

Making Sense of Datum Transformations

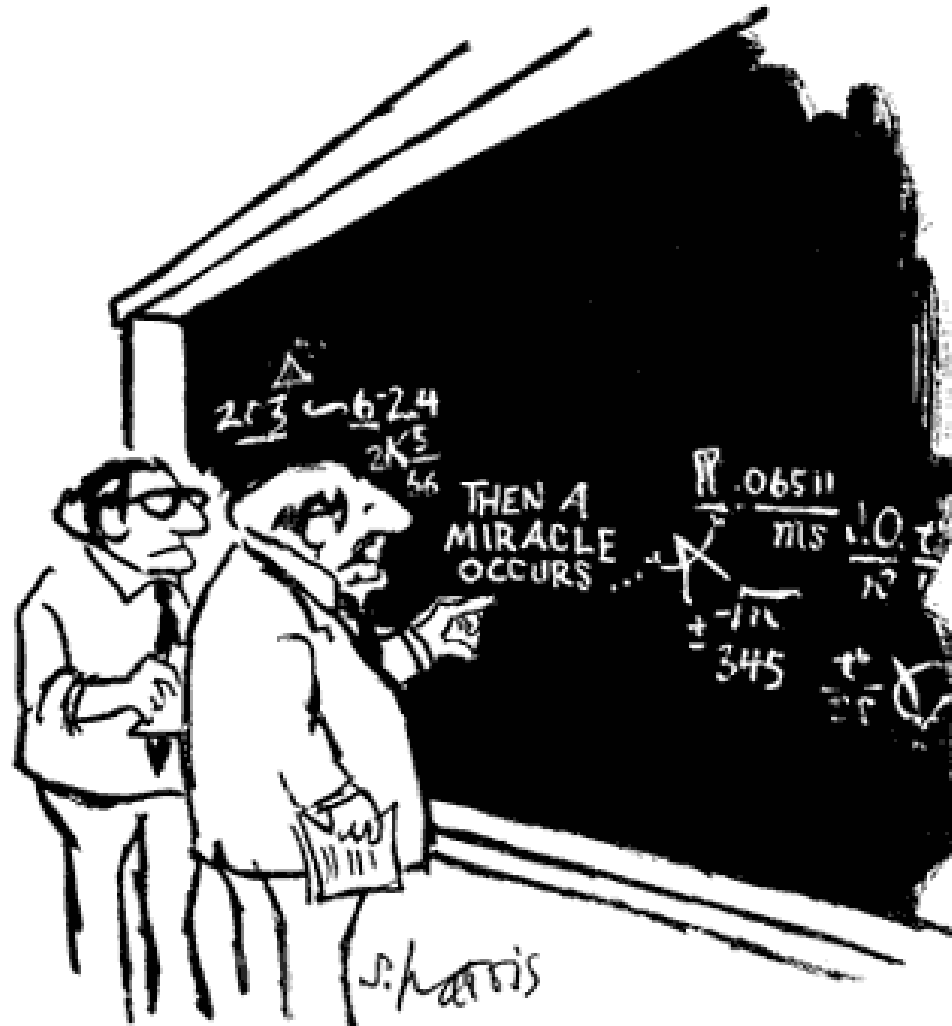
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BLUE MARBLE
GEOGRAPHICS

WHERE GIS DATA CONVERSION SOLUTIONS ARE BORN

Datum Transformations



"I think you should be more explicit here in step two."

A Datum is only a Datum

- Common confusion:
 - “Flavors” of a datum
 - NAD27-CONUS
 - NAD27-Mexico
 - NAD27-Canada
- These all represent the same datum, with differing *transformation* parameters relating it to WGS84

Transformation

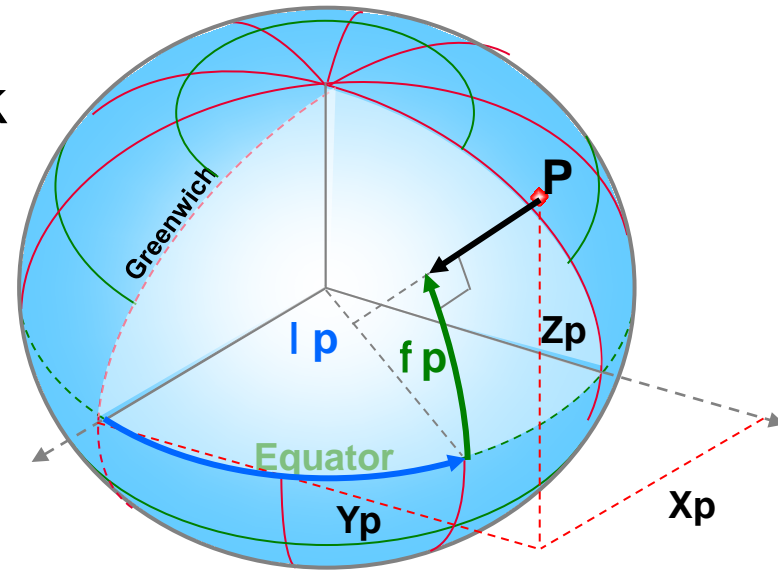
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Conversion

- The process changes your data

Methods of Transformation

- 3 Parameter: dX, dY, dZ
- 7 Parameter: $dX, dY, dZ, rX, rY, rZ, k$
 - 4 Parameter
 - 6 Parameter
 - 14 Parameter (Time Dependent)
- 10 Parameter Molodensky-Badekas
 $dX, dY, dZ, rX, rY, rZ, k, X, Y, Z$
- Grid based (HARN/NADCON, NTv2, OSTN02, ...)
- Horizontal Time Dependent Positioning (N. America)
- Polynomial Methods



7 Parameter Troubles

7 Parameter shifts have a special complication

Parameters: dX , dY , dZ , rX , rY , rZ , k

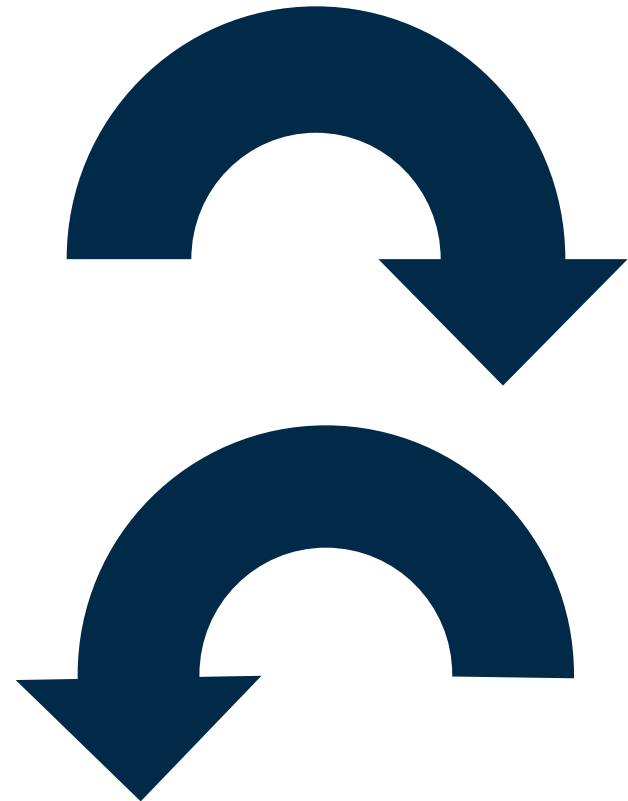
– **Rotation** parameters have two conventions

- If Position Vector Rotation has

- dX , dY , dZ , **rX , rY , rZ** , k

- Coordinate Frame Rotation

- dX , dY , dZ , **$-rX$, $-rY$, $-rZ$** , k



Direction of Transformation

- Common Transformations are to WGS84
 - When parameters are documented, the direction of the shift is fundamental.



Local Datum to WGS84

or

WGS84 to Local Datum?



- Signs of Shifts will Change!
 - Must be accounted for when defining new transformations

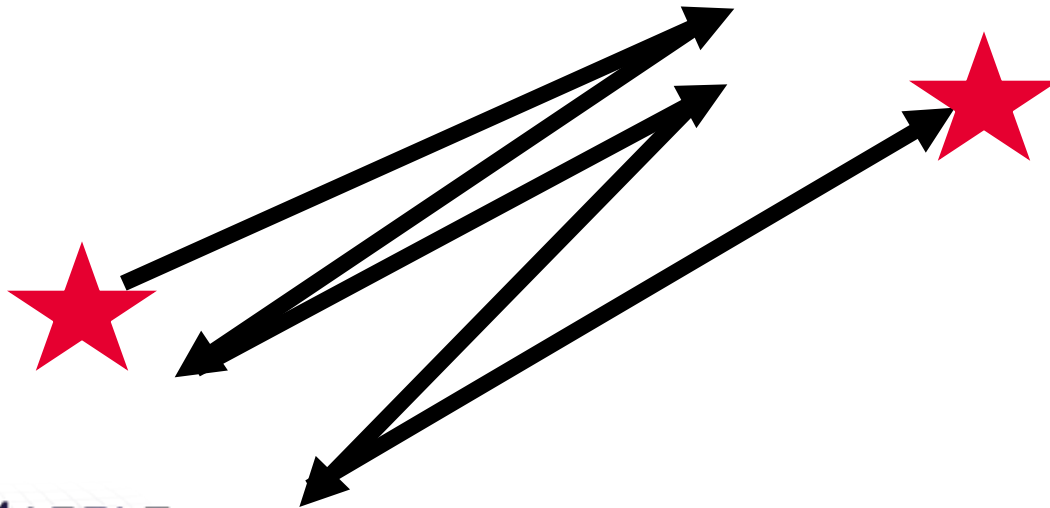
When do transformations occur?

- Inside the GPS
- Post-processing GPS data
- Data changing hands
- Importing to GIS project
- Exporting from GIS
- Putting it back into the GPS



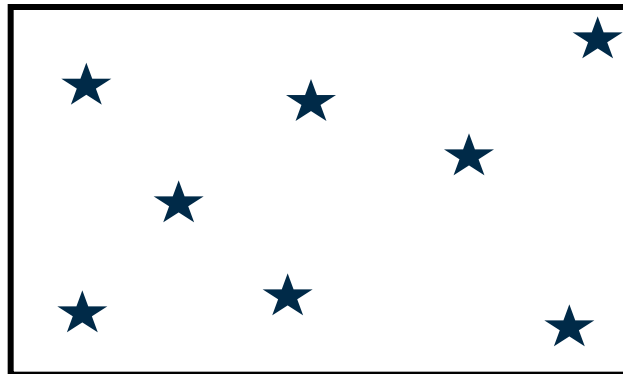
Repeated Transformations

- In exchanging spatial data with other users CRS requirements may change
 - Multiple transformations degrade the integrity of the data
 - Coordinates can “drift”, especially when differing (or poor quality) transformations are used



Geographically Appropriate

- Transformation parameters are derived from controls in a specific geographic area
- Your data must be within the same area to use those parameters.
- If your parameters were derived for a different area, the accuracy of your transformed data will be questionable



Transformations – NAD27 to NAD83



Only one of these is in the right place...

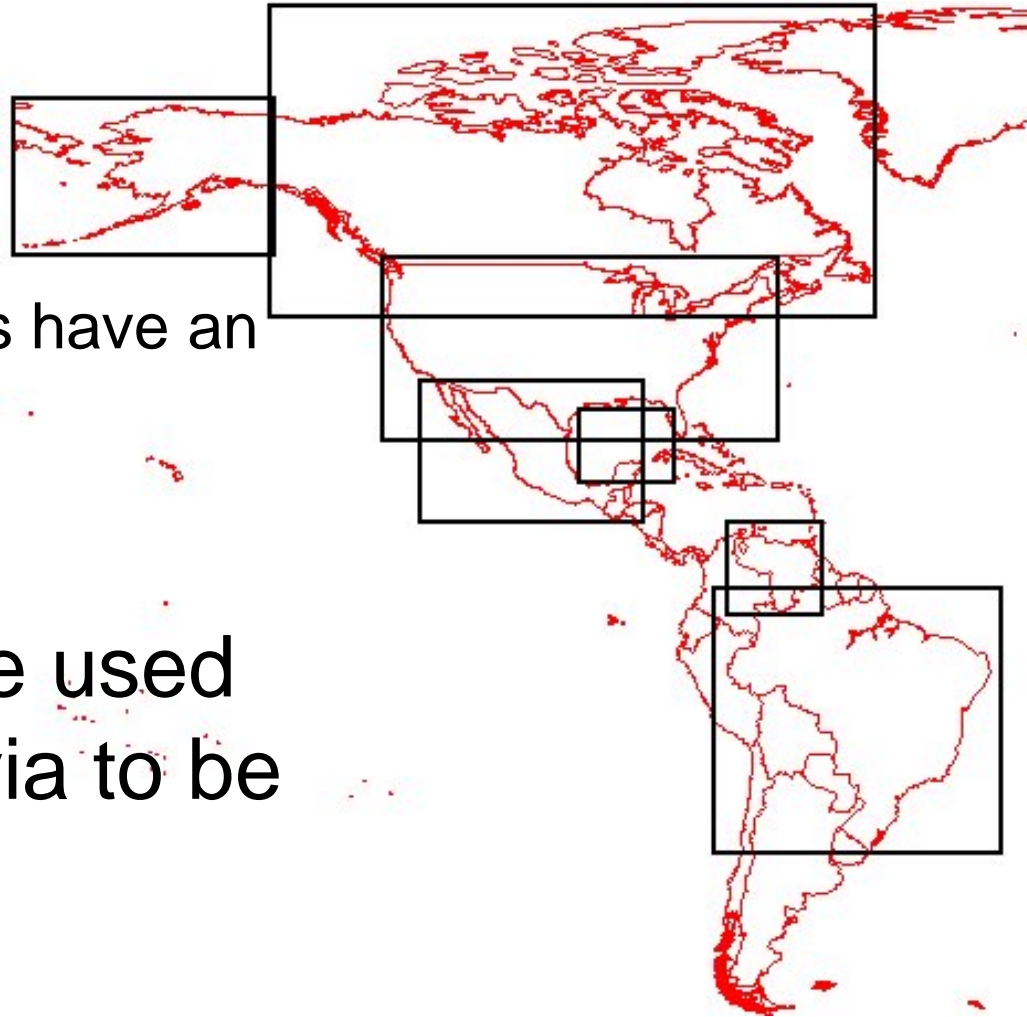


Areas of Use

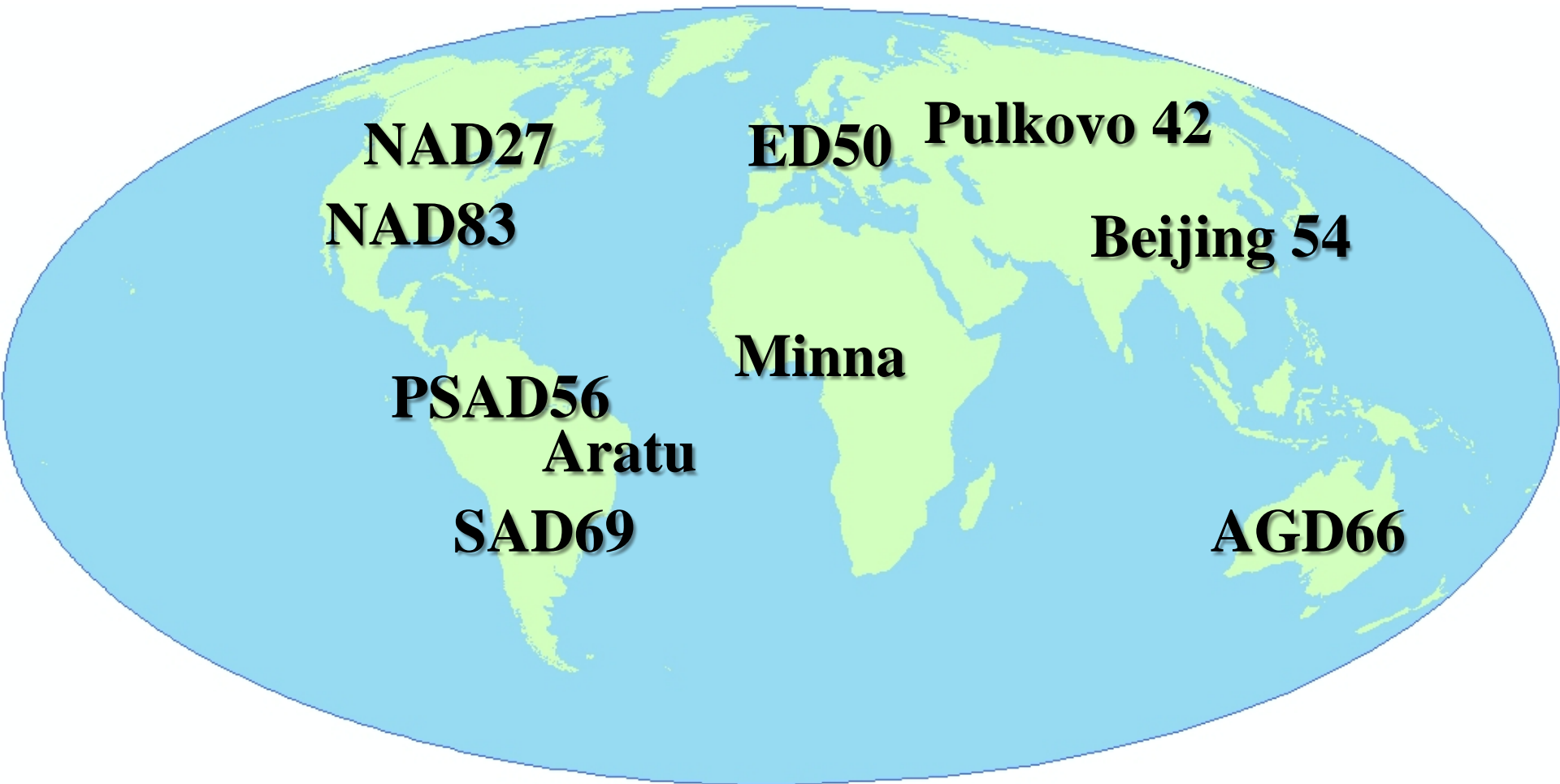
- Geographic Area of Use
 - Define where a set of parameters are useful and accurate
 - Can be assigned to geodetic parameters
- Have been published as Lat/Long bounding box
 - Polygons are more precise
 - Political boundaries
 - NTV2 grid files

Where do Areas of Use come from?

- **EPSG Dataset**
www.epsg-registry.org
 - All EPSG transformations have an Area of Use
 - Accuracy is published
- Area of Use has to be used for more than just trivia to be truly useful!



Datums to Give Care



Wrap up

- Know your datum
- Find out the parameters
- Understand the transformation method
 - Shift direction
 - Rotation sense
- Apply them in the right area
- Avoid multiple transformations

A globe of the Earth is centered in the image, showing the continents of North and South America, Africa, and Europe. The globe is surrounded by a dense shower of small, dark, rectangular confetti pieces that appear to be falling or flying around it. The background is a solid light gray color.

Thank you!
Questions?