

# GIS in Water Resources

Fall 2016

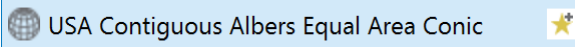
## Homework #1

### Goal

The goal of this homework is to reinforce the lecture material on Geodesy, Map Projections and Coordinate Systems by having you identify attributes and perform hand calculations related to coordinate systems and distances between points on a spherical earth.

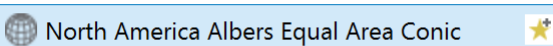
### 1. Map Projection Parameters

In Exercise 3, you have used two forms of the Albers Equal Area Projection:

(1) The 

Layer Properties: Basin

General	<b>▼ Spatial Reference</b> <table border="1"><tr><td>Projected Coordinate System</td><td>NAD 1983 Albers</td></tr><tr><td>Projection</td><td>Albers</td></tr><tr><td>WKID</td><td>0</td></tr><tr><td>Authority</td><td></td></tr><tr><td>Linear Unit</td><td>Meter (1.0)</td></tr><tr><td>False Easting</td><td>0.0</td></tr><tr><td>False Northing</td><td>0.0</td></tr><tr><td>Central Meridian</td><td>-96.0</td></tr><tr><td>Standard Parallel 1</td><td>29.5</td></tr><tr><td>Standard Parallel 2</td><td>45.5</td></tr><tr><td>Latitude Of Origin</td><td>37.5</td></tr><tr><td>Geographic coordinate system</td><td>GCS North American 1983</td></tr></table>	Projected Coordinate System	NAD 1983 Albers	Projection	Albers	WKID	0	Authority		Linear Unit	Meter (1.0)	False Easting	0.0	False Northing	0.0	Central Meridian	-96.0	Standard Parallel 1	29.5	Standard Parallel 2	45.5	Latitude Of Origin	37.5	Geographic coordinate system	GCS North American 1983
Projected Coordinate System		NAD 1983 Albers																							
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False Easting		0.0																							
False Northing		0.0																							
Central Meridian		-96.0																							
Standard Parallel 1		29.5																							
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Latitude Of Origin		37.5																							
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▼ Spatial Reference

Projected Coordinate System	North America Albers Equal Area Conic
Projection	Albers
WKID	102008
Authority	Esri
Linear Unit	Meter (1.0)
False Easting	0.0
False Northing	0.0
Central Meridian	-96.0
Standard Parallel 1	20.0
Standard Parallel 2	60.0
Latitude Of Origin	40.0
Geographic coordinate system	GCS North American 1983

- (a) What earth datum is used in these coordinate systems?
- (b) What map projection is used in these coordinate systems?
- (c) Prepare a map showing the outline of the continental United States for each projection. Show on the map the Central Meridian, Latitude of Origin and the Standard Parallels. Use the Web Mercator view to draw these lines. Some additional information to help with doing this is given at: <http://www.caee.utexas.edu/prof/maidment/giswr2016/Visual/LivingAtlas.pptx>
- (d) The geographic coordinates of UT Austin are: 30° 17' 10" N and 97°44' 22" W. Assuming a spherical earth with radius 6371.0 km, calculate the distances in meters that UT Austin is south of the latitude of origin and west of the central meridian for the **NAD83 Albers** projection (the first of the two given above).
- (e) Create a point feature for UT Austin in geographic coordinates and use ArcGIS Pro to project its location to the NAD83 Albers projection. Use the **Add XY Coordinates** function in ArcGIS Pro to find its projected coordinates. Compare those with the ones you worked out in part (d) assuming a spherical earth.
- (f) Take the **Basin** feature class used in Exercise 3 and find its **Shape\_Length** and **Shape\_Area** in both of the above map projections. Are these quantities the same in both projections?

## 2. Sizes of DEM Cells

The National Water Model uses 1 km cells to describe the land-atmosphere water balance on the earth's surface. The locations of UT Austin and USU Logan, are shown below. Assuming the earth is spherical with a radius of 6371 km, determine the equivalent lengths of the lines AB and BC in decimal degrees at these locations.



University of Texas at Austin

$30^{\circ}17'10''\text{N}, 97^{\circ}44'22''\text{W}$



Utah State University

$41^{\circ}44'54''\text{N}, 111^{\circ}48'30''\text{W}$

