

DATUM TRANSFORMATIONS INVOLVING WGS84

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OVERVIEW: In order to project data from one datum to another, it is necessary to specify the appropriate geographic transformation. For a list of geographic transformations to use in specific geographic areas, users can visit:

<http://support.esri.com/index.cfm?fa=knowledgebase.techarticles.articleShow&d=21327>

Click on the [ArcGIS Projection Engine v.9.x Datum transformation methods and appropriate geographic areas](#) link in the related information at the bottom of the page.

For example, to transform between WGS 84 and NAD 83, the geographic transformation method that should be used (in ArcGIS 9.1) in the United States is:

NAD_1983_To_WGS_1984_5

A SPECIAL CASE WITH WGS84: WGS84 is a geoid based datum, whereas NAD83 and NAD27 are ellipsoid based datums. Ellipsoid based datums are three parameter datums (describing X, Y, and Z axes at the center of the earth). The seven parameter datum describes the origin (X, Y, and Z) as well as the rotation about each of the three axes along with difference in scale. Transform between three and seven parameter datums is therefore rather tricky, requiring very well written algorithms with regional specificity.

HOW TO: To apply a geographic transformation during projection, open Arc Toolbox and go to Data Management Tools, Projections and Transformations, Feature, and Project. In the wizard that pops up, specify your input and output datasets, and the coordinate system you want to project the data into. If a change in datum is required, the geographic transformation box will load with various options to choose from. If these options are not activated, you probably need to define the geographic reference for the input dataset.

A PROBLEM: Previous versions of ArcGIS did not have a reliable geographic transformation between WGS 84 and NAD 83. As a result, many users have relied upon Trimble Pathfinder Office software to perform these transformations. As it has been previously determined that this transformation process functioned correctly, we will henceforth refer to these transformations as the *Reference*. Using this process however, was somewhat cumbersome as it may require additional import/export steps.

AN EXPERIMENT: On 8/11/05, we compared transformation results between *Reference* Trimble Pathfinder Office and ArcGIS 9.1 (using methods described above). We found very little difference in the locations/positions of the two polygon shapefiles. The ArcGIS 9.1 polygons were offset only 0.5 cm south and 0.7 cm west of the *Reference* polygons. Note: In this observation we had no absolute ground truth for where the exact location of the shapefile should have been, rather we are assuming that output from Trimble's software is a reliable standard. Therefore this is an experiment in relative accuracy.