Preliminary Results of Evaluation of the INTERMAP's Airborne Gravity Data

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National Ocean Service
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Positioning America for the Future

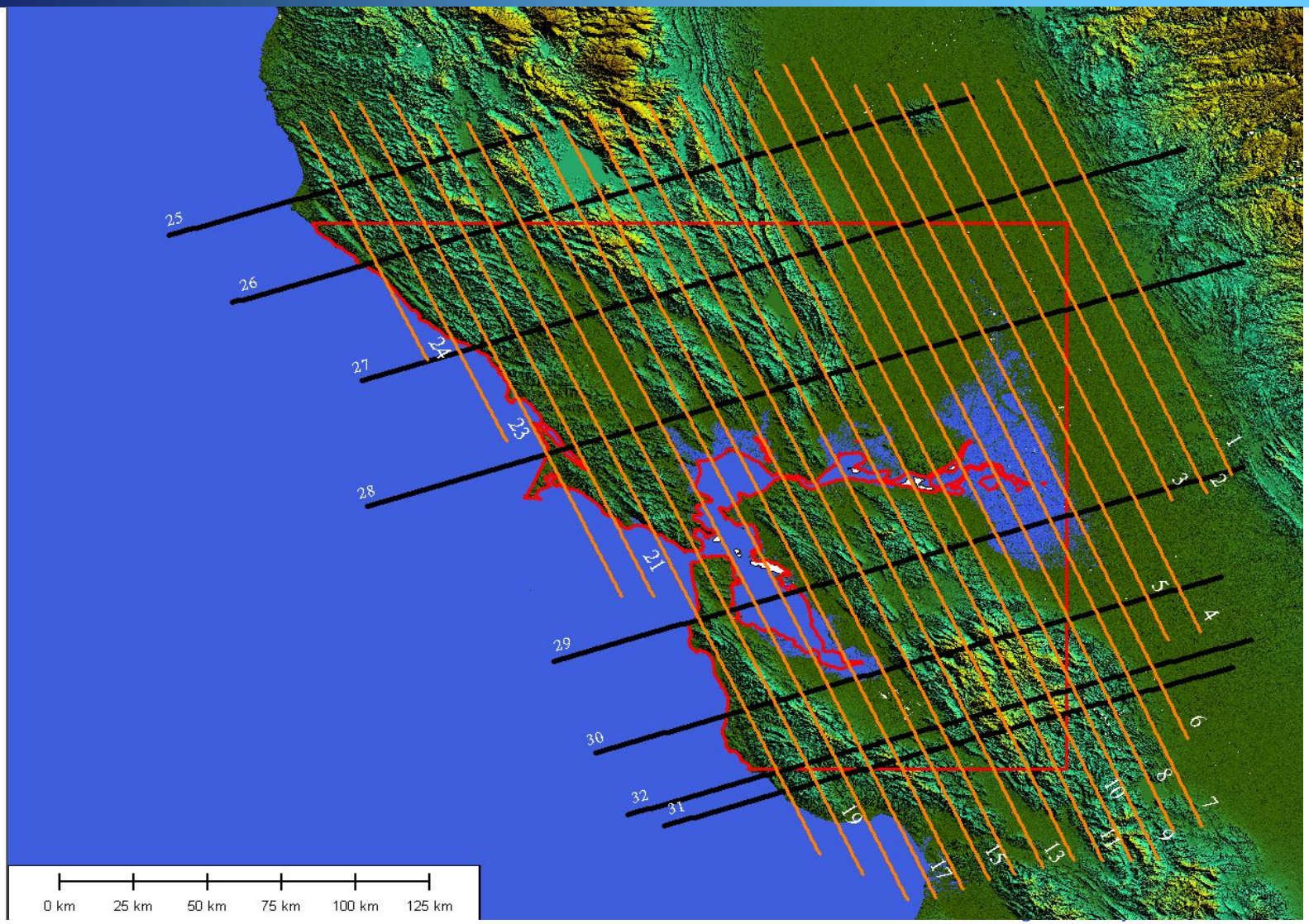
OVERVIEW

- Background
- Methodology of upward continuation
- Preliminary comparison results
- Conclusion
- Future works

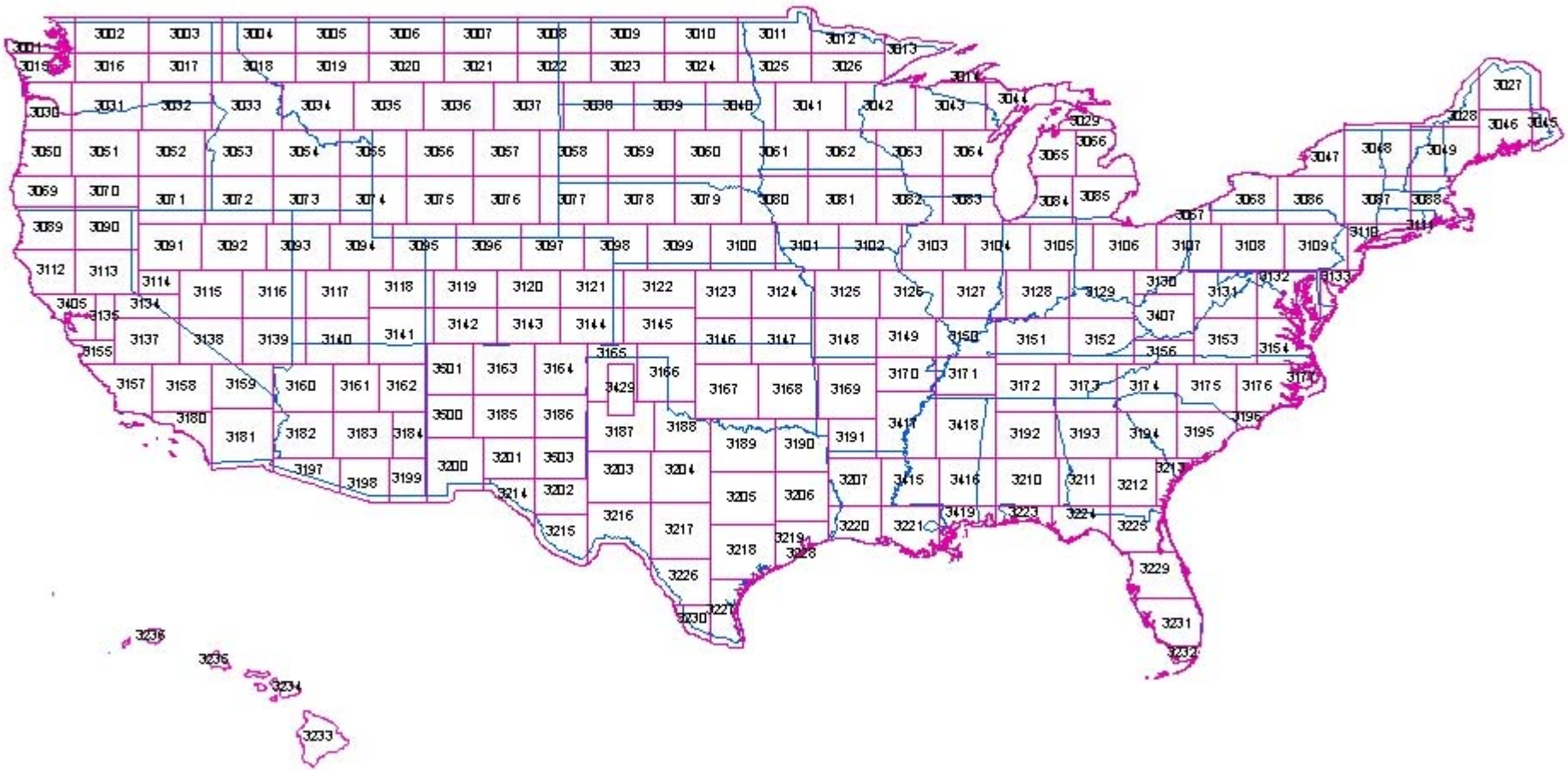
Background

- Geoid computation needs accurate gravity data
- Gravity data as a by-product of the INTERMAP's ISAR mission (example in California)
- INTERMAP's Airborne Gravity System (AGS)
- AGS gravity data accuracy (2-3 mgal at flight altitude)
- INTERMAP's future flight plan
- Our validation plan

Flight Tracks in California



NMUSA_v7



Dec. 06 2005

Validation Methods (1)

Poisson Integral

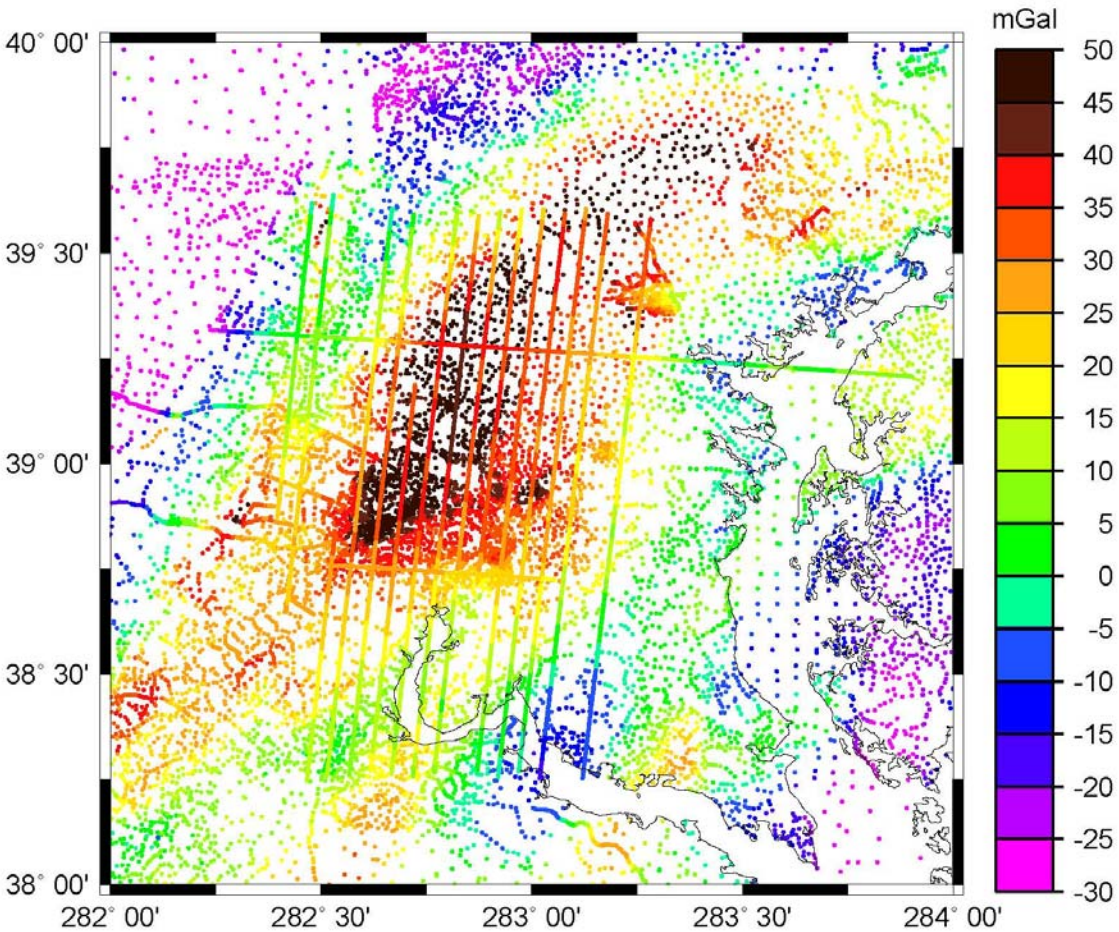
- 1’x1’ of NGS surface gravity data
- Spherical integration over an area of 34° latitude by 76° longitude
- Surface gravity data assumed on the mean Earth’s surface

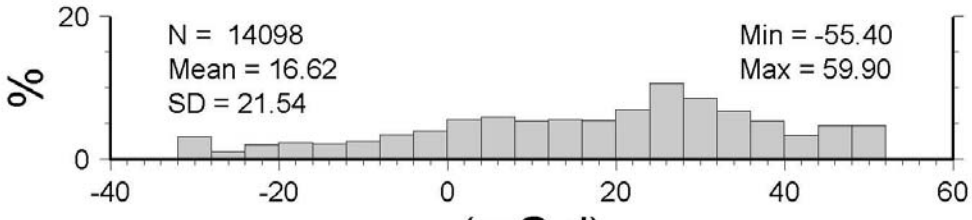
Validation Methods (2)

2D Fourier Series

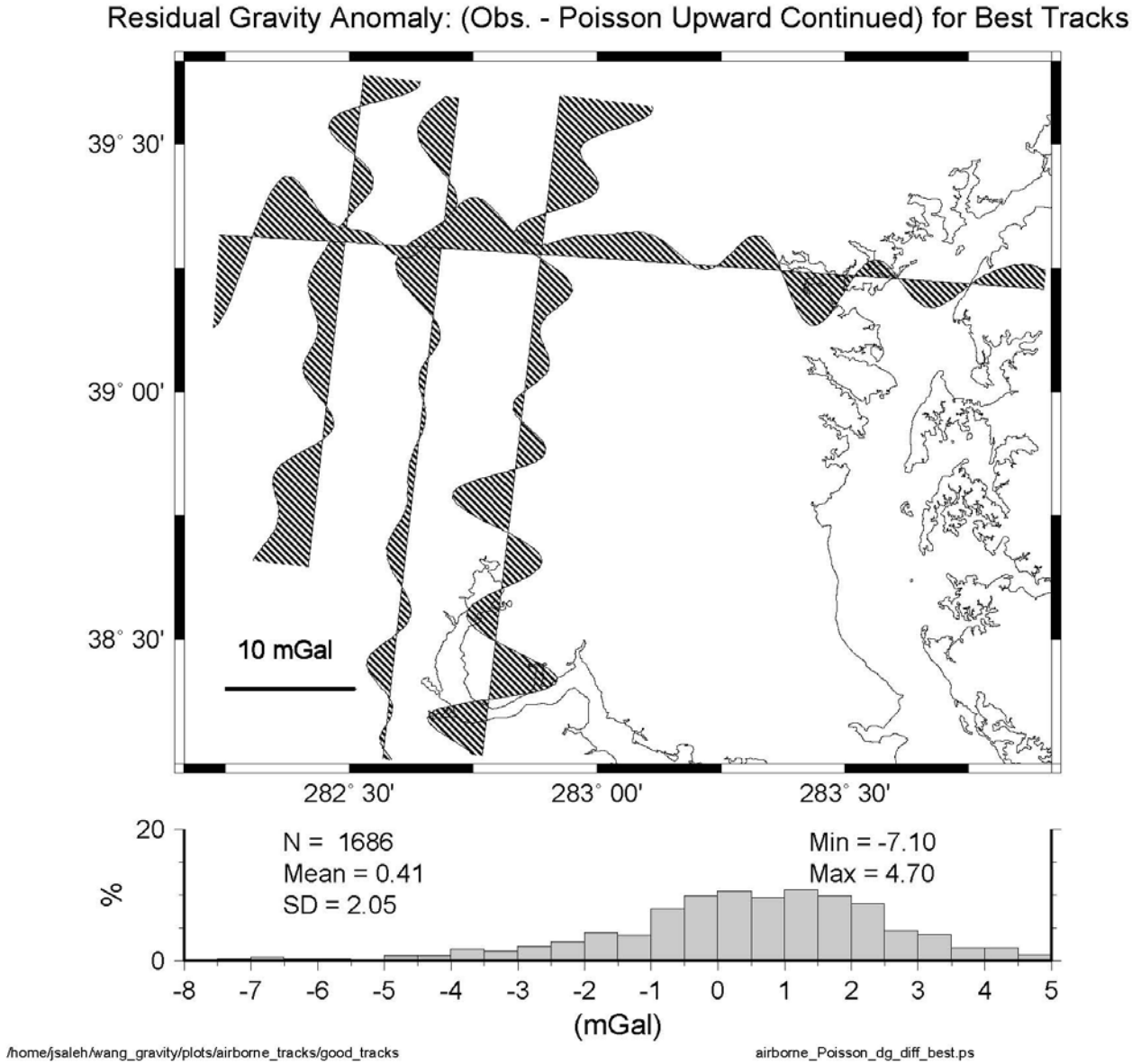
- Whole CONUS (34° latitude by 76° longitude) split into 1° by 1° cells
- Local reference system used
- Series provide not only upward continuation, but also downward continuation
- 2D F-Series are much more computationally efficient
- Surface gravity data assumed on the Earth's surface (effect of topography is considered)

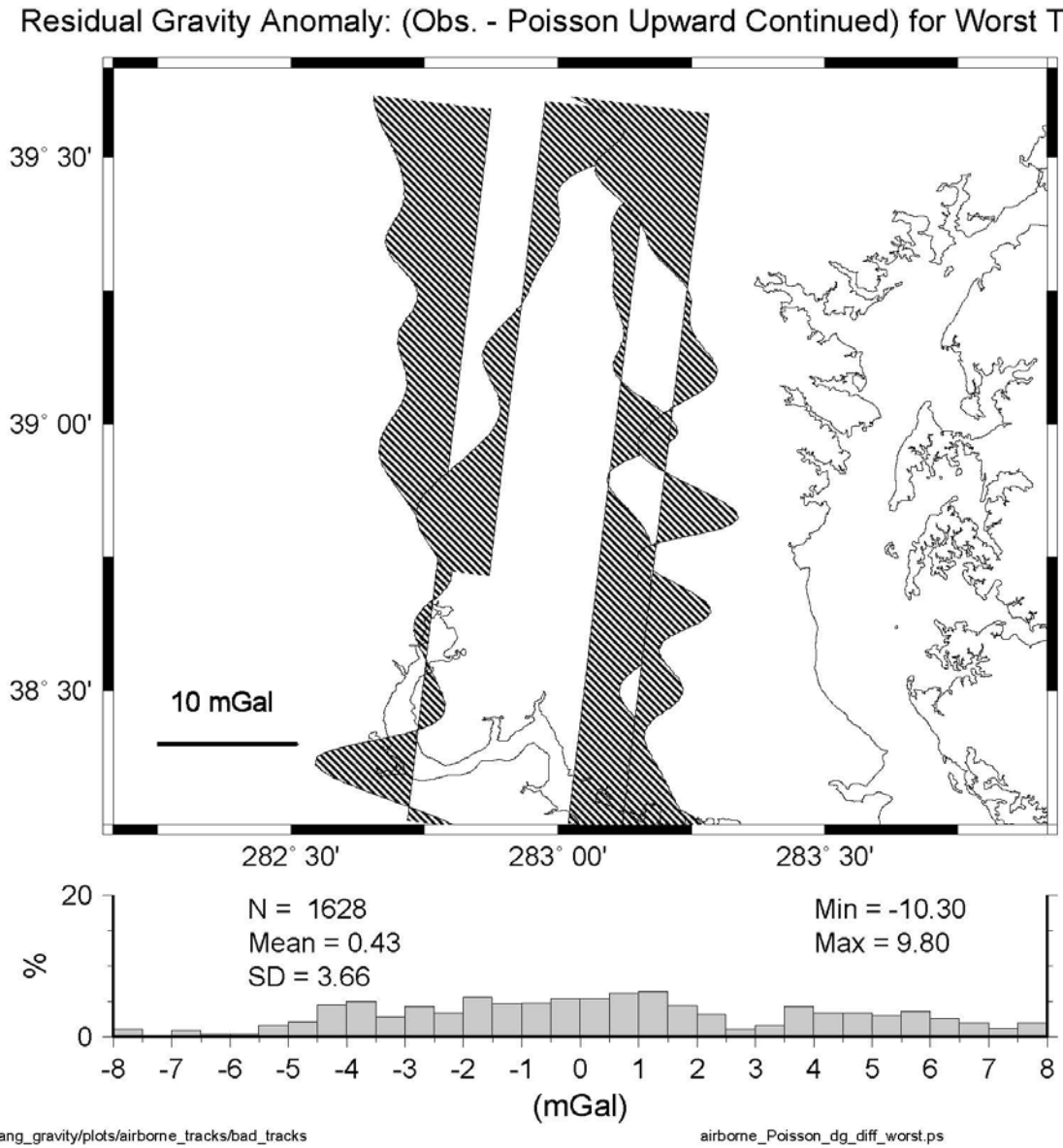
NGS/DMA and Airborne Gravity Data in Baltimore





America for the Future


Residual Gravity Anomaly: (Obs. - Poisson Upward Continued) for Best Tracks
39° 30'
39° 00'
38° 30'
10 mGal
282° 30'
283° 00'
283° 30'
20
%
0
N = 1686
Mean = 0.41
SD = 2.05
Min = -7.10
Max = 4.70
-8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5
(mGal)
/home/jsaleh/wang_gravity/plots/airborne_tracks/good_tracks
airborne_Poisson_dg_diff_best.ps


Residual Gravity Anomaly: (Obs. - Poisson Upward Continued) for Worst Tracks
39° 30'
39° 00'
38° 30'
10 mGal
282° 30'
283° 00'
283° 30'
20
%
0
N = 1628
Mean = 0.43
SD = 3.66
Min = -10.30
Max = 9.80
-8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8
(mGal)
/home/jsaleh/wang_gravity/plots/airborne_tracks/bad_tracks
airborne_Poisson_dg_diff_worst.ps

Statistics of Gravity Anomaly at Altitude (mgal)

	Airborne	F-Series	Poisson
No. of Pts	6252	6252	6252
Mean	20.4	19.7	19.5
RMS	23.8	22.9	22.7
Min. Value	-27.2	-20.6	-20.2
Max. Value	42.0	37.0	37.6

Statistics of Gravity Anomaly Diff. at Altitude (mgal)

	Airborne-F Series	Airborne-Poisson	F Series - Poisson
No. of Pts	6252	6252	6252
Mean	0.7	1.0	-0.2
RMS	2.7	2.8	0.4
Min. Value	-10.6	-10.3	-1.0
Max. Value	9.1	9.8	0.9

Conclusions

- Verified 2-3 mgal accuracy of AGS data in a relatively flat area at flight altitude
- Different upward continuation methods produced very similar results
- Bad tracks indicate a trend: more crossover tracks are needed and QC will be important

Future Works

- Expecting data form California
- If the data from CA were the same quality and we decide to acquire the data, QC will be an important step for data quality
- Procedure of downward continuation needs to be developed
- More updated ground truth (absolute gravity) are needed to tie the data accurately