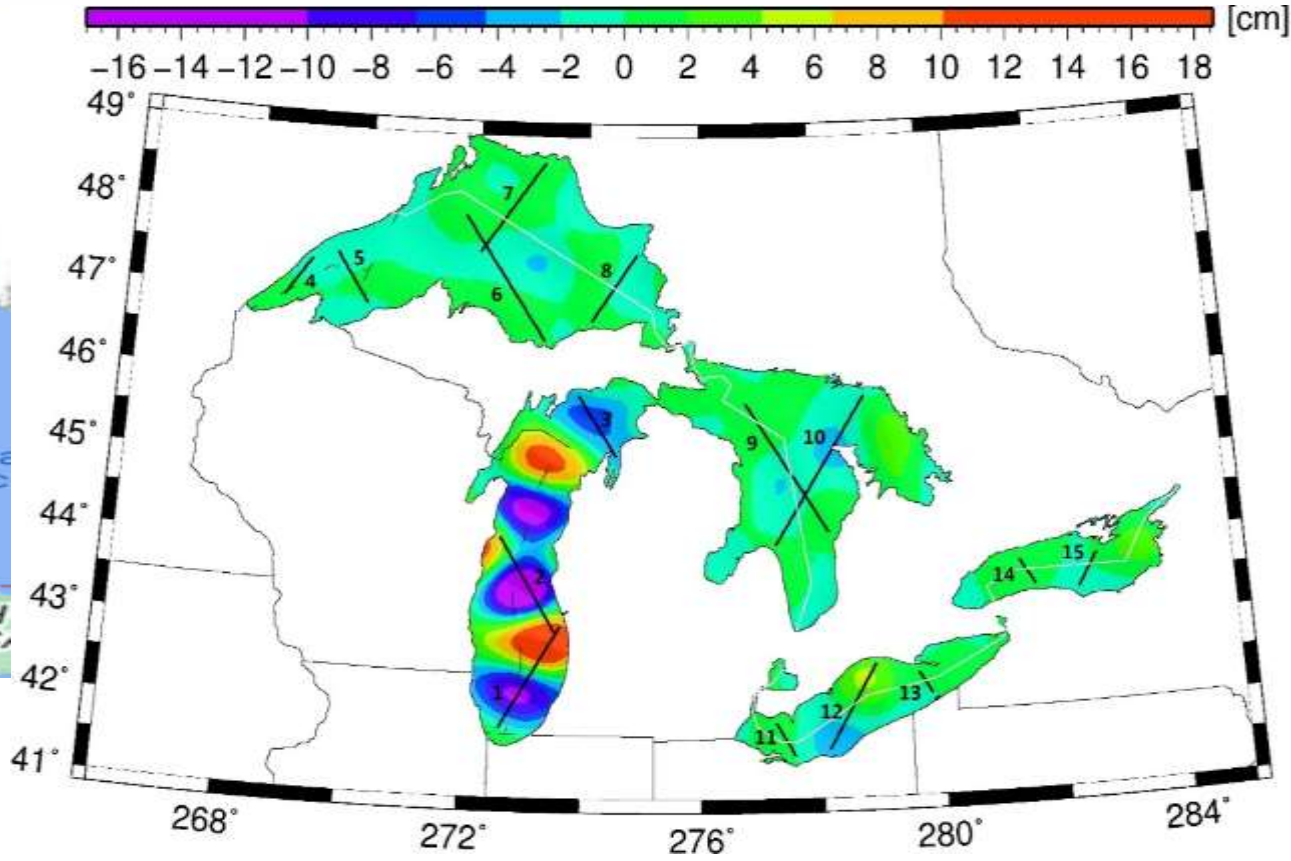


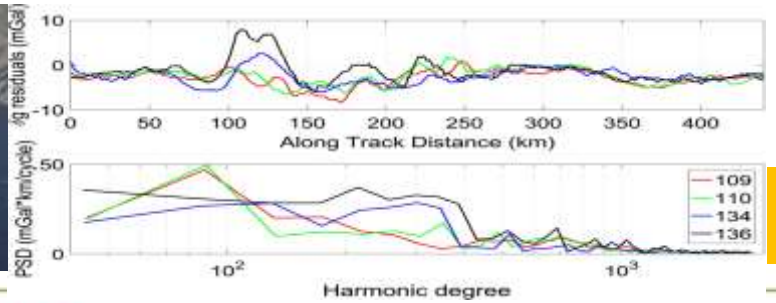


GRAV-D data



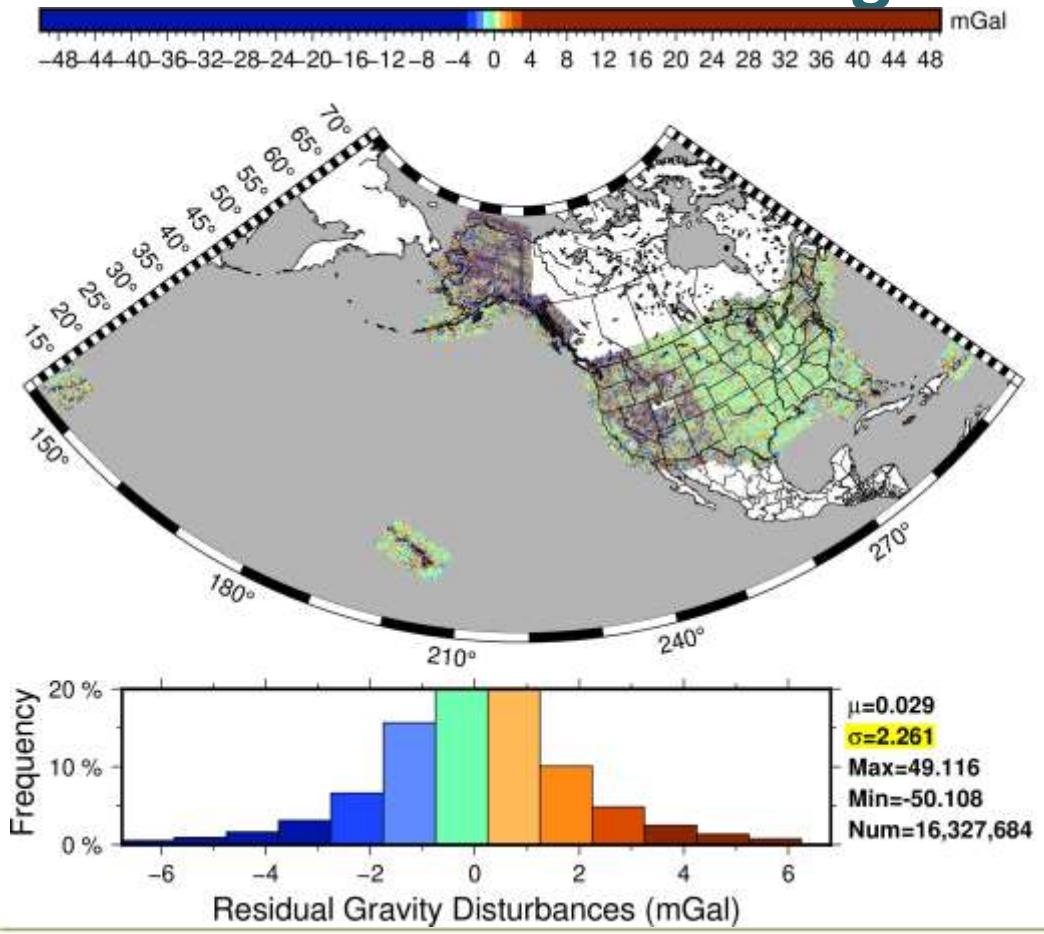


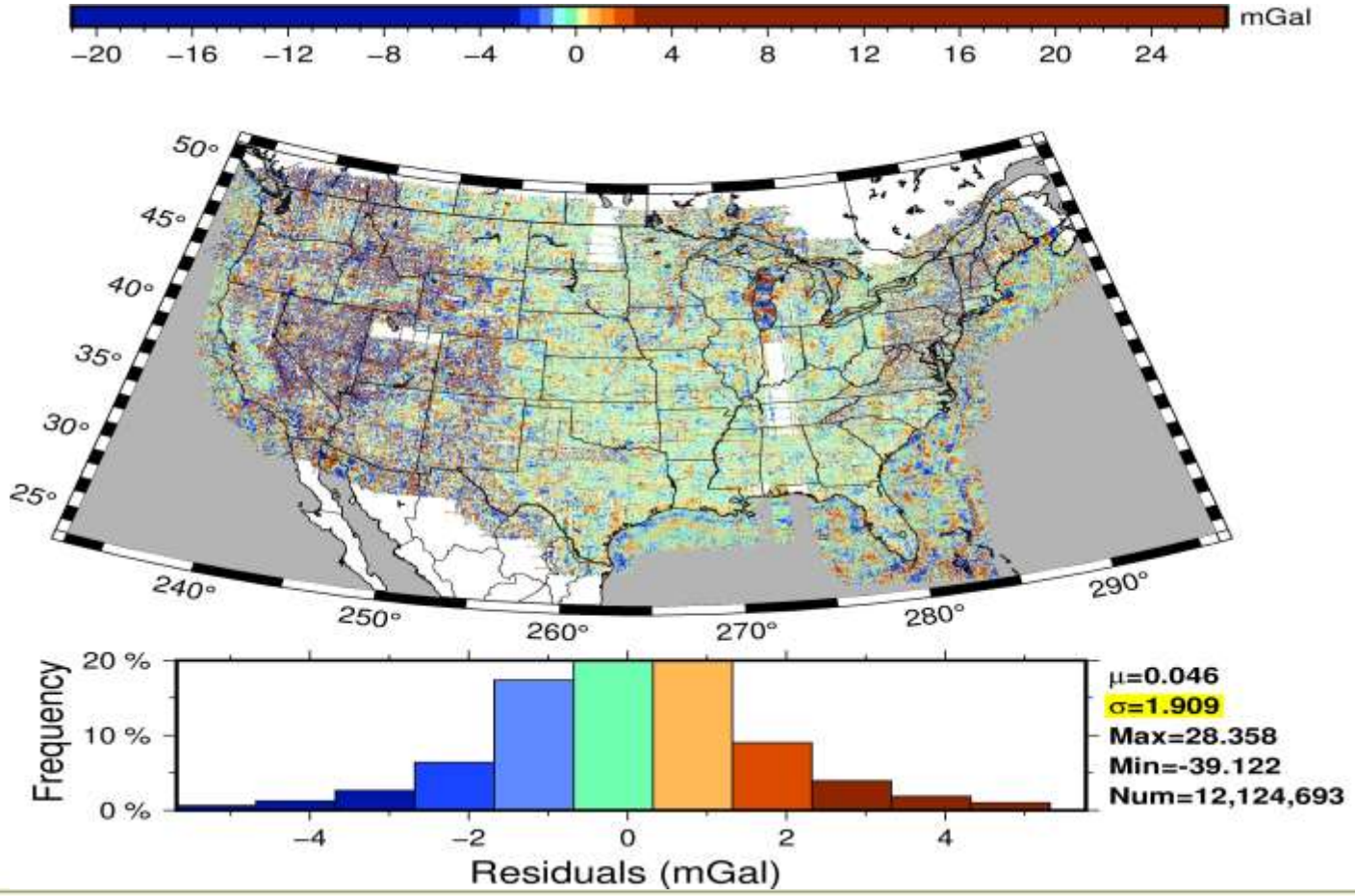




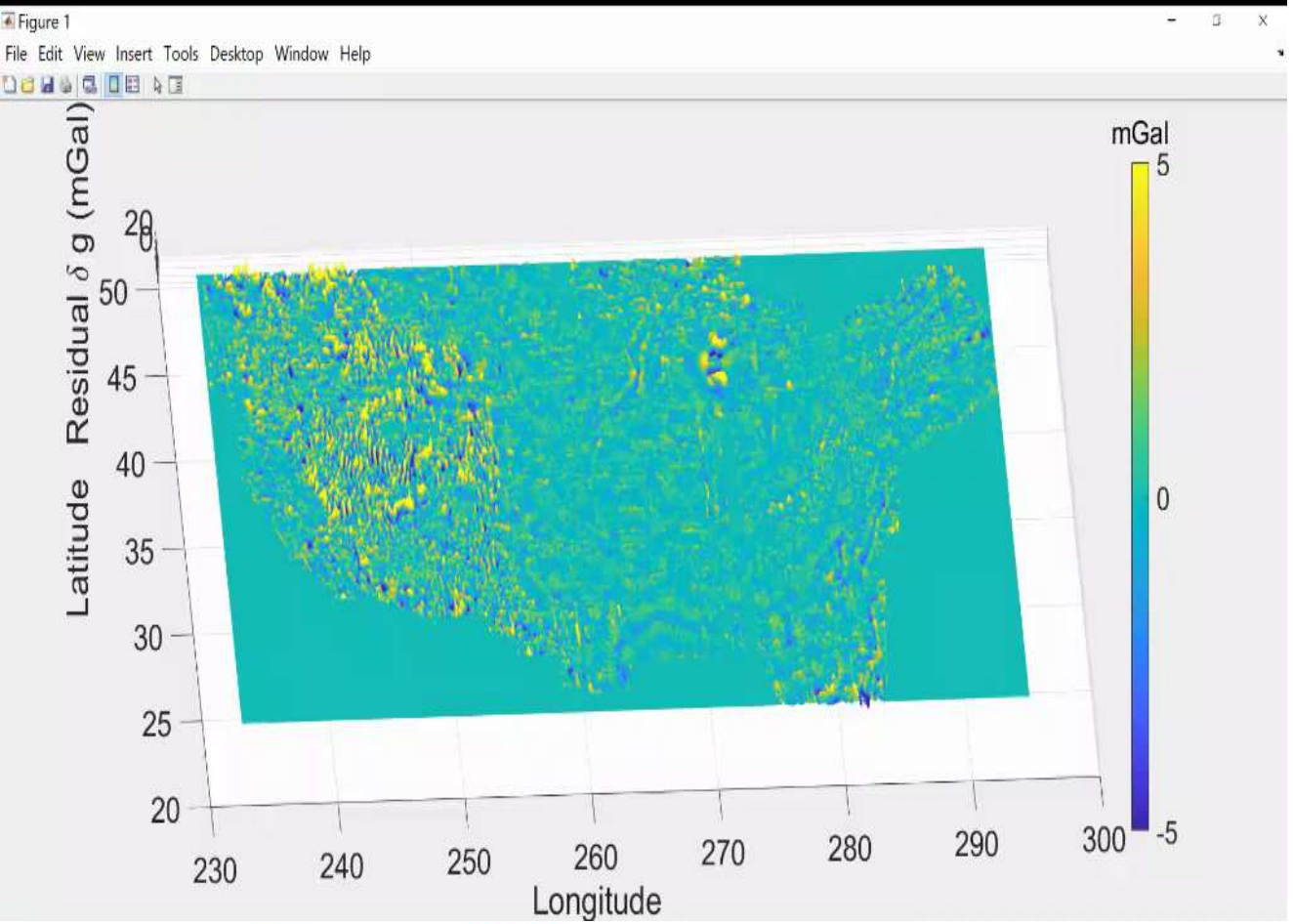
Li X, Crowley JW, Holmes SA, Wang YM (2016) The contribution of the GRAV-D airborne gravity to geoid determination in the Great Lakes region. Geophys Res Lett 43:4358–4365

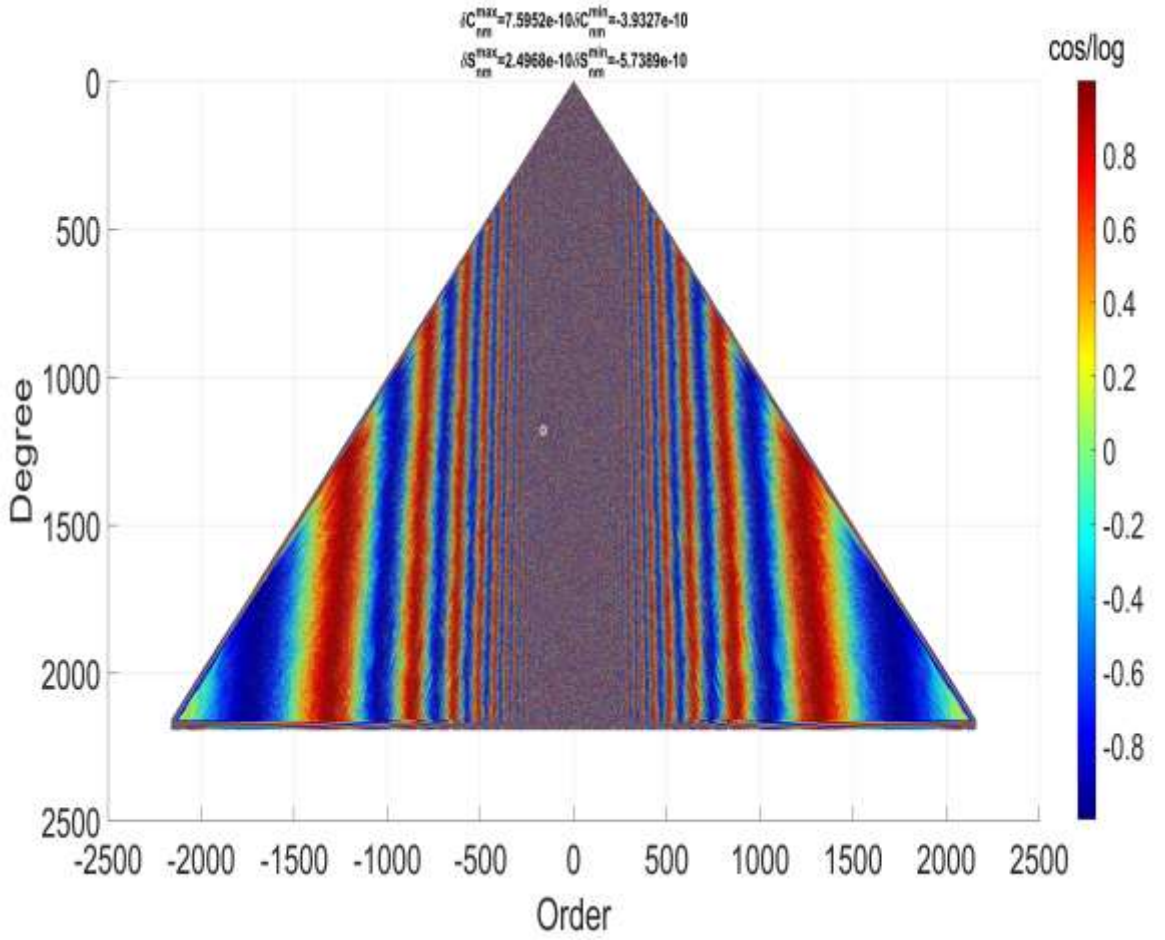
"Adding" GRAV-D to xGEOID22refB



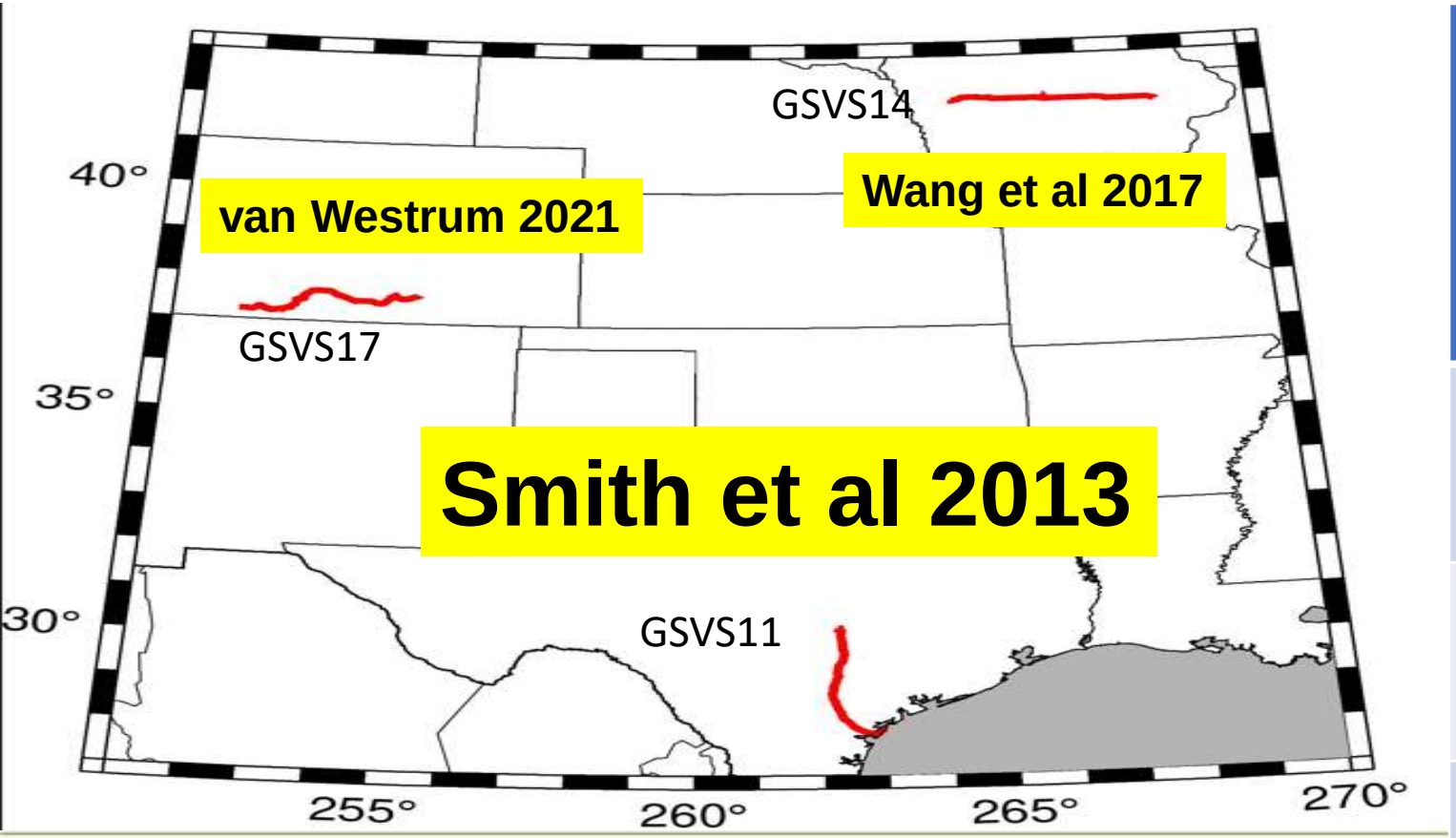


"Adding" GRAV-D to xGEOID22refB



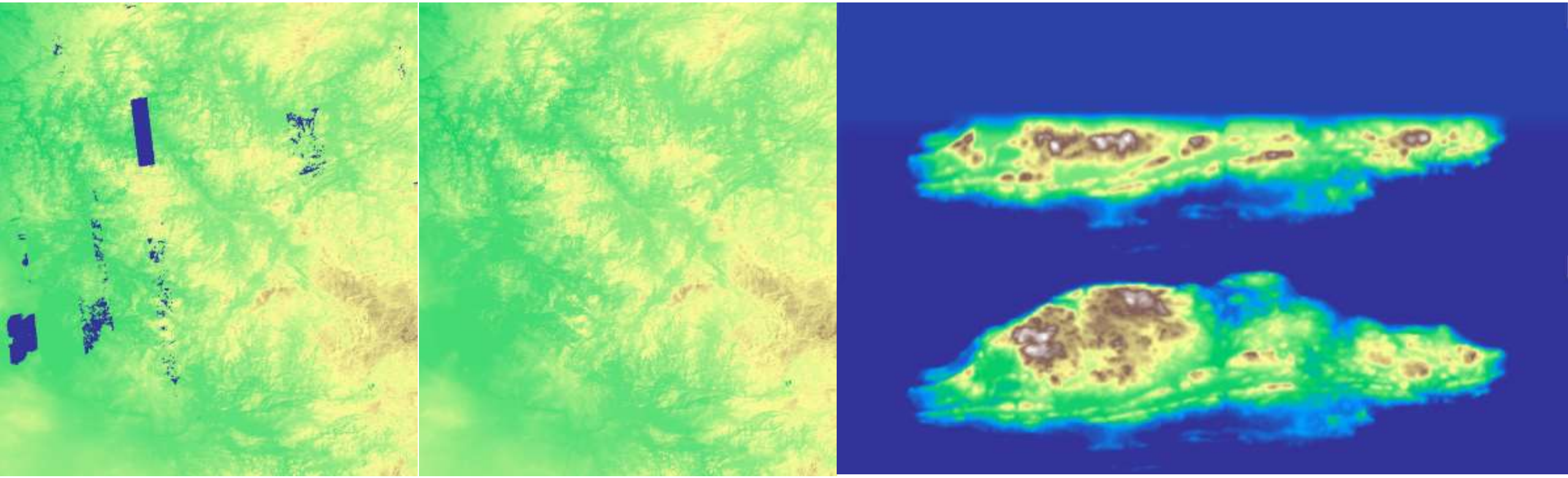


GSVS testing results

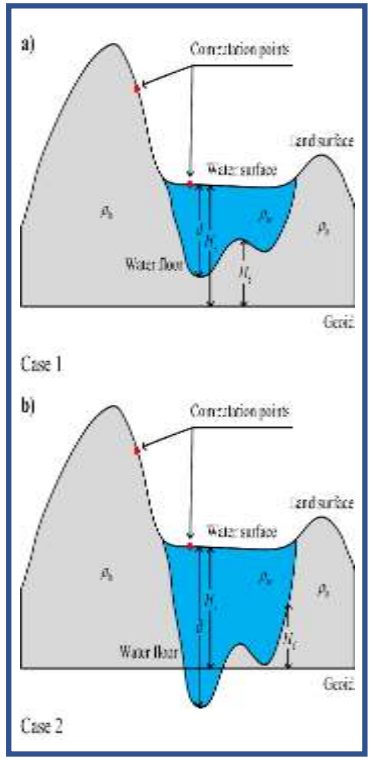


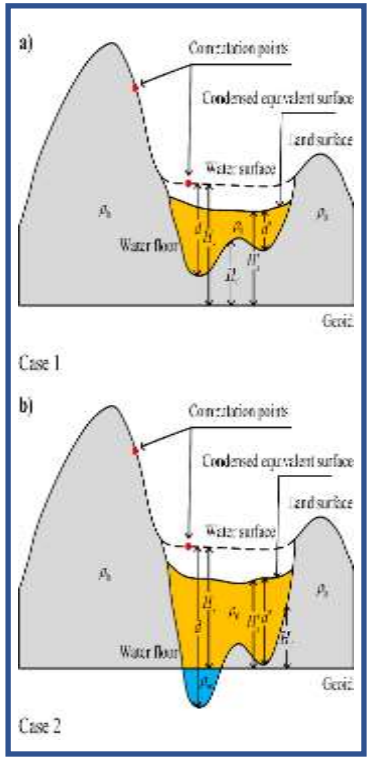
ς Precision (cm)	xGeoid20 refA	xGeoid20 refB
GSVS11	1.63	1.13
GSVS14	1.40	1.38
GSVS17	3.14	3.09

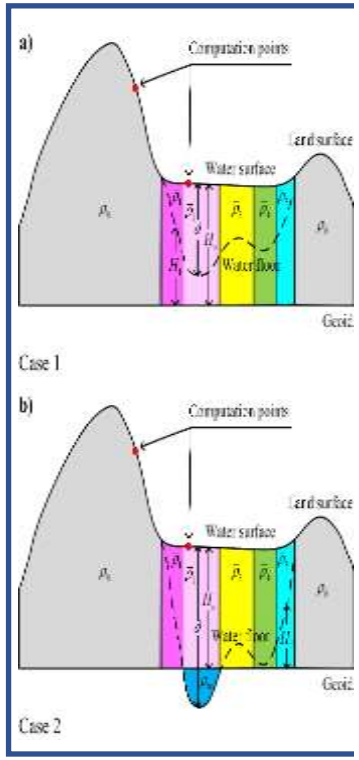
DEM updates

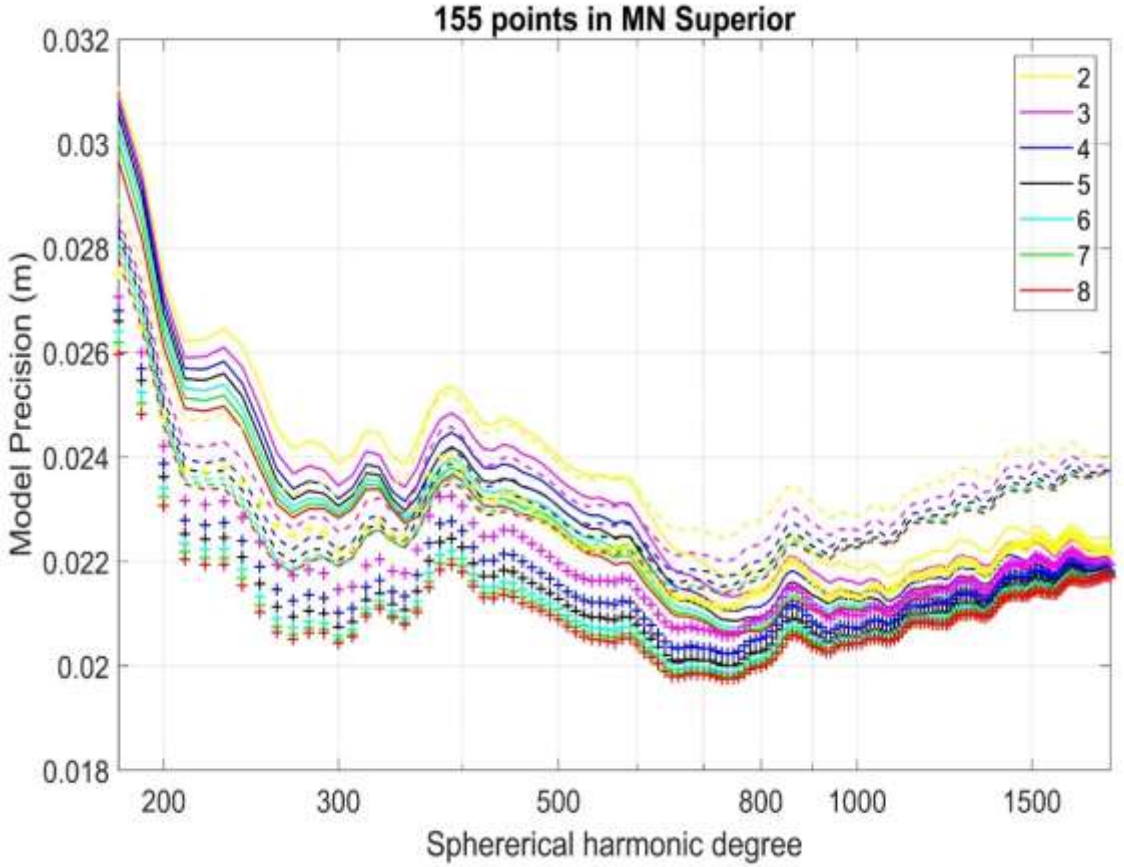


Method Updates

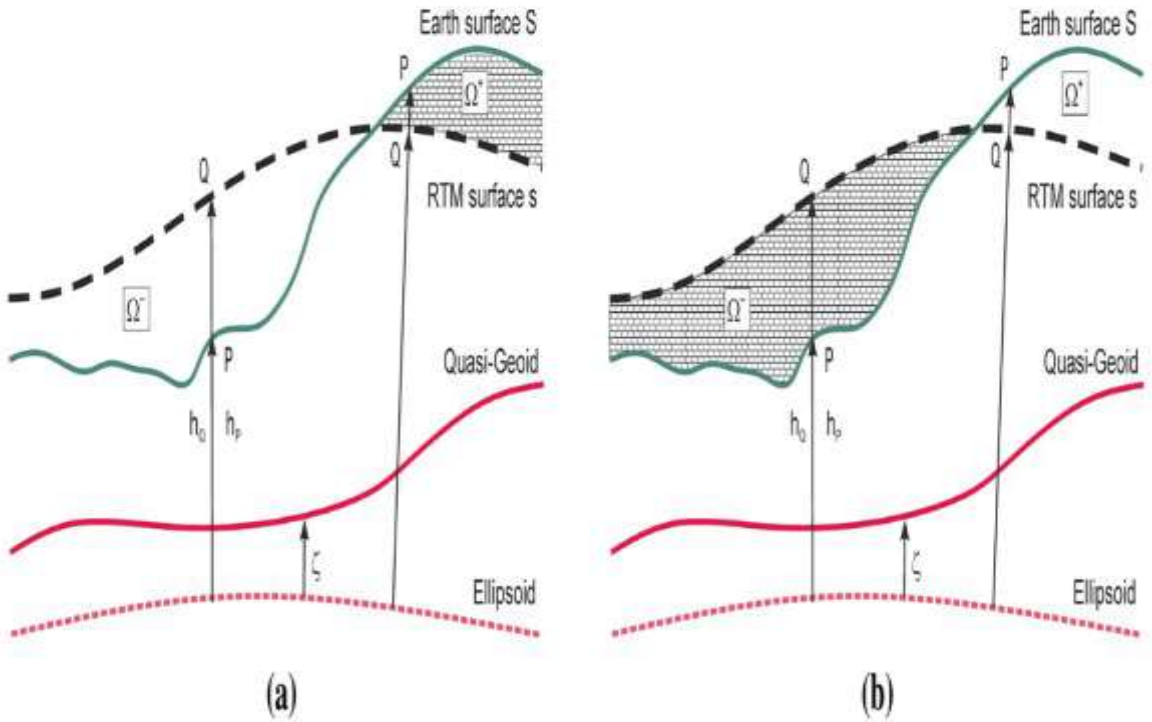






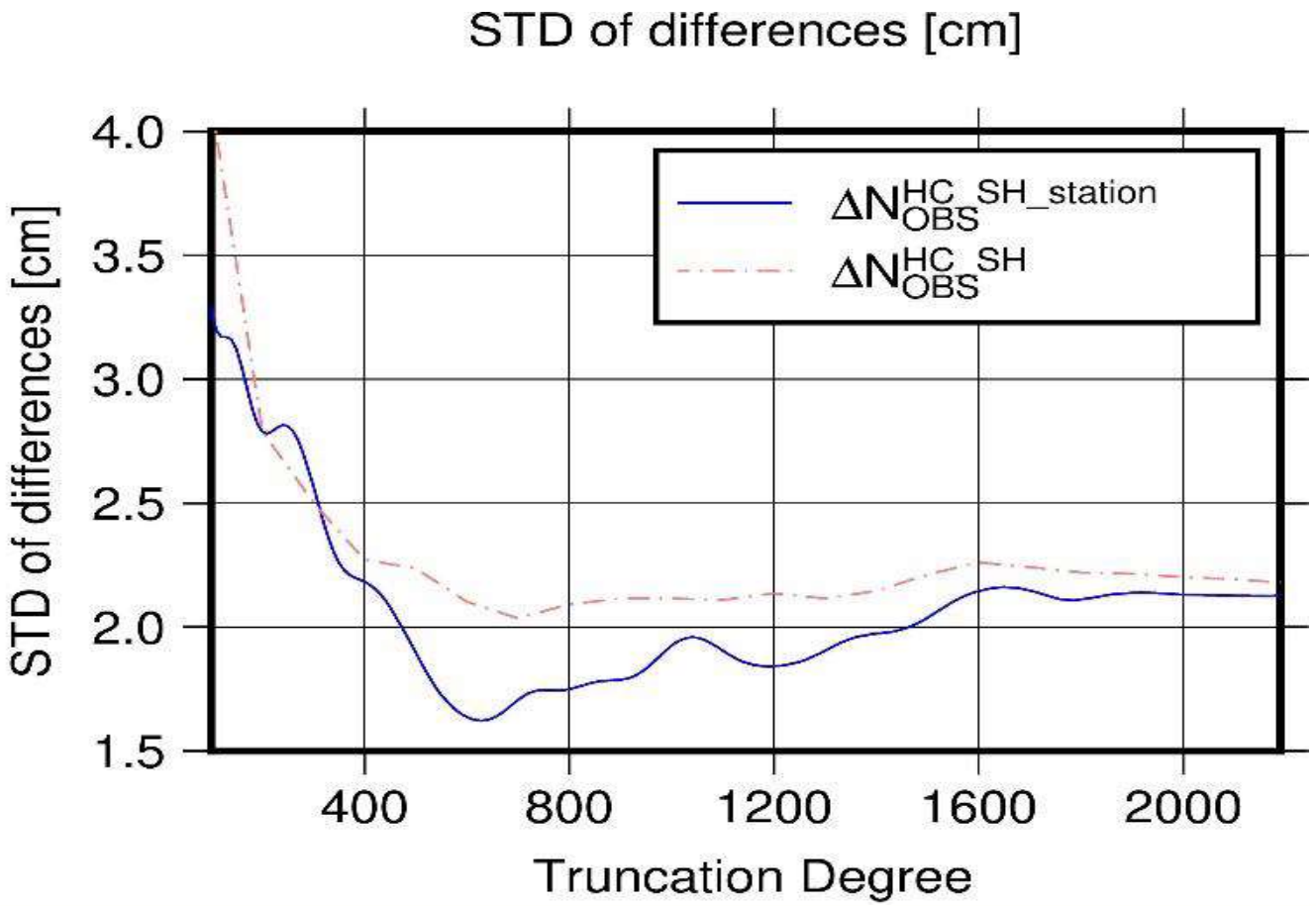


Method Updates



HC method	Truncation degree	Minimum value of STDs (cm)
HC with UBP	700	2.05
HC with LBP	700	2.05
HC with BS	700	2.05
HC with LBS	700	2.05
HC with TS	700	2.10
HC with SH	700	2.04
HC with complete method	2500	2.29

Method Updates



Summary

1. Scalar airborne gravity data (10-km cross-track resolution and about 30-km along-track resolution) are collected to cover almost all US territories.
2. Airborne data are combined into a global reference model in the spherical harmonic coefficient level and yield better results along all GSVS lines.
3. Many computation tests are performed on several key approximations to guarantee cm-level computational accuracies.

Key References

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