NADCON Accuracy in the Gulf of Mexico

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NAD 83 Readjustment

- "Clean up" of nearly 200 years of NGS surveying data
- Change in reference ellipsoid

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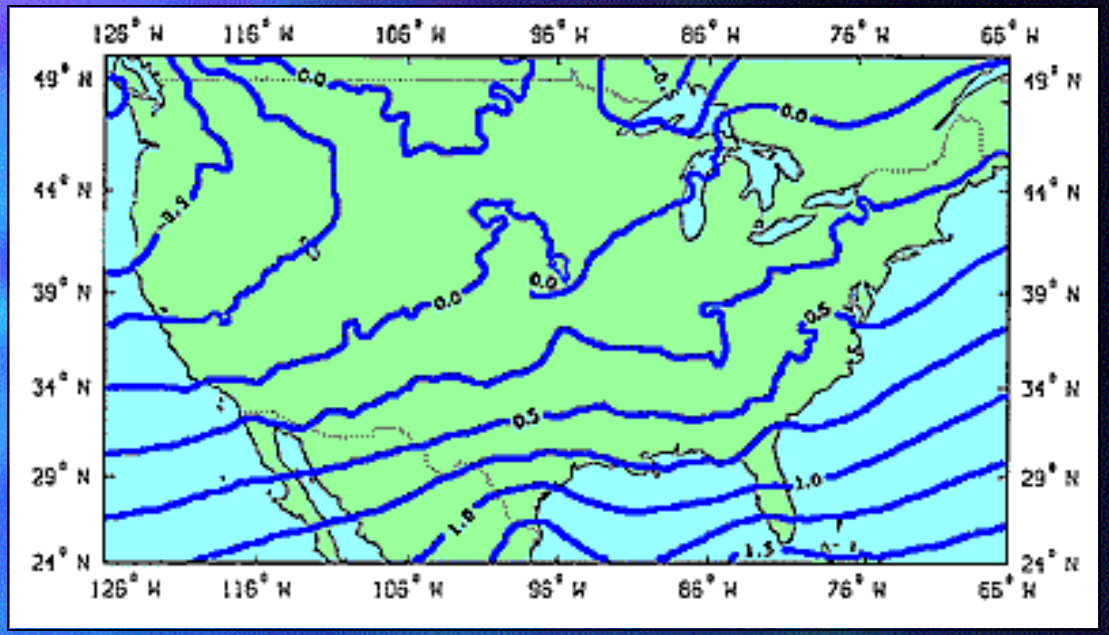
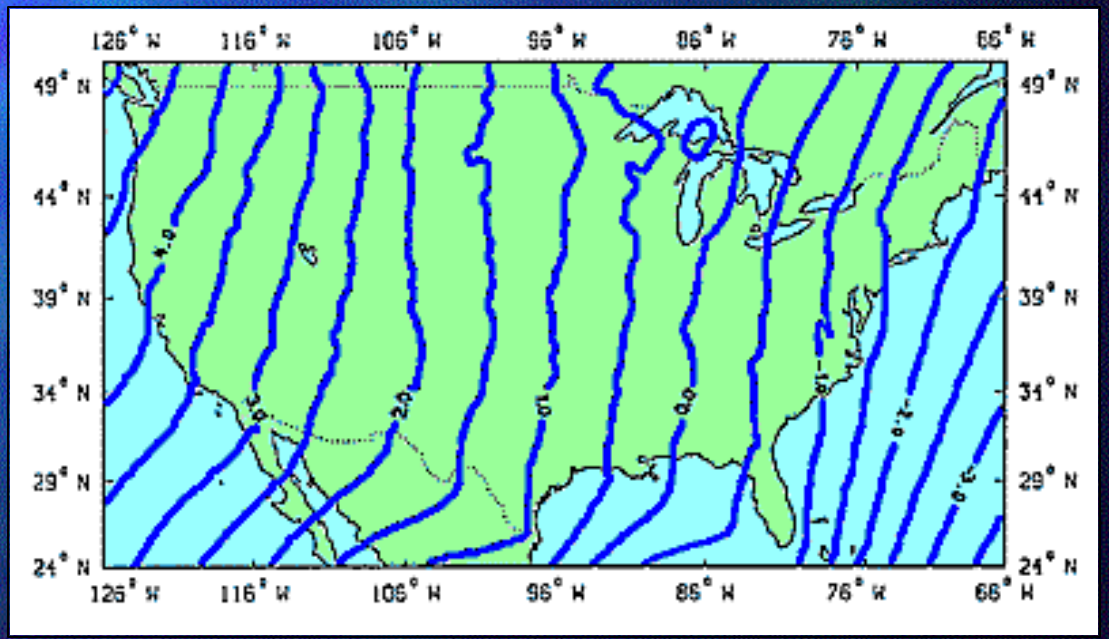
- Shift between NAD 27 and NAD 83 is neither uniform nor simple

NAD 27 to NAD 83 Datum Shifts

Latitude
(Seconds of arc)



Longitude
(Seconds of arc)



Techniques for Converting Coordinates Between Datums

- Geocentric coordinate changes (i.E., Changing the ellipsoid)
- Analytic conversions
- Interpolation from a grid

Type 1: Geocentric Coordinate Conversions

- Modern geodetic datums:
  - Cartesian coordinate systems
  - Origin is the center of the earth
- Until the advent of satellites, values for the center of the earth and its radii were poorly known

Geocentric Conversions, Cont.

- One or more locations and directions on the surface of the earth were assumed to be exact.
  - For NAD 27, the coordinates of a geodetic control mark named meades ranch was assumed to be exact.
  - The direction to a nearby control station was also assumed to be exact.

Geocentric Conversions, Cont.

- If you assume all measurements and calculations are exact:
  - Translating and rotating the center of the coordinate system
  - And adding a scale factor

→ Will accurately convert coordinates between datums.

Geocentric Conversions, Cont.

- This is the simplest type of datum coordinate conversion.
- A simple calculator can easily handle it.
- In a perfect world, it would be perfect.

Type 2: Analytic Conversions

- Because geocentric conversions cannot account for errors in measurements or calculations, analytic conversion techniques must be used to obtain higher accuracies.

Analytic Conversions, Cont.

- One technique adds add extra parameters, or "fudge factors" to a geocentric conversion.
- These extra parameters cause the conversion to fit better-but generally only over a limited region.

Analytic Conversions, Cont.

- Another technique uses an analytic formula, such as polynomial surface fitting.
  - Known shifts are used to fit the surface
- These can be extremely accurate in the area for which there are dense known shifts.

Analytic Conversions, Cont.

- The most accurate analytic conversions require a lot of time and or computer power or are limited to a small geographic area.

Type 3: Grid Interpolation

- Grid interpolation is a two step process
  1. A large analytic conversion is created and the results of this conversion are gridded.
  2. The grid is interpolated for each locations where a datum conversion is required.

Type 3: Grid Interpolation

- There are two errors sources:
  1. The error due to the analytic conversion
  2. The interpolation error:
     - Mainly depends on the grid spacing
     - Also depends on the type of interpolation (linear, cubic spline, etc.)

- **NADCON uses grid interpolation**

The NADCON Datum Conversion Software Package

- NADCON grids are created by the national geodetic survey using a technique called minimum curvature
- As with other analytical techniques, minimum curvature works best where the data is dense.
  - Outside of the area where data exist, the minimum curvature technique extrapolates.

Nadcon

- Because the minimum curvature technique fits all the data, the extrapolated values are derived from all the data, not just the closest.
  - This may result in better extrapolation, or worse.
- Without known values for testing the accuracy of extrapolated values are can never be known.

NADCON Documentation

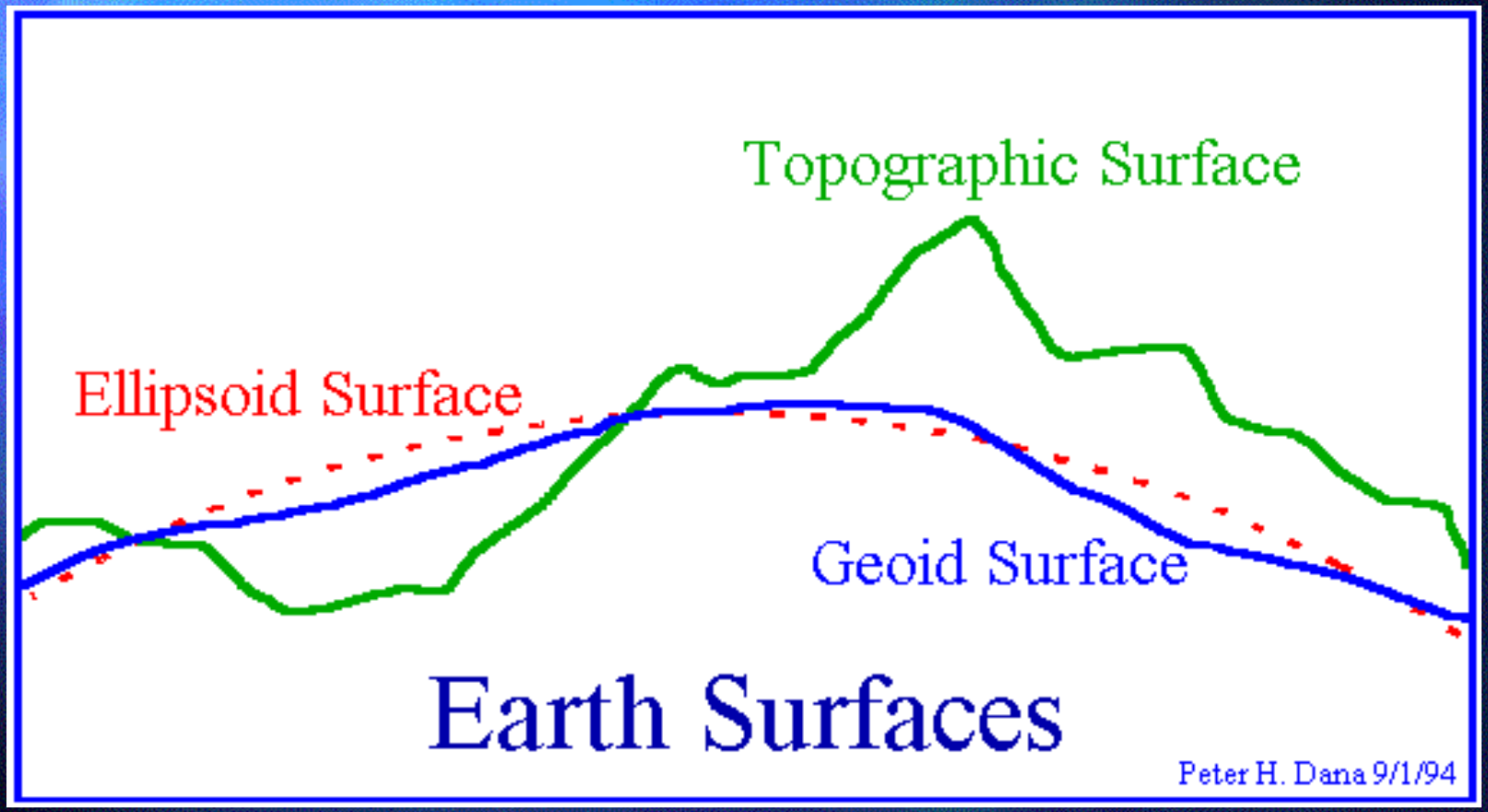
The accuracy of the transformations should be viewed with some caution. At the 67 percent confidence level, this method introduces approximately 0.15 meter uncertainty within the conterminous united states, 0.50 meter uncertainty within alaska, 0.20 meter uncertainty within hawaii, and 0.05 meter uncertainty within puerto rico and the virgin islands. In areas of sparse geodetic data coverage NADCON may yield less accurate results, but seldom in excess of 1.0 meter. Transformations between NAD 83 and states/regions with high accuracy reference networks (HARNS) introduce approximately 0.05 meter uncertainty. Transformations between old datums (NAD 27, old hawaiian, puerto rico etc.) And HARN could combine uncertainties (e.G. NAD 27 to HARN equals 0.15 meter + 0.05 meter = 0.20 meter). **In near offshore regions, results will be less accurate but seldom in excess of 5.0 meters. Farther offshore NAD 27 was undefined. Therefore, the NADCON computed transformations are extrapolations and no accuracy can be stated.**

Gulf of Mexico

NADCON in the Gulf of Mexico

- How accurate is NADCON in the gulf of mexico?
- Is consistency between applications important?
- Are there other considerations?

Backup Slide
Geoid and Ellipsoid



Backup Slide
Datum Differences