7.6 Vector Operations

7.6.1 Unique ID

Functionality

The Unique ID operation can be used to assign a unique identifier to all elements in a segment, polygon or point map. The result is an ID map that contains the same geographic information as the input map but now each point, segment or polygon has a unique ID. Further an attribute table is created which uses the same ID domain as the output map; the table contains one column with the original classes, IDs or values of the input map. The domain of the table together with the column establishes the relation between the original classes, IDs or values in the input map and the output IDs.

Example
In this example, the Unique ID operation is applied on segment map Water that uses a class domain Water which contains three classes: River, Stream 1 and Stream 2. The output segment map has an ID domain with IDs named Seg 1 to Seg 5. The output table uses the same ID domain as the output map.
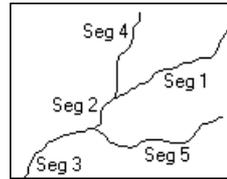
Input segment map: Output segment map: Output table:
Class domain water   ID domain   ID domain

Applying the Unique ID operation on a segment map will result in an output map with ID codes Seg 1, Seg 2, Seg 3, etc.
Applying the Unique ID operation on a polygon map will result in an output map with ID codes Pol 1, Pol 2, Pol 3, etc.
Applying the Unique ID operation on a point map will result in an output map with ID codes Pnt 1, Pnt 2, Pnt 3, etc.

Requirements for the input map
No special requirements for the input point, segment or polygon map.

Domain of output map and output table
The Unique ID operation creates a new ID domain for the output map and the output table; the IDs have names Pol 1, Pol 2, etc. when the operation is performed on a polygon map; Seg 1, Seg 2, etc. when performed on a segment map; and Pnt 1, Pnt 2, etc. when performed on a point map. This output domain is either stored as a separate object or is stored by the output map (internal domain).

The operation creates an output attribute table which is linked to the output map. The output table uses the same ID domain as the output map. The output table contains one column (with the same name as the input map) which stores the original classes, IDs or values of the input map. The domain of the table together with this column establishes the relation between the original classes, IDs or values in the input map and the output IDs.

The table automatically obtains the same name as the output map. In case a table with this name already exists, the table is assigned a new name consisting of the input map name and a sequential number.

Coordinate system of output map
The output map uses the same coordinate system and coordinate boundaries of the input map.

☞ Once you have a segment or polygon map with unique IDs, you can calculate lengths of individual segments or areas of individual polygons by calculating a segment histogram or polygon histogram of the output map with the Histogram operation.

☞ For more information on internal domains and representations, refer to How to open internal domains/representations.

Dialog box

This operation can be used to assign a unique ID to all elements in a segment, polygon or point map. The result is an ID map that contains the same geographic information as the input map but now each point, segment or polygon has a unique ID. Further an attribute table is created which uses the same ID domain as the output map; the table contains one column with the original classes, IDs or values of the input map. The domain of the table together with the column establishes the relation between the original classes, IDs or values in the input map and the output IDs.

Dialog box options
Input map:	Select an input point, segment or polygon map. Open the list box and select the desired input map, or drag a map directly from the Catalog into this box. No special input map requirements.
New domain:	Select this check box if you want to store the output ID domain as a separate object (recommended). Subsequently, type a name for the new domain. Clear this check box to obtain an output ID domain which is stored by the output map (internal domain).
Output map:	Type a name for the output map that will contain the points, segments or polygons with unique IDs. This name will also be used for the output attribute table.
Show:	Select this check box if you want the output map to be displayed in a map window when the operation has finished. Clear this check box if you do not want to see this map immediately: you simply define how the output map should be created.

Description: Optionally, type a description for the output map. The description appears in title bar when the output map is displayed.

A dependent output map and an attribute table are created. Furthermore, IDs for the output map and attribute table can be stored in a new ID domain or can be stored by the output map (internal domain).

Command line

The Unique ID operation can be directly executed by typing one of the following expressions on the command line of the Main window:

To apply the Unique ID operation on point maps:

OUTMAP = `PointMapNumbering`(InputMap)

OUTMAP = `PointMapNumbering`(InputMap, NewDomain)

To apply the Unique ID operation on segment maps:

OUTMAP = `SegmentMapNumbering`(InputMap)

OUTMAP = `SegmentMapNumbering`(InputMap, NewDomain)

To apply the Unique ID operation on polygon maps:

OUTMAP = `PolygonMapNumbering`(InputMap)

OUTMAP = `PolygonMapNumbering`(InputMap, NewDomain)

where:

OUTMAP	is the name of your output point, segment or polygon map. This name will also be given to the output table.
PointMapNumbering	is the command to start the Unique ID operation on point maps.
SegmentMapNumbering	is the command to start the Unique ID operation on segment maps.
PolygonMapNumbering	is the command to start the Unique ID operation on polygon maps.
InputMap	is the name of the input point, segment or polygon map.
NewDomain	is an optional parameter to specify a name for the output ID domain; if this parameter is not specified, the output domain will be stored by the output map (internal domain).

When the definition symbol = is used, a dependent output map is created; when the assignment symbol := is used, the dependency link is immediately broken after the output map has been calculated. When the NewDomain parameter is used, a new ID domain is also created.

Algorithm

First, this operation copies the original point, segment or polygon map into a new point, segment or polygon map. In case of point and polygon maps the geographic information will be exactly the same, in case of segment maps the deleted segments will not be copied to the new file.

In the next step, a unique ID is assigned to each point, segment or polygon in the output map. This is done according to the storage sequence of the points, segments or polygons in the input map.

Furthermore, an attribute table is created. This table has the same ID domain as the output map. The table contains one column. For each output ID, the original class name, ID, or value of the input map is listed.

Output domain

The Unique ID operation creates a new ID domain for the output map and the output table; the IDs have names Pol 1, Pol 2, etc. when the operation is performed on a polygon map; Seg 1, Seg 2, etc. when performed on a segment map; and Pnt 1, Pnt 2, etc. when performed on a point map. This output domain is either stored as a separate object or is stored by the output map (internal domain).

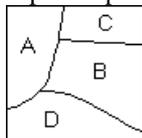## 7.6.2 Attribute map of polygon map

Functionality

By creating an attribute map of a polygon map, the class name or ID of each polygon in the original map is replaced by the value, class or ID found in a certain column in an attribute table.

A polygon map using a Class or ID domain, can have extra attribute information on the classes or identifiers in the map. These attributes are stored in columns in an attribute table. The attribute table can be linked to the map to which it refers, or to the domain of the map. You can check whether an attribute table is linked to the polygon map or to its domain through the Properties dialog box of the map or the domain.

Example of creating an attribute map

In the pictures below, an attribute map is created for the acreage of cash crops (ha) for units A, B, C, and D in the input map.
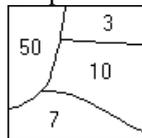
Input map: Attribute table: Output attribute map:

Input map requirements
- the input map needs to be a map with a domain of the Class or ID type;
- the table, from which you want to choose a column, should use the same domain as the map;
- the attribute table can be linked to the map or to its domain;
- the attribute table should have one or more columns with attribute values, classes or IDs.

An attribute map can be created from any column with a value, class or ID domain, but not from a column using domain String.

Domain and coordinate system of output map
The output map uses the same domain as the specified attribute column. The output map uses the same coordinate system and coordinate boundaries as the input map.

☞ This operation creates a permanent attribute map. To temporarily display an attribute map, you can select the option 'Attribute' in the Display Options dialog box when displaying a polygon map.
☞ The colors in which an attribute map is displayed, depend on the domain of the specified attribute column:
- if you used a domain Class attribute column and when this domain already has a user-defined representation, then this representation is automatically selected in the Display Options dialog box which appears when you display the attribute map. In the Display Options dialog box, you can also select another existing representation or create a new representation by clicking the create button.
- if you used a domain Value attribute column, you can either select one of the standard value representations or create your own representation by clicking the create button in the Display Options dialog box which appears when you display the attribute map.
☞ You can also create attribute maps of raster maps, attribute maps of segment maps and attribute maps of point maps.

Dialog box

By creating an attribute map of a polygon map, the class name or ID of each polygon in the original map is replaced by the value, class or ID found in a certain column in an attribute table.

A polygon map using a Class or ID domain, can have extra attribute information on the classes or identifiers in the map. These attributes are stored in columns in an attribute table. The attribute table can be linked to the map to which it refers, or to the domain of the map. You can check whether an attribute table is linked to the polygon map or to its domain through the Properties dialog box of the map or the domain.

Dialog box options

Input polygon map:	Select an input polygon map. Open the list box and select the desired input map, or drag a polygon map directly from the Catalog into this box. The input map should be a domain Class or ID map.
Table:	By default, the attribute table linked to the selected input map or to its domain is shown. In case you want to use another table, select a table with the same domain as the input map from the list box.
Attribute:	Select an attribute column from the attribute table.
Output polygon map:	Type a name for the output polygon map that will contain the attribute values.
Show:	Select this check box if you want the output map to be displayed in a map window when the operation has finished. Clear this check box if you do not want to see this map immediately: you simply define how the output map should be created.
Description:	Optionally, type a description for the output map. The description appears in the title bar when the output map is displayed.

A dependent output map is created.

Command line

The Attribute map of polygon map operation can be directly executed by typing one of the following expressions on the command line of the Main window:

OUTMAP = PolygonMapAttribute(InputPolMapName, ColumnName)

OUTMAP = PolygonMapAttribute(InputPolMapName,
            TableName.ColumnName)

where:

OUTMAP	is the name of your output polygon map.
PolygonMapAttribute	is the command to start the creation of an attribute map of a polygon map.
InputPolMapName	is the name of your input polygon map. For the first expression, the attribute table needs to be linked to the input map or its domain.
TableName	is the name of an attribute table. The attribute table should use the same domain as the input map.
ColumnName	is the name of an attribute column in the attribute table.

When the definition symbol = is used, a dependent output map is created; when the assignment symbol := is used, the dependency link is immediately broken after the output map has been calculated.

Algorithm

The program scans the polygon map polygon by polygon.

Each polygon is copied to the output map while:
- the class name or ID of each polygon in the input map is replaced with the attribute value that belongs to this class or ID as found in the attribute table.

Undefined values are assigned to an output polygon:
- if the polygon name in the input map is undefined, or
- if the class name, ID, or value in the selected attribute column is undefined.

7.6.3 Mask polygons

Functionality

The Mask Polygons operation allows you to selectively copy polygons of an input polygon map into a new output polygon map. The user has to specify a mask to select and retrieve the class names, IDs or values of the polygons that are to be copied.

By specifying a mask, you can search for polygons with a certain class name, ID or value. A mask is in fact a simple query to find (retrieve), display or use only those polygons in a map that have certain class names, identifiers or values. A mask contains one or more search strings in which wild cards, asterisks (∗) and question marks (?), are allowed. You can enter as many search strings in a mask as you like; separate the strings by commas.

Mask syntax
- search strings in a mask are compared with the classes, IDs or values of the domain of a map; when a map uses a class or ID domain and the classes or IDs have codes, the mask works on the codes and on the names and on the combination of codes and names,
- to find/retrieve one specific class name, identifier or value: type that class name, ID or identifier in the mask,
- to find/retrieve multiple class names, identifiers or values: separate the different class names, identifiers or values in the mask by commas (it does not matter whether you use spaces before or after a comma)
- you can use asterisks as wild cards to replace zero or more characters in class names, IDs or values, for example ∗ or `water*` or `1*,2*,3*` , or even `*25,*50,*75,*00`, or `A*b*,D*g*`
- you can use question marks as wild cards to replace single characters in class names, identifiers or values, for example `Ab?, D?` , `Gl?` or `?p, ??i`, or `A*b??, D*g??`
- in a dialog box, you should not use quotes around class names, identifiers or values,
- on the command line, you must use double quotes around the complete mask.

Examples

- When a polygon map contains topographic features, and you want to copy the polygons in which part of the class name is 'park' or 'square'; use as mask: `*park*,*square*`
- When a polygon map contains cadastral plots identified by IDs between 1000 and 9999, and you want to copy the polygons with an ID that starts with a 1, e.g. IDs 101, 102, 103, etc.; use as mask: `1*`
- When a polygon map contains information on population density per polygon, and you want to copy the polygons with a population density between 200 and 250; use as mask: `20*,21*,22*,23*,24*,250`

For more information, see How to use masks.

Requirements for input polygon map
No special input map requirements.

Domain and coordinate system of output map
The output polygon map uses the same domain as the input polygon map. The output polygon map uses the same coordinate system and coordinate boundaries as the input polygon map.

☞ This operation creates a new polygon map. You can also display specific polygons of a polygon map in a map window without creating a new polygon map: select the Mask check box in the Display Options dialog box of the polygon map which appears when you open the polygon map. Then, specify the mask, i.e. the class names, identifiers or values of the polygons that you want to display.

Dialog box

The Mask Polygons operation allows you to selectively copy polygons of an input polygon map into a new output polygon map. The user has to specify a mask to select and retrieve the class names, IDs or values of the polygons that are to be copied. For more information on masks, see Mask Polygons : functionality and How to use masks.

Dialog box options

Input polygon map:	Select an input polygon map. Open the list box and select the desired input map, or drag a polygon map directly from the Catalog into this box. No special input map requirements.
Mask:	Type (multiple) search strings to find the polygons that you want to copy. For more information, see Mask Polygons : functionality and How to use masks.
Output polygon map:	Type a name for the output polygon map that will contain the copied polygons.

Show: Select this check box if you want the output map to be
                              displayed in a map window when the operation has
                              finished. Clear this check box if you do not want to see
                              this map immediately: you simply define how the
                              output map should be calculated.

Description: Optionally, type a description for the output map. The
                              description appears in the title bar when the output map
                              is displayed.

A dependent output map is created.

Command line

The Mask Polygons operation can be directly executed by typing the following
expression on the command line of the Main window:

OUTMAP = `PolygonMapMask`(InputPolygonMap,"mask")

where:
OUTMAP   is the name of your output polygon map.
`PolygonMapMask`   is the command to start the Mask Polygons operation.
InputPolygonMap   is the name of the input polygon map.
`"mask"`   are the (multiple) search strings to find the classes, IDs
                      or values in the input map that you want to copy into
                      the output map; on the command line, the total mask
                      needs to be surrounded by double quotes.

When the definition symbol = is used, a dependent output map is created; when the
assignment symbol := is used, the dependency link is immediately broken after the
output map has been calculated.

Algorithm

The Mask Polygons operation first copies all polygons of the input map into the
output map.

Then, the polygons of which the name, code, or value do not match one of the
search strings specified in the mask are deleted.

7.6.4 Assign labels to polygons

Functionality

The Assign Labels to Polygons operation can be used to recode polygons in a polygon map according to label points in a point map. For each label point, the surrounding polygon is determined; then the class name, ID, or value of the label point is assigned to that polygon.

Input map requirements
For the input polygon map and the input point map there are no special requirements.

Domain and coordinate system of output map
The output polygon map uses the same domain as the input point map.
The output polygon map uses the same coordinate system and coordinate boundaries as the input polygon map. When the coordinate systems of the input maps are different (e.g. different projections) but compatible, the coordinates of the point map will be transformed to the coordinate system of the polygon map.

☞ To create polygon labels, you can use the Polygons to Points operation.

Dialog box

The Assign Labels to Polygons operation can be used to recode polygons in a polygon map according to label points in a point map. For each label point, the closest polygon is determined; then the class name, ID or value of the label point is assigned to that polygon.

Dialog box options

Input polygon map:	Select an input polygon map. Open the list box and select the desired input map, or drag a polygon map directly from the Catalog into this box. No special input map requirements.
Label points:	Similarly, select an input point map.
Output polygon map:	Type a name for the output polygon map that will contain the recoded polygons.
Show:	Select this check box if you want the output map to be displayed in a map window when the operation has finished. Clear this check box if you do not want to see this map immediately: you simply define how the output map should be created.
Description:	Optionally, type a description for the output map. The description appears in the title bar when the output map is displayed.

A dependent output map is created.

Command line

The Assign labels to polygons operation can be directly executed by typing the following expression on the command line of the Main window:

OUTMAP = `PolygonMapLabels`(InputPolygonMap,InputPointMap)

where:

OUTMAP	is the name of your output polygon map.
`PolygonMapLabels`	is the command to start the Assign labels to polygons operation.
InputPolygonMap	is the name of the input polygon map.
InputPointMap	is the name of the input point map.

When the definition symbol = is used, a dependent output map is created; when the assignment symbol := is used, the dependency link is immediately broken after the output map has been calculated.

Algorithm

The Assign labels to polygons operation copies the polygon map and assigns the undefined value to all polygons. Next, for each label point, the surrounding polygon is determined. Then the class name, ID or value of the label point is assigned to that polygon. If there is no point in a polygon, the polygon will keep the undefined value.

If the input polygon map and the input point map have a different but compatible coordinate system, a coordinate transformation in performed on the point map before the determination of which polygon surrounds a point.

7.6.5 Transform polygons

Functionality

The Transform polygon map operation transforms polygons in a polygon map to a new coordinate system. All points are transformed as individual coordinate pairs from one coordinate system to another.

The operation can be used for example:
- to integrate data of different sources in different projections
- to present data or results in a more appropriate projection.

Input requirements

This operation requires:
- An input polygon map which coordinate system has a certain known projection or uses the ILWIS `LatLon` coordinate system. When the map projection is unknown, no transformation is possible.
- Another coordinate system which is the target coordinate system.

Domain and coordinate system of output map
The output polygon map uses the same domain as the input polygon map. The output map gets the selected coordinate system with the transformed coordinate boundaries as the input map. Also the selected coordinate system needs to have a certain known projection or the ILWIS LatLon coordinate system. When the map projection is unknown, no transformation is possible.

Note that when selecting a map projection, for smaller areas (larger scales) the differences can be neglected and for large areas (small scales) the differences can be very large. Be sure before calculating an area to transform to an equal-area projection otherwise the results calculated will not be corrected.

☞   To create a coordinate system with a projection, refer to: ILWIS objects : coordinate systems.
☞   When you work with multiple neighbouring map sheets, it is advised to use one coordinate system containing the smallest minimum X and Y, and the largest maximum X and Y coordinates of all those map sheets. Then, use this coordinate system for all your maps.
☞   For better understanding it is advisable to add a graticule (Layers menu in the map window, choose Add Annotation) to the map window.
☞   Straight lines are usually defined by their start and end points. Therefore they remain straight lines when they are transformed to another projection; only the coordinates of the begin and end points change. It is advised to increase the number of intermediate points to preserve the shape of the segment. Intermediate points can be added to a segment with Densify segment operation. Therefore, first segments need to be extracted from the polygons before the operation can be performed.

Dialog box

The Transform polygon map operation transforms polygons in a polygon map to a new coordinate system. All points are transformed as individual coordinate pairs from one coordinate system to another.

Dialog box options

Input polygon map:	Select an input polygon map. Open the list box and select the desired input map, or drag a polygon map directly from the Catalog into this box.
Coordinate system:	Select an existing target coordinate system for the output map. Open the list box and select the desired coordinate system, or drag a coordinate system directly from the Catalog into this box.
Output polygon map:	Type a name for the output polygon map that will contain the polygons that are created from the polygons in the input map.

Show:	Select this box if you want the output map to be displayed in a map window when the operation has finished. Clear this box if you do not want to see this map immediately: you simply define how the output map should be created.
Description:	Optionally, type a description for the output map. The description appears in the title bar when the output map is displayed.

A dependent output map is created.

Command line

The Transform polygon map operation can be directly executed by typing the following expression on the command line of the Main window:

OUTMAP = `PolygonMapTransform`(InputPolygonMapName,
           CoordinateSystem)

where:

OUTMAP	is the name of your output polygon map.
`PolygonMapTransform`	is the command to start the Transform Polygon operation.
InputPolygonMapname	is the name of your input polygon map.
CoordinateSystem	is the name of your target coordinate system.

When the definition symbol = is used, a dependent output map is created; when the assignment symbol := is used, the dependency link is immediately broken after the output map has been calculated.

Algorithm

The transform polygons map operation transforms individual coordinate pairs from the source coordinate system to the target coordinate system.

In the first step the polygons are copied.

In the next step the boundaries are transformed. All points are transformed as individual coordinate pairs from the source projection to the target projection.

In the last step new polygon areas and boundaries are calculated.

7.6.6 Attribute map of segment map
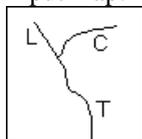
Functionality

By creating an attribute map of a segment map, the class name or ID of each segment in the original map is replaced by the value, class or ID found in a certain column in an attribute table.

A segment map using a Class or ID domain, can have extra attribute information on the classes or identifiers in the map. These attributes are stored in columns in an attribute table. The attribute table can be linked to the map to which it refers, or to the domain of the map. You can check whether an attribute table is linked to the segment map or to its domain through the Properties dialog box of the map or the domain.

Example of creating an attribute map
In the pictures below, an attribute map is created for the average discharge (m^3/sec) in October for rivers C, L, and T.

Input map: Attribute table: Output attribute map:

Input map requirements
- the input map needs to be a map with a domain of the Class or ID type;
- the table, from which you want to choose a column, should use the same domain as the map;
- the attribute table can be linked to the map or to its domain;
- the attribute table should have one or more columns with attribute values, classes or IDs.

An attribute map can be created from any column with a value, class or ID domain, but not from a column using domain String.

Domain and coordinate system of output map
The output map uses the same domain as the specified attribute column. The output map uses the same coordinate system and coordinate boundaries as the input map.

☞   This operation creates a permanent attribute map. To temporarily display an attribute map, you can select the option 'Attribute' in the Display Options dialog box when displaying a segment map.

☞   The colors and line widths in which an attribute map is displayed, depend on the domain of the specified attribute column:

- if you used a domain Class attribute column and when this domain already has a user-defined representation, then this representation is automatically selected in the Display Options dialog box which appears when you display the attribute map. In the Display Options dialog box, you can also select another existing representation or create a new representation by clicking the create button.
- if you used a domain Value attribute column, you can either select one of the standard value representations or create your own representation by clicking the create button in the Display Options dialog box which appears when you display the attribute map.

☞   You can also create attribute maps of raster maps, attribute maps of polygon maps and attribute maps of point maps.

Dialog box

By creating an attribute map of a segment map, each segment code in the original map is replaced by the value found in a certain column in the attribute table.

A segment map using a Class or ID domain, can have extra attribute information on the classes or identifiers in the map. These attributes are stored in columns in an attribute table. The attribute table can be linked to the map to which it refers, or to the domain of the map. You can check whether an attribute table is linked to the segment map or to its domain through the Properties dialog box of the map or the domain.

Dialog box options

Input segment map:	Select an input segment map. Open the list box and select the desired input map, or drag a segment map directly from the Catalog into this box. The input map should be a domain Class or ID map.
Table:	By default, the attribute table linked to the selected input map or to its domain is shown. In case you want to use another table, select a table with the same domain as the input map from the list box.
Attribute:	Select an attribute column from the attribute table.
Output segment map:	Type a name for the output segment map that will contain the attribute values.
Show:	Select this check box if you want the output map to be displayed in a map window when the operation has finished. Clear this check box if you do not want to see this map immediately: you simply define how the output map should be created.
Description:	Optionally, type a description for the output map. The description appears in the title bar when the output map is displayed.

A dependent output map is created.

Command line

The Attribute map of segment map operation can be directly executed by typing one of the following expressions on the command line of the Main window:

OUTMAP = SegmentMapAttribute(InputSegMapName, ColumnName)

OUTMAP = SegmentMapAttribute(InputSegMapName,
        TableName.ColumnName)

where:

OUTMAP	is the name of your output segment map.
SegmentMapAttribute	is the command to start the creation of an attribute map of a segment map.
InputSegMapName	is the name of your input segment map. For the first expression, the attribute table needs to be linked to the input map or its domain.
TableName	is the name of an attribute table. The attribute table should use the same domain as the input map.
ColumnName	is the name of an attribute column in the attribute table.

When the definition symbol = is used, a dependent output map is created; when the assignment symbol := is used, the dependency link is immediately broken after the output map has been calculated.

Algorithm

The program scans the segment map segment by segment.

Each segment is copied to the output map while:
■ the original class name or ID of each segment in the input map is replaced with the attribute value that belongs to this class or ID as found in the attribute table.

Undefined values are assigned to an output segment:
■ if the segment name in the input map is undefined, or
■ if the class name, ID, or value in the selected attribute column is undefined.

7.6.7 Mask segments

Functionality

The Mask Segments operation allows you to selectively copy segments of an input segment map into a new segment map. The user has to specify a mask to select and retrieve the class names, identifiers or values of segments that are to be copied.

By specifying a mask, you can search for segments with a certain class name, ID or value. A mask is in fact a simple query to find (retrieve), display or use only those segments in a map that have certain class names, identifiers or values. A mask contains one or more search strings in which wild cards, asterisks (∗) and question marks (?), are allowed. You can enter as many search strings in a mask as you like; separate the strings by commas.

Mask syntax
- search strings in a mask are compared with the classes, IDs or values of the domain of a map; when a map uses a class or ID domain and the classes or IDs have codes, the mask works on the codes and on the names and on the combination of codes and names,
- to find/retrieve one specific class name, identifier or value: type that class name, ID or identifier in the mask,
- to find/retrieve multiple class names, identifiers or values: separate the different class names, identifiers or values in the mask by commas (it does not matter whether you use spaces before or after a comma)
- you can use asterisks as wild cards to replace zero or more characters in class names, IDs or values, for example `road*`,`riv*` or `1*`,`2*`,`3*`, or even `*25`,`*50`,`*75`,`*00`, or `A*b*`,`D*g*`
- you can use question marks as wild cards to replace single characters in class names, identifiers or values, for example `Ab?`,`D?`,`Gl?` or `?p`,`??i`, or `A*b??`,`D*g??`
- in a dialog box, you should not use quotes around class names, identifiers or values,
- on the command line, you must use double quotes around the complete mask.

Examples
- When a segment map contains topographic features, and you want to copy the segments with class names 'river' and 'road'; use as mask: `river,road`
- When a segment map contains pipe lines identified by IDs between 1000 and 9999, and you want to copy the segments with an ID that starts with a 1, e.g. IDs 1001, 1002, 1003, etc.; use as mask: `1*`
- When a segment map contains height values between 0 and 5000m, and you want to copy the segments with a height value between 1000 and 1500; use as mask: `10*`,`11*`,`12*`,`13*`,`14*`,`1500`

For more information, see How to use masks.

Requirements for input segment map
No special input map requirements.

Domain and coordinate system of output map
The output segment map uses the same domain as the input segment map. The output segment map uses the same coordinate system and coordinate boundaries as the input segment map.

☞   This operation creates a new segment map. You can also display specific segments of a segment map in a map window without creating a new segment map: select the Mask check box on the Display Options dialog box of the segment map which appears when you open the segment map. Then, specify the mask, i.e. the class names, identifiers or values of the segments that you want to display.

☞   To copy a certain area of a segment map into a new segment map, see Sub-map of segment map.

☞   To combine two or more segment maps, see Glue segment maps.

Dialog box

The Mask Segments operation allows you to selectively copy segments of a segment map into a new segment map. The user has to specify a mask to select and retrieve the class names, identifiers or values of the segments that are to be copied. For more information, see Mask Segments : functionality and How to use masks.

Dialog box options

Input segment map: Select an input segment map. Open the list box and select the desired input map, or drag a segment map directly from the Catalog into this box. No special input map requirements.

Mask: Type (multiple) search strings to find the segments that you want to copy. For more information, see Mask Segments : functionality and How to use masks.

Output segment map: Type a name for the output segment map that will contain the copied segments.

Show: Select this check box if you want the output map to be displayed in a map window when the operation has finished. Clear this check box if you do not want to see this map immediately: you simply define how the output map should be created.

Description: Optionally, type a description for the output map. The description appears in the title bar when the output map is displayed.

A dependent output map is created.

Command line

The Mask Segments operation can be directly executed by typing the following expression on the command line of the Main window:

OUTMAP = `SegmentMapMask`(InputSegmentMap,"mask")

where:
OUTMAP   is the name of your output segment map.
`SegmentMapMask`   is the command to start the Mask Segments operation.
InputSegmentMap   is the name of the input segment map.

`"mask"`	are the (multiple) search strings to find the classes, IDs or values in the input map that you want to copy into the output map; on the command line, the total mask needs to be surrounded by double quotes.

When the definition symbol = is used, a dependent output map is created; when the assignment symbol := is used, the dependency link is immediately broken after the output map has been calculated.

Algorithm

The Mask Segments operation simply copies those segments of the input map of which the name, code, or value matches one of the search strings specified in the mask into the output segment map.

7.6.8 Assign labels to segments

Functionality

The Assign Labels to Segments operation can be used to recode segments in a segment map according to label points in a point map. For each label point, the closest segment is determined; then the class name, ID or value of the label point is assigned to that segment.

Input map requirements
For the input segment map and the input point map there are no special requirements.

Domain and coordinate system of output map
The output segment map uses the same domain as the input point map.

The output segment map uses the same coordinate system and coordinate boundaries as the input segment map. When the coordinate systems of the input maps are different (e.g. different projections) but compatible, the coordinates of the point map will be transformed to the coordinate system of the segment map.

☞ To create segment labels, you can use the Segments to Points operation.

Dialog box

The Assign Labels to Segments operation can be used to recode segments in a segment map according to label points in a point map. For each label point, the closest segment is determined; then the class name, ID or value of the label point is assigned to that segment.

Dialog box options

Input segment map:	Select an input segment map. Open the list box and select the desired input map, or drag a segment map directly from the Catalog into this box. No special input map requirements.
Label points:	Similarly, select an input point map.
Output segment map:	Type a name for the output segment map that will contain the recoded segments.
Show:	Select this check box if you want the output map to be displayed in a map window when the operation has finished. Clear this check box if you do not want to see this map immediately: you simply define how the output map should be created.
Description:	Optionally, type a description for the output map. The description appears in the title bar when the output map is displayed.

A dependent output map is created.

Command line

The Assign labels to segments operation can be directly executed by typing the following expression on the command line of the Main window:

OUTMAP = SegmentMapLabels(InputSegmentMap,InputPointMap)

OUTMAP = SegmentMapLabels(InputSegmentMap, InputPointMap, *setdomain*)

where:

OUTMAP	is the name of your output segment map.
SegmentMapLabels	is the command to start the Assign labels to segments operation.
InputSegmentMap	is the name of the input segment map.
InputPointMap	is the name of the input point map.
setdomain	yes | no, optional parameter to set the domain of the output map; is this parameter is not specified, the domain of the input segment map will be used for the output segment map.
yes	is an optional parameter to use the domain of the input point map as the domain for the output segment map.
no	is an optional parameter to use the domain of the input segment map as the domain for the output segment map.

When the definition symbol = is used, a dependent output map is created; when the assignment symbol := is used, the dependency link is immediately broken after the output map has been calculated.

Algorithm

The Assign labels to segments operation copies the input segment map and assigns the undefined value to all segments. Next, for each label point, the closest segment is determined. Then the class name, ID or value of the label point is assigned to that segment.

If the input segment map and the input point map have a different but compatible coordinate system, a coordinate transformation is performed on the point map before the determination of which segment is closest to a point.

7.6.9 Sub-map of segment map

Functionality

The Sub-map of segment map operation copies a rectangular part of a segment map into a new segment map. The user has to specify minimum and maximum XY-coordinates for the new segment map.

The Sub-map of segment map operation allows you to change the coordinate boundaries of your segment map. The output segment map can be smaller than the input map, but it can also be larger.
- If the output map is smaller than the input map, then input segments are clipped at the specified output coordinate boundaries and subsequently copied into the new output segment map.
- If the output map is larger than the input map, all input segments are copied, and extra space is created around the segments of the original segment map.

☞ The Sub-map of segment map operation permanently reduces or enlarges the area covered by a segment map.
- To temporarily reduce the area of a segment map, you can zoom in on the segment map in a map window. The result can even be stored as a map view.
- To temporarily enlarge the area of a segment map, i.e. to create white space around a segment map in a map window for annotation purposes, you can use the Extend Window command on the Options menu in the map window, or you can zoom in on the segment map and drag a rectangle partly outside the map window. The result can even be stored as a map view.

Requirements for input segment map
No special input map requirements.

Domain and coordinate system of output map
The output segment map uses the same domain as the input segment map. The output segment map uses the same coordinate system as the input segment map; the coordinate boundaries for this output segment map are user-defined.

☞   To selectively copy segments with a specific code from one segment map into a new
        segment map, see Mask segments.
☞   To combine up to four segment maps into one output map, use the Glue segment
        maps operation; for each input map, a mask can be specified, further the coordinate
        boundaries for the output map can be specified.

Dialog box

The Sub-map of segment map operation copies a rectangular part of a segment map
into a new segment map. The user has to specify minimum and maximum XY-
coordinates for the new segment map.

Dialog box options

Input segment map:	Select an input segment map. Open the list box and select the desired input map, or drag a segment map directly from the Catalog into this box. No special input map requirements.
MinX, MinY:	Type the minimum X-coordinate and the minimum Y-coordinate for the output map.
MaxX, MaxY:	Type the maximum X-coordinate and the maximum Y-coordinate for the output map.
Output segment map:	Type a name for the output segment map that will contain the copied segments.
Show:	Select this check box if you want the output map to be displayed in a map window when the operation has finished. Clear this check box if you do not want to see this map immediately: you simply define how the output map should be created.
Description:	Optionally, type a description for the output map. The description appears in the title bar when the output map is displayed.

A dependent output map is created.

Command line

The sub-map of segment map operation can be directly executed by typing the
following expression on the command line of the Main window:

OUTMAP = SegmentMapSubMap(InputSegmentMap, minX, minY, maxX,
            maxY)

where:

OUTMAP	is the name of your output segment map.
SegmentMapSubMap	is the command to start the sub-map of segment map operation.
InputSegmentMap	is the name of the input segment map.

minX	minimum X-coordinate of output segment map (real number).
minY	minimum Y-coordinate of output segment map (real number).
maxX	maximum X-coordinate of output segment map (real number).
maxY	maximum Y-coordinate of output segment map (real number).

When the definition symbol = is used, a dependent output map is created; when the assignment symbol := is used, the dependency link is immediately broken after the output map has been calculated.

Algorithm

The Sub-map of segment map operation copies a rectangular part of a segment map into a new segment map.

The user has to specify minimum and maximum XY-coordinates for the output segment map. These XY-coordinates define the so-called clipping rectangle.

Then:
- Segments that entirely fall within the clipping rectangle are copied to the output map without modifications;
- Segments that have one intersection with the clipping rectangle, obtain a node at the intersection, and then the parts within the clipping rectangle are copied into the new output map;
- Segments that have more than one intersection with the clipping rectangle, obtain nodes at each intersection, and then the parts within the clipping area are copied as multiple segments into the output map.
- Segments that completely fall outside the clipping rectangle are not copied.

7.6.10 Glue segment maps

Functionality

The Glue segment maps operation glues or merges two or more segment maps into one output segment map. You can thus merge for instance segment maps that were digitized as separate segment maps from different map sheets.

By default, the operation copies all segments of the input maps into the output map. You can also specify a mask to select and retrieve the class names, IDs or values of the segments that are to be copied into the output map. For more information on how to use a mask, see also Mask segments : functionality.

By default, the operation finds the minimum and maximum X and Y coordinates used in the input maps and creates from this the coordinate boundaries for the output map. The output map thus comprises the total area of all input maps. You

can also define the coordinate boundaries of the output map yourself, by specifying a so-called 'clip boundary'. Then, all segments of the input maps that fall within these coordinates are copied.

Input map requirements

All input segment maps should be of the same domain type, i.e. two or more Class maps, two or more ID maps, or two or more Value maps. The contents of the input domains does not necessarily need to be the same. For more information, see the section Domain of output map below. Furthermore, the input segment maps should have the same or a compatible coordinate system; input segment maps may not use coordinate system Unknown.

Domain of output map

- When combining segment maps with a Value domain, the output map always uses the system Value domain. The value range for the output map is determined by the smallest minimum and the largest maximum of all input maps; the precision is determined by the smallest precision of the input maps.
- When combining segment maps with the same Class domain, the output map also uses this Class domain. In case the class names in the input domains are different, both domains are merged into a new domain, and the output domain then contains all domain items, i.e. all classes, and the output map thus shows both input maps with their original class names. The new domain is either stored as a separate object, or is stored by the output map (internal domain).
- When combining segment maps with ID domains, the same procedure is followed as for Class maps but the output domain is an ID domain.

Coordinate system of output map

The output segment map uses the coordinate system of the first input map. The coordinate boundaries for the output map are determined from all input maps or are as specified by the user. When the coordinate systems of the input maps are different (e.g. different projections) but compatible, the coordinates will be transformed to the coordinate system of the first input map.

☞ This operation has similar functionality as the CopySeg program in ILWIS 1.4.

☞ When merging segments of different map sheets into one output segment map, segments that are supposed to continue in two or more sheets are not automatically connected to each other. When you break the dependency links of the output map in the Properties dialog box of the output map, you can edit the output map in the Segment editor using the Move Points and Split/Merge mode.

☞ For more information on internal domains and representations, see How to open internal domains/representations.

Dialog box

The Glue segment maps operation glues or merges two or more segment maps into one output map. By default, the output segment map then comprises the total area of all input maps. The domains of the input maps are merged when needed.

For each input map, the user can further specify a mask to select and retrieve the class names, IDs or values of the segments that are to be copied into the output map. The user can also specify a clip boundary, to copy only those segments to the output map which fall within the specified coordinate boundaries of the output map.

In the dialog box, the number of input maps is limited to four. On the command line, this limitation is not present.

Dialog box options

Number of input maps:	Select the number of segment maps that you want to glue or merge together (2, 3, or 4).
Input map names:	Select the input segment maps. You can always glue segment maps of the same domain type. For more information on mergeable domain types, see Glue segment maps : functionality.
Masks:	Type for each segment map (multiple) search strings to find the segments that you want to be copied into the output map. By default, all segments of all input maps are copied. For more information on masks, see Mask segments : functionality or How to use masks.
Clip boundary:	Select this check box if you want to limit or extend the area comprised by the output map: specify the coordinate boundaries for the output map yourself. Clear this check box if you want that the output map comprises the whole area of all input maps.
MinX, MinY:	Type the minimum X-coordinate and the minimum Y-coordinate for the output map.
MaxX, MaxY:	Type the maximum X-coordinate and the maximum Y-coordinate for the output map.
New domain:	When merging Class or ID maps that do not use the same domain, select this box if you want to store the output domain as a separate object (recommended). Subsequently, type a name for the new domain. Clear this check box to obtain an output Class or ID domain which is stored by the output map (internal domain).
Output segment map:	Type a name for the output segment map that will contain the copied segments.
Show:	Select this check box if you want the output map to be displayed in a map window when the operation has finished. Clear this check box if you do not want to see this map immediately: you simply define how the output map should be created.
Description:	Optionally, type a description for the output map. The description appears in the title bar when the output map is displayed.

A dependent output map is created. When needed and specified, a new domain is also created.

Command line

The Glue segment maps operation can be directly executed by typing one of the following expressions on the command line of the Main window:

OUTMAP = `SegmentMapGlue`(InputSegmentMap1, "mask1", InputSegmentMap2, "mask2")

OUTMAP = `SegmentMapGlue`(InputSegmentMap1, "mask1", InputSegmentMap2, "mask2", NewDomain)

OUTMAP = `SegmentMapGlue`(InputSegmentMap1, "mask1", InputSegmentMap2, "mask2", InputSegmentMap3, "mask3"), etc.

OUTMAP = `SegmentMapGlue`(minX, minY, maxX, maxY, InputSegmentMap1, "mask1", InputSegmentMap2, "mask2")

OUTMAP = `SegmentMapGlue`(minX, minY, maxX, maxY, InputSegmentMap1, "mask1", InputSegmentMap2, "mask2", NewDomain)

OUTMAP = `SegmentMapGlue`(minX, minY, maxX, maxY, InputSegmentMap1, "mask1", InputSegmentMap2, "mask2", InputSegmentMap3, "mask3"), etc.

On the command line, you can specify as many input maps and their masks as needed.

where:

OUTMAP	is the name of your output segment map.
`SegmentMapGlue`	is the command to start the Glue segment map operation.
InputSegmentMap1	is the name of the first input segment map.
InputSegmentMap2	is the name of the second segment map.
InputSegmentMap3	is the name of the third segment map (optional).
Mask1	are the (multiple) search strings to find the classes, IDs or values of the segments in the first input map that you want to copy into the output map; on the command line, the total mask for each input map needs to be surrounded by double quotes. To copy all segments, use as mask: "*".
Mask2	are the (multiple) search strings to find the classes, IDs or values of the segments in the second input map that you want to copy into the output map.
Mask3	are the (multiple) search strings to find the classes, IDs or values of the segments in the third input map that you want to copy into the output map.
minX	minimum X-coordinate of output segment map (real number).

minY	minimum Y-coordinate of output segment map (real number).
maxX	maximum X-coordinate of output segment map (real number).
maxY	maximum Y-coordinate of output segment map (real number).
NewDomain	is an optional parameter, when merging Class or ID maps that do not have the same domain, to specify a name for the new output domain in which all input domain items will be merged. When input Class or ID domains are not the same and this parameter is not specified, the new output domain in which all input domain items are merged will be stored by the output map (internal domain).

When the definition symbol = is used, a dependent output map is created; when the assignment symbol := is used, the dependency link is immediately broken after the output map has been calculated. When Class or ID maps are merged that do not have the same domain, and the NewDomain parameter is used, a new output domain is also created.

Algorithm

The Glue segment maps operation glues or merges two or more segment maps into one output segment map. By default, the output map then comprises the area of all input maps. The domains of the input maps are merged when needed.

Rules
To copy segment from the input maps into the output map, the following rules are applied:
- the class names, IDs or values of the input segments must match the specified mask, and
- the input segments must at least partially fall within the specified clip boundary (also called clipping rectangle):
    - segments that entirely fall within the clipping rectangle are copied to the output map without modifications;
    - segments that have one intersection with the clipping rectangle, obtain a node at the intersection, and then the parts within the clipping rectangle are copied into the new output map;
    - segments that have more than one intersection with the clipping rectangle, obtain nodes at each intersection, and then the parts within the clipping area are copied as multiple segments into the output map.

By default, all segments are copied into the output map. By default, coordinate boundaries for the output map are determined from the coordinate boundaries of all input maps. When the coordinate systems of the input maps are different but compatible, the segment coordinates will be transformed to the coordinate system of the first input map.

Output domain
- When merging two maps with the same domain, the output map will also use that domain.
- When merging Value maps, the value range for the output map is determined by the smallest minimum and the largest maximum of all input maps; the precision is determined by the smallest precision of all input maps.
- When merging Class maps or ID maps that do not have the same domain, a new output domain is created which contains all domain items, i.e. all classes. The new domain is either stored as a separate object, or is stored by the output map (internal domain).

7.6.11 Densify segment coordinates

Functionality

The Densify segment coordinates operation allows you to obtain more intermediate coordinates within segments. The segments of an input map are copied, and extra intermediate coordinates are added to the segments in the output map at a user-specified distance.

☞ It is advised to use the Densify segment coordinates operation before a Transform segments operation is performed. The Transform segments operation only transforms the coordinates of existing nodes and intermediate coordinates within segments.

Requirements for input segment map
No special input map requirements.

Domain and coordinate system of output map
The output segment map uses the same domain as the input segment map.
The output segment map uses the same coordinate system and the same coordinate boundaries as the input segment map.

Dialog box

The Densify segment coordinates operation allows you to obtain more intermediate coordinates within segments. The segments of an input map are copied, and extra intermediate coordinates are added to the segments in the output map at a user-specified distance. It is advised to use this operation before a Transform segments operation is performed.

Dialog box options

Input segment map: Select an input segment map. Open the list box and select the desired input map, or drag a segment map directly from the Catalog into this box. No special input map requirements.

Distance:	Type a value for the distance interval (in meters) at which you want to obtain extra intermediate coordinates within segments.
Output segment map:	Type a name for the output segment map that will contain the copied segments.
Show:	Select this check box if you want the output map to be displayed in a map window when the operation has finished. Clear this check box if you do not want to see this map immediately: you simply define how the output map should be created.
Description:	Optionally, type a description for the output map. The description appears in the title bar when the output map is displayed.

A dependent output map is created.

Command line

The Densify segment coordinates operation can be directly executed by typing the following expression on the command line of the Main window:

OUTMAP = SegmentMapDensifyCoords(InputSegmentMap, distance)

where:

OUTMAP	is the name of your output segment map.
SegmentMapDensifyCoords	is the command to start the Densify segment coordinates operation.
InputSegmentMap	is the name of the input segment map.
distance	is the distance interval(in meters) at which new coordinates should be inserted in segments; real value > 0.

When the definition symbol = is used, a dependent output map is created; when the assignment symbol := is used, the dependency link is immediately broken after the output map has been calculated.

Algorithm

The Densify segment coordinates operation allows you to obtain more intermediate coordinates within segments. It is advised to use this operation before a Transform segments operation is performed.

All nodes and existing intermediate coordinates within segments of the input map are copied into the output map. Extra intermediate coordinates are added to the segments in the output map at a user-specified distance.

If a segment would obtain more than 1000 intermediate points, the original segment is split into two. It is advised not to use a too small distance interval, as

this may result in too many segments; a segment map cannot contain more than 32767 segments.

7.6.12 Tunnel segments

Functionality / Algorithm

The Tunnel segments operation reduces the amount of intermediate points within segments in a segment map. The segments of the input map are copied into a new segment map. However, for every three consecutive intermediate points within a segment, the middle one is omitted if it falls within a user-defined tunnel-width. Redundant nodes can also be removed.

Tunneling
In a segment map, each segment is stored as a begin node, an end node and usually one or more intermediate coordinates. Tunneling (see Figure 1) constructs a tunnel around 3 points within a segment at a time. Each time, it is determined whether the middle coordinate falls inside the tunnel or not:

- if the middle coordinate falls outside the tunnel it will be copied into the output map, and the next tunnel will start from this point;
- if the middle coordinate falls inside the tunnel, it will not be copied to the output map. This results in a straight line between the first and the third point. The next tunnel will then start from the third point.

The tunnel has a user-defined width in meters.
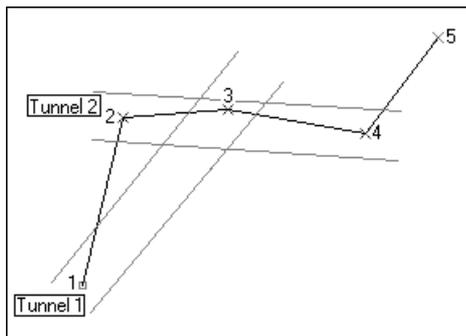
Fig. 1: Tunneling: The first tunnel is constructed around node 1, and intermediate coordinates 2 and 3. Intermediate coordinate 2 falls outside the tunnel and thus remains. The second tunnel is constructed around intermediate coordinates 2, 3, and 4. Intermediate coordinate 3 falls inside the tunnel and is thus omitted. Now that point 3 is omitted, the next tunnel will be constructed around intermediate coordinates 4, 5, and 6 (point 6 is not in this picture).

☞ When you use an extremely large tunnel width, all intermediate points between begin and end nodes may be deleted. The output map may then contain only straight lines between your begin and end nodes.

Removing superfluous nodes

Nodes form the beginning and end points of segments. Two or more segments are connected to each other when they share a node. In the special case that only two segments with the same code are connected to each other by a node, this node is not necessary, as one segment going through all the points of both segments would do. With the Tunnel segment operation, you can remove these superfluous nodes.

Input map requirements

No special input map requirements.

Domain and coordinate system of output map

The output segment map uses the same domain as the input segment map. The output segment map uses the same coordinate system and the same coordinate boundaries as the input segment map.

☞   To insert more intermediate coordinates within segments, use the Densify segment coordinates operation.

Dialog box

The Tunnel segments operation reduces the amount of intermediate points within segments in a segment map. The segments of the input map are copied into a new segment map. However, for every three consecutive intermediate points within a segment, the middle one is omitted if it falls within a user-defined tunnel-width. Redundant nodes can also be removed.

Dialog box options

Input segment map:	Select an input segment map. Open the list box and select the desired input map, or drag a segment map directly from the Catalog into this box. No special input map requirements.
Tunnel width:	Type a value for the tunnel width in meters (real value >= 0). If a tunnel width of 0 is specified, no tunneling is performed. For more information, see also Tunnel segments : functionality.
Remove superfluous nodes:	Select this check box if you want to remove superfluous nodes from the segment map (recommended). Clear this check box if you want all existing nodes to remain.
Output segment map:	Type a name for the output segment map that will contain the copied segments.
Show:	Select this check box if you want the output map to be displayed in a map window when the operation has finished. Clear this check box if you do not want to see this map immediately: you simply define how the output map should be created.

Description: Optionally, type a description for the output map. The description appears in the title bar when the output map is displayed.

A dependent output map is created.

Command line

The Tunnel segments operation can be directly executed by typing the following expression on the command line of the Main window:

OUTMAP = SegmentMapTunneling(InputSegmentMap, tunnel width, remove nodes)

where:

OUTMAP	is the name of your output segment map.
SegmentMapTunneling	is the command to start the Tunnel segments operation.
InputSegmentMap	is the name of the input segment map.
tunnel width	is the width of the tunnel in meters; real value >= 0; when a tunnel width of 0 is specified, no tunneling is performed.
remove nodes	yes │ no ; remove superfluous nodes or not.

When the definition symbol = is used, a dependent output map is created; when the assignment symbol := is used, the dependency link is immediately broken after the output map has been calculated.

7.6.13 Transform segments

Functionality

The Transform segment map operation transforms segments in a segment map to a new coordinate system. All points are transformed as individual coordinates from one coordinate system to another.

The operation can be used for example:
- to integrate data of different sources in different projections,
- to preserve data or results in a more appropriate projection.

Input requirements

This operation requires:
- An input segment map which coordinate system has a certain known projection or uses the ILWIS LatLon coordinate system. When the map projection is unknown, no transformation is possible.
- Another coordinate system which is the target coordinate system.

Domain and coordinate system of output map
The output segment map uses the same domain as the input segment map. The
output map gets the selected coordinate system with the transformed coordinate
boundaries of the input map. Also the selected coordinate system needs to have a
certain known projection or the ILWIS LatLon coordinate system. When the map
projection is unknown, no transformation is possible.

Note that when selecting a map projection, for smaller areas (larger scales) the
distortion often can be neglected and for large areas (small scales) this can be very
large.

☞ To create a coordinate system with a projection, refer to: ILWIS objects : coordinate
    systems.
☞ When you work with multiple neighbouring map sheets, it is advised to use one
    coordinate system containing the smallest minimum X and Y, and the largest
    maximum X and Y coordinates of all those map sheets. Then, use this coordinate
    system for all your maps.
☞ For better understanding it is advisable to add a graticule (Layers menu in the map
    window, choose Add Annotation) to the map window.
☞ Straight lines are usually defined by their start and end points. Therefore they
    remain straight lines when they are transformed to another projection; only the
    coordinates of the begin and end points change. It is advised to increase the number
    of intermediate points to preserve the shape of the segment. Intermediate points can
    be added to a segment with Densify segment coordinates.

Dialog box

The Transform segment map operation transforms segments in a segment map to a
new coordinate system. All points are transformed as individual coordinate from
one coordinate system to another. Both coordinate systems require projection
information or have the ILWIS LatLon coordinate system.

Dialog box options:

Input Segment Map:	Select the name of the input segment map. Open the list box and select the desired input map, or drag a segment map directly from the Catalog into this box.
Coordinate system:	Select an existing target coordinate system for the output map. Open the list box and select the desired coordinate system, or drag a coordinate system directly from the Catalog into this box.
Output Segment map:	Type a name for the output segment map.
Show:	Select this box if you want the output map to be displayed in a map window when the operation has finished. Clear this box if you do not want to see this map immediately: you simply define how the output map should be created.

Description: Optionally, type a description for the output map. The description appears in the title bar when the output map is displayed.

A dependent output map is created.

Command line

The Transform segment map operation can be directly executed by typing the following expression on the command line of the Main window:

OUTMAP = SegmentMapTransform(InputSegmentMapName,
CoordinateSystem)

where:

OUTMAP   is the name of your output segment map.
SegmentMapTransform   is the command to start the Transform Segment operation.
InputSegmentMapName   is the name of your input segment map.
CoordinateSystem   is the name of your target coordinate system.

When the definition symbol = is used, a dependent output map is created; when the assignment symbol := is used, the dependency link is immediately broken after the output map has been calculated.

Algorithm

The segments are retrieved from the input map. All points are transformed as individual coordinate pairs from one coordinate system to another.

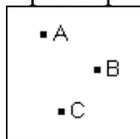### 7.6.14 Attribute map of point map

Functionality

By creating an attribute map of a point map, the class name or ID of each point in the original map is replaced by the value, class or ID found in a certain column in an attribute table.

A point map using a Class or ID domain, can have extra attribute information on the classes or identifiers in the map. These attributes are stored in columns in an attribute table. The attribute table can be linked to the map to which it refers, or to the domain of the map. You can check whether an attribute table is linked to the point map or to its domain through the Properties dialog box of the map or the domain.

Example of creating an attribute map
In the pictures below, an attribute map is created for the average monthly rainfall (mm) for stations A, B, and C.
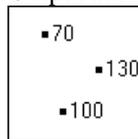
Input map: Attribute table: Output attribute map:

Input map requirements
- the input map needs to be a map with a domain of the Class or ID type;
- the table, from which you want to choose a column, should use the same domain as the map;
- the attribute table can be linked to the map or to its domain;
- the attribute table should have one or more columns with attribute values, classes or IDs.

An attribute map can be created from any column with a value, class or ID domain, but not from a column using domain String.

Domain and coordinate system of output map
The output map uses the same domain as the specified attribute column. The output map uses the same coordinate system and coordinate boundaries as the input map.

☞ This operation creates a permanent attribute map. To temporarily display an attribute map, you can select the option 'Attribute' in the Display Options dialog box when displaying a point map.

☞ The colors and symbols in which an attribute map is displayed, depend on the domain of the specified attribute column:
- if you used a domain Class attribute column and when this domain already has a user-defined representation, then this representation is automatically selected in the Display Options dialog box which appears when you display the attribute map. In the Display Options dialog box, you can also select another existing representation or create a new representation by clicking the create button.
- if you used a domain Value attribute column, you can either select one of the standard value representations or create your own representation by clicking the create button in the Display Options dialog box which appears when you display the attribute map.

☞ You can also create attribute maps of raster maps, attribute maps of polygon maps and attribute maps of segment maps.

Dialog box

By creating an attribute map of a point map, the class name or ID of each point in the original map is replaced by the value, class or ID found in a certain column in an attribute table.

A point map using a domain Class or ID, can have extra attribute information on the classes or identifiers in the map. These attributes are stored as columns in an

attribute table. You can check whether an attribute table is linked to the point map or to its domain through the Properties dialog box of the map or the domain.

Dialog box options

Input point map:	Select an input point map. Open the list box and select the desired input map, or drag a point map directly from the Catalog into this box. The input map should be a domain Class or ID map.
Table:	By default, the attribute table linked to the selected input map or to its domain is shown. In case you want to use another table, select a table with the same domain as the input map from the list box.
Attribute:	Select an attribute column from the attribute table.
Output point map:	Type a name for the output point map that will contain the attribute values.
Show:	Select this check box if you want the output map to be displayed in a map window when the operation has finished. Clear this check box if you do not want to see this map immediately: you simply define how the output map should be created.
Description:	Optionally, type a description for the output map. The description appears in the title bar when the output map is displayed.

A dependent output map is created.

Command line

The Attribute map of point map operation can be directly executed by typing one of the following expressions on the command line of the Main window:

OUTMAP = `PointMapAttribute`(InputPntMapName, ColumnName)

OUTMAP = `PointMapAttribute`(InputPntMapName,
          TableName.ColumnName)

where:

OUTMAP	is the name of your output point map.
`PointMapAttribute`	is the command to start the creation of an attribute map of a point map.
InputPntMapName	is the name of your input point map. For the first expression, the attribute table needs to be linked to the input map or its domain.
TableName	is the name of an attribute table. The attribute table should use the same domain as the input map but it does not need to be linked to the point map or its domain.
ColumnName	is the name of an attribute column in the attribute table.

When the definition symbol = is used, a dependent output map is created; when the assignment symbol := is used, the dependency link is immediately broken after the output map has been calculated.

Algorithm

The program scans the point map point by point.

Each point is copied to the output map while:
- the original class name or ID of each point in the input map is replaced with the attribute value that belongs to this class or ID as found in the attribute table.

Undefined values are assigned to an output point:
- if the point name in the input map is undefined, or
- if the class name, ID, or value in the selected attribute column is undefined.

7.6.15 Mask points

Functionality

The Mask Points operation allows you to selectively copy points of an input point map into a new output point map. The user has to specify a mask to select and retrieve the class names, IDs or values of the points that are to be copied.

By specifying a mask, you can search for points with a certain class name, ID or value. A mask is in fact a simple query to find (retrieve), display or use only those points in a map that have certain class names, identifiers or values. A mask contains one or more search strings in which wild cards, asterisks (*) and question marks (?), are allowed. You can enter as many search strings in a mask as you like; separate the strings by commas.

Mask syntax
- search strings in a mask are compared with the classes, IDs or values of the domain of a map; when a map uses a class or ID domain and the classes or IDs have codes, the mask works on the codes and on the names and on the combination of codes and names,
- to find/retrieve one specific class name, identifier or value: type that class name, ID or identifier in the mask,
- to find/retrieve multiple class names, identifiers or values: separate the different class names, identifiers or values in the mask by commas (it does not matter whether you use spaces before or after a comma)
- you can use asterisks as wild cards to replace zero or more characters in class names, IDs or values, for example `borehole*` or `1*,2*,3*`, or even `*25,*50,*75,*00`, or `A*b*,D*g*`
- you can use question marks as wild cards to replace single characters in class names, identifiers or values, for example `Ab?,D?,Gl?` or `?p,??i`, or `A*b??,D*g??`

- in a dialog box, you should not use quotes around class names, identifiers or values,
- on the command line, you must use double quotes around the complete mask.

Examples
- When a point map contains topographic features, and you want to copy points with class names 'city' and 'mountain peak'; use as mask: `city, mountain peak`
- When a point map contains bore holes identified by IDs between 100 and 999, and you want to copy the points with an ID that starts with a 1, e.g. IDs 101, 102, 103, etc.; use as mask: `1*`
- When a point map contains information on precipitation in millimeters, and you want to copy the points with a precipitation between 400 and 600; use as mask: `4*,5*,6*`

For more information, see How to use masks.

Requirements for input point map
No special input map requirements.

Domain and coordinate system of output map
The output point map uses the same domain as the input point map. The output point map uses the same coordinate system and coordinate boundaries as the input point map.

☞   This operation creates a new point map. You can also display specific points of a point map in a map window without creating a new point map: select the Mask check box on the Display Options dialog box of the point map which appears when you open the point map. Then, specify the mask, i.e. the class names, identifiers or values of the points that you want to display.

☞   To copy a certain area of a point map into a new point map, see Sub-map of point map.

Dialog box

The Mask Points operation allows you to selectively copy points of an input point map into a new output point map. The user has to specify a mask to select and retrieve the class names, IDs or values of the points that are to be copied. For more information, see Mask Points : functionality and How to use masks.

Dialog box options

Input point map: Select an input point map. Open the list box and select the desired input map, or drag a point map directly from the Catalog into this box. No special input map requirements.

Mask: Type (multiple) search strings to find the points that you want to copy. For more information, see Mask Points : functionality and How to use masks.

Output point map: Type a name for the output point map that will contain the
                         copied points.
Show: Select this check box if you want the output map to be
                         displayed in a map window when the operation has finished.
                         Clear this check box if you do not want to see this map
                         immediately: you simply define how the output map should
                         be calculated.
Description: Optionally, type a description for the output map. The
                         description appears in the title bar when the output map is
                         displayed.

A dependent output map is created.

Command line

The Mask Points operation can be directly executed by typing the following
expression on the command line of the Main window:

OUTMAP = `PointMapMask`(Input PointMap,"mask")

where:
OUTMAP   is the name of your output point map.
`PointMapMask`   is the command to start the Mask Points operation.
InputPointMap   is the name of the input point map.
`"mask"`   are the (multiple) search strings to find the classes, IDs or
                       values in the input map that you want to copy into the
                       output map; on the command line, the total mask needs to
                       be surrounded by double quotes.

When the definition symbol = is used, a dependent output map is created; when the
assignment symbol := is used, the dependency link is immediately broken after the
output map has been calculated.

Algorithm

The Mask Points operation simply copies those points of the input map of which
the name, code, or value matches one of the search strings specified in the mask
into the output point map.

7.6.16 Sub-map of point map

Functionality

The Sub-map of point map operation copies all points within a user-specified rectangle into a new point map. The user has to specify minimum and maximum XY-coordinates for the new point map.

This operation allows to change the coordinate boundaries of your point map. The output point map can be smaller than the input map, but it can also be larger.

- If the output map is smaller than the input map, then only the points within the rectangle of the specified output coordinates are copied into the new output point map.
- If the output map is larger than the input map, all input points are copied, and extra space is created around the points of the original point map.

☞ The Sub-map of point map operation permanently reduces or enlarges the area covered by a point map.

- To temporarily reduce the area of a point map, you can zoom in on the point map in a map window. The result can be stored as a map view.
- To temporarily enlarge the area of a point map, i.e. to create white space around a point map in a map window for annotation purposes, you can use the Extend Window command on the Options menu in the map window, or you can zoom in on the point map and drag a rectangle partly outside the map window. The result can be stored as a map view.

Requirements for input point map

No special input map requirements.

Domain and coordinate system of output map

The output point map uses the same domain as the input point map. The output point map uses the same coordinate system as the input point map; the coordinate boundaries for this output point map are user-defined.

Dialog box

The Sub-map of point map operation copies all points within a user-specified rectangle into a new point map. The user has to specify minimum and maximum XY-coordinates for the new point map.

Dialog box options

Input point map:	Select an input point map. Open the list box and select the desired input map, or drag a point map directly from the Catalog into this box. No special input map requirements.
MinX, MinY:	Type the minimum X-coordinate and the minimum Y-coordinate for the output map.

MaxX, MaxY:	Type the maximum X-coordinate and the maximum Y-coordinate for the output map.
Output point map:	Type a name for the output point map that will contain the copied points.
Show:	Select this check box if you want the output map to be displayed in a map window when the operation has finished. Clear this check box if you do not want to see this map immediately: you simply define how the output map should be created.
Description:	Optionally, type a description for the output map. The description appears in the title bar when the output map is displayed.

A dependent output map is created.

Command line

The sub-map of point map operation can be directly executed by typing the following expression on the command line of the Main window:

OUTMAP = PointMapSubMap(InputPointMap, minX, minY, maxX, maxY)

where:

OUTMAP	is the name of your output point map.
PointMapSubMap	is the command to start the sub-map of point map operation.
InputPointMap	is the name of the input point map.
minX	minimum X-coordinate of output point map (real number).
minY	minimum Y-coordinate of output point map (real number).
maxX	maximum X-coordinate of output point map (real number).
maxY	maximum Y-coordinate of output point map (real number).

When the definition symbol = is used, a dependent output map is created; when the assignment symbol := is used, the dependency link is immediately broken after the output map has been calculated.

Algorithm

The Sub-map of point map operation copies all points within a user-specified rectangle into a new point map. The user has to specify minimum and maximum XY-coordinates for the output point map.

Then:
- all points of the input map that fall within the output coordinate rectangle are copied to the output point map;
- points of the input map that fall outside the coordinate rectangle are not copied into the output point map.

7.6.17 Glue point maps

Functionality

The Glue point maps operation glues or merges two or more point maps into one output point map. You can thus merge for instance point maps that were digitized as separate point maps from different map sheets.

By default, the operation copies all points of the input maps into the output map. You can also specify a mask to select and retrieve the class names, IDs or values of the points that are to be copied into the output map. For more information on how to use a mask, see also Mask points : functionality.

By default, the operation finds the minimum and maximum X and Y coordinates used in the two, three or four different input maps and creates from this the coordinate boundaries for the output map. The output map thus comprises the total area of all input maps. You can also define the coordinate boundaries of the output map yourself, by specifying a so-called 'clip boundary'. Then, all points of the input maps that fall within these coordinates are copied.

Input map requirements
All input point maps should be of the same domain type; i.e. two or more Class maps, two or more ID maps, or two or more Value maps. The contents of the input domains does not necessarily need to be the same. For more information, see the section Domain of output map below. Furthermore, the input point maps should have the same or a compatible coordinate system; input point maps may not use coordinate system Unknown.

Domain of output map
- When combining point maps with a Value domain, the output map always uses the system Value domain. The value range for the output map is determined by the smallest minimum and the largest maximum of all input maps; the precision is determined by the smallest precision of the input maps.
- When combining point maps with the same Class domain, the output map also uses this Class domain. In case the class names in the input domains are different, both domains are merged into a new domain, and the output domain then contains all domain items, i.e. all classes, and the output map thus shows both input maps with their original class names. The new domain is either stored as a separate object, or is stored by the output map (internal domain).
- When combining point maps with ID domains, the same procedure is followed as for Class maps but the output domain is an ID domain.

☞ For more information on internal domains and internal representations, see How to open internal domains/representations.

Coordinate system of output map
The output point map uses the coordinate system of the first input map. The coordinate boundaries for the output map are determined from all input maps or are as specified by the user. When the coordinate systems of the input maps are different (e.g. different projections) but compatible, the point coordinates will be transformed to the coordinate system of the first input map.

Dialog box

The Glue point maps operation glues or merges two or more point maps into one output map. By default, the output point map then comprises the total area of all input maps. The domains of the input maps are merged when needed.

For each input map, the user can further specify a mask to select and retrieve the class names, IDs or values of the points that are to be copied into the output map. The user can also specify a clip boundary, to copy only those points to the output map which fall within the specified coordinate boundaries of the output map.

In the dialog box, the number of input maps is limited to four. On the command line, this limitation is not present.

Dialog box options

Number of input maps:	Select the number of point maps that you want to glue or merge together (2, 3, or 4).
Input map names:	Select the input point maps. You can always glue point maps of the same domain type. For more information on mergeable domain types, see Glue point maps : functionality.
Masks:	Type for each point map (multiple) search strings to find the points that you want to be copied into the output map. By default, all points of all input maps are copied. For more information on masks, see Mask points : functionality or How to use masks.
Clip boundary:	Select this check box if you want to limit or extend the area comprised by the output map: specify the coordinate boundaries for the output map yourself. Clear this check box if the output map should comprise the whole area of all input maps.
MinX, MinY:	Type the minimum X-coordinate and the minimum Y-coordinate for the output map.
MaxX, MaxY:	Type the maximum X-coordinate and the maximum Y-coordinate for the output map.
New domain:	When merging Class or ID maps that do not use the same domain, select this box if you want to store the output domain as a separate object (recommended). Subsequently, type a name for the new domain. Clear this

	check box to obtain an output Class or ID domain which is stored by the output map (internal domain).
Output point map:	Type a name for the output point map that will contain the copied points.
Show:	Select this check box if you want the output map to be displayed in a map window when the operation has finished. Clear this check box if you do not want to see this map immediately: you simply define how the output map should be created.
Description:	Optionally, type a description for the output map. The description appears in the title bar when the output map is displayed.

A dependent output map is created. When needed and specified, a new domain is also created.

Command line

The Glue point maps operation can be directly executed by typing one of the following expressions on the command line of the Main window:

OUTMAP = `PointMapGlue(InputPointMap1, "mask1", InputPointMap2, "mask2")`

OUTMAP = `PointMapGlue(InputPointMap1, "mask1", InputPointMap2, "mask2", NewDomain)`

OUTMAP = `PointMapGlue(InputPointMap1, "mask1", InputPointMap2, "mask2", InputPointMap3, "mask3")`, etc.

OUTMAP = `PointMapGlue(minX, minY, maxX, maxY, InputPointMap1, "mask1", InputPointMap2, "mask2")`

OUTMAP = `PointMapGlue(minX, minY, maxX, maxY, InputPointMap1, "mask1", InputPointMap2, "mask2", NewDomain)`

OUTMAP = `PointMapGlue(minX, minY, maxX, maxY, InputPointMap1, "mask1", InputPointMap2, "mask2", InputPointMap3, "mask3")`, etc.

On the command line, you can specify as many input maps and their masks as needed.

where:

OUTMAP	is the name of your output point map.
PointMapGlue	is the command to start the Glue point map operation.
InputPointMap1	is the name of the first input point map.
InputPointMap2	is the name of the second point map.
InputPointMap3	is the name of the third point map (optional).
Mask1	are the (multiple) search strings to find the classes, IDs or values of the points in the first input map that you want to

	copy into the output map; on the command line, the total mask for each input map needs to be surrounded by double quotes. To copy all points, use as mask: "∗".
Mask2	are the (multiple) search strings to find the classes, IDs or values of the points in the second input map that you want to copy into the output map.
Mask3	are the (multiple) search strings to find the classes, IDs or values of the points in the third input map that you want to copy into the output map.
minX	minimum X-coordinate of output point map (real number).
minY	minimum Y-coordinate of output point map (real number).
maxX	maximum X-coordinate of output point map (real number).
maxY	maximum Y-coordinate of output point map (real number).
NewDomain	is an optional parameter, when merging Class or ID maps that do not have the same domain, to specify a name for the new output domain in which all input domain items will be merged. When input Class or ID domains are not the same and this parameter is not specified, the new output domain in which all input domain items are merged will be stored by the output map (internal domain).

When the definition symbol = is used, a dependent output map is created; when the assignment symbol := is used, the dependency link is immediately broken after the output map has been calculated. When Class or ID maps are merged that do not have the same domain, and the NewDomain parameter is used, a new output domain is also created.

Algorithm

The Glue point maps operation glues or merges two or more point maps into one output map. By default, the output map then comprises the area of all input maps. The domains of the input maps are merged when needed.

Rules

To copy point from the input maps into the output map, the following rules are applied:
- the class names, IDs or values of the input points must match the specified mask, and
- the input points must fall within the specified clip boundary.

By default, all points are copied into the output map. By default, coordinate boundaries for the output map are determined from the coordinate boundaries of all input maps. When the coordinate systems of the input maps are different but compatible, the point coordinates will be transformed to the coordinate system of the first input map.

Output domain
- When merging two maps with the same domain, the output map will also use that domain.
- When merging Value maps, the value range for the output map is determined by the smallest minimum and the largest maximum of all input maps; the precision is determined by the smallest precision of all input maps.
- When merging Class maps or ID maps that do not have the same domain, a new output domain is created which contains all domain items, i.e. all classes. The new domain is either stored as a separate object, or is stored by the output map (internal domain).

7.6.18 Transform points

Functionality

The Transform point map operation transforms points in a point map to a new coordinate system. All coordinate pairs are transformed from a source coordinate system to a target coordinate system.

The operation can be used for example:
- to integrate data of different sources in different projections,
- to present data or results in a more appropriate projection.

Input requirements
- An input point map which coordinate system has a certain known projection or uses the ILWIS LatLon coordinate system. When the map projection is unknown, no transformation is possible.
- Another coordinate system which is the target coordinate system.

Domain and coordinate system of output map
The output point map uses the same domain as the input point map. The output map gets the selected coordinate system with the transformed coordinate boundaries of the input map. Also the selected coordinate system needs to have a certain known projection or the ILWIS LatLon coordinate system. When the map projection is unknown, no transformation is possible.

☞ To create a coordinate system with a projection, refer to: ILWIS objects : coordinate systems.
☞ When you work with multiple neighbouring map sheets, it is advised to use one coordinate system containing the smallest minimum X and Y, and the largest maximum X and Y coordinates of all those map sheets. Then, use this coordinate system for all your maps.
☞ For better understanding it is advisable to add a graticule (Layers menu in the map window, choose Add Annotation) to the map window.

Dialog box

The Transform point map operation transforms points in a point map to a new coordinate system. All coordinate pairs are transformed from one coordinate system to another. Both coordinate systems require projection information or have the ILWIS LatLon coordinate system.

Dialog box options

Input point map:	Select an input point map. Open the list box and select the desired input map, or drag a point map directly from the Catalog into this box.
Coordinate system:	Select an existing target coordinate system for the output map. Open the list box and select the desired coordinate system, or drag a coordinate system directly from the Catalog into this box.
Output point map:	Type a name for the output point map that will contain the points that are created from the points in the input map.
Show:	Select this box if you want the output map to be displayed in a map window when the operation has finished. Clear this box if you do not want to see this map immediately: you simply define how the output map should be created.
Description:	Optionally, type a description for the output map. The description appears in the title bar when the output map is displayed.

A dependent output map is created.

Command line

The Transform point map operation can be directly executed by typing the following expression on the command line of the Main window:

OUTMAP = `PointMapTransform`(InputPointMapName, CoordinateSystem)

where:

OUTMAP	is the name of your output point map.
`PointMapTransform`	is the command to start the Transform Point operation.
InputPointMapname	is the name of your input point map.
CoordinateSystem	is the name of your target coordinate system.

When the definition symbol = is used, a dependent output map is created; when the assignment symbol := is used, the dependency link is immediately broken after the output map has been calculated.

Algorithm

The Transform point map operation transforms points in a point map to a new coordinate system. All coordinate pairs are transformed from a source coordinate system to a target coordinate system. Both coordinate systems require project information or have the ILWIS LatLon coordinate system.

7.6.19 Transform coordinates

Functionality/ Dialog box

Transform coordinates allows you to type in XY-coordinates using a certain coordinate system, and shows the resulting XY-coordinates in another coordinate system. Both coordinate systems require projection information.

The coordinate transformation can be useful to check whether the transformation is correct. When typing the X and Y coordinates of a point of interest to be transformed, you are able to interactively view the output coordinates for the selected point.*

This dialog box appears:
- when you choose Transform coordinates from the Operations, Vector operations, Points menu in the Main window, or
- when you double-click the Transform coordinates item in the Operation-list, or
- when you clicked with the right mouse button on a coordinate system in the Catalog.

Dialog box options

Input coordinate system:	Select the input coordinate system. Open the list box and select the desired coordinate system, or drag a coordinate system directly from the Catalog into this box. If a description exists for this coordinate system, this description will appear one line below this Input Coordinate System.
Input coordinate:	Type the X and Y coordinates of the point of interest.
Output coordinate system:	Select the output coordinate system. Open the list box and select the desired coordinate system, or drag a coordinate system directly from the Catalog into this box. If a description exists for this coordinate system, this description will appear one line below this Output Coordinate System.
Output coordinate:	The calculated coordinates for the point of interest in the output projection will be displayed in the text box.

☞ If the ILWIS LatLon coordinate system is used, coordinates are presented as geographic coordinates.