



Coordinate systems and transformations in action

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Technical Workshop

Objectives

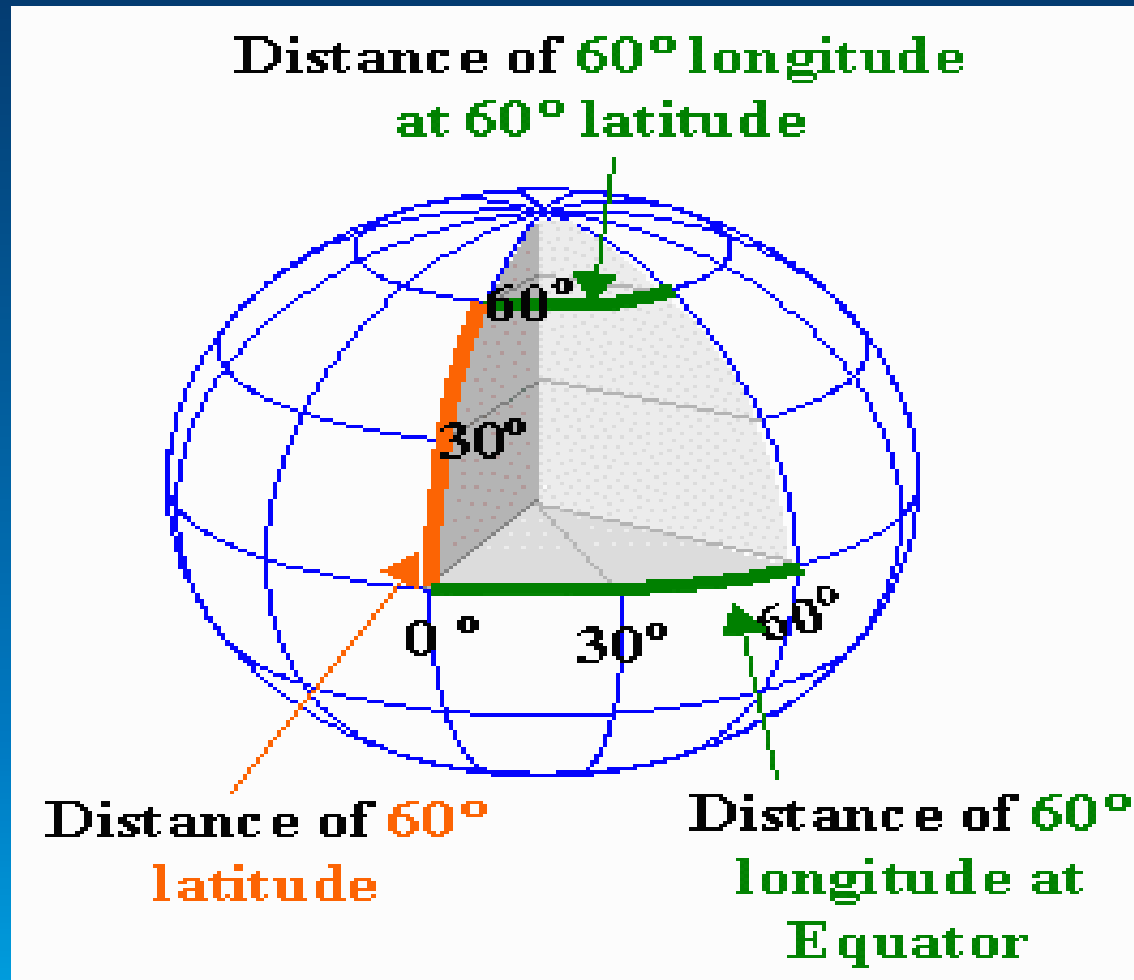
- **Coordinate systems**
 - **Geographic versus projected**
 - **Project considerations**
 - **'Gotchas'**
- **Identifying an unknown coordinate system**
- **Picking a geographic/datum transformation**

Session ID: 1408

Note: Presentation will be available on the Proceedings CD

Coordinate systems

Geographic coordinate system



Geographic coordinate system

(gcs, geogcs)

- Name
- Datum
 - Spheroid
- Prime Meridian
- Angular unit of measure

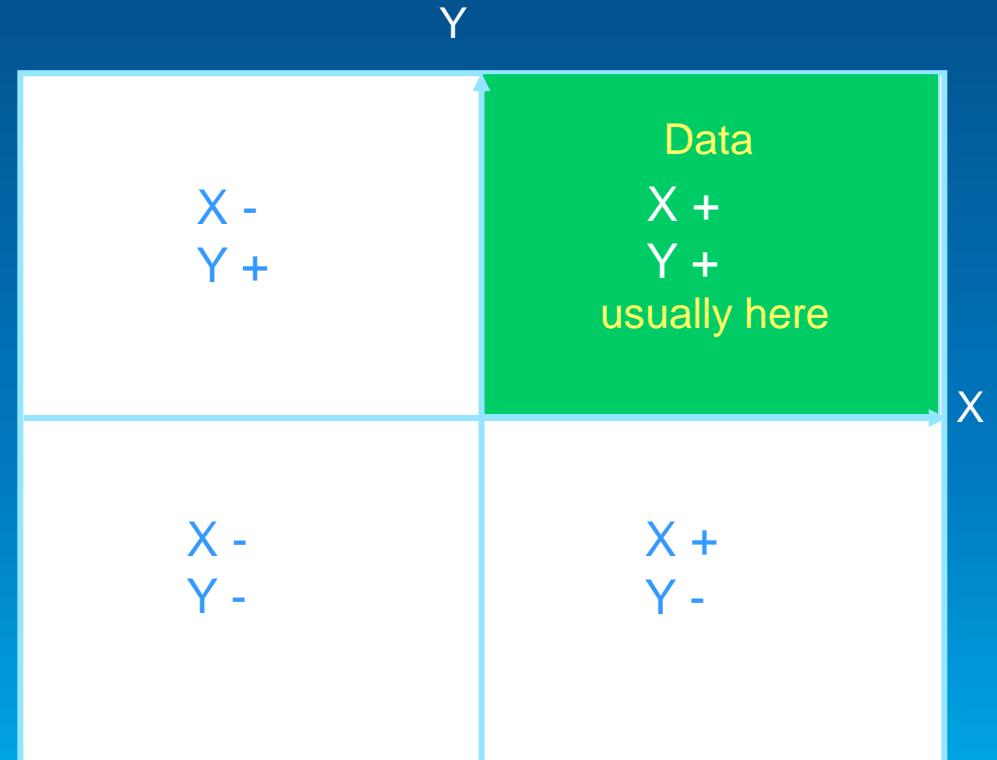
Geographic coordinate system

(gcs, geogcs)

- **Name (European Datum 1950)**
- **Datum (European Datum 1950)**
 - **Spheroid (International 1924)**
- **Prime Meridian (Greenwich)**
- **Angular unit of measure (Degrees)**

Projected coordinate system

- Linear units
- Lengths, angles, and areas are constant
- Shape, area, and distance may be distorted



Projected coordinate system

(pcs, projcs)

- Name
- GCS
- Map projection
- Projection parameters
- Linear unit of measure

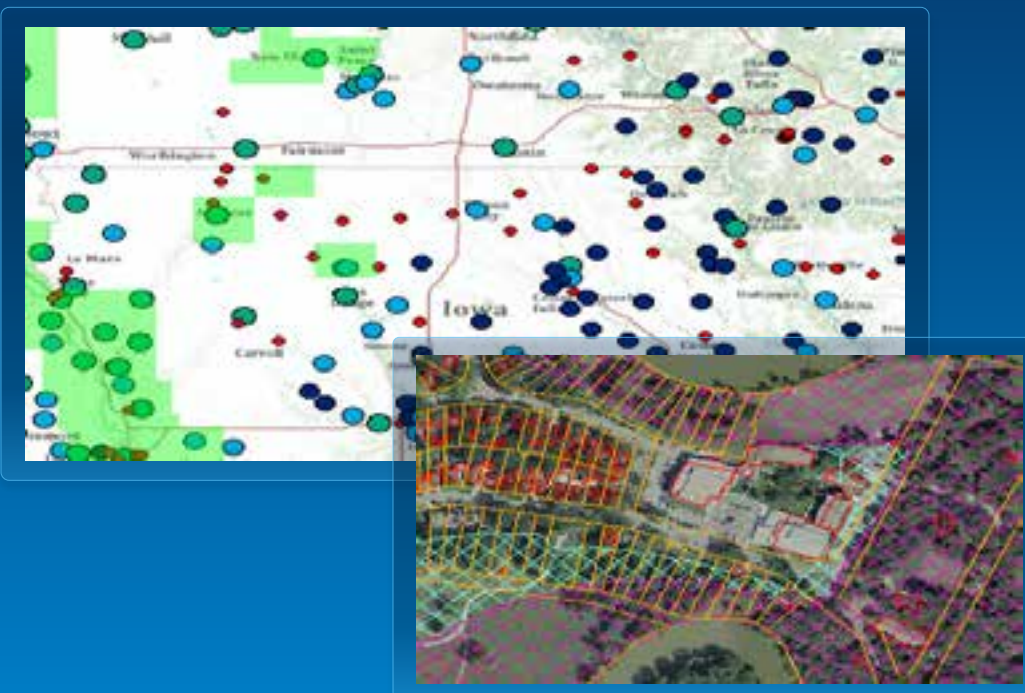
Projected coordinate system

(pcs, projcs)

- **Name (NAD 1983 UTM Zone 11N)**
- **GCS (NAD 1983)**
- **Map projection (Transverse Mercator)**
- **Projection parameters (central meridian, latitude of origin, scale factor, false easting, false northing)**
- **Linear unit of measure (Meters)**

Demonstration

Geographic versus Projected



Choosing the right coordinate system

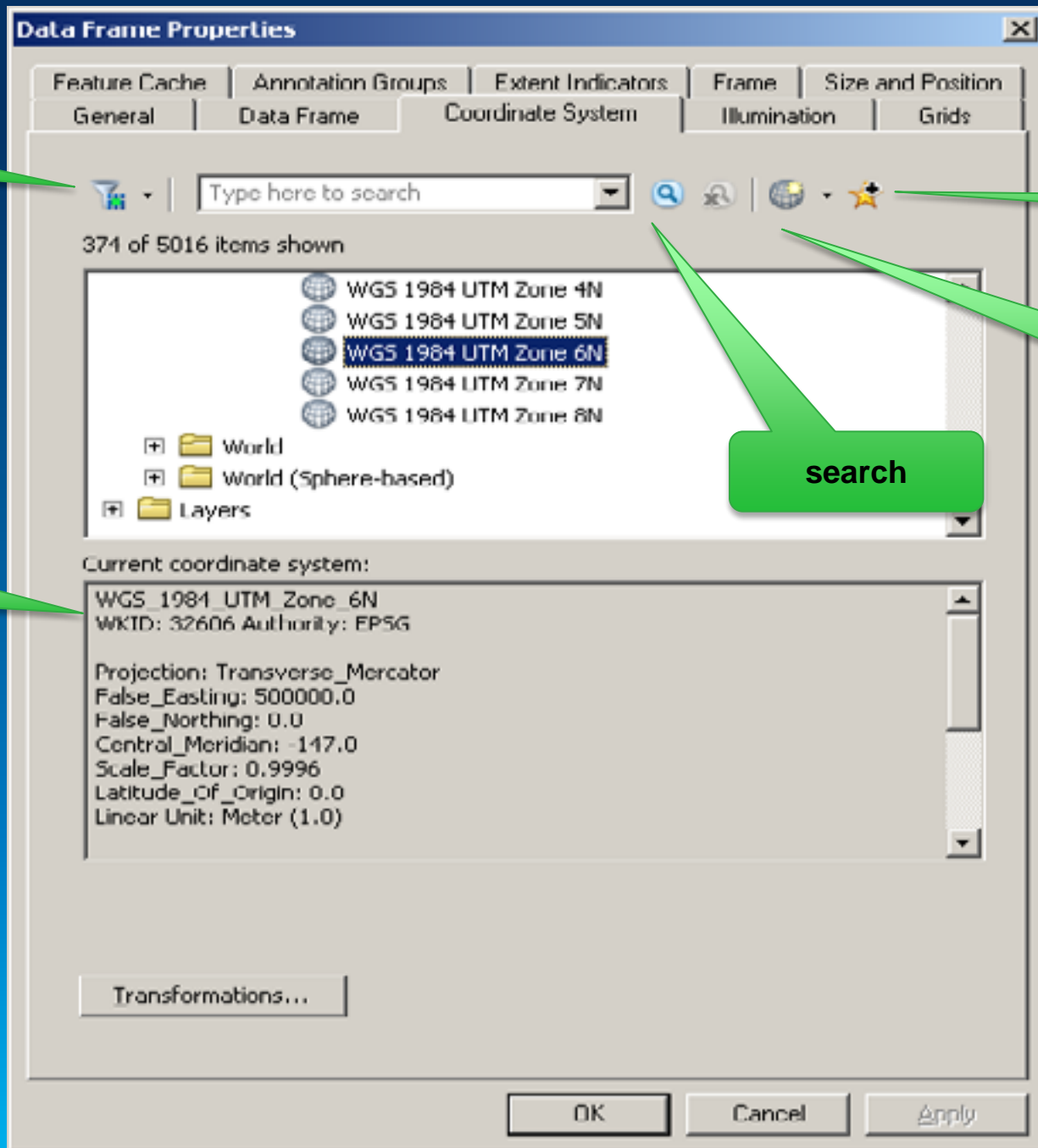
- **What does your boss think?**
- **What are other government agencies/partners using?**
- **For what purposes are the data going to be used?**
- **Minimize projecting data on the fly**
 - **Impacts performance**

Coordinate system gotchas

- **Defining a coordinate system updates the metadata ONLY**
 - Doesn't affect the coordinate values
 - Define data in its current coordinate system, then project
- **Datum transformations are important!**
 - Omit or choose the wrong one—up to 200 m
 - Multiple ones exist—up to you to decide which one is best
 - See Knowledge Base article #21327
- **Add XY Data tool uses the map's coordinate system by default**

What happened to the prj files?

- **Coordinate systems were stored as .prj files**
 - ArcGIS home\Coordinate Systems
- **At 10.1, virtual folder structure**
- **Search by area, name, WKID/code**
- **Favorites are usable everywhere**
- **Use Import to access your own prj files**



spatial filter

favorites

create or import
coordinate system

search

well-known ID

Transformations...

OK

Cancel

Apply



Demonstration

Improved coordinate system dialogs

Unknown coordinate systems

Unknown coordinate systems

- **ALWAYS** define the coordinate system
- **Good professional practice - help your successor**
- **Units are unknown**
- **Map scale is incorrect**
- **Geodatabase tools can't use default values**

What if I don't know my data's coordinate system?

- Check the data provider or source
- Check any existing metadata
- Similar data types
- What coordinate systems are used in the area?
 - <http://www.epsg.org>
 - <http://www.epsg-registry.org>

What if I don't know my data's coordinate system?

- Try using ArcMap to figure it out

- See Knowledge Base article 24893

HowTo: Identify an unknown coordinate system using ArcMap

- Live Training Seminar (free)

Working with Map Projections and Coordinate Systems in ArcGIS

http://training.esri.com/acb2000/showdetl.cfm?did=6&Product_id=826&2

Familiarize yourself with common coordinate systems

- Know what ones are used in the area
- Learn what the layer extents should be

San Diego, California		
NAD 1983	X / longitude	Y / latitude
Geographic	-116.67 °	33 °
UTM zone 11N	530,000 m	3,650,000 m
State Plane (California zone 6)	1,960,000 m	593,000 m

Real world example

- **Longitude: -88.365934**
Latitude: 28.738369

Calculated NAD 27 XY Coords:

Longitude: 10431702.916855

Latitude: 1202802.892336

What do you know?

decimal degrees

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Latitude: 28.738369

Calculated NAD 27 XY Coords:

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In the U.S.

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No units

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X or Y?

No units

Demonstration

Identifying Unknown Data



Geographic (datum) transformations

Geographic transformations

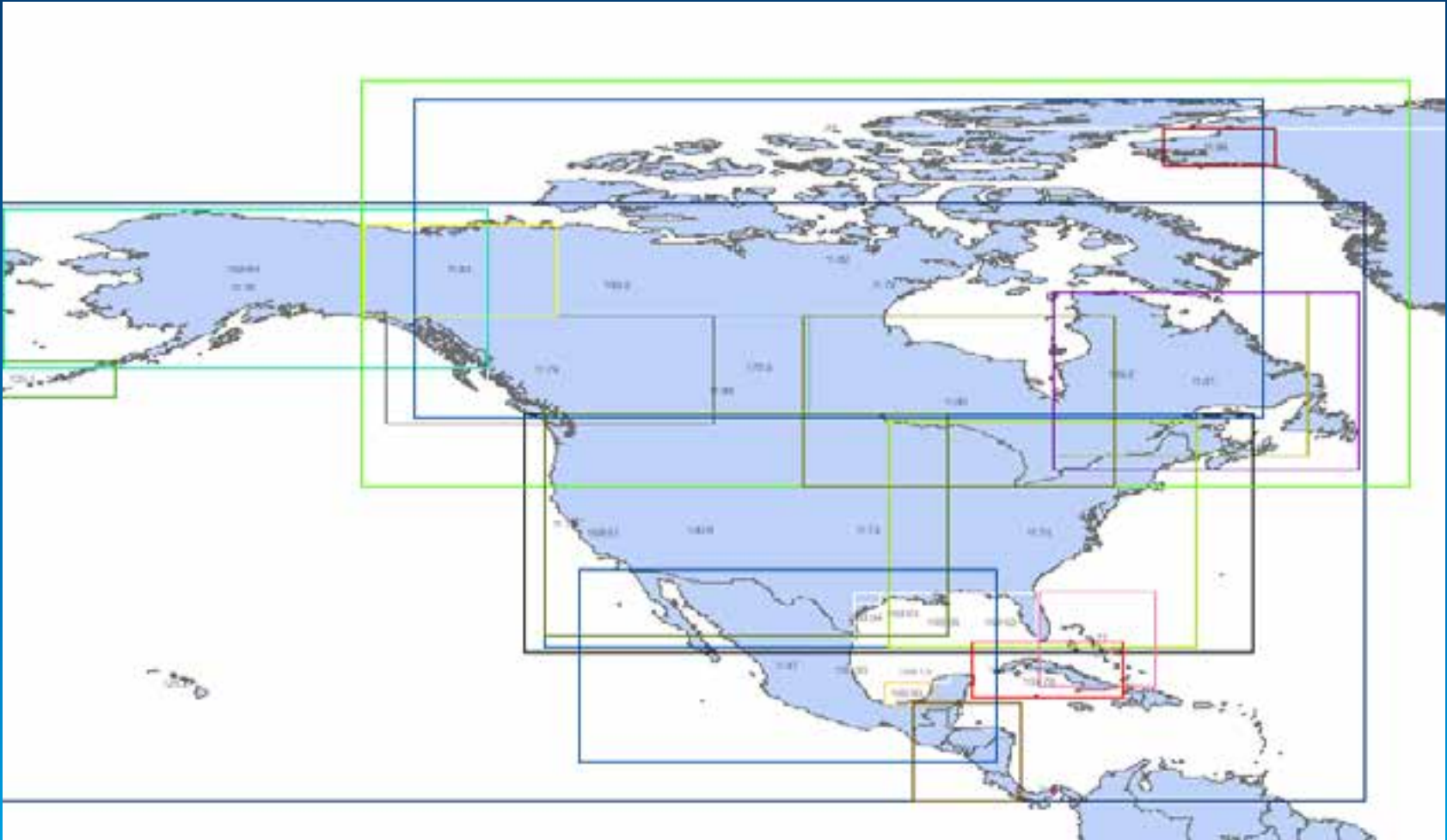
- Convert between two geographic coordinate systems
- Offsets can be significant

San Diego, California		
Geographic	Longitude	Latitude
NAD 1927	-116.6691455 °	32.9999533 °
NAD 1983	-116.6700000 °	33.0000000 °
NAD 1983 HARN	-116.6700004 °	33.0000000 °

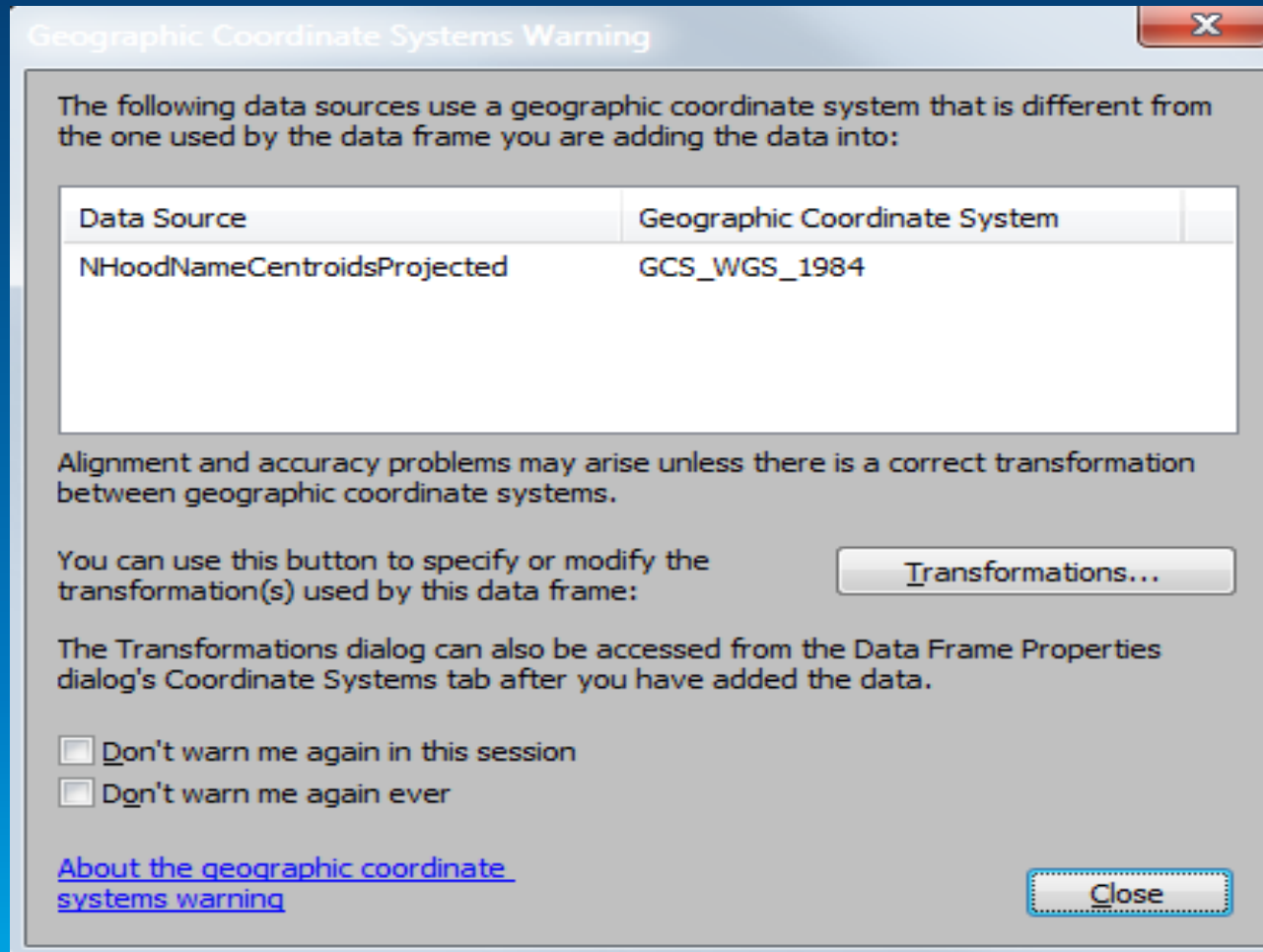
Datum transformations are important!

- **Omit or choose the wrong one—up to 200 m**
- **Multiple ones exist**
 - up to you to decide which one is best
- **See Knowledge Base article #21327**

Transformations in North America



Warning: different geographic coordinate system...

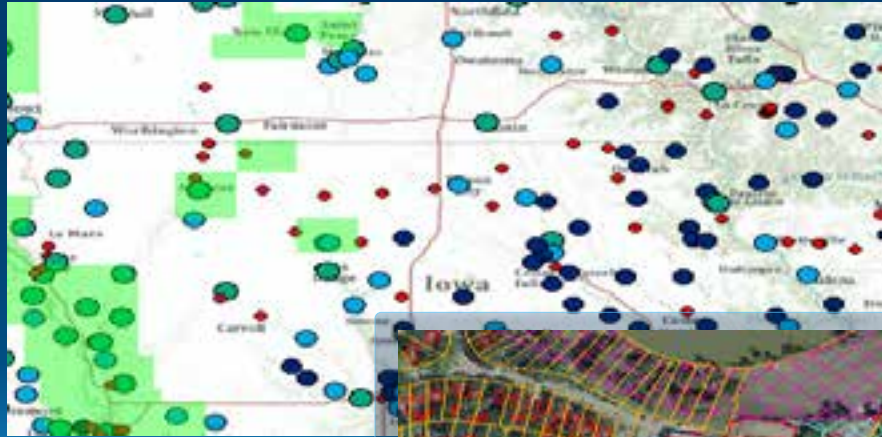


Services and coordinate systems

- **If publishing through ArcMap, set up transformations there**
 1. **Change the coordinate system of the data frame or add data in 'other' GCS**
 2. **Set the appropriate transformation**
 3. **Change back the data frame's coordinate system or remove the data**
- **Server will use the transformation Server if data is requested in that coordinate system**

Demonstration

Working with Geographic Transformations



Wrap-up

More information

- **Don't forget the Knowledge Base!**
 - <http://support.esri.com>
 - 23025, 29129, 24893, 29035, 17420
- **ESRI forums for user-to-user help**
 - <http://forums.arcgis.com>
- **Virtual Campus**
 - <http://campus.esri.com>
 - Live Training Seminar and Course
- <http://www.epsg.org>
 - Database of coordinate systems & datums
 - *Guidance Note 7-2*

Books, etc.

- **Maher.** *Lining Up Data in ArcGIS*
- **Meyer.** *Introduction to Geometrical and Physical Geodesy*
- **Snyder.** *Map Projections: A Working Manual*
 - http://pubs.er.usgs.gov/djvu/PP/PP_1395.pdf
- **Flacke & Kraus.** *Coordinate systems in ArcGIS*
- **Snyder & Voxland.** *An Album of Map Projections.* **USGS PP 1453**
 - <http://infotrek.er.usgs.gov/pubs>
- **Iliffe and Lott.** *Datums and Map Projections*

Thank you...

- **Please fill out the session survey:**

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Paper – pick up and put in drop box



Understanding our world.