- Separate 2D waves by omitting the /LR3D flag
- A single 3D wave by using the /LR3D flag

When you use /LR3D, ImageLoad stores each image from the TIFF file in a layer of the 3D output wave. This option works with grayscale images only, not with full color (e.g., RGB).

**EXIF Metadata**

Some applications embed metadata (information about the image) in EXIF format. In both JPEG and TIFF files, the metadata is stored using TIFF tags. To read the metadata, use the /RAT flag, even if you are loading a JPEG file.

**Examples**

```
// Load all images from a TIFF stack into separate 2D waves
ImageLoad /C=-1 /T=TIFF

// Load a single image from a TIFF stack into a 2D wave
ImageLoad/S=10/C=1/T=TIFF     // Load image 10 (zero based)

// Load all images from a TIFF stack into a single 3D wave
ImageLoad/LR3D/S=0/C=-1/T=TIFF

// Read all tags without loading any images
ImageLoad/C=-1/T=TIFF/RTIO

// Get the number of images in a TIFF stack
NewDataFolder/O/S tmp
ImageLoad/C=-1/T=TIFF/RTIO
Print V_numImages
KillDataFolder :
```

**See Also**

**Loading Image Files** on page II-157.

The **ImageSave** operation for saving waves as image files.

# ImageMorphology

**ImageMorphology** [***flags***] ***Method imageMatrix***

The ImageMorphology operation performs one of several standard image morphology operations on the source *imageMatrix*. Unless the /O flag is specified, the resulting image is saved in the wave M_ImageMorph. The operation applies only to waves of type unsigned byte. All ImageMorphology methods except for watershed use a structure element. The structure element may be one of the built-in elements (see /E flag) or a user specified element.

Erosion, Dilation, Opening, and Closing are the only methods supported for a 3D *imageMatrix*.

**Parameters**

*Method* is one of the following names:

| | |
|---|---|
| BinaryErosion | Erodes the source binary image using a built-in or user specified structure element (see /E and /S flags). |
| BinaryDilation | Dilates the source binary image using a built-in or user specified structure element (see /E and /S flags). |
| Closing | Performs the closing operation (dilation followed by erosion). The same structure element is used in both erosion and dilation. Note that this operation is an idempotent, which means that there is no point of executing it more than once. |
| Dilation | Performs a dilation of the source grayscale image using either a built-in structure element or a user specified structure element. The operation supports only 8-bit gray images. |
| Erosion | Erodes the source grayscale image using either a built-in structure element or a user specified structure element. The operation supports only 8-bit gray images. |

Opening — Performs an opening operation (erosion followed by dilation). The same structure element is used in both erosion and dilation. Note that this operation is an idempotent which means that there is no point of executing it more than once.

TopHat — Calculates the difference between the eroded image and dilated image using the same structure element.

Watershed — Calculates the watershed regions for grayscale or binary image. Use the /N flag to mark all nonwatershed lines as NaNs. The /L flag switches from using 4 neighboring pixels (default) to 8 neighboring pixels.

**Flags**

/E=*id* — Uses a particular built in structure element. The following are the built-in structure element. The following are the built-in structure elements; make sure to use the appropriate id for the dimensionality of *imageMatrix*:

| *id* | Element | Origin | Shape |
|---|---|---|---|
| 1 | 2x2 | (0,0) | square (default) |
| 2 | 1x3 | (1,1) | row (in 3x3 square) |
| 3 | 3x1 | (1,1) | column (in 3x3 square) |
| 4 | 3x3 | (1,1) | cross (in 3x3 square) |
| 5 | 5x5 | (2,2) | circle (in 5x5 square) |
| 6 | 3x3 | (1,1) | full 3x3 square |
| 200 | 2x2x2 | (1,1,1) | symmetric cube |
| 202 | 2x2x2 | (1,1,1) | 2 voxel column in Y direction |
| 203 | 2x2x2 | (1,1,1) | 2 voxel column in X direction |
| 204 | 2x2x2 | (1,1,1) | 2 voxel column in Z direction |
| 205 | 2x2x2 | (1,1,1) | XY plane |
| 206 | 2x2x2 | (1,1,1) | YZ plane |
| 207 | 2x2x2 | (1,1,1) | XZ plane |
| 300 | 3x3x3 | (1,1,1) | symmetric cube |
| 301 | 3x3x3 | (1,1,1) | symmetric ball |
| 302 | 3x3x3 | (1,1,1) | 3 voxel column in Y direction |
| 303 | 3x3x3 | (1,1,1) | 3 voxel column in X direction |
| 304 | 3x3x3 | (1,1,1) | 3 voxel column in Z direction |
| 305 | 3x3x3 | (1,1,1) | XY plane |
| 306 | 3x3x3 | (1,1,1) | YZ plane |
| 307 | 3x3x3 | (1,1,1) | XY plane |
| 500 | 5x5x5 | (2,2,2) | symmetric cube |
| 501 | 5x5x5 | (2,2,2) | symmetric ball |
| 700 | 7x7x7 | (3,3,3) | symmetric cube |
| 701 | 7x7x7 | (3,3,3) | symmetric ball |

Note that this flag has no effect on watershed calculations.

/I= *iterations* — Repeats the operation the specified number of *iterations*.

/L — Uses 8-connected neighbors instead of 4.