Implementing Geometric and Geophysical Datums for the United States in 2022 (Paper 7610)

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Session TS02G – Datum Definition

REPLACING NAD 83 IN 2022
NAD 83 => Geometric Reference Frame

- Primary access shifts from bench marks to GNSS/OPUS
- Datum Offset w.r.t. IGS/IWGS84
- Bench marks tied to new reference frame and secondary
- Implementation in 2022

A brief history of NAD 83

- Original realization completed in 1986
  - Consisted (almost) entirely of classical (optical) observations
- “High Precision Geodetic Network” (HPGN) and “High Accuracy Reference Network” (HARN) realizations
  - Most done in 1990s, essentially state-by-state
  - GNSS based, with classical obs. incl. in adjustments
  - Did NOT use CORS as constraints
- National Re-Adjustment of 2007
  - NAD 83(CORS96) and (NSRS2007)
  - Simultaneous nationwide adjustment (GNSS only)
- New realization: NAD 83(2011) epoch 2010.00
Simplified Concept of NAD 83 vs. ITRF2008

Earth's Surface

NOAA's National Geodetic Survey
Positioning America for the Future

h83
h08

NAD 83 Origin

ITRF2008 Origin

2.2 meters
How will the new datums affect you?

The **new geometric reference frame** will change latitude, longitude, and ellipsoid height in CONUS and AK between **1 and 2 meters**.
Online Positioning User Service (OPUS)

Fast, easy, consistent access to NSRS

- Over 2.8 millions solutions processed since 2002
- Processed automatically on NGS computers
- Solution via email in minutes

http://www.geodesy.noaa.gov/OPUS/

Implementation

- Foundation CORS tied to IGS solutions
- Stacking/Reprocessing yields consistent CORS coordinates
- Bench Marks are then adjusted to fit CORS control
- GNSS/OPUS derived positions supersede bench mark values
- Velocities applied to revert back to common epoch (2022.0)
- Effectively provides “fixed” plate & state plane coordinates
- Permits use for RTK positioning at current epoch
REPLACING NAVD 88 IN 2022

NAVD 88 => Geopotential Reference Frame

• Primary access shifts from bench marks to GNSS & geoid

• Datum Offset w.r.t. global gravity models from satellite data

• Bench marks tied to new reference frame and secondary

• Implementation in 2022
How will the new datums affect you?

The new vertical (geopotential) datum will change heights 50 cm on average with a 1 m tilt towards the Pacific Northwest.
1930s Leveling for the Conterminous United States

Experimental Geoid 14B with Aerogravity Blocks
\[ W_0 = 62,636,856.00 \text{ m}^2/\text{s}^2 \]

Implementation

- Airborne gravity collection continues through 2020
- Airborne data normalized to satellite data
- Surface gravity normalized to satellite/airborne
- Spectrally merged data available either as grid or maybe SHM

- Geometric coordinates determined using GNSS/OPUS
- Gravimetric geoid model interpolated for conversion
- Geometric and geopotential velocities can be applied
Summary

- NAD 83 and NAVD 88 both have inherent datum defects
- Both have inherent quality issues from age of data
- Both will be replaced by remote sensing derived data
- Physical heights will be derived from geometric and a geoid
- Geometric frame will follow on IGS solution closest to 2022
- Geopotential frames will incrementally finish in 2022
- Both new reference frames will provide global consistency

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QUESTIONS?