

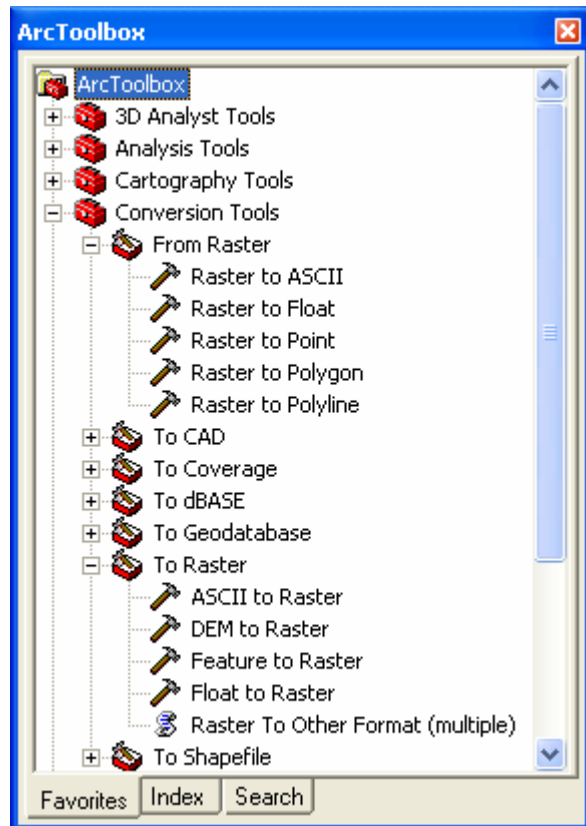


# **Geoprocessing and georeferencing raster data**

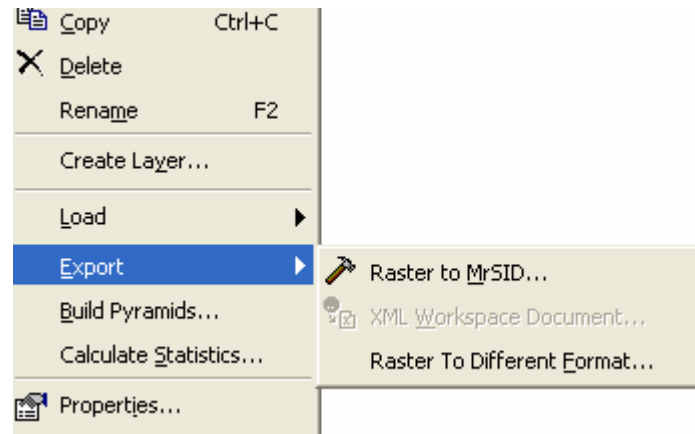


# Raster conversion tools

## Geoprocessing tools

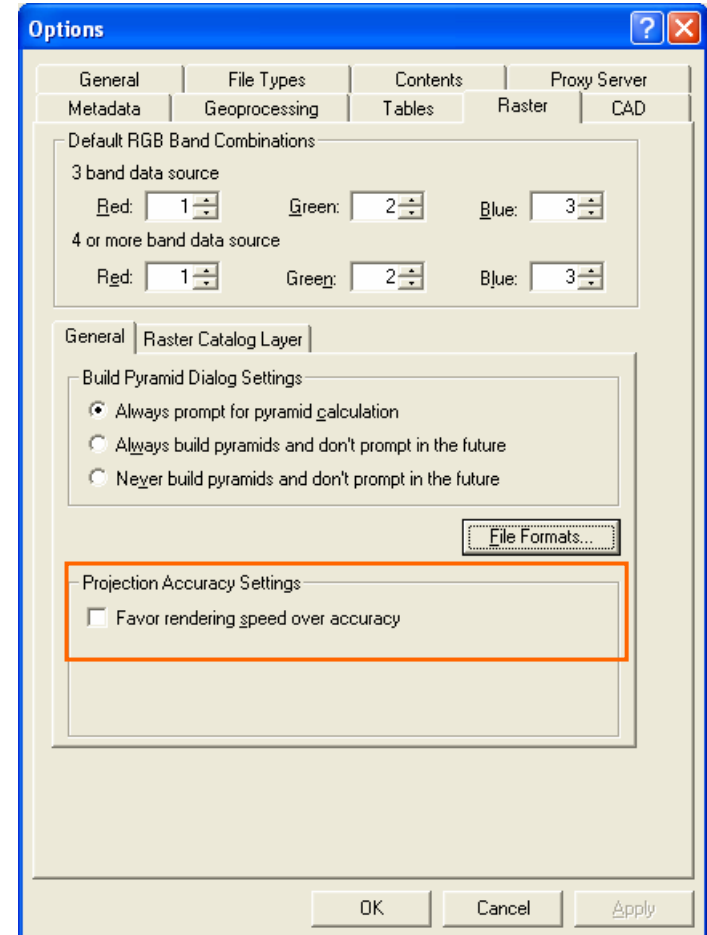


## ArcCatalog tools



# ArcMap - raster projection options

- ❑ Best situation - all inputs have same spatial reference
- ❑ Simple or robust algorithm choice
- ❑ Applies projection on the fly
  - Projection of data frame or first layer
- ❑ Export option - data frame or original projection
  - Various export formats



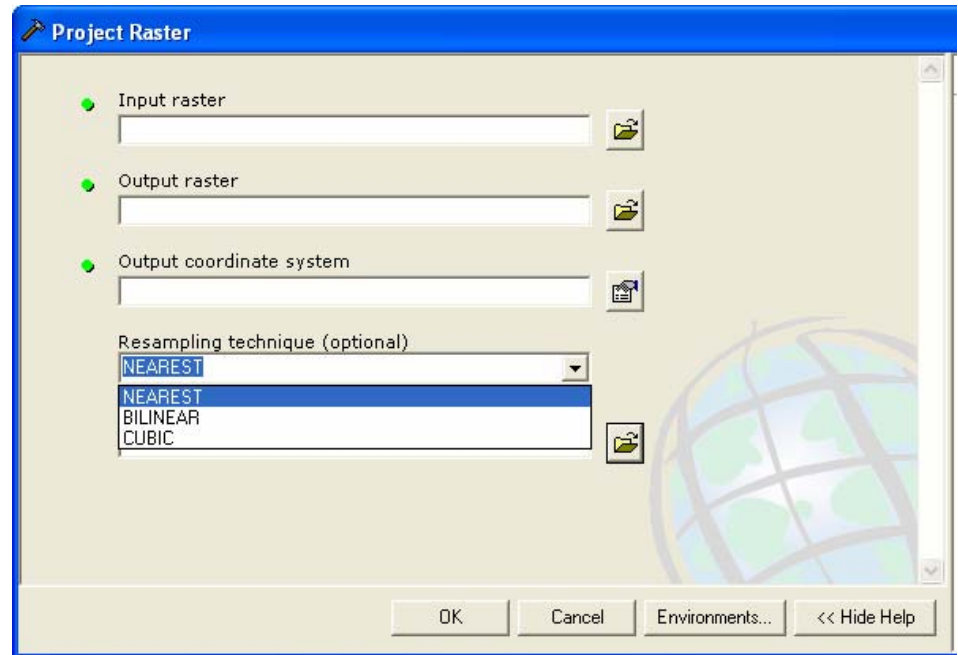
# Geoprocessing - raster projection

## ❑ Data Management Tools - > Projections

- Best raster projection tool
- Use resample method
  - Nearest neighbor
  - Bilinear interpolation
  - Cubic convolution
- Option to specify registration points
  - origin point for anchoring output cells

## ❑ Geoprocessing environment

- General settings for geoprocessing
- Applied to all output rasters



# Conversion on the fly

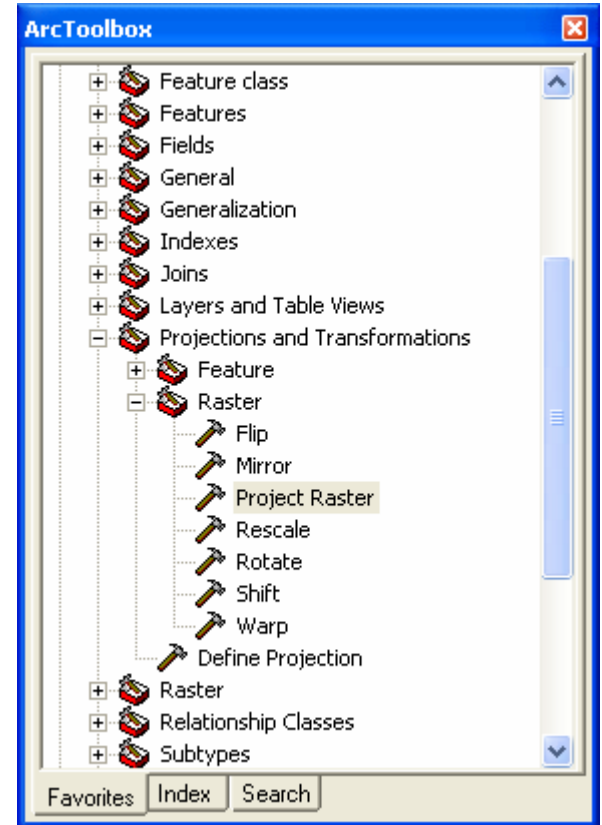
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- ❑ **Many functions accept feature or raster data as input**
  - Feature data automatically converted when necessary
  
- ❑ **Non-grid rasters converted to grid for analysis**
  - Consider converting compressed data before processing

# Geoprocessing - raster tools

## □ Tools to:

- Flip raster along horizontal axis.
- Flip raster along vertical axis.
- Converts between two coordinate systems.
- Scale by the specified x and y
- Rotate around a specified point by a specified angle
- Shift by specified x and y shift
- Transform using links



# Conversion: polygon to raster

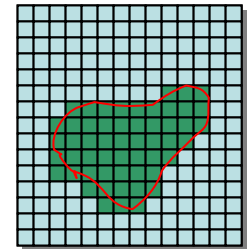
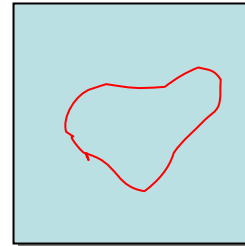
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## ❑ Convert using string or numeric field

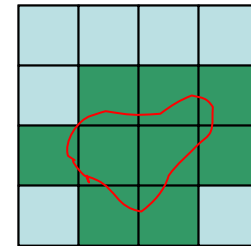
- Unique attributes assigned value in the output raster
- Conversion field added to VAT

## ❑ May results in:

- Loss of detail
  - Smaller cell size — better representation
  - Larger cell size — more generalization
- Loss of topological relationships



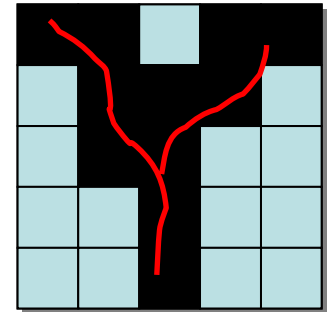
100m



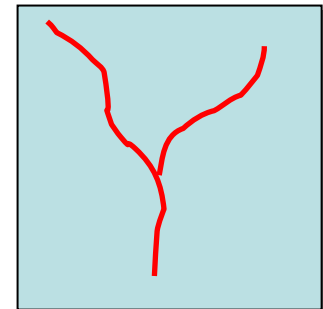
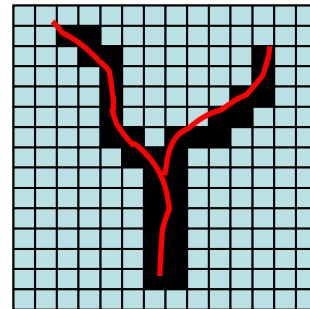
400m

# Conversion: line to raster

- ❑ Identifies raster cell crossed by the line
  - Codes cells with the attribute value associated with line
  - if more than one value for a cell
    - longest arc used
- ❑ Cell size should be
  - Average width of the linear features



Lines





# Conversion: Point to raster

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## ❑ Method:

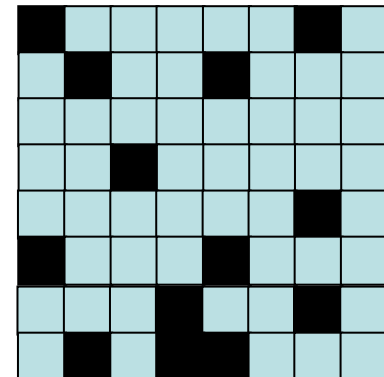
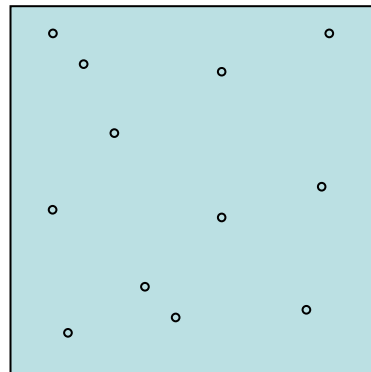
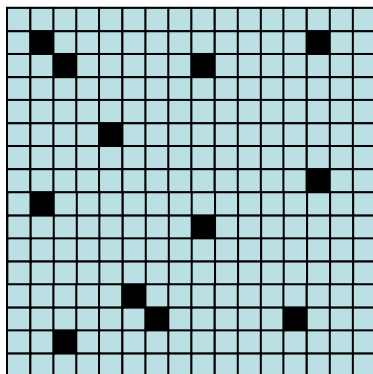
- Cell with center closest to point  $xy$  - coded with attribute of point

## ❑ NoData assigned if no point available.

## ❑ Cell size — overriding factor

## ❑ Note:

- Most often interpolate  $z$  values for points, not convert
- Seldom can original points be retrieved from converted raster without loss



# Conversion: Raster to feature

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## ❑ Raster to polygon

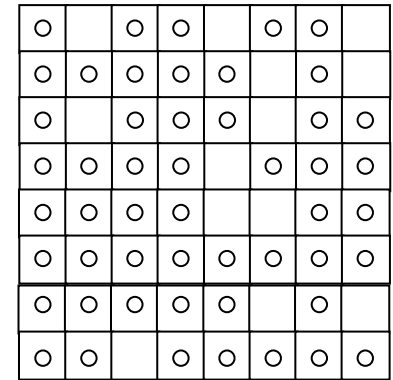
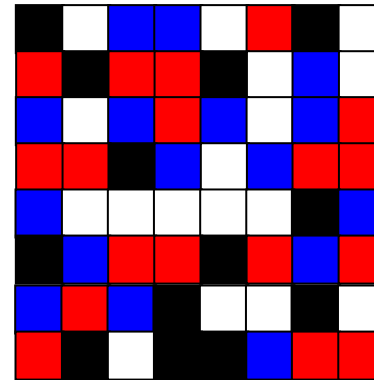
- Regions vector polygons
- Cell size controls “blockiness”
- Deploy raster generalization to reduce “stair-step” effect

## ❑ Raster to lines

- Stream to feature tool

## ❑ Raster to Point

- center of cell
- defines point feature XV

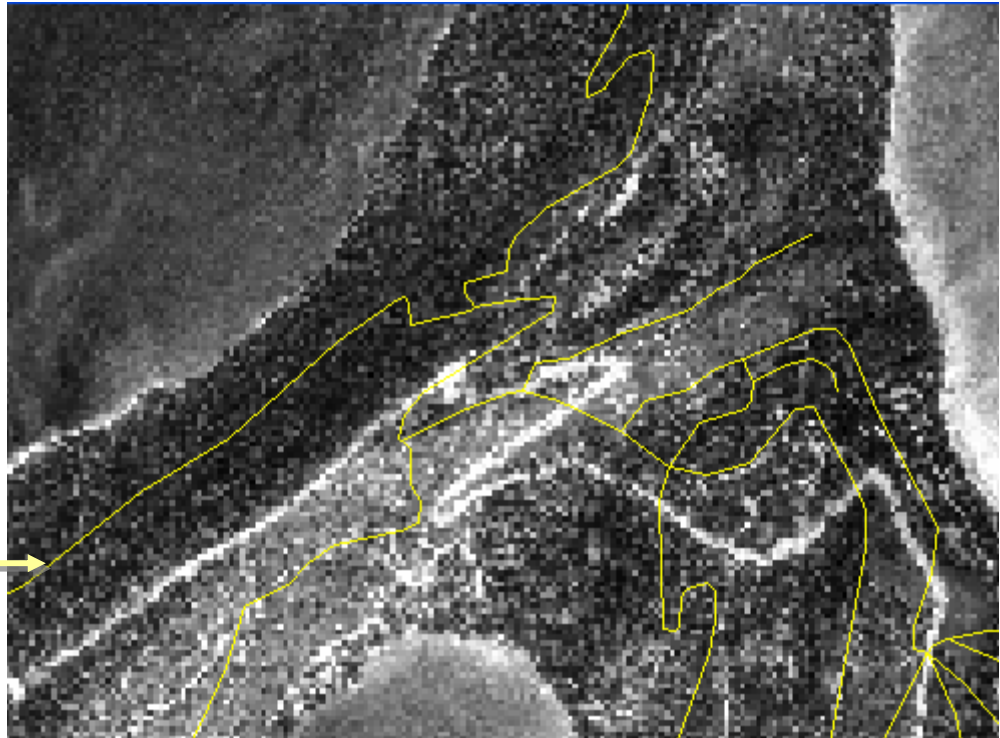


# Georeferencing a raster

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Image: Not georeferenced

Vector Data

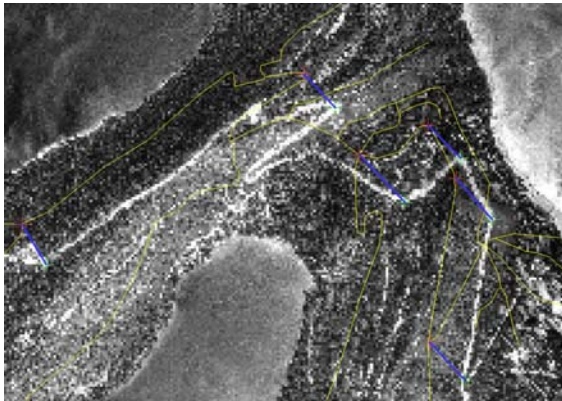


# Georeferencing steps

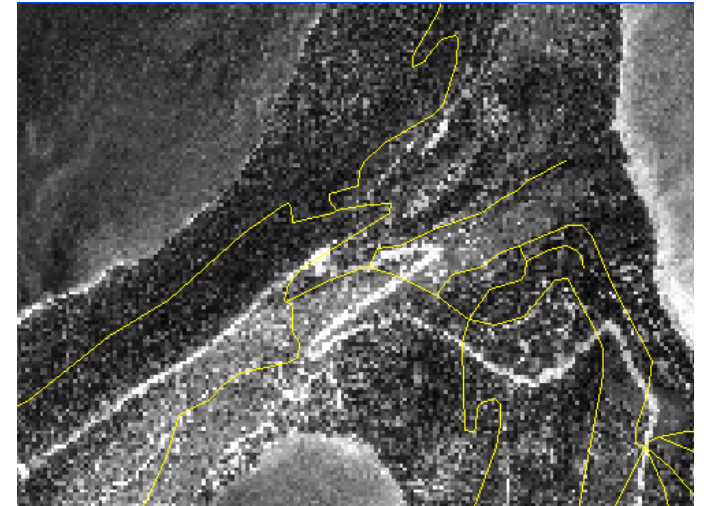
1. Add Georeferencing toolbar



3. Establish Links



2. Add Layers



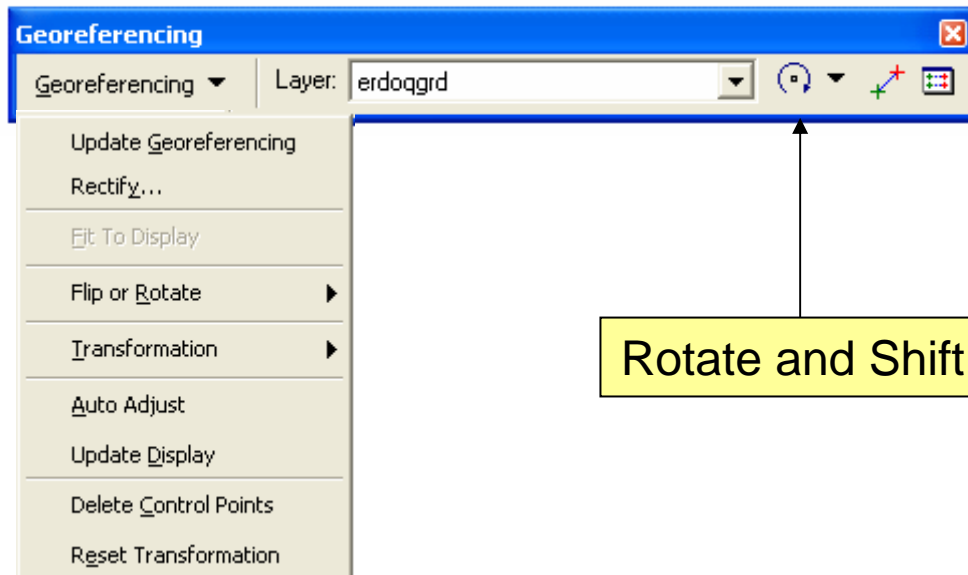
4. Assess Accuracy

5. Save Transformation  
Update georeferencing  
Rectify

# Georeferencing toolbar

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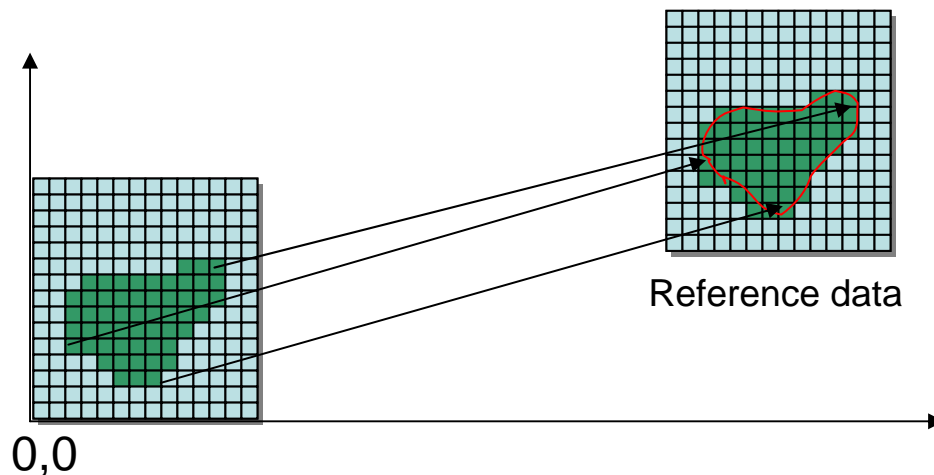
- ❑ Component of ArcGIS deployed in ArcMap.
- ❑ Does not require ArcGIS Spatial Analyst



# Establishing links

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- ❑ Links used to tie unreferenced raster to geo-referenced source data
- ❑ Requires:
  - At least three links
  - Evenly distributed over the entire raster
- ❑ Choose Link features that will not change position with time



# Assessing accuracy of links

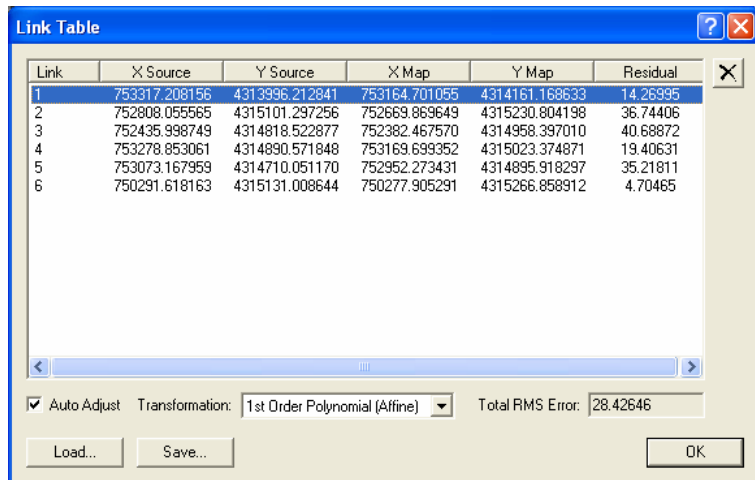
## ❑ The Link Table

- Shows accuracy of transformation
- Reports residual error of each link and RMS error for whole image

## ❑ RMS error depends on

- Raster cell size
- Accuracy in adding links

$$\text{RMS} = \sqrt{\frac{E_1^2 + E_2^2 + \dots + e_n^2}{n}}$$



The screenshot shows a 'Link Table' dialog box with a table of link data and transformation settings. The table has columns for Link, X Source, Y Source, X Map, Y Map, and Residual. The data is as follows:

Link	X Source	Y Source	X Map	Y Map	Residual
1	753317.208156	4313996.212841	753164.701055	4314161.168633	14.26995
2	752808.055565	4315101.297256	752669.869649	4315230.804198	36.74406
3	752435.998749	4314818.522877	752382.467570	4314958.397010	40.68872
4	753278.853061	4314890.571848	753169.699352	4315023.374871	19.40631
5	753073.167959	4314710.051170	752952.273431	4314895.918297	35.21811
6	750291.618163	4315131.008644	750277.905291	4315266.858912	4.70465

Below the table, there are checkboxes for 'Auto Adjust' (checked) and 'Transformation' set to '1st Order Polynomial (Affine)'. The 'Total RMS Error' is displayed as 28.42646. At the bottom, there are 'Load...', 'Save...', and 'OK' buttons.

# Initiating transformation

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## ❑ Final stage of alignment

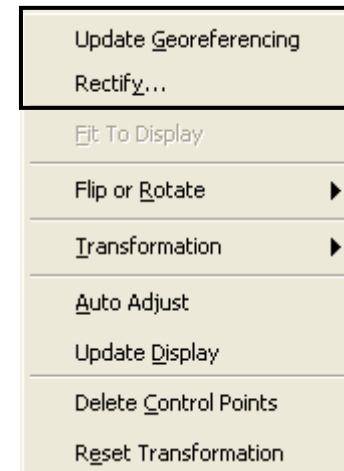
- Two choices

## ❑ Update Georeferencing

- Transformation information stored with raster and used when displayed or analyzed
- No resampling of original data

## ❑ Rectify

- Raster is resampled
- New output created

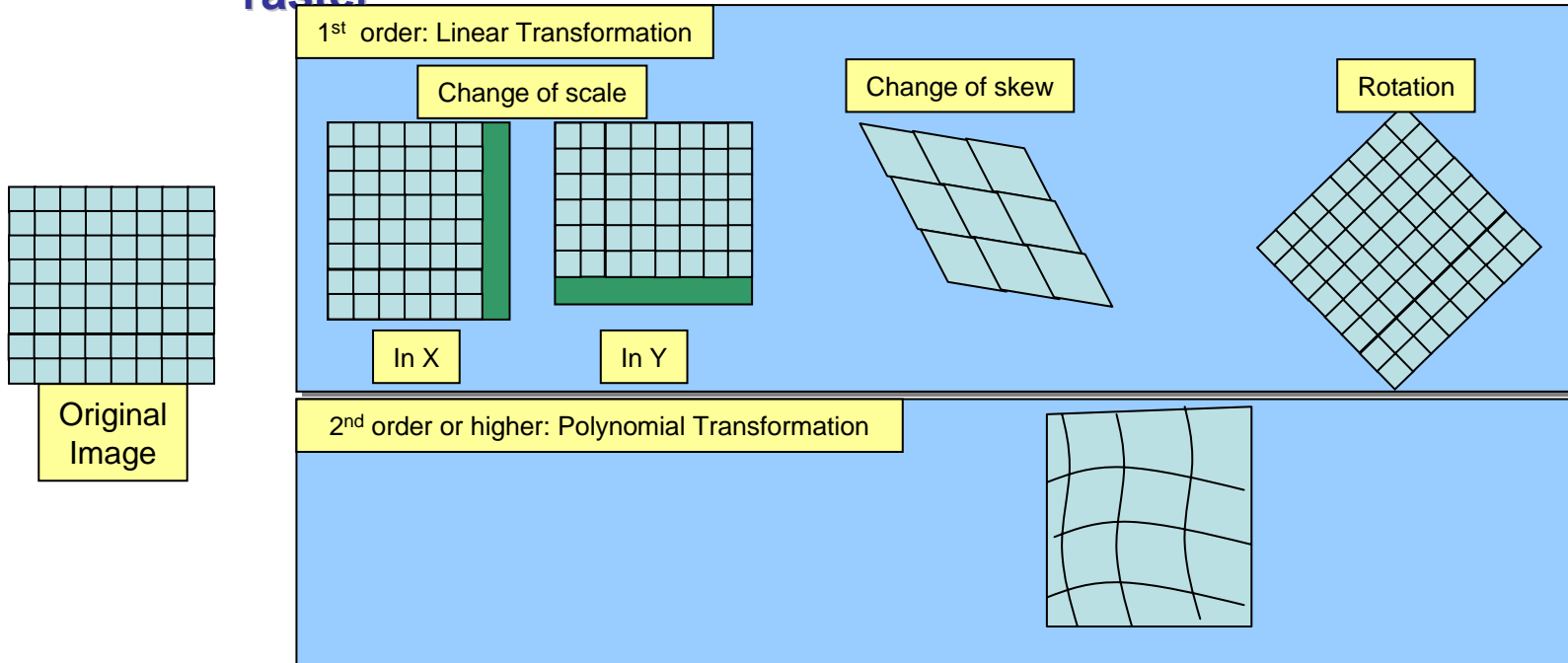




# Transformation process

## ❑ Applies polynomial equation to unreferenced raster

- Source coordinates converted to rectified coordinates
- Transformation complexity determined by:
  - polynomial order number of links and distortion of source raster



# **The Rectification process**

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- ☐ **Creates output raster from link positions**
- ☐ **Resamples source raster**
- ☐ **Fits source raster to output raster**