



Future Modernization of the NSRS Horizontal and Vertical Datum and GRAV-D

2012 Alaska Surveying and Mapping Conference

16 Slides

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Modernization

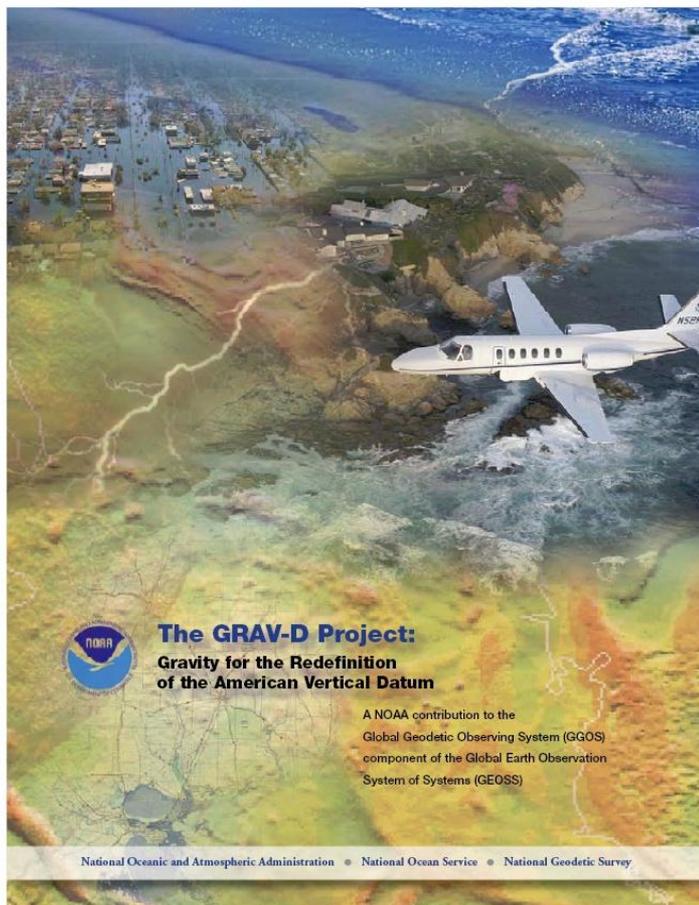
New Geopotential “Vertical” Datum

- 2022 estimated completion (**GRAV-D**)
- Defined by combination of GNSS and gravity data
- Project Manager: mark.eckl@noaa.gov

New Geometric “Horizontal” Datum

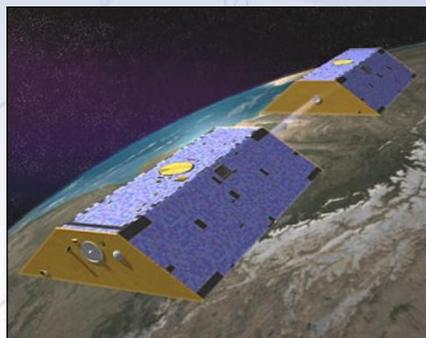
- 2022 estimated completion
- Primary access through GNSS technology and active control (CORS) instead of passive marks
- Project Manager: joe.evjen@noaa.gov

Gravity for the Redefinition of the American Vertical Datum (GRAV-D)



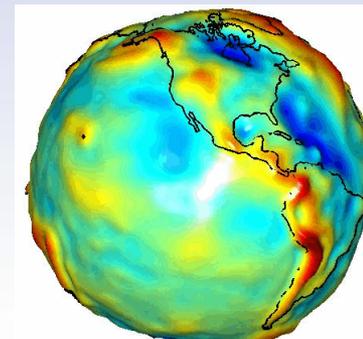
- **Replace the Vertical Datum of the USA by 2022 (at today's funding) with a gravimetric geoid accurate to 1 cm**
- Orthometric heights accessed via GNSS accurate to 2 cm
- Three thrusts of project:
 - Airborne gravity survey of entire country and its holdings
 - Long-term monitoring of geoid change
 - Partnership surveys
- Working to launch a collaborative effort with the USGS for simultaneous magnetic measurement

Building a Gravity Field



GRACE and GOCE (not shown)

Long Wavelengths:
(≥ 350 km)

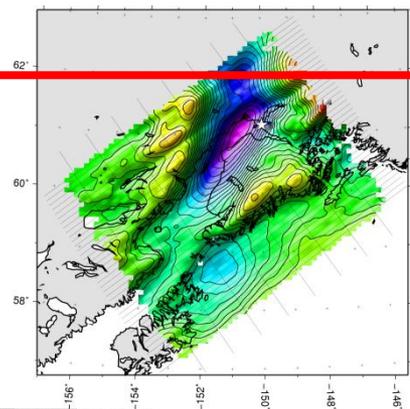


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Airborne Measurement

Intermediate Wavelengths
(500 km to 20 km)

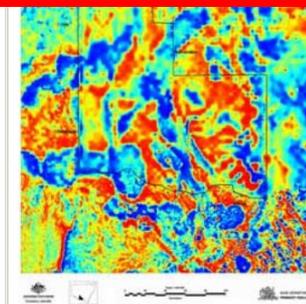


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Surface Measurement

Short Wavelengths
(< 100 km)

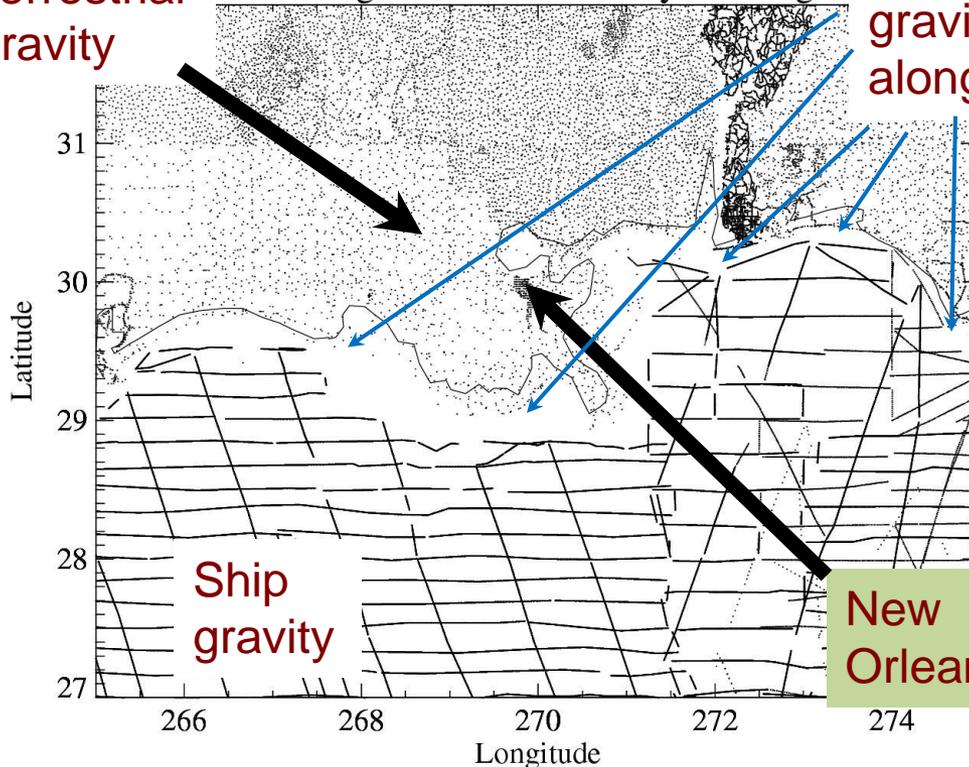


Problems with Gravity Holdings

Terrestrial
gravity

Existing Gulf Coast Gravity Holdings

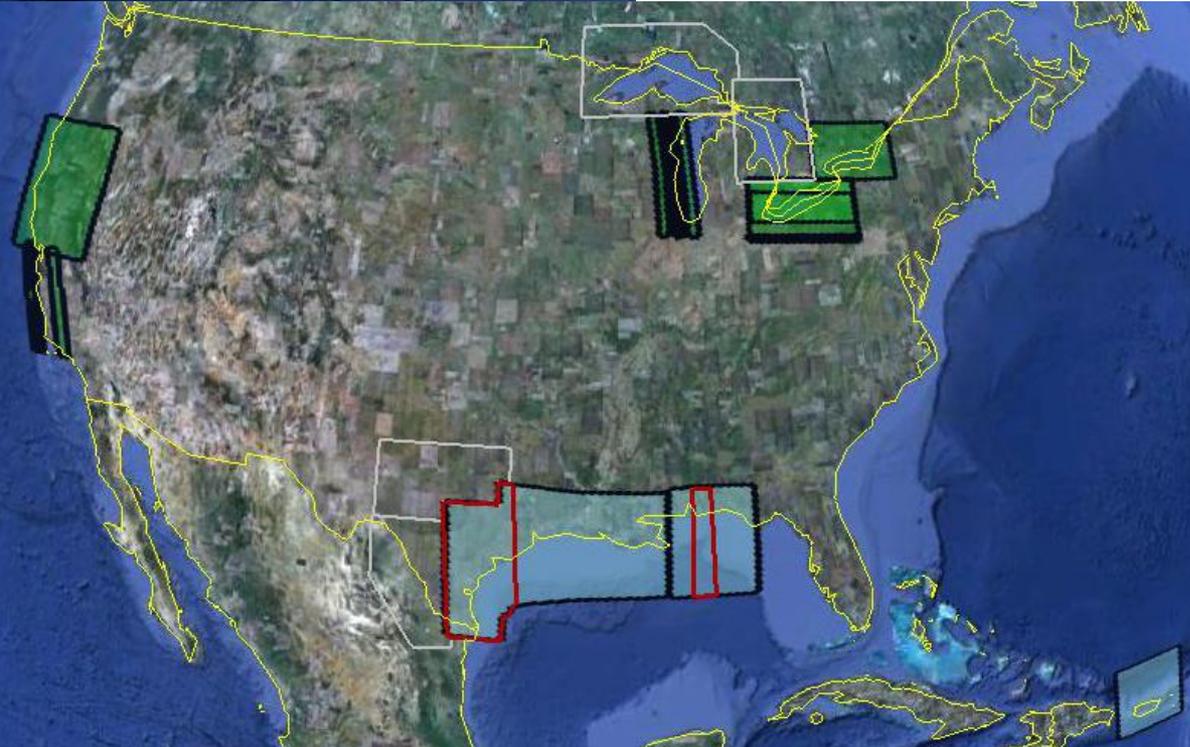
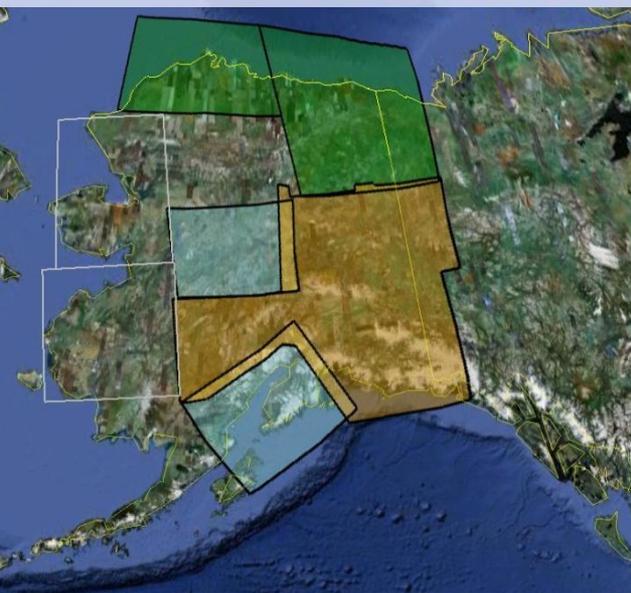
20-100 km
gravity gaps
along coast



- Field is not sampled uniformly
- Data range in age and quality, some w/o metadata
- Some surveys have systematic errors

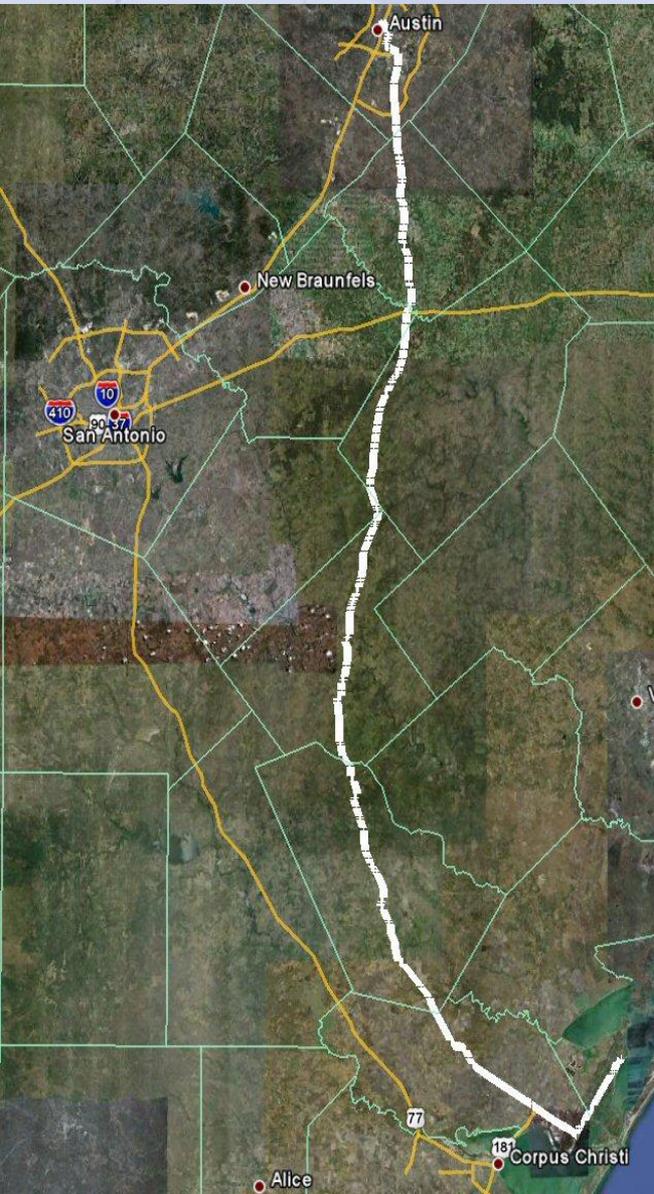
GRAV-D Status

- In FY 11 airborne surveys were conducted in Alaska, California/Oregon, and the Great Lakes
- 15.60% of the country completed
- Potential locations for flights in FY 12 include southern portions of Alaska, the Great Lakes, Texas
- TX and AL data available, all Gulf of Mexico data to be released by Q3
- Data and metadata at: http://www.ngs.noaa.gov/GRAV-D/data_products.shtml



- Potential FY 2012
- FY 2011
- FY 2010
- Pre-FY 2010
- Data Released

2011 Geoid Slope Validation Survey



Goals: Observe geoid shape (slope) using multiple independent terrestrial survey methods

- GPS + Leveling
- Deflections of the Vertical

Compare ***observed*** slopes (from terrestrial surveys) to ***modeled*** slopes (from gravimetry or satellites)

- With / Without new GRAV-D airborne gravity



GPS



LIDAR/
Imagery



DoV



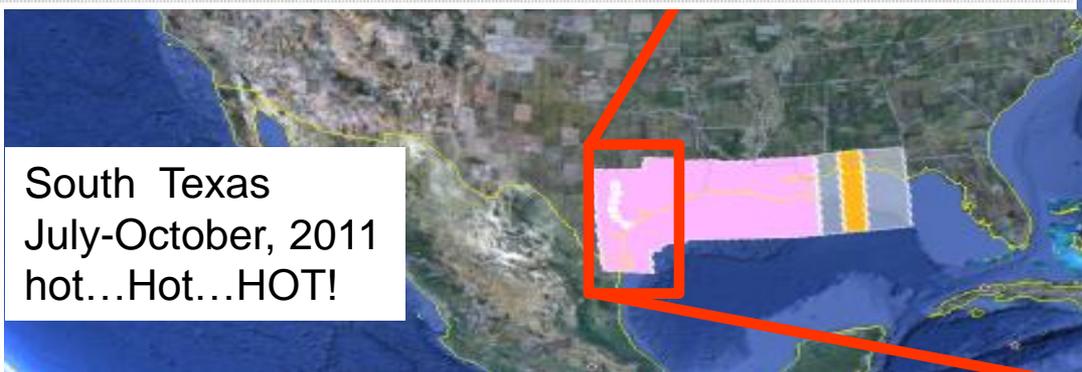
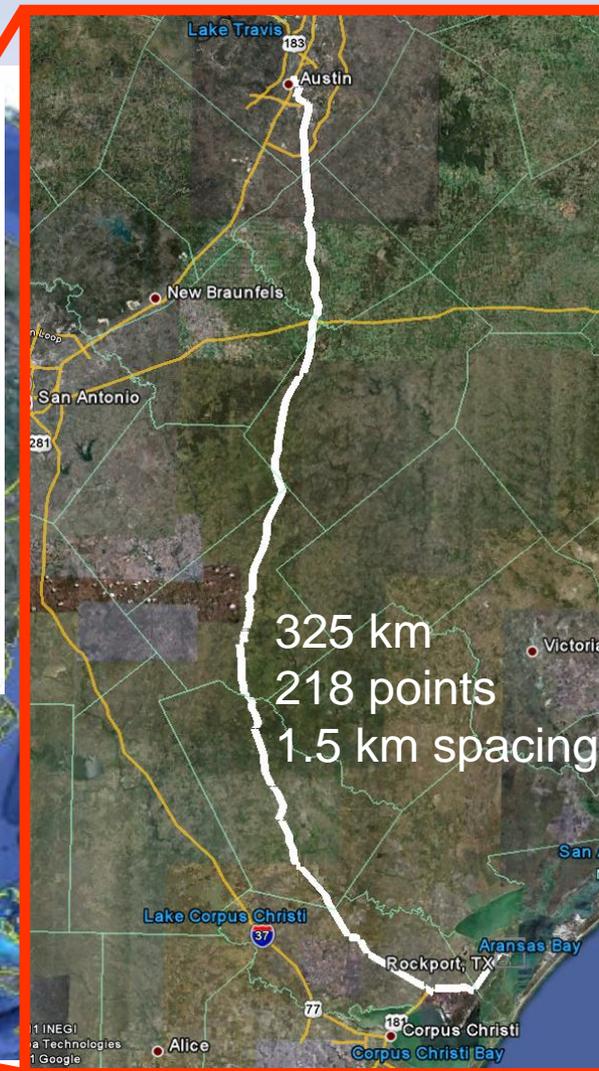
Leveling



Gravity

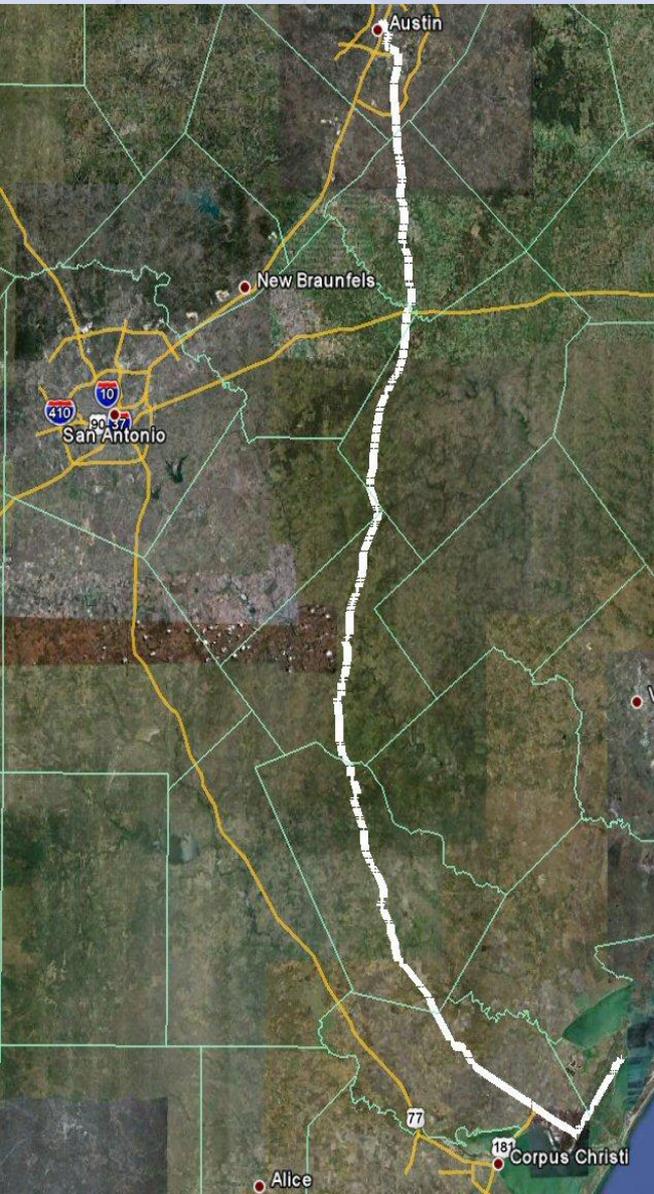
The Chosen Line

Today Aug 1	Tue 2	Wed 3	Thu 4	Fri 5	Sat 6	Sun 7	Mon 8	Tue 9	Wed 10
Sunny	Mostly Sunny	Sunny	Sunny	Sunny	Sunny	Mostly Sunny	Partly Cloudy	Partly Cloudy	Sunny
107°F High	108°	107°	106°	106°	106°	105°	105°	104°	104°
80° Low	80°	79°	78°	78°	78°	78°	77°	77°	78°
EXPAND GRAPH									



South Texas
July-October, 2011
hot...Hot...HOT!

2011 Geoid Slope Validation Survey



Initial results presented at AGU:

“Airborne gravity improves the geoid at all wavelengths”

Stay tuned for the next Geoid Slope Validation Survey in 2013...location TBD.

Two major issues to face in the future

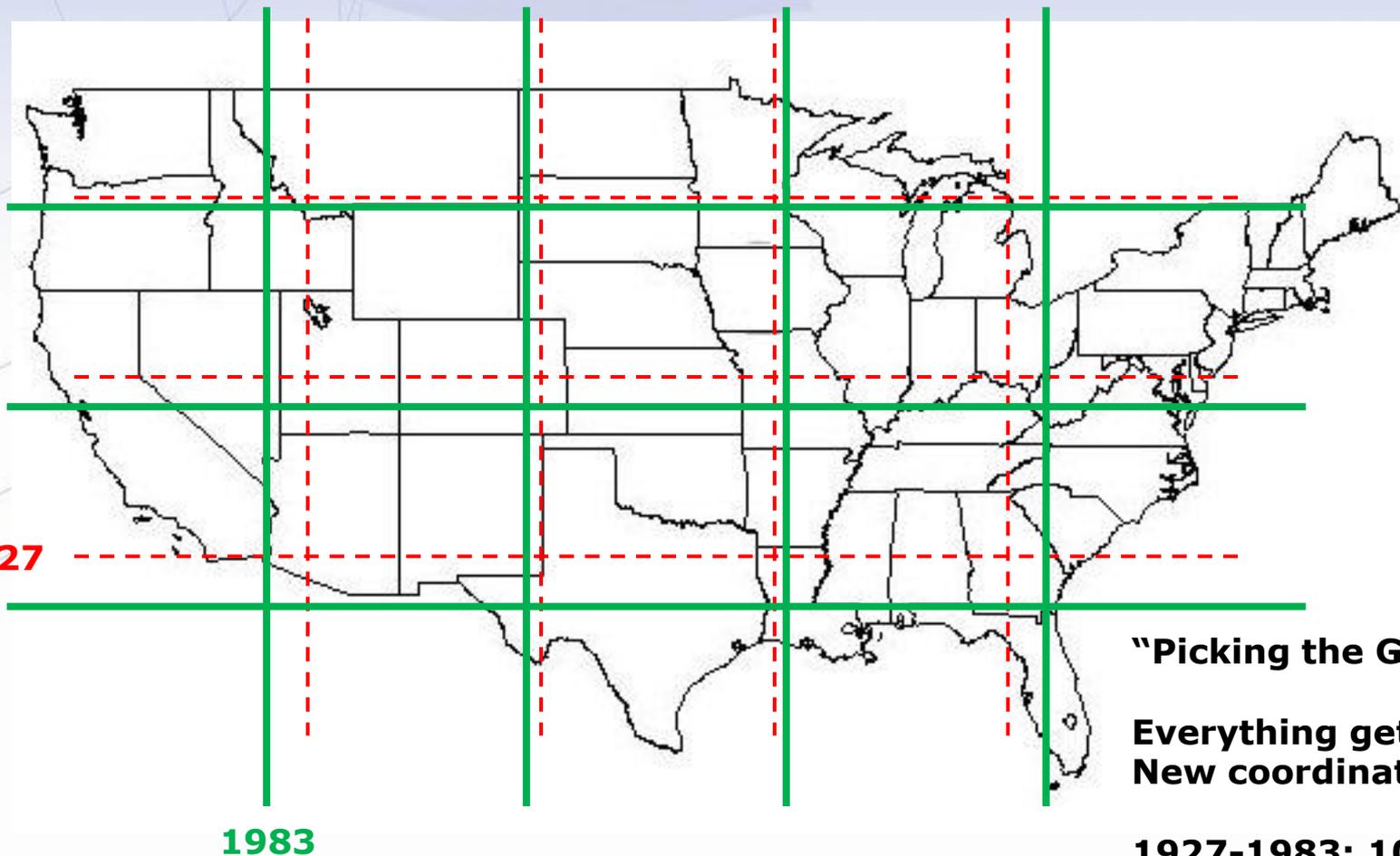
BIG issue: Changing the datum

- “Picking the grid for latitude, longitude, etc”
- *Rarely* changed: 1920's, 1980's....**2022**
- Moving to ECEF

Smaller issue: Adjusting the coordinates within a datum

- “Correcting coordinates of geodetic control points *on* the grid”
 - For: Actual motion
 - Or For: Better data processing
- Done regularly, but cautiously

Changing the Datum



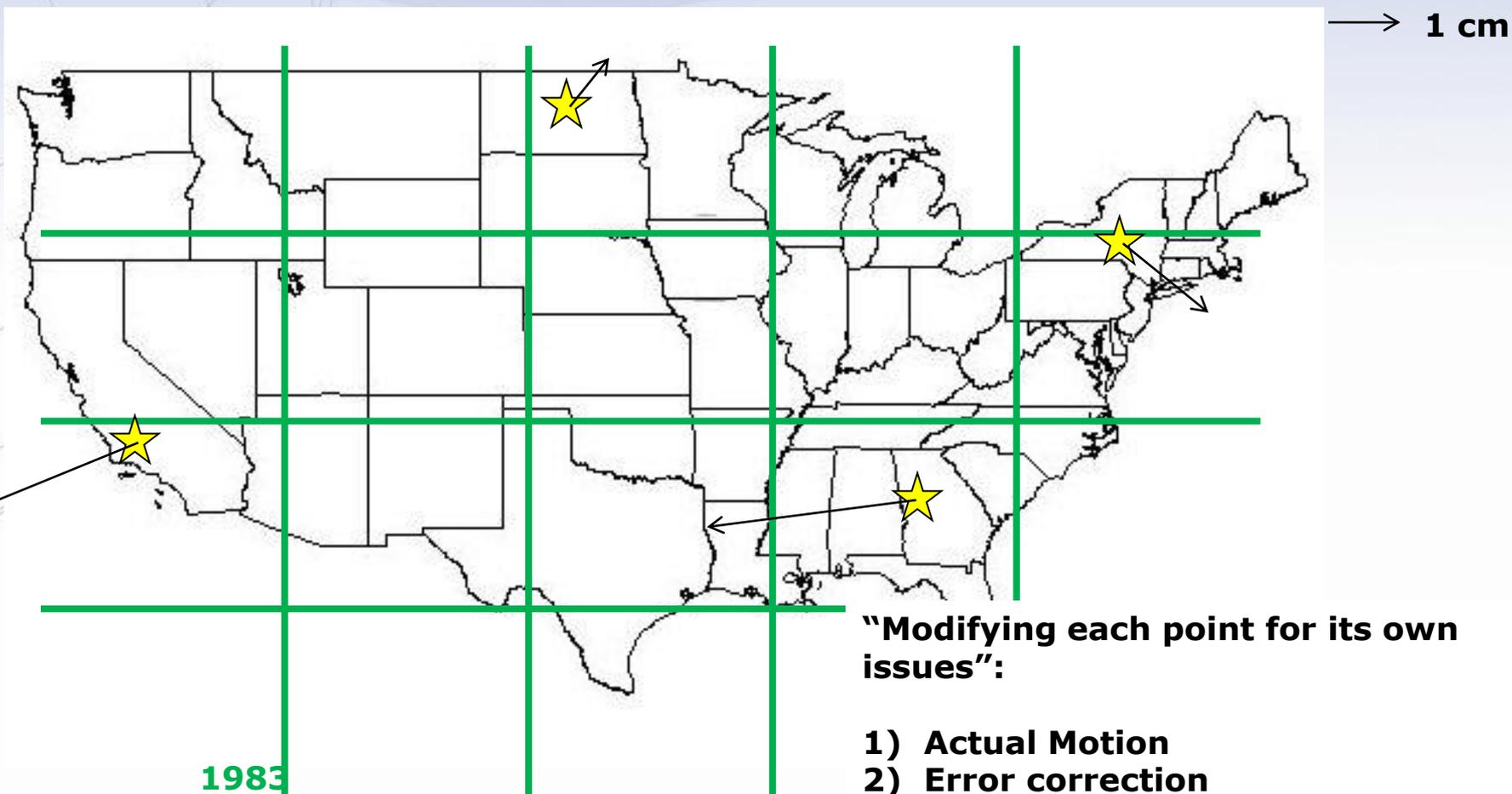
"Picking the Grid"

**Everything gets a
New coordinate!!**

**1927-1983: 100's of
meters**

1983-2022: 1-2 meters

Adjusting Coordinates *within* the Datum



“Modifying each point for its own issues”:

- 1) Actual Motion**
- 2) Error correction**
- 3) New Information**

On the order of centimeters
Done regularly: Next MYCS 2016?

For now you can expect overall coordinate change to NA2011...

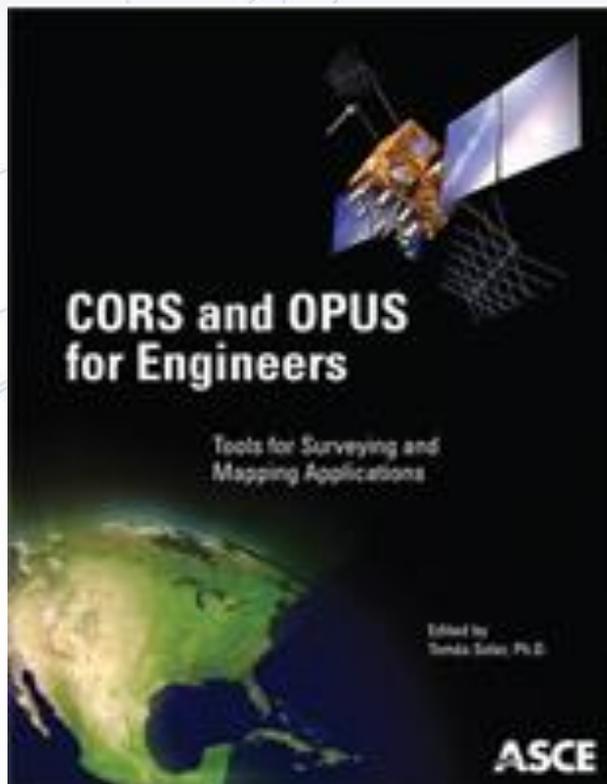
Horizontal: Mean ~**2 cm** (± 6 cm), median ~0 cm

Vertical: Mean ~ **-1 cm** (± 2 cm), median ~ -1 cm

This is for change in realization *and* reference epoch

NAD 83(CORS96) epoch 2002.00 → **NAD 83(2011) epoch 2010.00**

NEW BOOK - CORS Monograph CORS and OPUS for Engineers: Tools for Surveying and Mapping Applications



- Edited by Tomás Soler and sponsored by ASCE and NGS
- Publication is out and available on the ASCE website
- Is useful to OPUS users working in many different types of GPS scientific

Questions

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