

Introduction to PowerWorld Simulator: Interface and Common Tools



I6: Contouring and Advanced Visualization



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Contouring and Advanced Visualization



- Contouring
 - Underlay your oneline with an image
 - Detailed examples covered
- Other Features will be demonstrated
 - Geographic Data Views
 - Auto-created geographic data visualization
 - Emphasis of Display Objects
 - Make specific objects standout on your oneline
 - Dynamic Formatting
 - Allows for Conditional Dynamic Formatting of Onelines and Case Information Displays
 - Geographic Information System (GIS) Support
 - Reading ESRI Shapefiles (*.shp/*.dbf/*.shx groups)
 - Writing and reading KML files (used by Google Earth)
 - Read existing coordinate data



Contouring Visualization

Contouring Visualization



- What is Contouring used for?
- Using the Contour Options Dialog
- Examples
 - Bus Voltage Magnitudes
 - Line MVA Percentage Loadings
 - Line PTDFs
 - Or any other numeric quantity
- Recommendations on using Contouring

Uses of Contouring

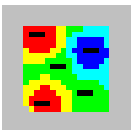


- Analyze large amounts of information all at once
- Get an overview at a glance
- Monitoring data
- Presenting data

Contour Options Dialog



- Contour Options Dialog is used to control the contouring used on a oneline
- Note: Contouring is available in Run Mode and Edit Mode
- Contour Options Dialog can be viewed by
 - Contouring option on oneline local menu
 - **Onelines** ribbon tab → **Contouring**
- Many Options: a useful technique is to place a contour first, and then edit the options to obtain desired visual characteristics



Contour Options Dialog - Contour Type Left Side



Select object type to contour.

Only object types present on
the active oneline are enabled.

Select the value you want to contour

Data Points per Line: for Line/
Transformer or Interface contours

Color Key (legend) options

Recalculate Contours is similar to
OK, but does not close the dialog.

The screenshot shows the 'Contour Options' dialog box with several tabs: 'Contour Type', 'Contour Type Options', 'Custom Color Map', 'Contour Data Points', and 'Contour Pixels'. The 'Contour Type' tab is active. It contains the following sections:

- Contour Type:** A group box with radio buttons for 'Object' (selected), 'Line/Transformer', 'Interface', 'Area', 'Generator', 'Substation', 'Zone', 'Injection Group', 'Supplemental Data', and 'Spatial Data'. Below this is a checkbox 'Do not include objects not presently visible due to Layers or Display Detail'.
- Value:** A dropdown menu showing 'Area\Number'.
- Filter Object Values:** Two buttons: 'Find...' and 'Define...'.
- Pixel Options:** A section with 'Data Points per Line' set to 15, a 'No Data Color' dropdown, a 'Specific Color' dropdown, and a 'Color Map %' set to 50.
- Color Key:** A section with a checked 'Draw Color Key' checkbox, a 'Title' field set to 'Area\Number', 'Entry Labels' fields, 'Dec.Pts.' set to 1, and 'Scalar' set to 1.0000. There are also checkboxes for 'Use Equal Spacing' and 'Show Value Panel'.
- Color Map:** A section with a 'Color Map' dropdown set to 'Blue=low, Red=High', a 'Reverse Color Map Colors' checkbox, a 'Brightness' slider, and a color bar.
- Values:** A section with checkboxes for 'Use absolute value', 'Ignore Above Max', 'Ignore Below Min', and 'Ignore Zero Values'. It also has fields for 'Maximum', 'Break High', 'Nominal', 'Break Low', and 'Minimum', all set to 1.0. There are 'Calculate Values' and 'Interpretation' (set to 'Fixed values') options.
- Contour Method:** A section with radio buttons for 'Standard (Shepard's)' (selected), 'Nearest Value', and 'Delaunay Triangulation'.
- Buttons:** At the bottom, there are buttons for 'Recalculate Contours', 'Save to AXD...', 'Load from AXD...', 'OK', 'Remove', 'Cancel', and 'Help'.

Orange arrows point from the text on the left to specific elements in the dialog: 'Object' radio button, 'Area\Number' dropdown, 'Data Points per Line' field, 'Draw Color Key' checkbox, 'Recalculate Contours' button, and the 'OK' button.

Contour Options Dialog - Interpretation



- Options for interpreting the Contour min, max, break high, break low, and nominal values
- Fixed Values (Default)
 - Use user input values
 - User input values have the same units as the contoured quantities
- Dynamic Values
 - Automatically determine min, max, nominal, etc.
 - Max = maximum data point value
 - Min = minimum data point value
 - Nominal = Average data point value
 - Break high = $(\text{Max} + \text{Average}) / 2$
 - Break low = $(\text{Min} + \text{Average}) / 2$

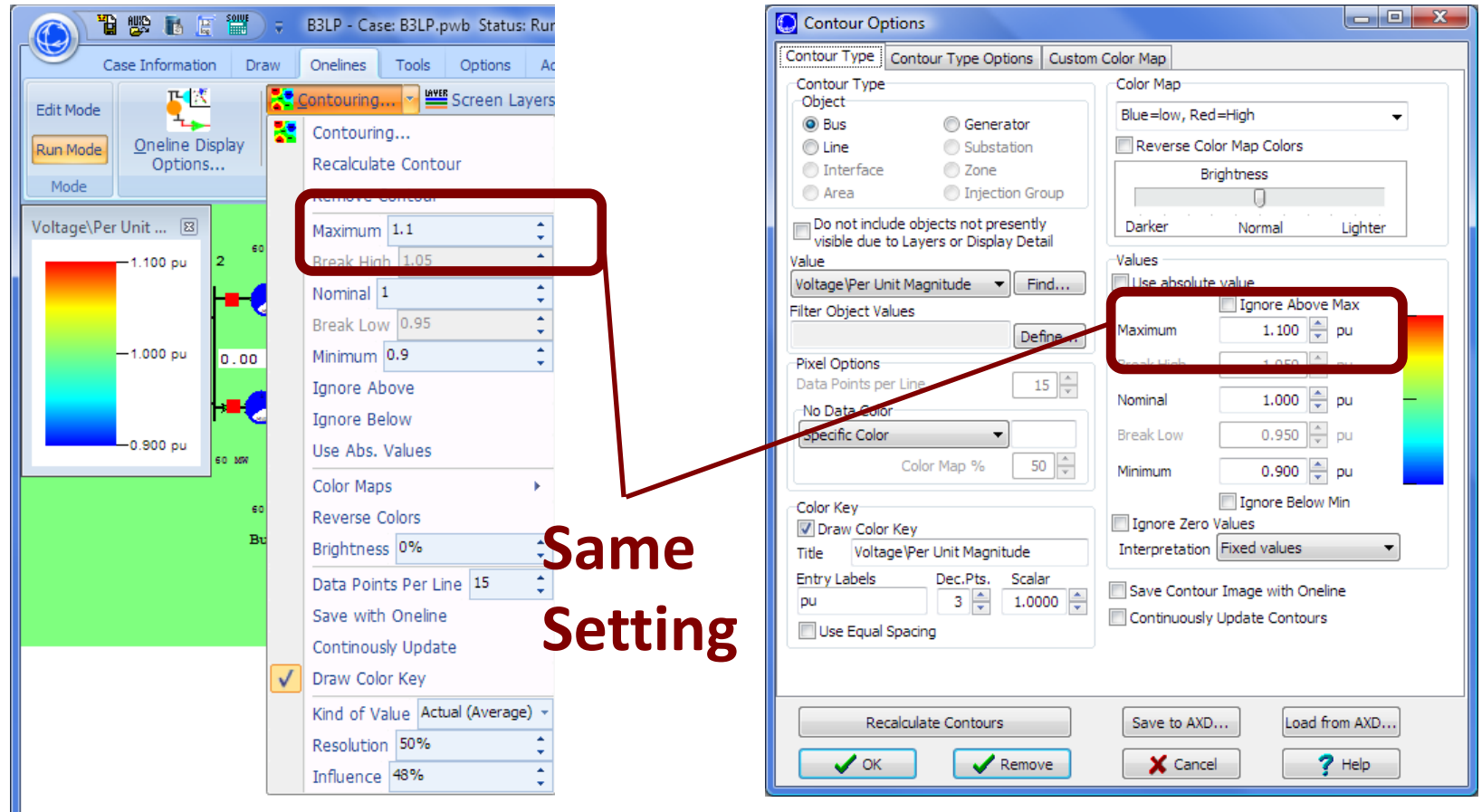
Contour Options Dialog - Interpretation



- Standard Deviations
 - Calculate mean, standard deviation
 - Put all values in terms of standard deviations away from the mean
 - User input values for min, max, etc are used with units of standard deviation (stdev)
- Percentiles
 - Sort data points from lowest to highest
 - Give the greatest data point a value of 100
 - Give the smallest data point a value of 0
 - User input values are used with units of percent (pct)

Contour Options Toolbar

- Select the contouring drop-down to show the same options available in the dialog.



Contour Options Dialog - Contour Type Options



Area of influence
about each
contoured point

Dynamic
contouring adjusts
influence region
according to
density of data
points

If **Use Fade To Value** is
checked, then
Percentage at which contour
begins to fade towards the
Fade To Value

Set contour resolution

Using Graphics Processing Unit
can greatly speed up contouring.
Option will automatically be
disabled if graphics card cannot
handle contouring acceleration.

Contour Type

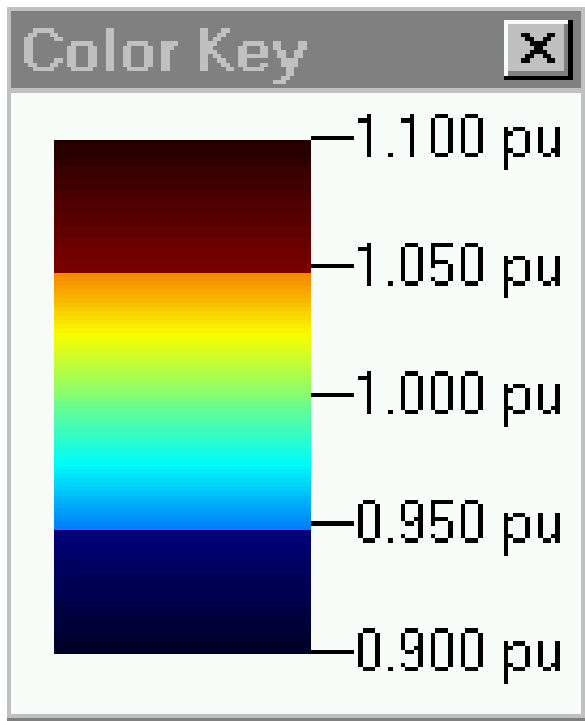


- Specify the type of display object that should be used for contouring
- Specify the value of the respective object to use
- Specify an Advanced Filter... to reduce what is contoured.

Values



- These define the values used in the color maps. (The color key displays the values)



Maximum (all values above are mapped to dark red)

Break High

Nominal

Break Low

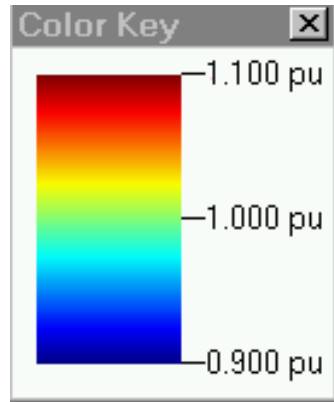
Minimum (all values below are mapped to dark blue)

Color Maps

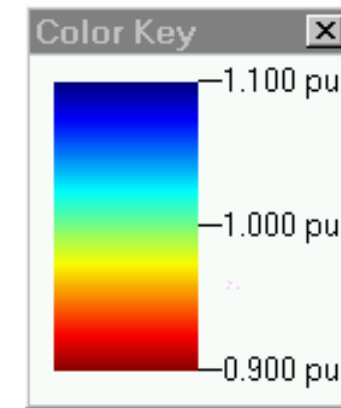


- Simulator offers several default Color Maps
- For contours for which both low and high values are of significance (such as Bus Voltages) the following color maps are recommended

Blue = Low,
Red = High



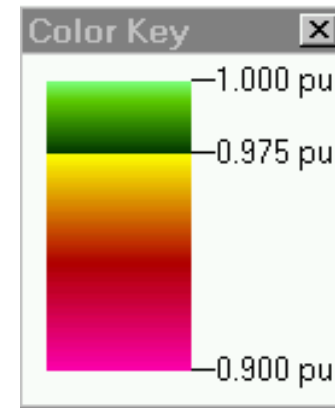
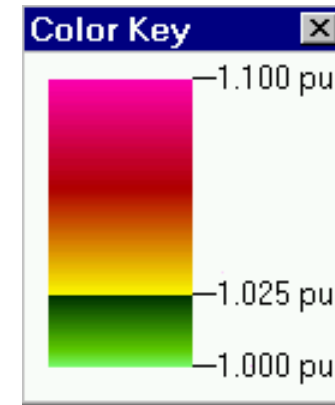
Reverse Colors
To get this



Color Maps



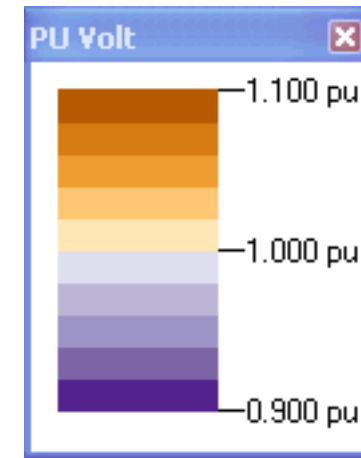
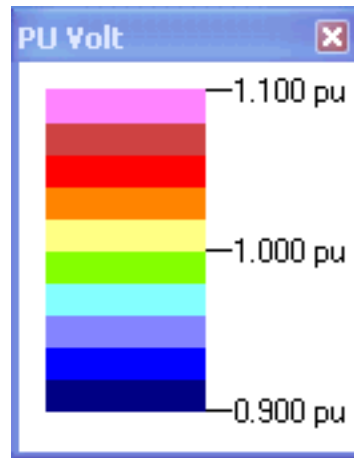
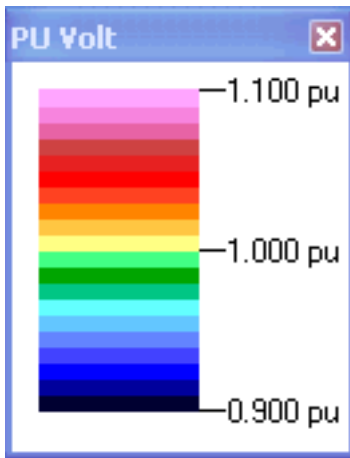
- For contours for which only high values are significant, Radar Map High Limits is recommended
- For contours for which only low values are significant, Radar Map Low Limits is recommended



Discrete Color Maps



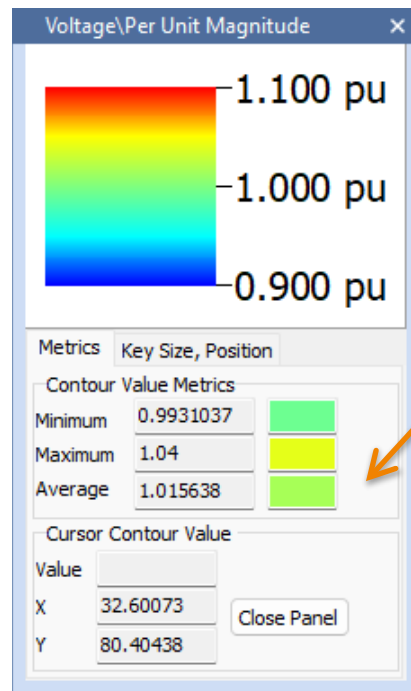
- Simulator also comes with several discrete color maps.
- Some examples are shown below.



Draw Color Key



- Checking Draw Color Key tells Simulator to draw a “color key dialog” along with the contour:

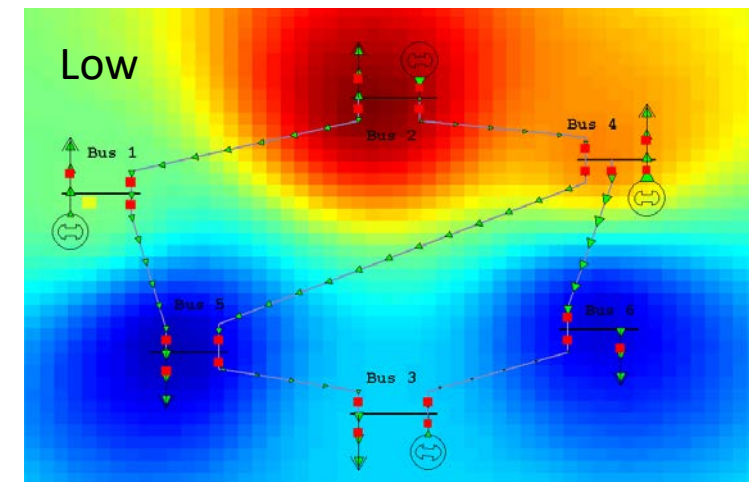
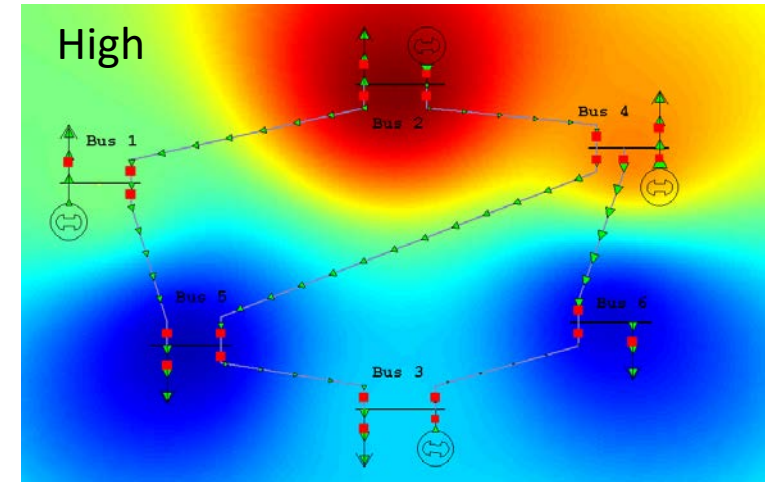


The Value Panel shows the underlying data and corresponding color of pixel at the mouse-over location (optionally show or hide it)

Contour Resolution



- Sets the resolution of the contour
- High means a better picture with more computation time required
- Low means a “grainy” picture with less computation time

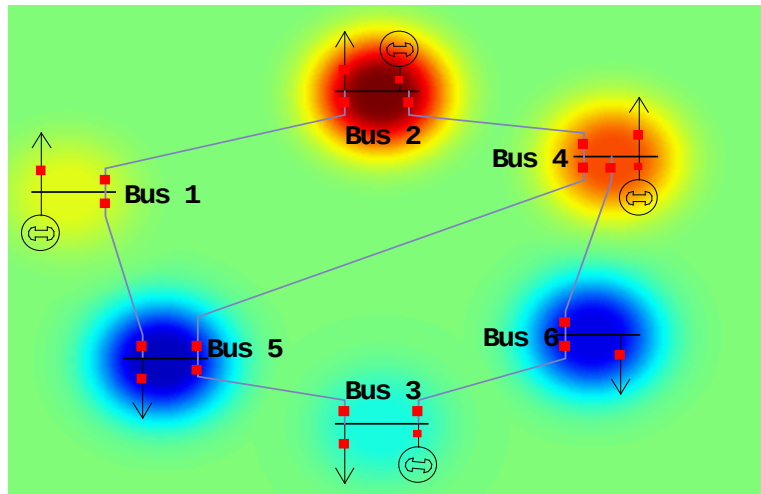


Influence Region

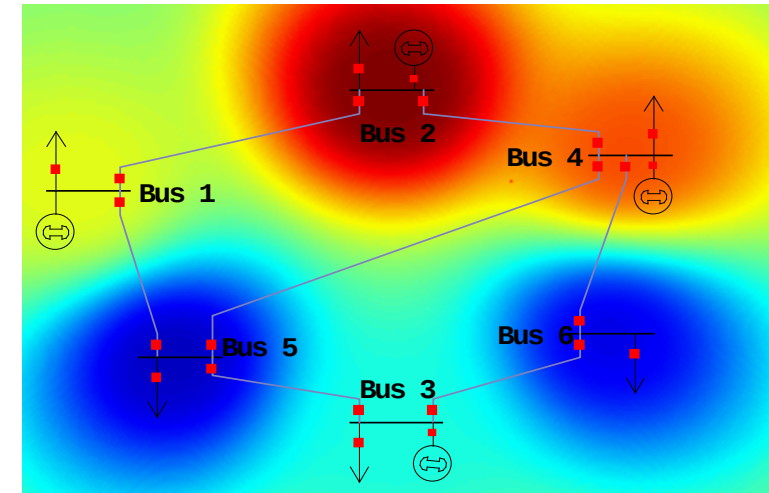


- Controls how large the “influence distance” is for a data point.

Influence Region Small



Influence Region Large

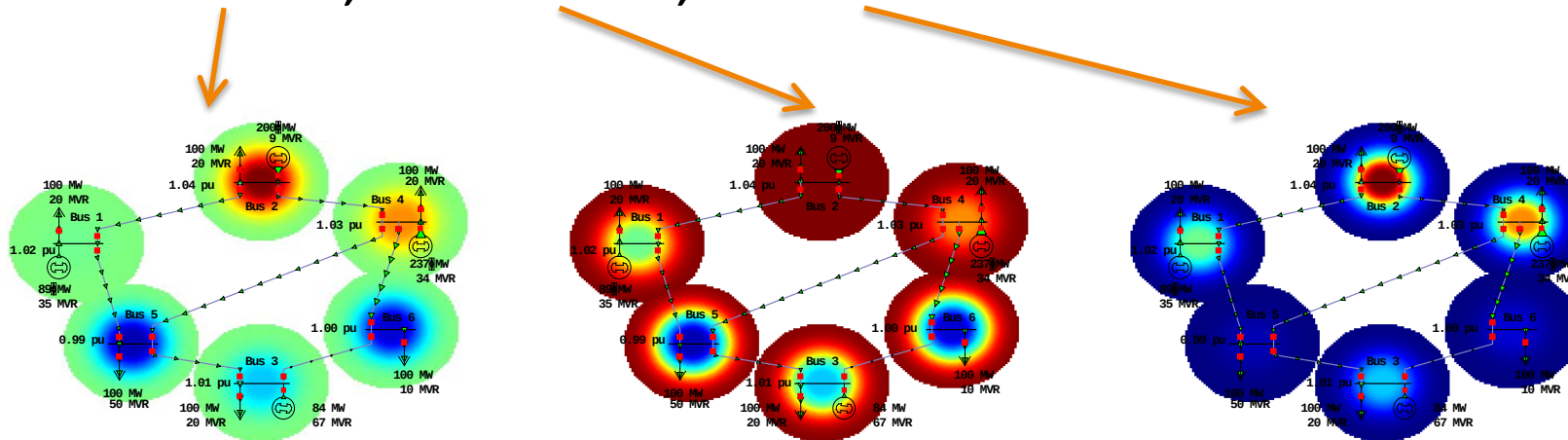


Note: These images are using the **Fade To Value**

Fade To Value



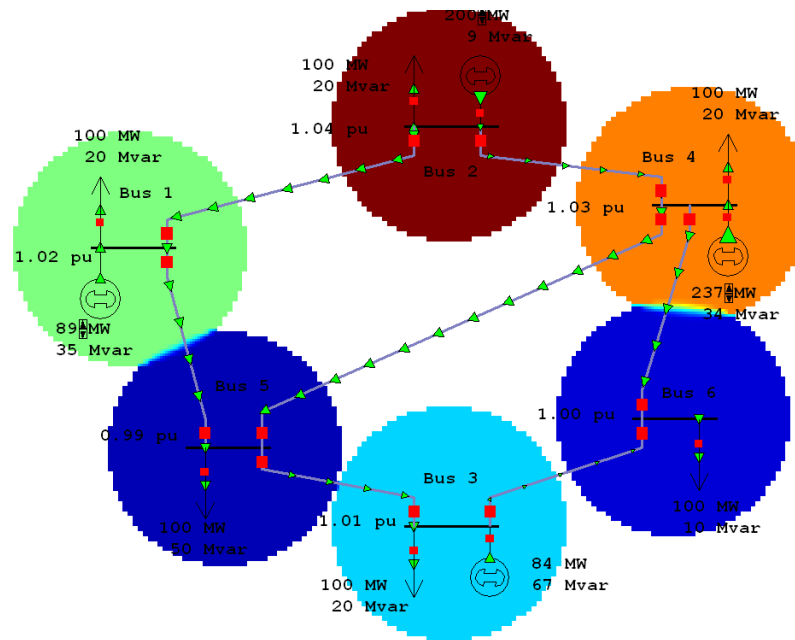
- As a value's influence moves away from the actual data point, the value “fades” to a user-specified value.
 - The same data is contoured in the figures below with different Fade To Values
 - Nominal, Maximum, Minimum



Use Fade To Value



- Uncheck the **Use Fade To Value**
 - Same picture as previous slide but we are no longer *fading*

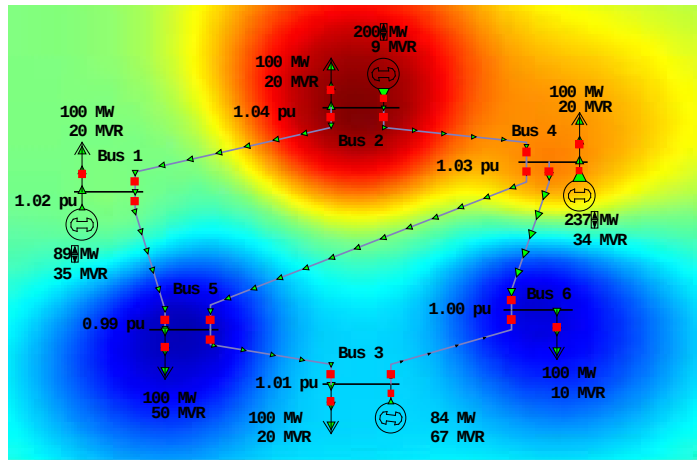


Kind of Value: Actual Value

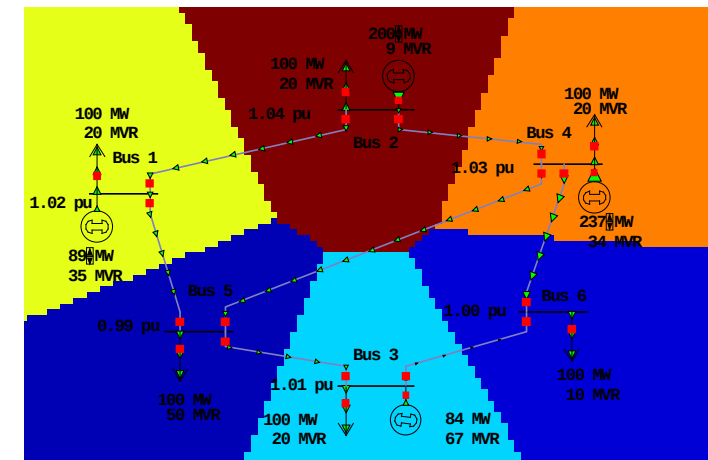


- Actual Value (Weighted Average) and Actual Value (Only Closest) both attempt to visualize the values of particular points.

Weighted Average creates a gradient by weighting colors by their distance from data points



Only Closest creates a color based only on the value of the closest data point



Kind of Value: Density of Values



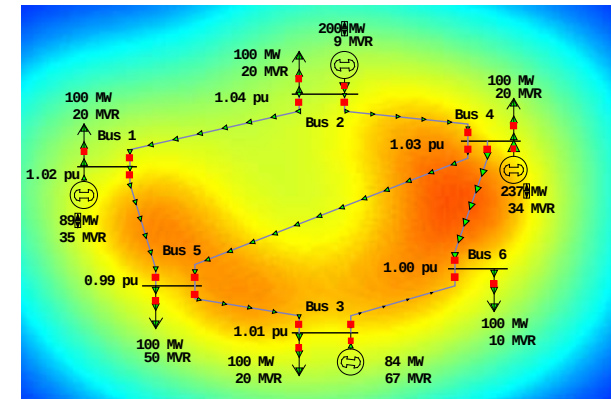
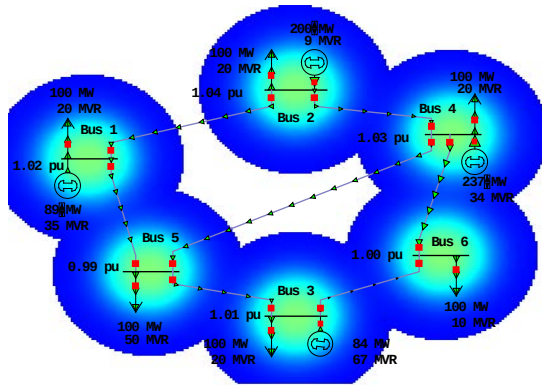
- Density of Values causes the colors on the contour to represent a Weighted Sum
- Useful when you want the following two situations to be equivalent
 - 1 bus with 600 MW of load
 - 6 buses next to each other with 100 MW of load each

Kind of Value:

Density of Values



- When using this option, the Influence Region has a great impact on the contour image created
 - Increasing the Influence Region, will cause the “sum” to be taken over a larger number of data points which will increase the values shown in the contour.

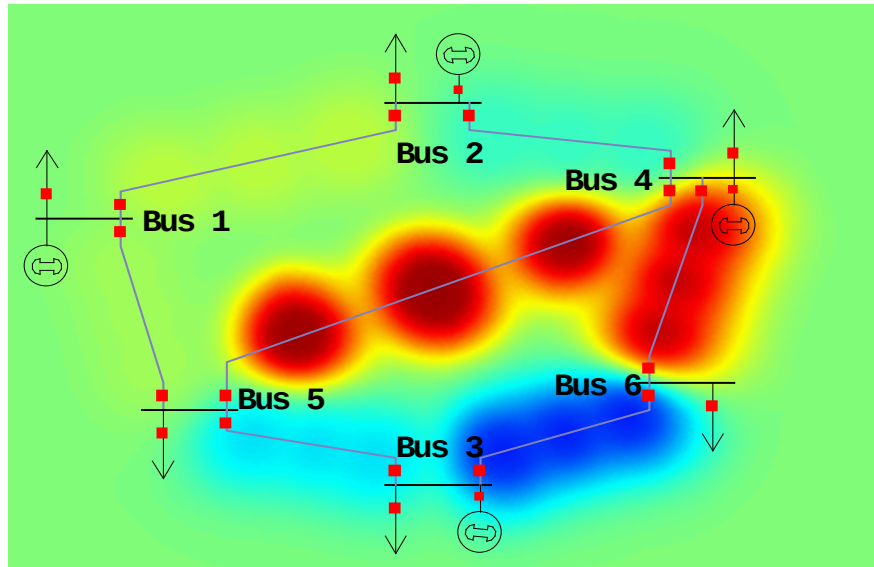


Data Points Per Line

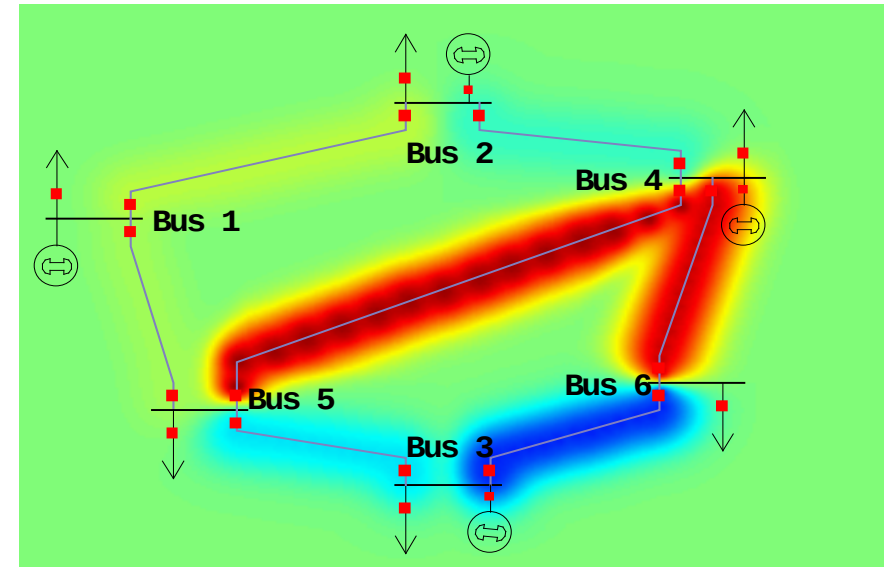


- Specifies the number of points used to represent a line in the contour algorithm

Data Points Per Line = 3



Data Points Per Line = 15

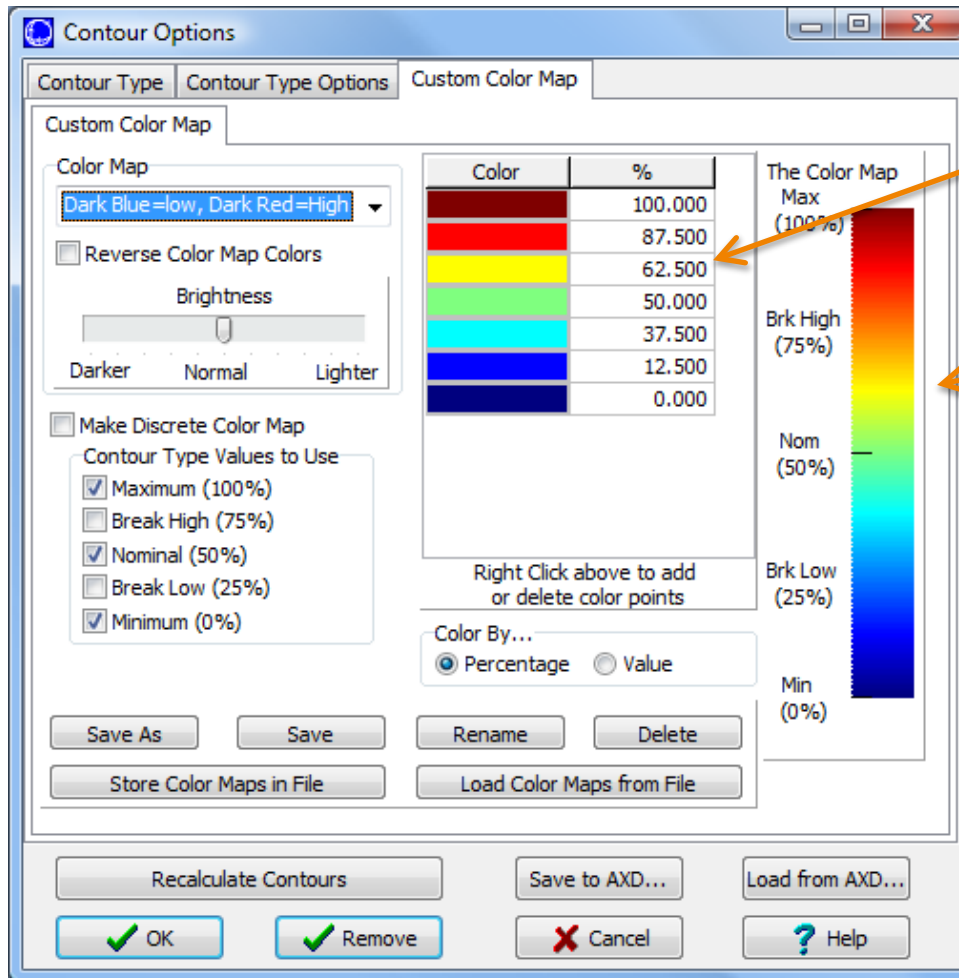


Continuously Update Contours



- Sets Simulator to regenerate a contour each time the system is updated.
- You can animate the contour by checking this
- Note: Because Simulator must now calculate the contour at each time step, this may slow down the simulation
 - Try reducing the resolution to speed up the animation

Custom Color Maps



Set range of color map

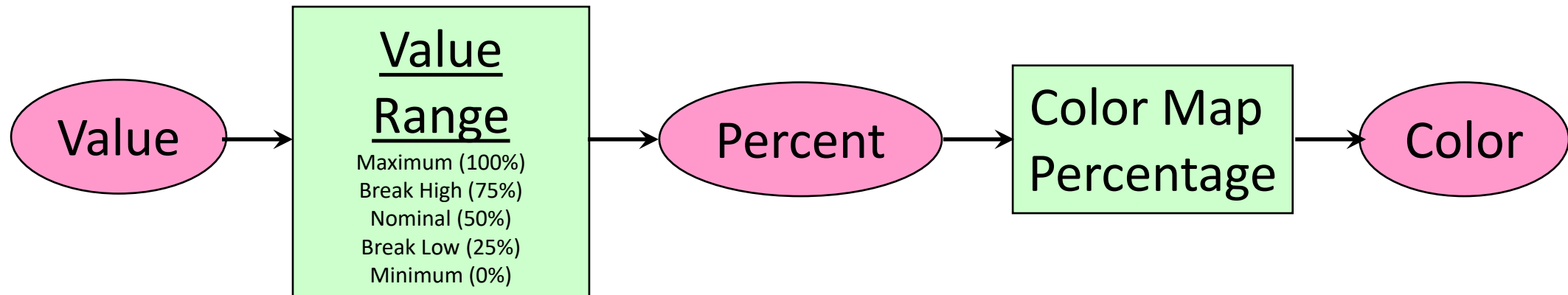
Shows custom color map as changes are made

Create custom color maps designed to show any contoured values highlighted in a specific manner

Color By... Percentage



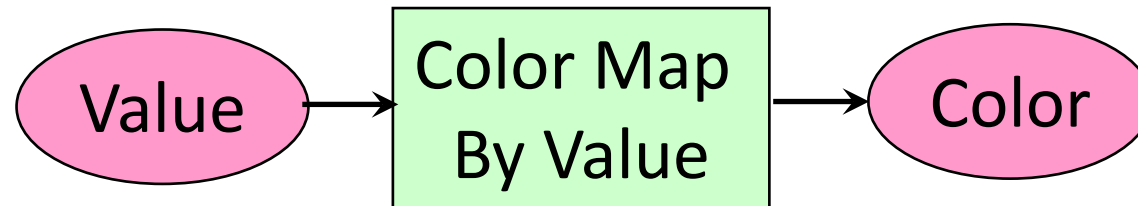
- Color by Percentage takes the Value and maps it to a Percentage using the Maximum,... Minimum Values specified on the first tab
 - The percentage is then mapped to a color using the Color Map
 - Advantage: Color Maps can be reused
 - Bus Per Unit Voltage, Marginal Cost, anything can use same
 - Disadvantage: You can only specify 5 values that map to specific colors



Color By... Value



- Color By Value removes the intermediate percentage
 - Value is mapped directly to Color using the Color Map
 - Advantage: You can be more precise with your coloring
 - You want to color bus objects by AREA Number using 20 specific colors
 - Disadvantage: You can't easily reuse the Color Map.



Defining the Color Map

- “Percentages” map to values defined on Contour Type Tab.

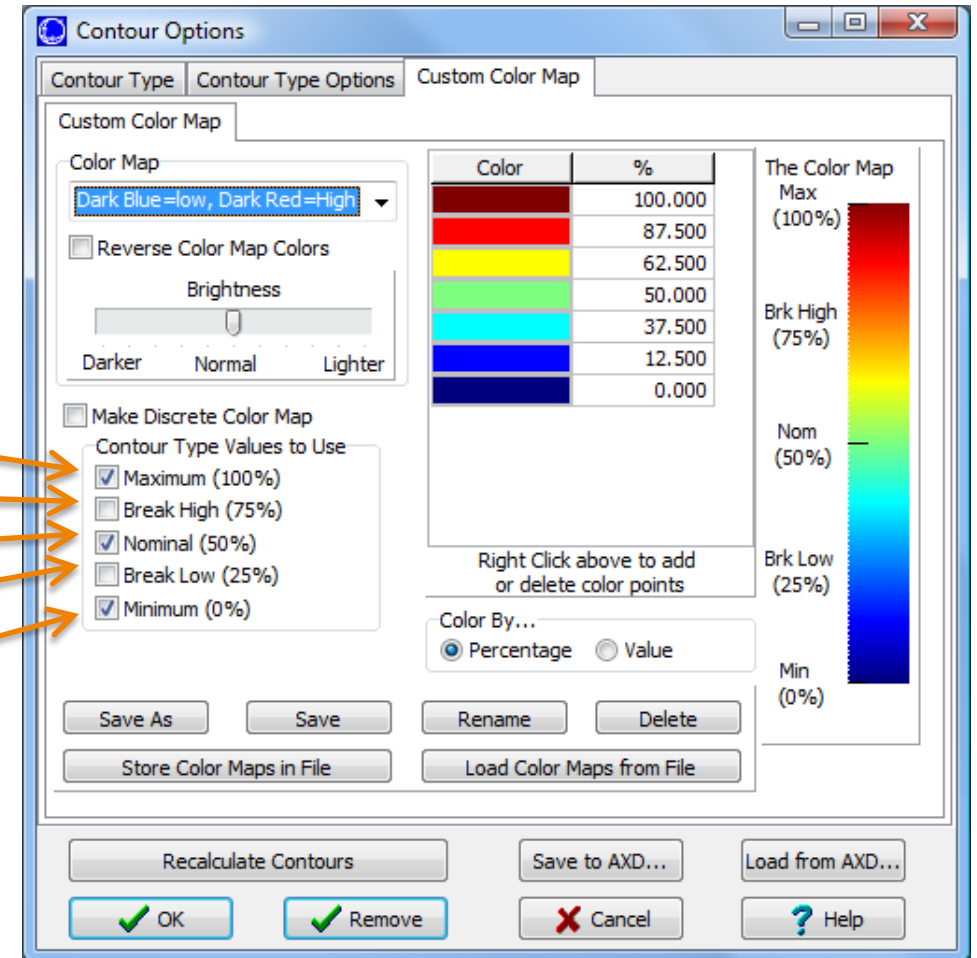
Abs Max = 100%

Lim Max = 75%

Nominal = 50%

Lim Min = 25%

Abs Min = 0%



Contour Data Points



Lists the object(s) on the one-line that influence contouring and the associated value and color for each

Contour Options

Contour Type | Contour Type Options | Custom Color Map | **Contour Data Points** | Contour Pixels

Spatial Data Contouring Symbol Options

☐ Show Spatial Data Point Symbols ☒ Use Background Fill

Symbol Size: 10.0000

☒ Automatically Set Size

Border Width (Pixels): 1

Fill Color: [Black]

Border Color: [Black]

Type of Symbol

☒ Circle ☐ Rectangle ☐ Triangle

Contour Metrics

Data Point Count: 6 Average: 1.014698

Minimum: 0.9931037 Maximum: 1.04

Contour Resolution

X Resolution: 144 Y Resolution: 93

	Object ID	Value	Pixel Color	X	Y	Latitude	Longitude
1	1 (One)	1.0200	[Yellow]	13.500	45.550		
2	2 (Two)	1.0400	[Yellow]	46.988	56.612		
3	3 (Three)	1.0100	[Yellow]	46.988	20.172		
4	4 (Four)	1.0300	[Yellow]	72.500	49.454		
5	5 (Five)	0.9931	[Green]	23.500	27.330		
6	6 (Six)	0.9951	[Green]	70.500	29.933		

Recalculate Contours Save to AXD... Load from AXD...

OK Remove Cancel Help

Contour Pixels



Shows all one-line pixels
and associated color in
different formats (color, Hex
code, RGB values)

Contour Options													
Contour Type		Contour Type Options		Custom Color Map		Contour Data Points		Contour Pixels					
	Pixel X Index	Pixel X	Pixel Y Index	Pixel Y	Pixel Value	Pixel Color	Pixel Latitude	Pixel Longitude	Pixel Color, Hex	Pixel Color, Red	Pixel Color, Green	Pixel Color, Blue	
1	1	0.2710	1	20.4532	1.0020				\$007AFF84	132	255	122	
2	2	0.9200	1	20.4532	1.0019				\$007AFF84	132	255	122	
3	3	1.5691	1	20.4532	1.0013				\$007CFF82	130	255	124	
4	4	2.2181	1	20.4532	1.0009				\$007DFF81	129	255	125	
5	5	2.8671	1	20.4532	1.0007				\$007DFF81	129	255	125	
6	6	3.5161	1	20.4532	1.0003				\$007EFF80	128	255	126	
7	7	4.1651	1	20.4532	1.0002				\$007FFF7F	127	255	127	
8	8	4.8141	1	20.4532	0.9998				\$0080FF7E	126	255	128	
9	9	5.4631	1	20.4532	0.9996				\$0080FF7E	126	255	128	
10	10	6.1122	1	20.4532	0.9993				\$0081FF7D	125	255	129	
11	11	6.7612	1	20.4532	0.9989				\$0082FF7C	124	255	130	
12	12	7.4102	1	20.4532	0.9986				\$0083FF7B	123	255	131	
13	13	8.0592	1	20.4532	0.9984				\$0083FF7B	123	255	131	
14	14	8.7082	1	20.4532	0.9981				\$0084FF7A	122	255	132	
15	15	9.3572	1	20.4532	0.9977				\$0085FF79	121	255	133	
16	16	10.0062	1	20.4532	0.9974				\$0086FF78	120	255	134	
17	17	10.6552	1	20.4532	0.9971				\$0086FF78	120	255	134	
18	18	11.3043	1	20.4532	0.9969				\$0087FF77	119	255	135	
19	19	11.9533	1	20.4532	0.9967				\$0087FF77	119	255	135	
20	20	12.6023	1	20.4532	0.9964				\$0088FF76	118	255	136	
21	21	13.2513	1	20.4532	0.9962				\$0089FF75	117	255	137	
22	22	13.9003	1	20.4532	0.9960				\$0089FF75	117	255	137	
23	23	14.5493	1	20.4532	0.9957				\$008AFF74	116	255	138	
24	24	15.1983	1	20.4532	0.9955				\$008BFF73	115	255	139	
25	25	15.8474	1	20.4532	0.9953				\$008BFF73	115	255	139	
26	26	16.4964	1	20.4532	0.9951				\$008BFF73	115	255	139	
27	27	17.1454	1	20.4532	0.9950				\$008CFF72	114	255	140	
28	28	17.7944	1	20.4532	0.9948				\$008CFF72	114	255	140	
29	29	18.4434	1	20.4532	0.9947				\$008DFF72	114	255	141	
30	30	19.0924	1	20.4532	0.9946				\$008DFF71	113	255	141	
31	31	19.7414	1	20.4532	0.9945				\$008DFF71	113	255	141	

Recalculate Contours

Save to AXD...

Load from AXD...

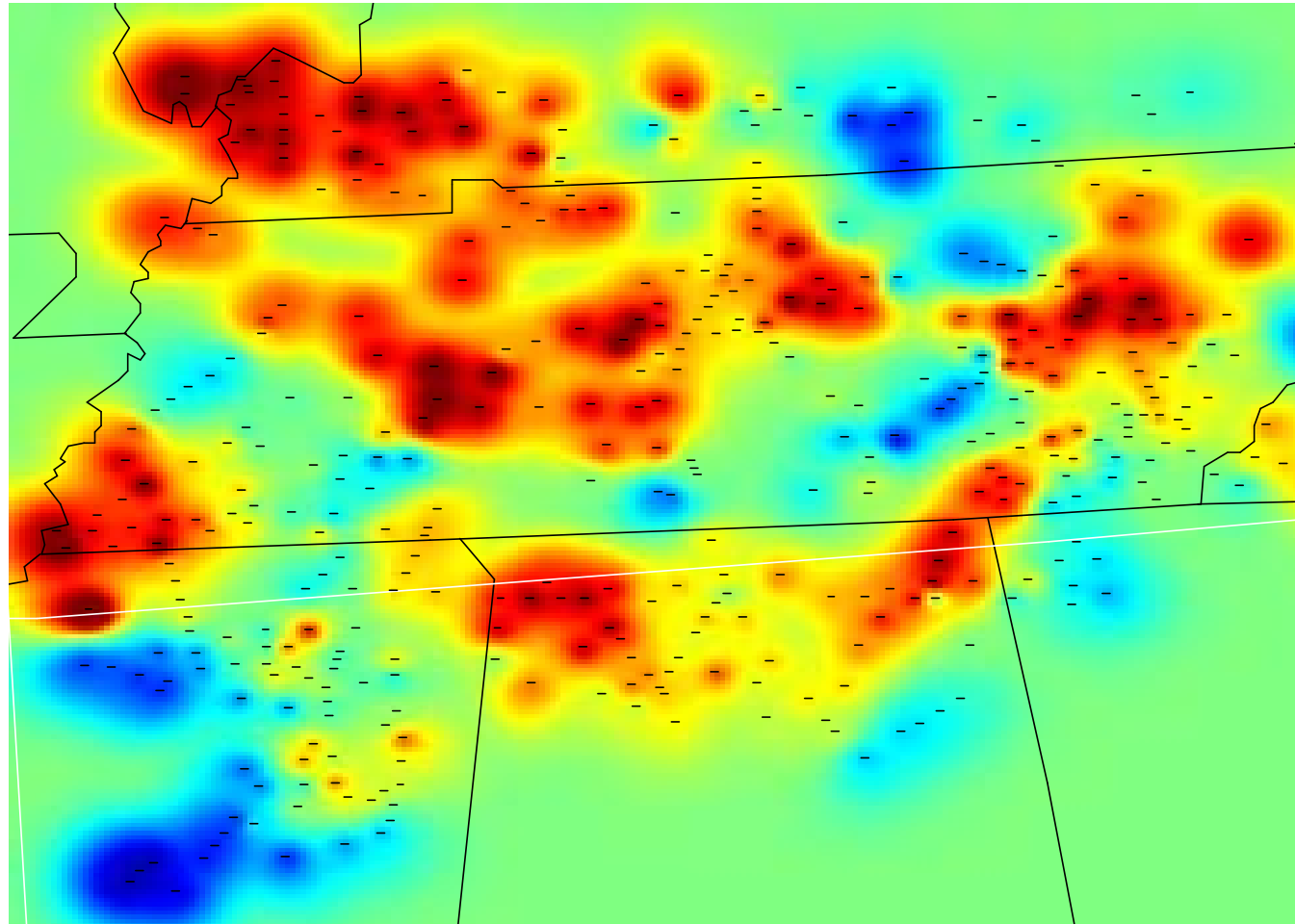
OK

Remove

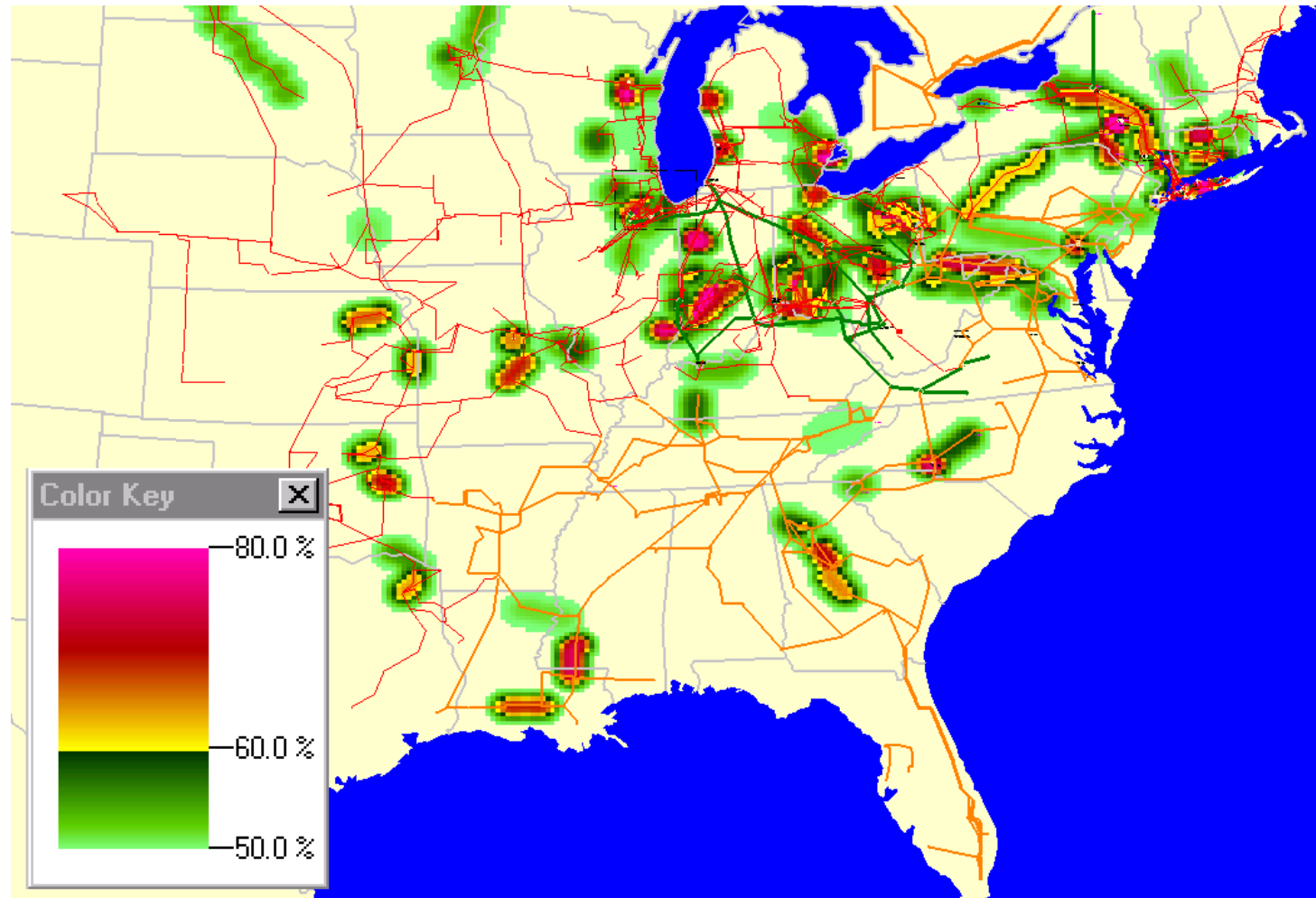
Cancel

Help

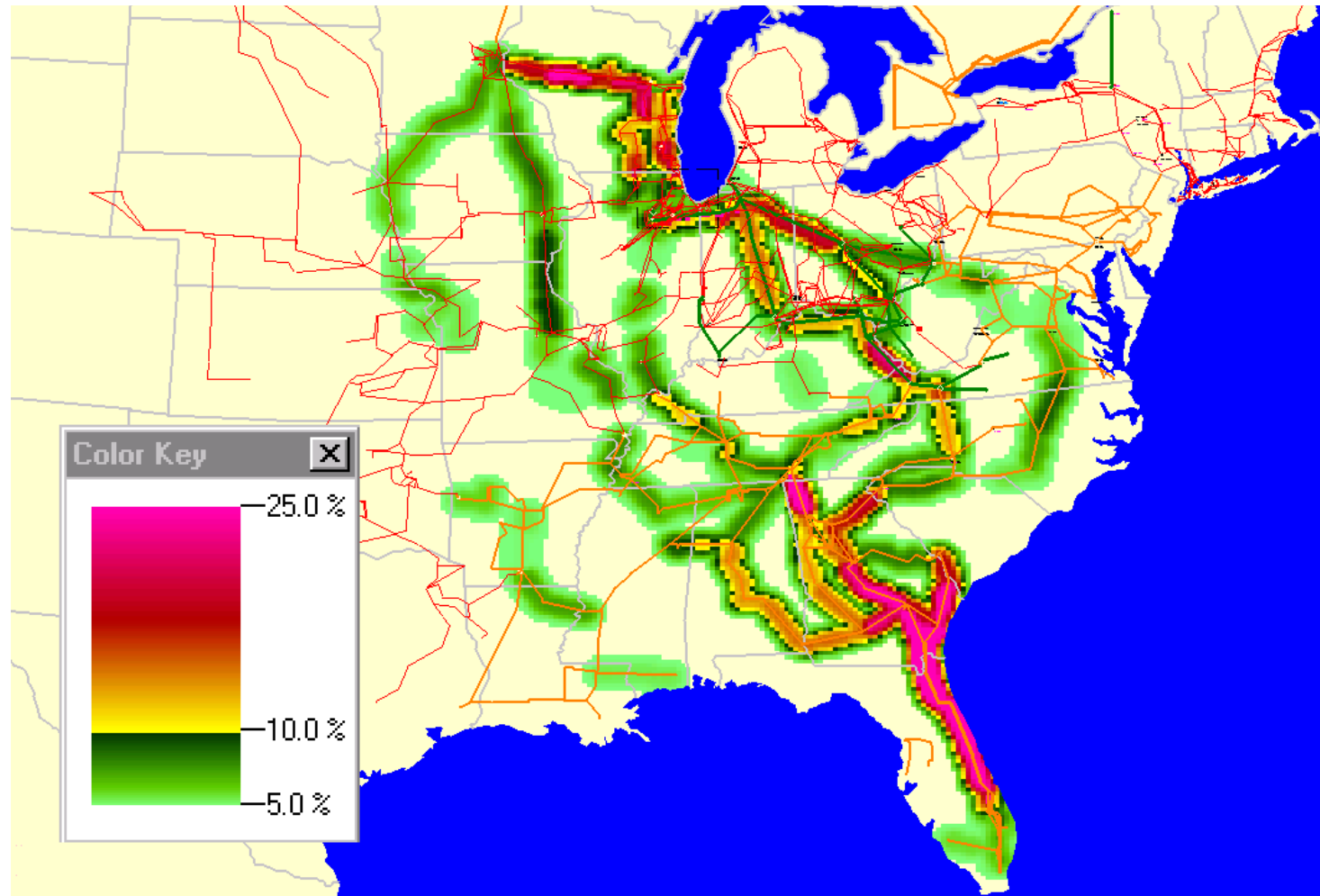
Bus Voltages in TVA at 161 kV



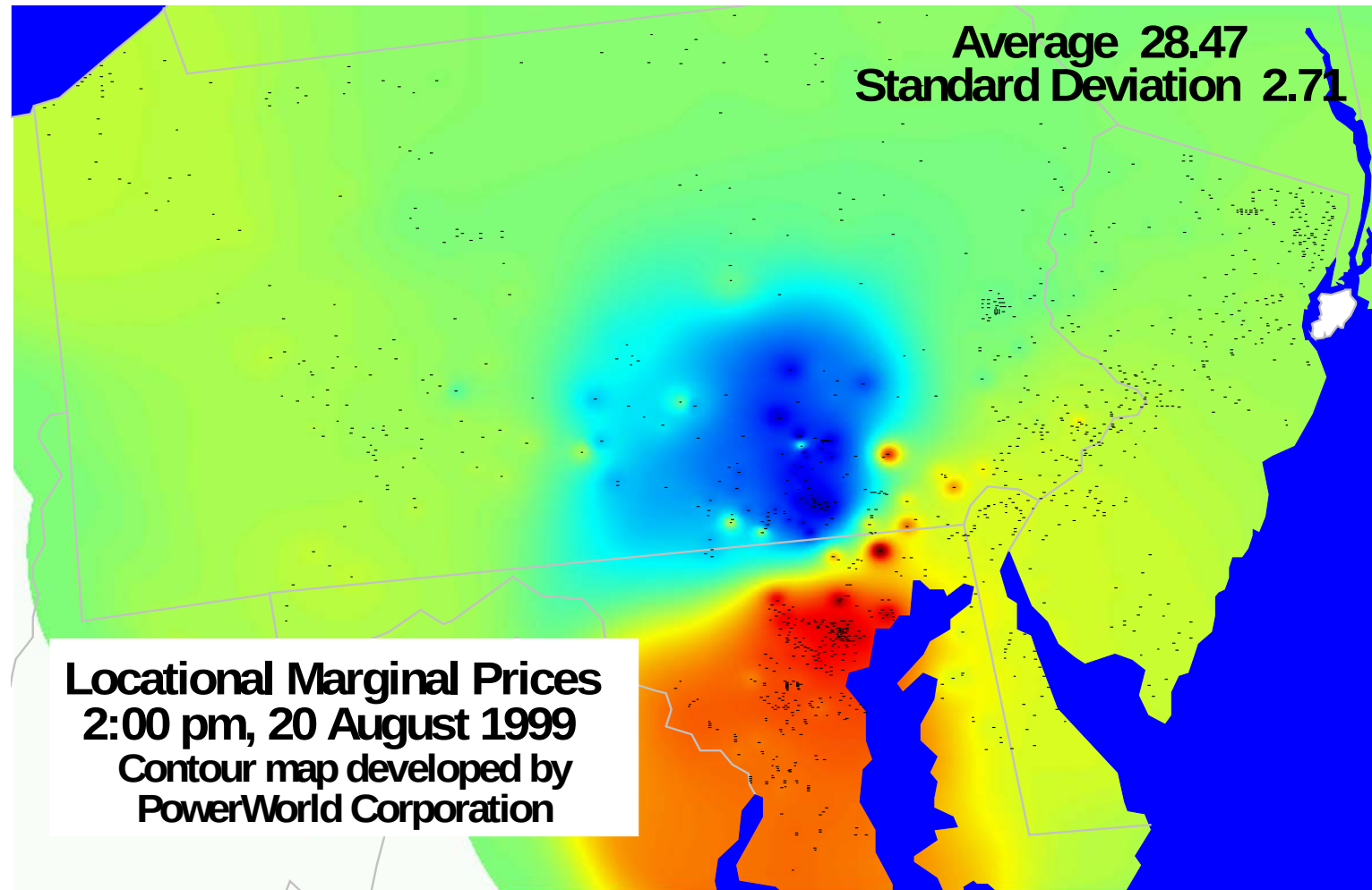
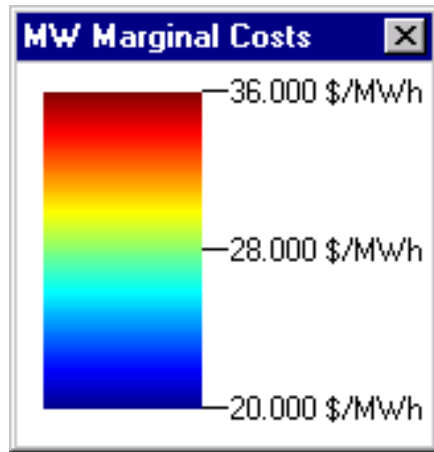
Line MVA Flow Percentage in the Eastern Interconnection



Power Transfer Distribution Factors (PTDFs)



Marginal Prices in PJM for 2:00 PM on August 20, 1999



Recommendations for Contouring



- Task-specific displays
 - Make your onelines so that they only convey one idea
 - For instance, don't show line pie charts on a bus voltage display. This creates clutter.

Voltage Contouring



- Sometimes run into strange contours due to LTCs.
- To avoid this, create onelines that only have one voltage level's buses displayed
 - Can create a different oneline for each voltage level if desired



Other Visualization Features

Geographic Data Views



- Allow quick creation and formatting of graphical representations of devices
 - Buses, generators, loads, switched shunts, transmission lines, substations, areas, zones, super areas, and injection groups
- Longitude and latitude coordinates must be specified with bus and/or substation records to place objects geographically on a display

Geographic Data Views



- Data field values used to format objects based on different attributes
 - Line Thickness, Line Color, Fill Color, Total Area, Rotation Angle, Rotation Rate, Visibility
- Options for creating available from the Case Information Toolbar under the **Geo** menu
- Geographic data view objects can be added to existing or new onelines

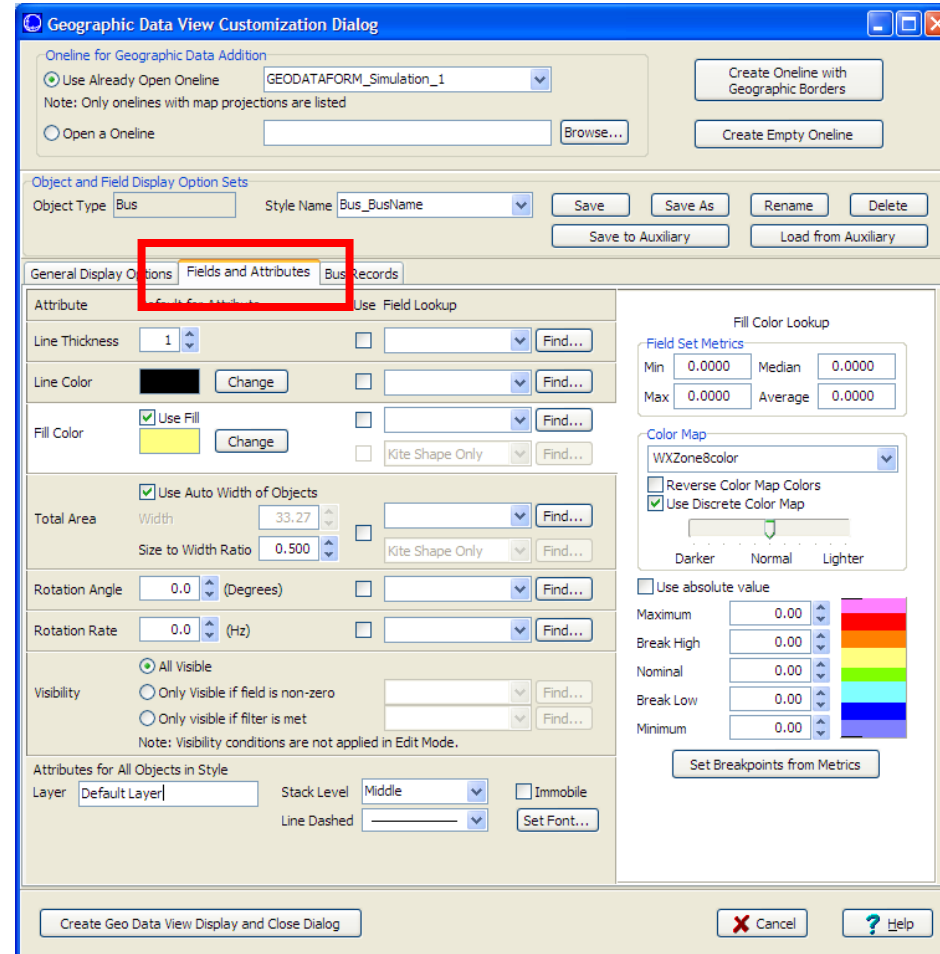
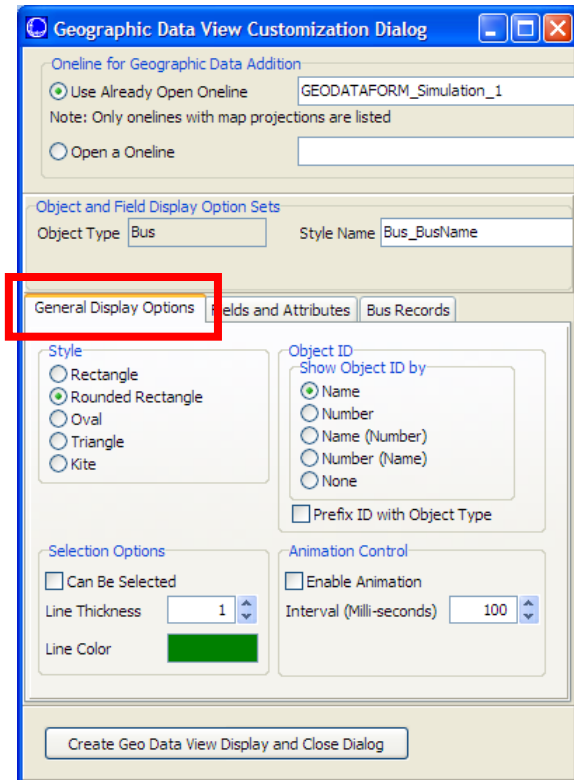


Geographic Data Views



- Geographic Data View Styles contain the set of options that dictate how a Geographic Data View object will look
 - Multiple objects will use the same style
 - Styles are dependent on the type of object being displayed

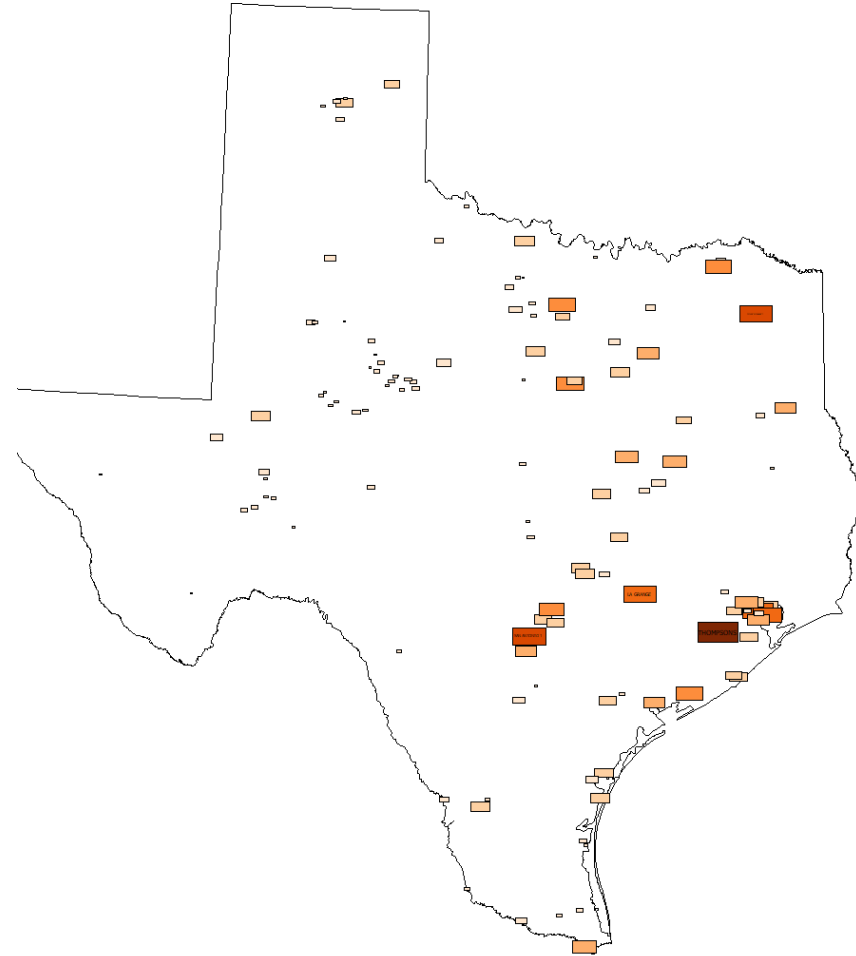
Geographic Data Views: Customization Dialog



Geographic Data Views



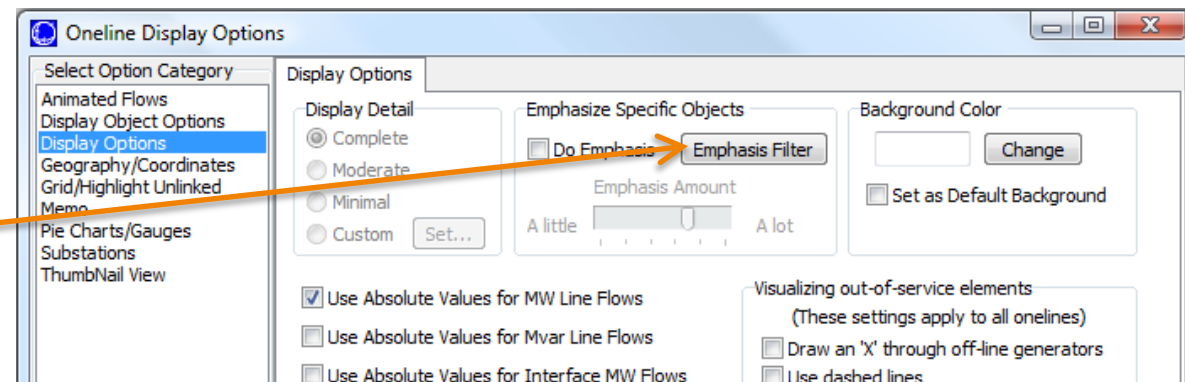
- ACTIVSg2000
- Substation Gen Mvar reserves + Switched Shunts (up)
- Fill Color: one-sided contour
- Total Area
- Visibility Filter to show only substations with >10 Mvar



Emphasis of Display Objects



- Emphasis of Display Objects
 - Make specific objects standout on your oneline
 - Builds on the Select by Criteria abilities
 - Combines this with the use of graphical *alpha blending* which merges two images together
 - To get to this
 - Go to the **Options** ribbon tab and select **Online Display Options** and click **Emphasis Filter** on **Display Options** page

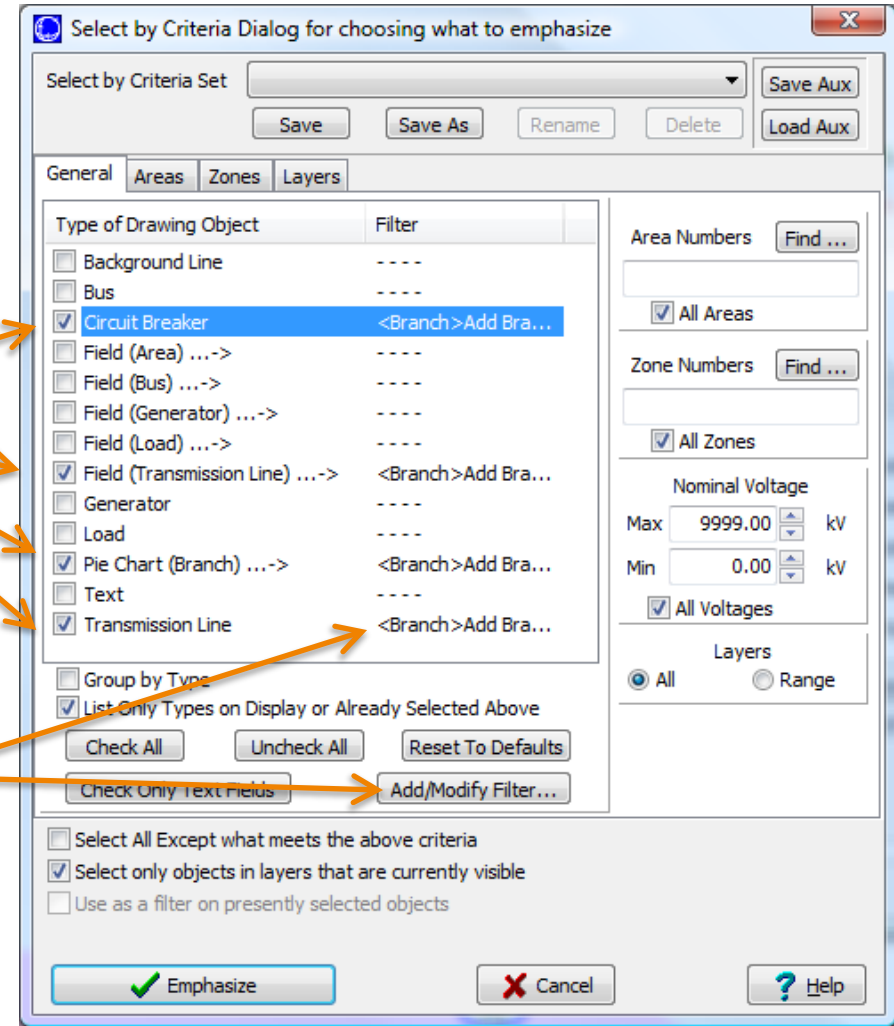


Select by Criteria Dialog for choosing what to emphasize

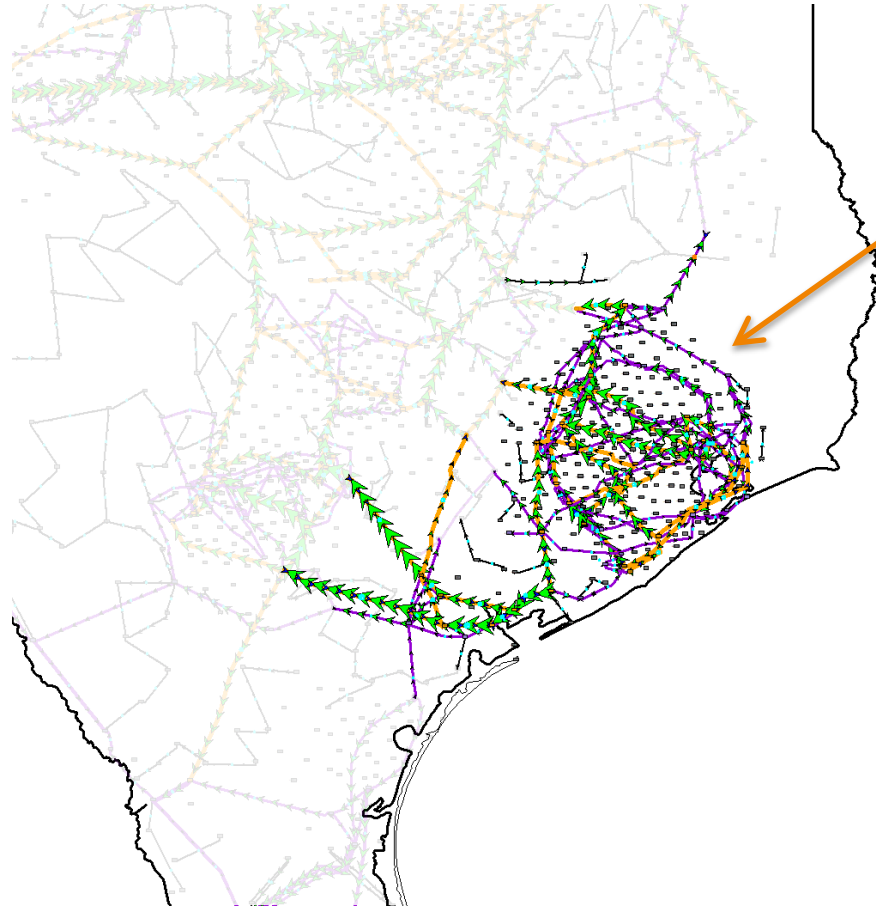
- Selecting what to emphasize works just like Select by Criteria

Choose all Transmission Line and Branch-Related Objects

Click Add/Modify Filter to define an Advanced Filter called *Add Branches >50%*



ACTIVSg2000 Example



Only Area 7 Objects are Emphasized

Select by Criteria Dialog for choosing what to emphasize

Select by Criteria Set: Area

Buttons: Save, Save As, Rename, Delete, Load Aux

General Areas Zones Layers

Type of Drawing Object	Filter
☒ Background Line	----
☒ Circuit Breaker	----
☒ Display Substation	----
☒ Display Transmission Line	----
☐ Geographic Display Substation	----
☒ Pie Chart (Branch) ...->	----
☒ Text	----

Area Numbers: 7

Zone Numbers: All Zones

Nominal Voltage: Max 9999.00 kV, Min 0.00 kV

Layers: All

Buttons: Check All, Uncheck All, Reset To Defaults, Check Only Text Fields, Add/Modify Filter...

Buttons: Emphasize, Cancel, Help

Emphasize Specific Objects

☒ Do Emphasis

Emphasis Filter

Emphasis Amount

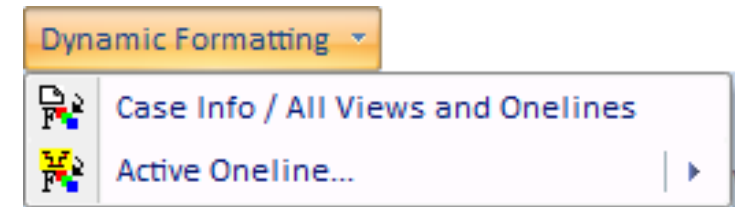
A little [Slider] A lot

Adjust the amount of emphasis

Dynamic Formatting



- Allows for Conditional Dynamic Formatting of Onelines and Case Information Displays
- Builds on existing features: Select by Criteria AND Advanced Filtering
- Go to the **Onelines** ribbon tab and select **Dynamic Formatting**, then pick which of the two levels of formatting you want
 - With the Case: **Case Info / All Views and Onelines**
 - Can apply to case information displays, bus views, sub views, and ALL onelines
 - With Individual Online: **Active Online**
 - Will apply to only a single oneline



Dynamic Formatting Dialog: Case Info / All Views And Onelines



Temporarily make
the formatting
inactive

Choose
Object Type

Choose an
Advanced Filter

Choose the screen
objects (or Case
Info items) this
should apply to →

FORCE an object
to be visible (i.e.
if other settings
would hide it)

Choose Fields to
apply to for some
kinds of objects

The screenshot shows the 'Dynamic Formatting (Case Info / All Views And Onelines)' dialog box. It has several sections: 'Format Name' at the top with buttons for 'New', 'Save', 'Save As', 'Rename', and 'Delete'; 'Object Type' set to 'Branch' with a 'Find...' button; 'Filter Criteria' set to 'Add Branches > 50%' with a 'Define...' button; checkboxes for 'Formatting Active' (checked) and 'Force Visibility' (unchecked); a 'Line/Fill' tab with settings for 'Line Thickness' (2), 'Dashed' (unchecked), 'Line Color' (orange), and 'Use Background Fill' (checked); a list of 'Type of Context Object' including 'Case Information Display ...->', 'Circuit Breaker', 'Field (Series Capacitor) ...->', 'Field (Transformer) ...->', 'Field (Transmission Line) ...->', 'Gauge (Branch) ...->', 'Geographic Display Branch', 'Line Flow Arrow', 'Pie Chart (Branch) ...->', 'Pie Chart (Line/Transformer) ...->', 'Series Capacitor', 'Transformer', and 'Transmission Line'; a 'Choose fields' section with 'All' selected and a list of 'Branch Fields' including 'MW\MW at From Bus', 'Mvar\Mvar at From Bus', 'MVA\MVA at From Bus', 'Amps\Amps at From Bus', 'MW\MW Loss', 'Mvar\Mvar Loss', 'Limit Monitoring\Limit MVA', 'Transformer\Tap Ratio', 'Transformer\Phase Shift (degrees)', 'Transformer\Tap Integer Position', 'Transformer\Auto Control Enabled', and 'Bypassed\ByPassed or Not Bypassed'; and a 'Show Only Commonly Used Fields' checkbox at the bottom right. At the bottom, there are buttons for 'OK', 'Help', 'Cancel', 'Save All To Aux File', and 'Load All From Aux File'. An annotation box highlights the 'Line/Fill' tab settings.

Choose Format
Attributes

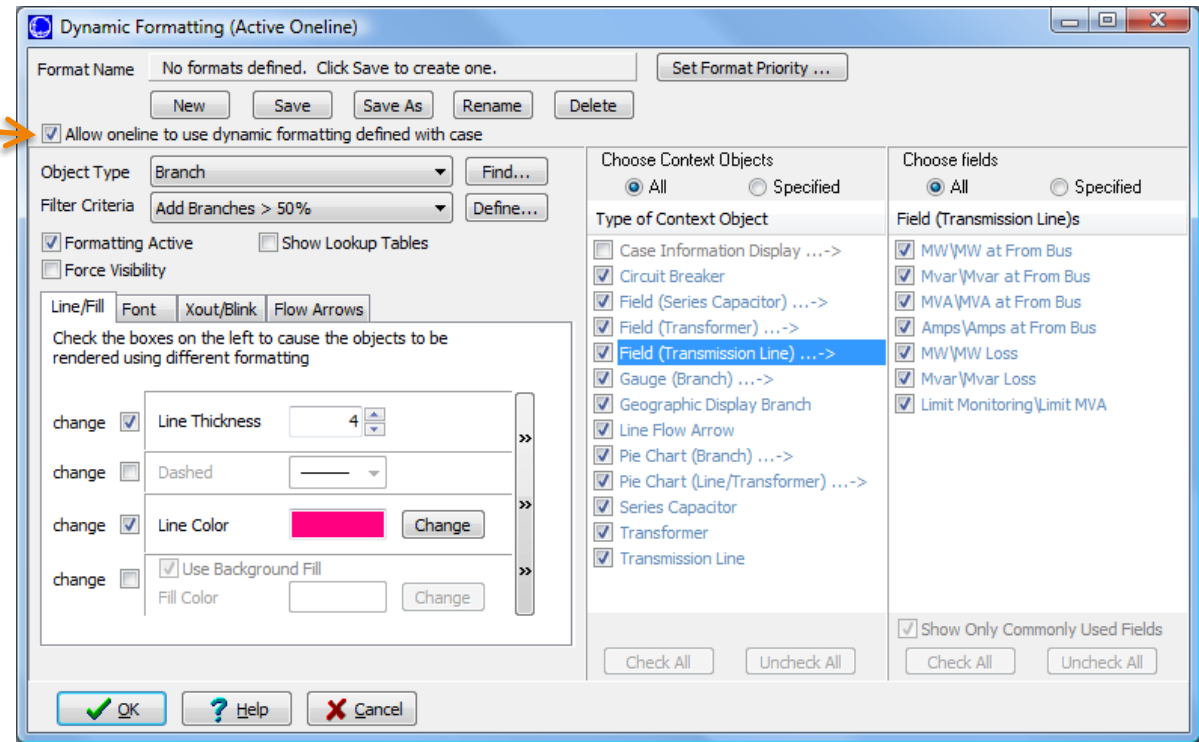
Only some attributes apply to case information displays

Dynamic Formatting Dialog: Active Oneline

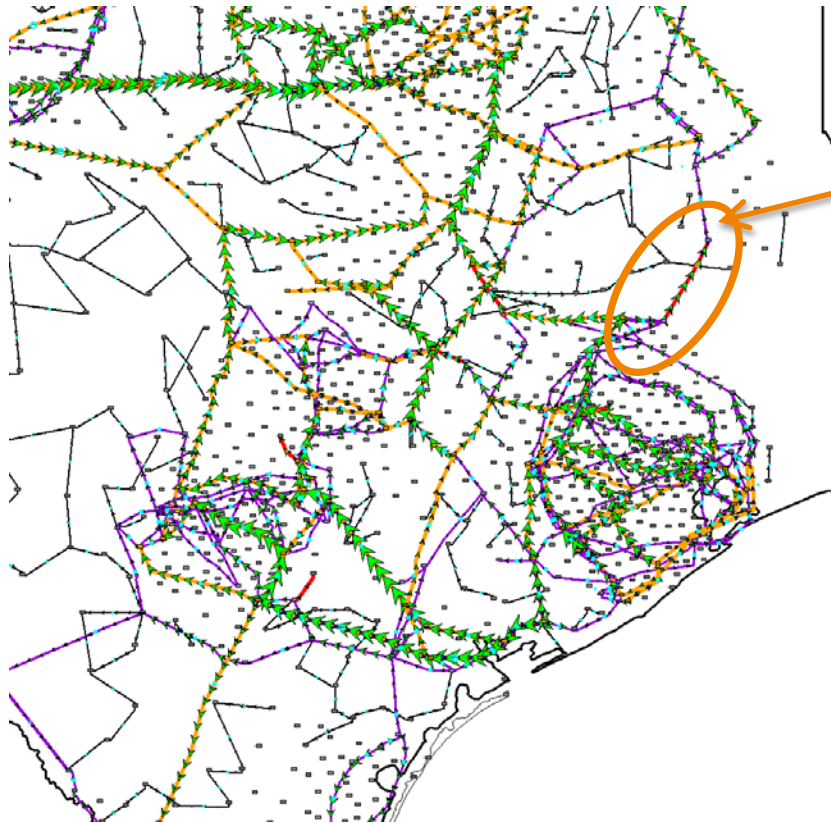


- For an active oneline formatting, it's the same, except that it only applies to this oneline

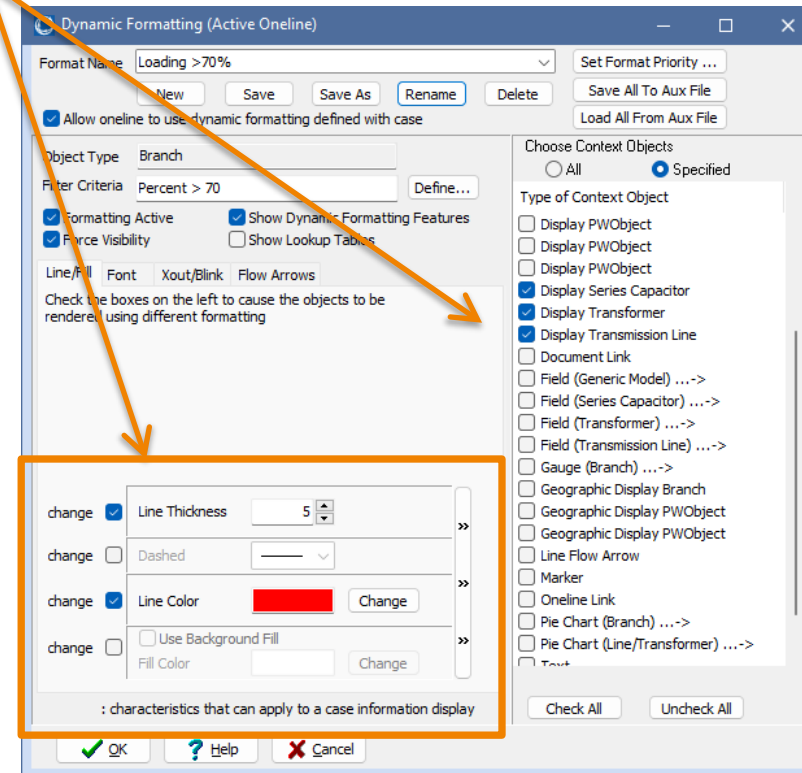
Specify whether the oneline makes use of the dynamic formatting defined with the case



ACTIVSg2000 Example Based on Line Loading

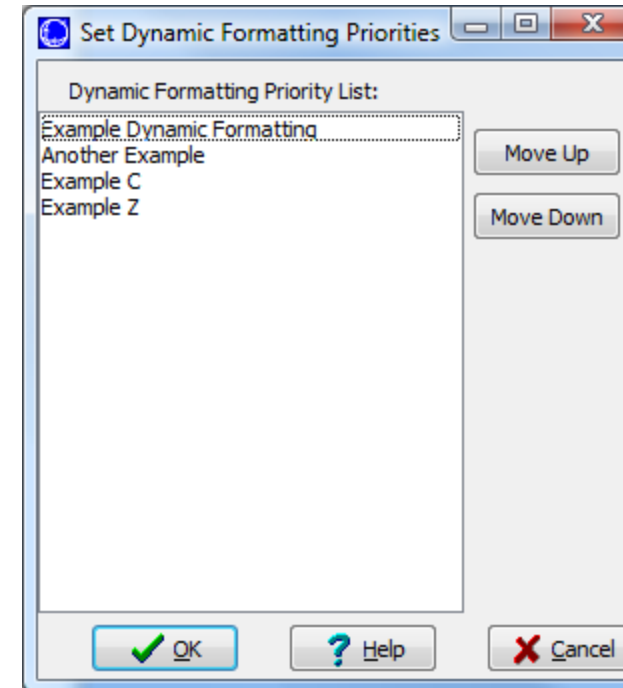


Lines above 70% loading are Thick (5 px) and Red



Dynamic Formatting Priority

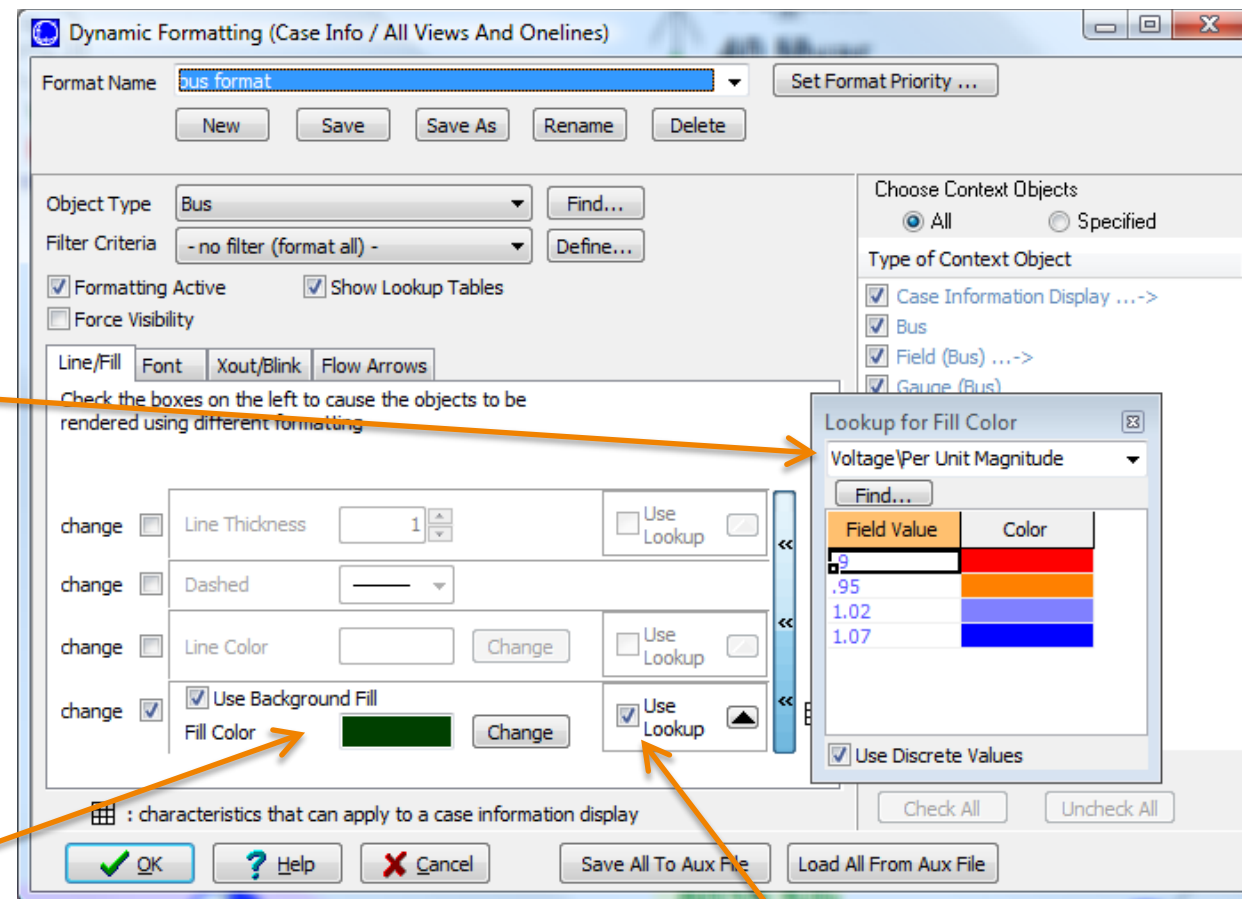
- You can specify several dynamic formatting choices.
- It is possible that they will “conflict” with one another.
- A priority must be specified.
 - Specific oneline dynamic formats always have priority over case dynamic formats
 - Within the individual class, you must click the Set Format Priority... Button to give a priority order.



Dynamic Formatting Lookup Tables

Lookup tables allow the definition of a table of field values and corresponding characteristic values. For this example, bus object line color will change based on the value of the per unit voltage magnitude.

Color if field value is less than the lowest defined value in the table



Check "Use Lookup"

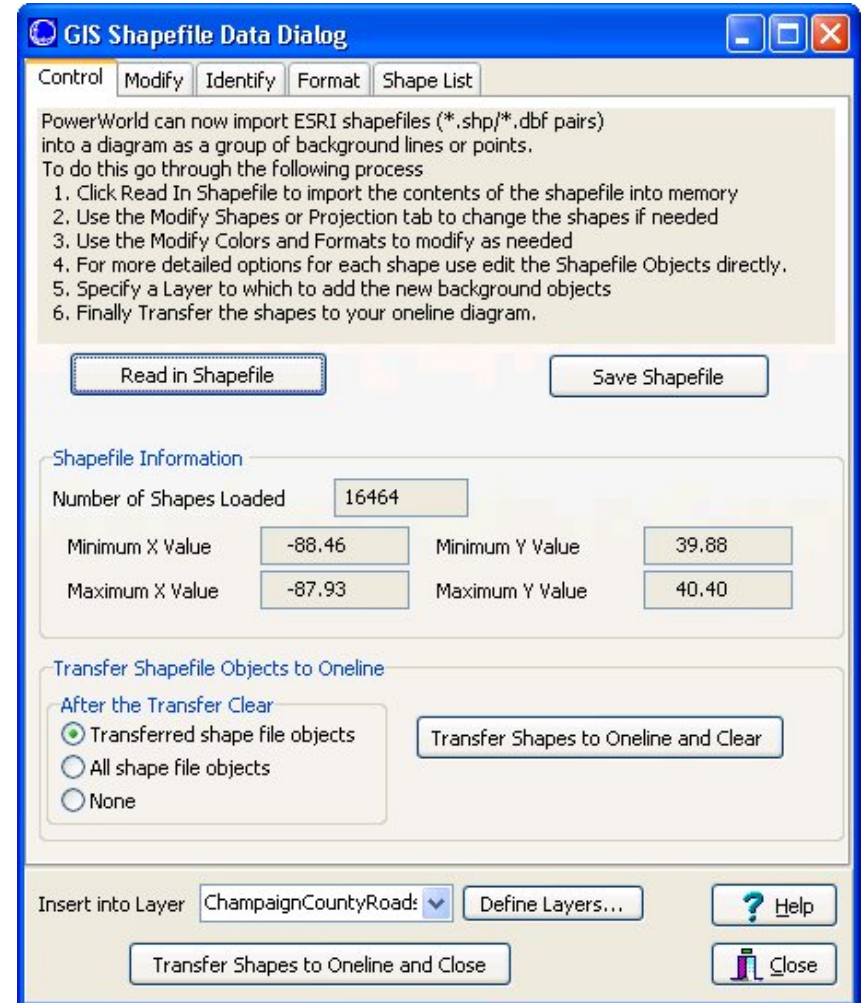
Geographic Information System Support



- Reading ESRI Shapefiles (*.shp/*.dbf/*.shx groups)
 - To open a shapefile go to the **Onelines** ribbon tab and select **GIS Tools**
→ **Insert GIS Data from Shapefile**
- Additional options under **Onelines** → **GIS Tools**

GIS Shapefile Data Dialog: Control Tab

- Click on **Read in Shapefile** to import the Shapefile contents into Memory
- Use the **Modify** tab to modify the x/y coordinate of shapes
- Use the **Identify** tab to assign identifier for display auxiliary files and link supplemental data
- Use **Format** tab to modify the colors and format of the shapes
- **Shape List** tab lists all of the objects in the file and their corresponding attributes
- Click **Transfer Shapes to Oneline...** to place shapes on the oneline



GIS Shapefile Data Dialog: Modify Tab



- If Shapefile is specified in Longitude/Latitude Coordinates, Convert to a map projection
- You may also modify the XY data by shifting or scaling it.

GIS Shapefile Data Dialog

Control Modify Identify Format Shape List

Do Map Projection of X/Y Values
If you read in a shapefile which has its coordinates specified in degrees of longitude and latitude, then you need to choose a map projection and convert those values to PowerWorld's x/y coordinate system

Map Projection
☒ North American (simple conic)
☐ Entire World (Mercator)
 Convert to specified Map Projection

Shift/Scale Shapefile X/Y Data
Use these options to modify the coordinate data specified in the shape file

Shift XY Data
 Shift X Values by: 0.00
 Shift Y Values by: 0.00
Shift XY Data

Scale XY Data
 Scale X Values by: 1.000
 Scale Y Values by: 1.000
Scale XY Data

Insert into Layer: ChampaignCountyRoad ▾ Define Layers... ? Help
Transfer Shapes to Oneline and Close Close

GIS Shapefile Data Dialog: Identify Tab



- Specify identifying string to use for uniquely identifying objects in display auxiliary file
- Link to supplemental data to provide identification for filtering, dynamic formatting, Select by Criteria, and custom hints

GIS Shapefile Data Dialog

Control Modify Identify Format Shape List

Identification String for Display Auxiliary Files

Prefix Attribute Suffix

Record Number

Linkage to Supplemental Data

☐ Link Display Objects to Supplemental Data

Supplemental Classification New...

Attribute for Supplemental Data Name CENSUS1

Insert into Layer ChampaignCountyRoad Define Layers...

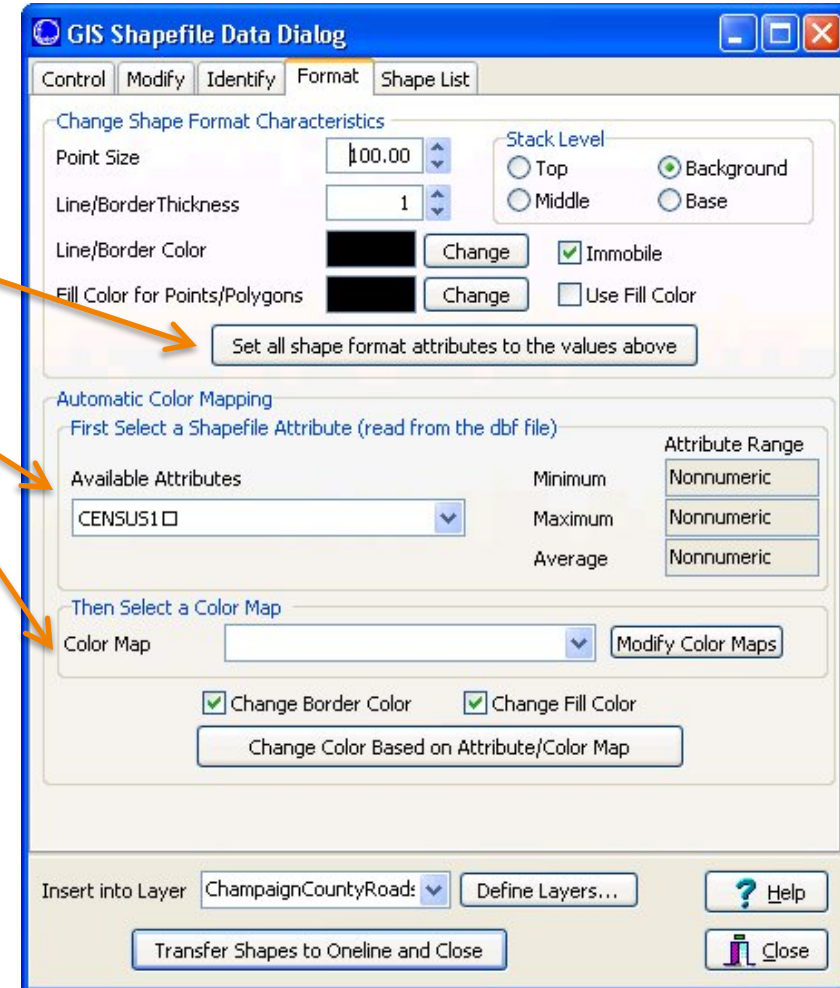
Transfer Shapes to Online and Close

Help Close

GIS Shapefile Data Dialog: Format Tab



- Modify the format of all the objects by choosing new attributes and clicking the button
- You may color using a Color Map if one of the data columns from the *.dbf file can be mapped accordingly



GIS Shapefile Data Dialog: Shape List Tab

- Finally, if you want more control, modify the attributes of the shapes directly.

Info from
*.shp file

Specify the Format
of each shape

Data from
*.dbf file

Record Number	Object Type	Include	Immobile	Thickness	Color	Fill Used	Fill Color	Stack Lev	TLID	FNODE	TNODE	LENGTH
1	Polyline	ES	YES	1		NO		Background	8798686	12432	12431	0.10804
2	Polyline	ES	YES	1		NO		Background	8798687	11630	11629	0.27830
3	Polyline	ES	YES	1		NO		Background	8798688	12128	11630	1.93137
4	Polyline	ES	YES	1		NO		Background	8798689	12128	12407	0.89390
5	Polyline	ES	YES	1		NO		Background	8798690	12128	12126	0.99958
6	Polyline	ES	YES	1		NO		Background	8798692	12132	12128	0.99874
7	Polyline	ES	YES	1		NO		Background	8798693	12132	12434	0.99329
8	Polyline	ES	YES	1		NO		Background	8798694	11803	12132	1.01531
9	Polyline	ES	YES	1		NO		Background	8798695	11626	11803	0.92873
10	Polyline	ES	YES	1		NO		Background	8798696	11626	11628	0.35268
11	Polyline	ES	YES	1		NO		Background	8798697	11626	11439	0.79709
12	Polyline	ES	YES	1		NO		Background	8798698	12435	12434	1.01299
13	Polyline	ES	YES	1		NO		Background	8798699	12135	12134	0.19212
14	Polyline	ES	YES	1		NO		Background	8798700	11615	11518	0.24516
15	Polyline	ES	YES	1		NO		Background	8798701	11615	11624	0.29751
16	Polyline	ES	YES	1		NO		Background	8798702	11805	11804	0.38205
17	Polyline	ES	YES	1		NO		Background	8798703	11805	11699	0.57595
18	Polyline	ES	YES	1		NO		Background	8798704	11805	12098	0.95183
19	Polyline	ES	YES	1		NO		Background	8798706	12140	12139	0.49932
20	Polyline	ES	YES	1		NO		Background	8798707	11585	11605	0.54973
21	Polyline	ES	YES	1		NO		Background	8798708	11809	11805	1.01154
22	Polyline	ES	YES	1		NO		Background	8798709	11809	11585	0.97587

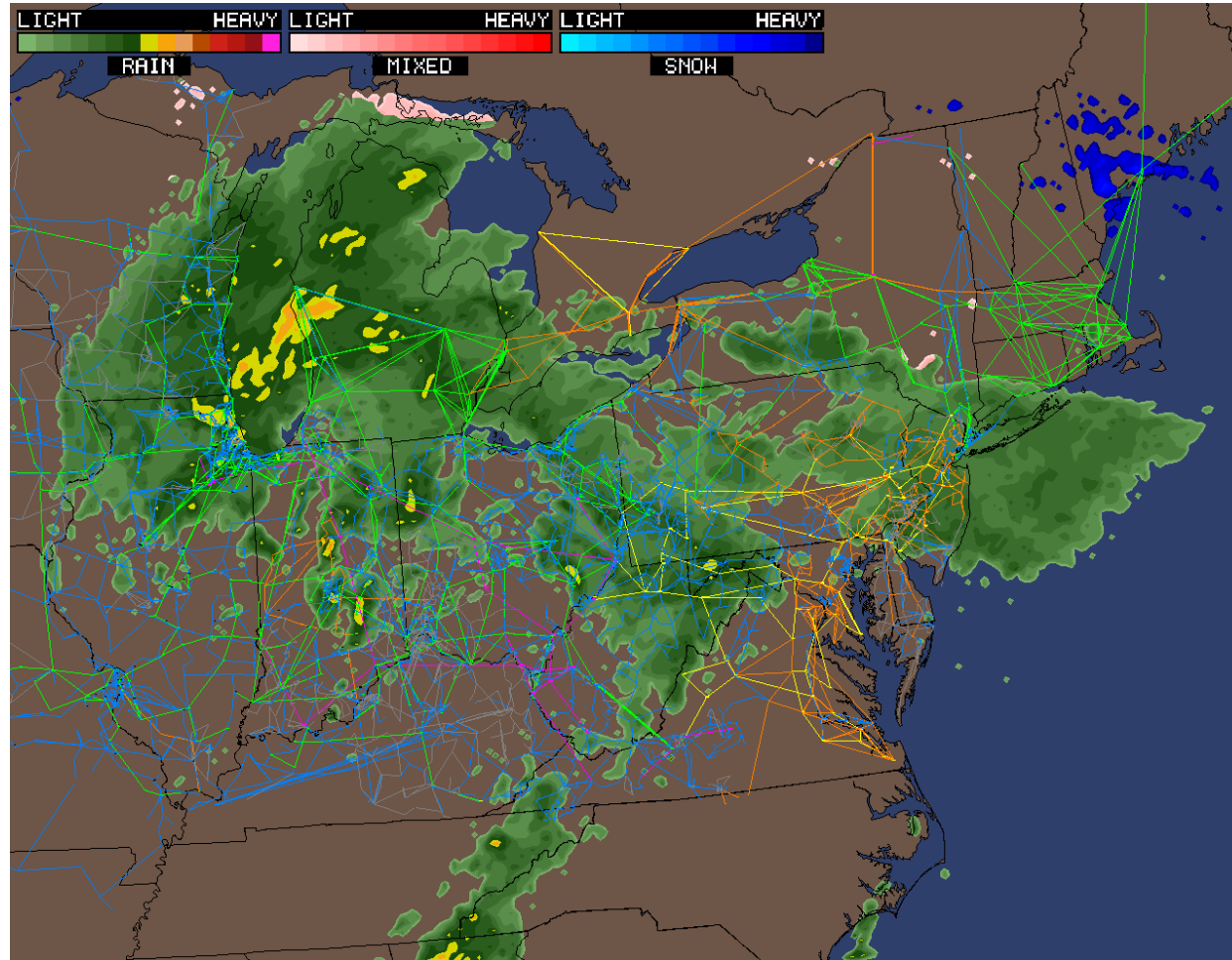
Insert into Layer: ChampaignCountyRoads Define Layers... ? Help

Transfer Shapes to Online and Close Close

Example GIS Shapefile: Reading a Radar Image



A Weather
Precipitation Radar
Image on a Oneline

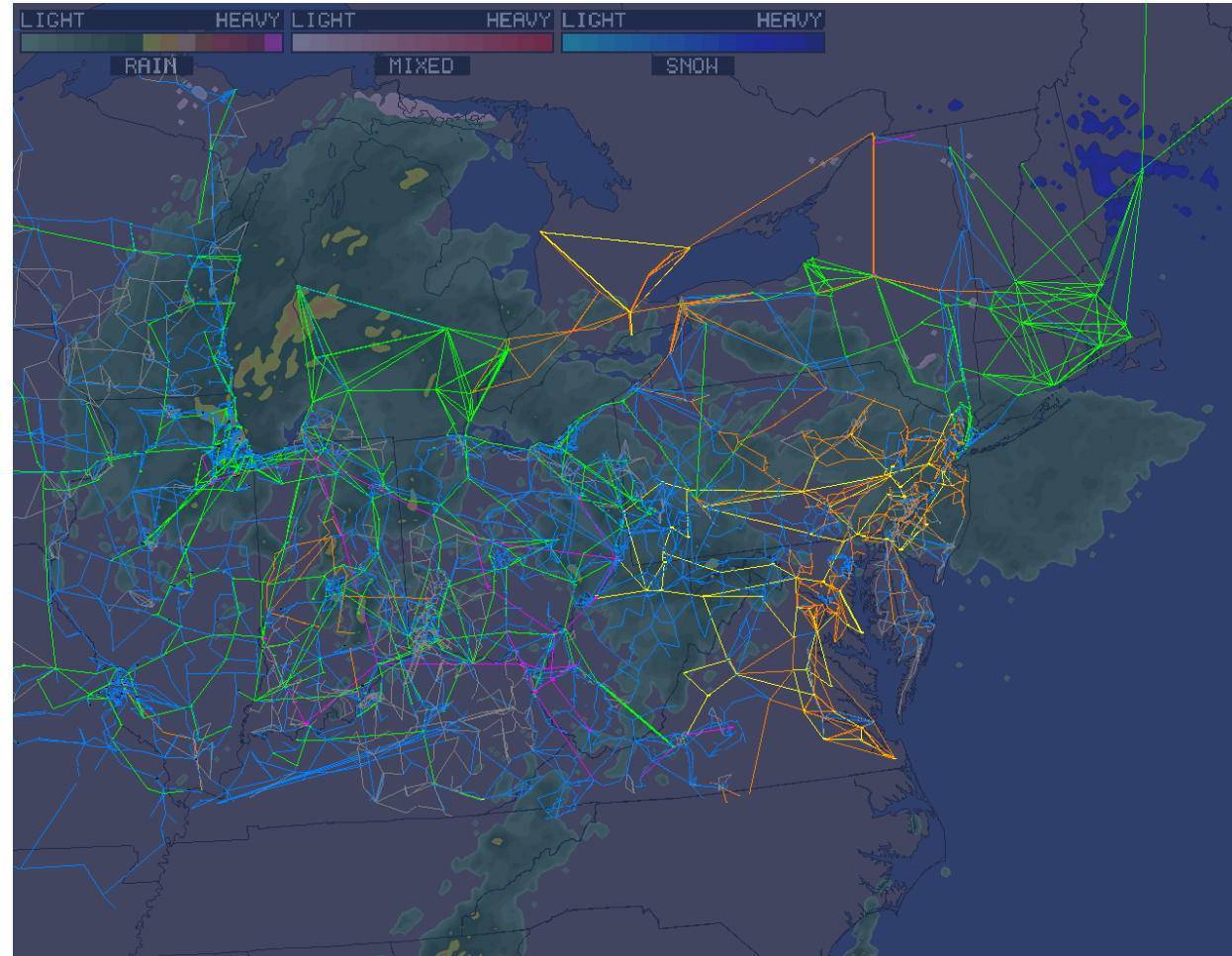


Combining GIS and Emphasis: Transmission System Emphasized



A Weather
Precipitation Radar
Image on a Oneline

Transmission System
Emphasized

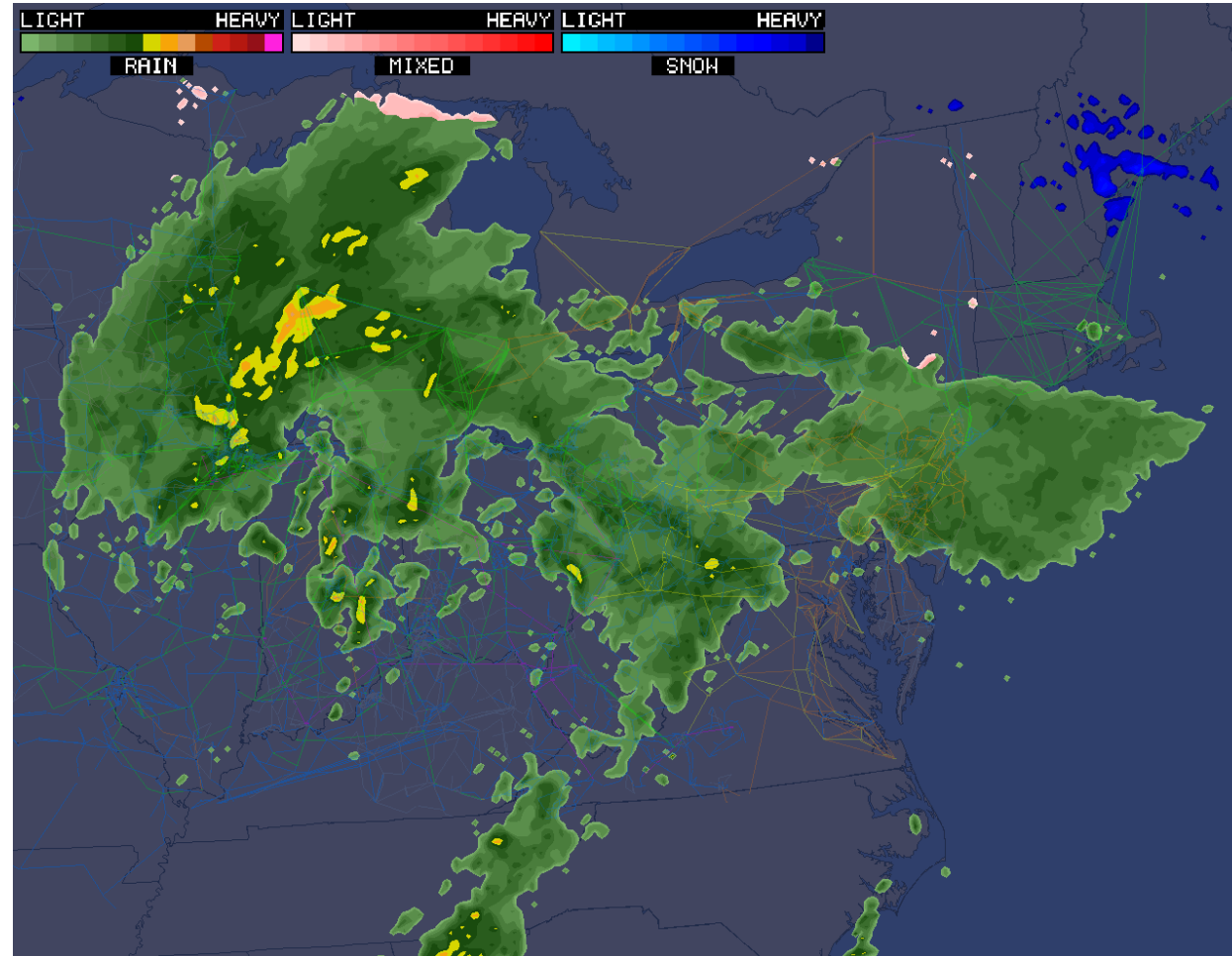


Combining GIS and Emphasis: Weather Radar Emphasized



A Weather
Precipitation Radar
Image on a Oneline

Weather Radar
Emphasized





KML Export and Import



- KML is the file format supported by geographical software such as Google Earth
- Simulator can write to KML files
 - Specify what objects and fields to export- small files are better
 - These files can be opened and viewed in Google Earth
- Simulator can read from KML files
 - The key fields must be correctly specified
 - Reads in one-line display object locations and format, does not modify fields of power system objects
 - Example, intended use of this feature:
 - Create KML files with Simulator
 - Modify objects, save as a new KML file, import back in
 - Ex., routing transmission lines, placing substations



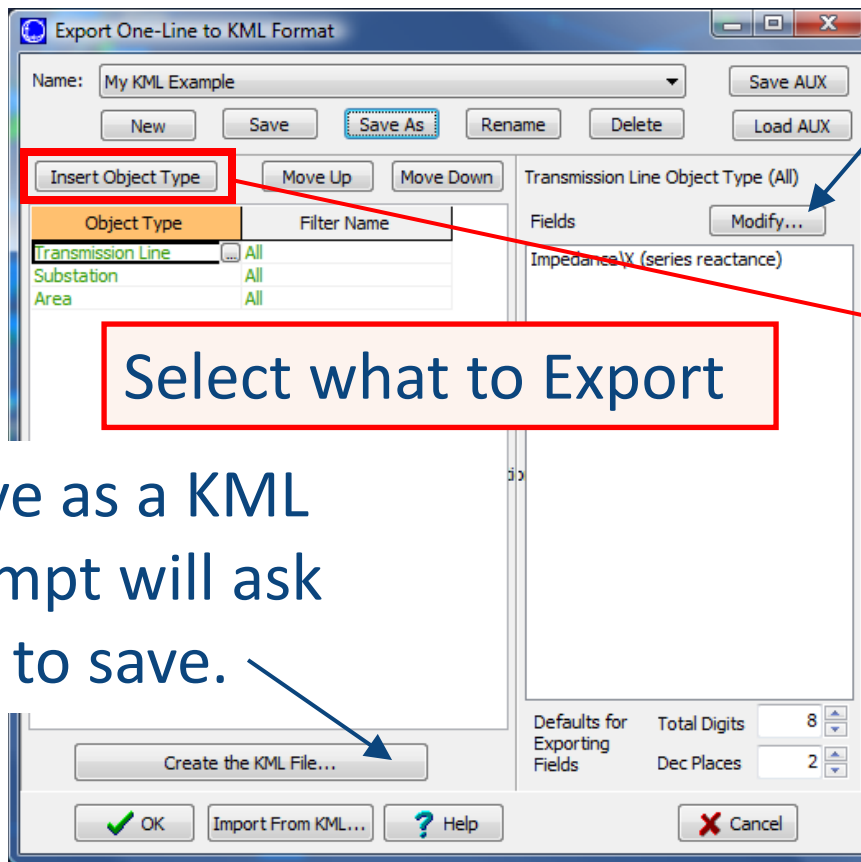
KML Export and Import



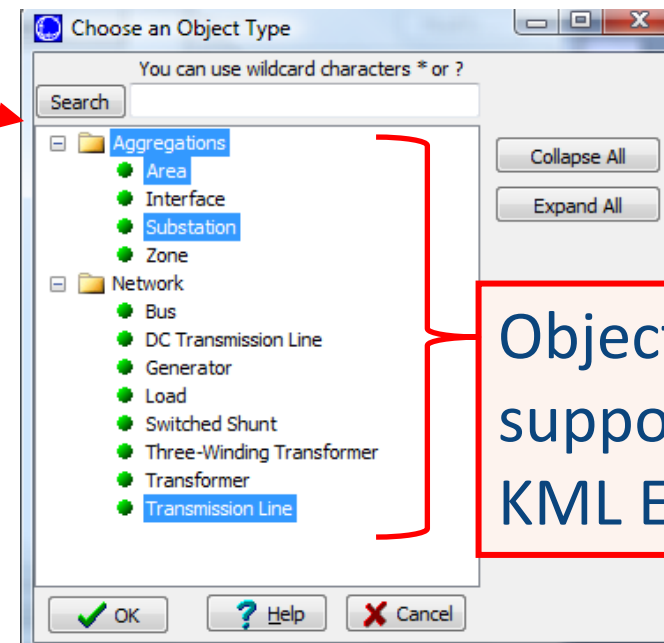
- Onelines must have a valid map projection
 - Objects must be associated with a latitude and longitude
 - You can use the **Populate Lat,Lon with Display X,Y** tool
- Key fields are exported by default to allow you to read your files back in
 - Icons and placemarks with information appear for different object types
 - Objects are emphasized when mouse is over them
- Recommendations
 - It seems to be easier to work with several small KML files instead of one large file
 - Use filters, and limit what object types and fields you export and import
- For more information about KML, see Google's KML Reference:
<http://code.google.com/apis/kml/documentation/kmlreference.html>

KML Export

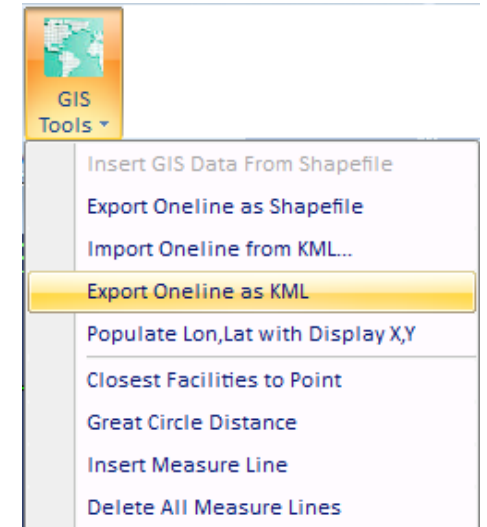
On the **Onelines** ribbon tab, choose **GIS Tools** → **Export Online as KML**



Optionally, add extra fields to export

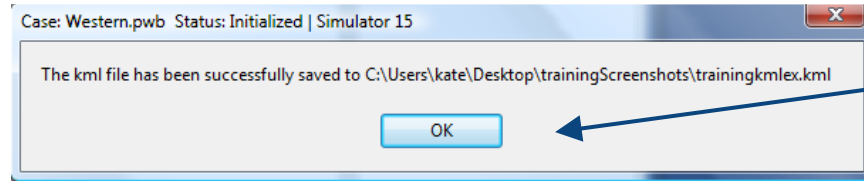


Object types supported by KML Export

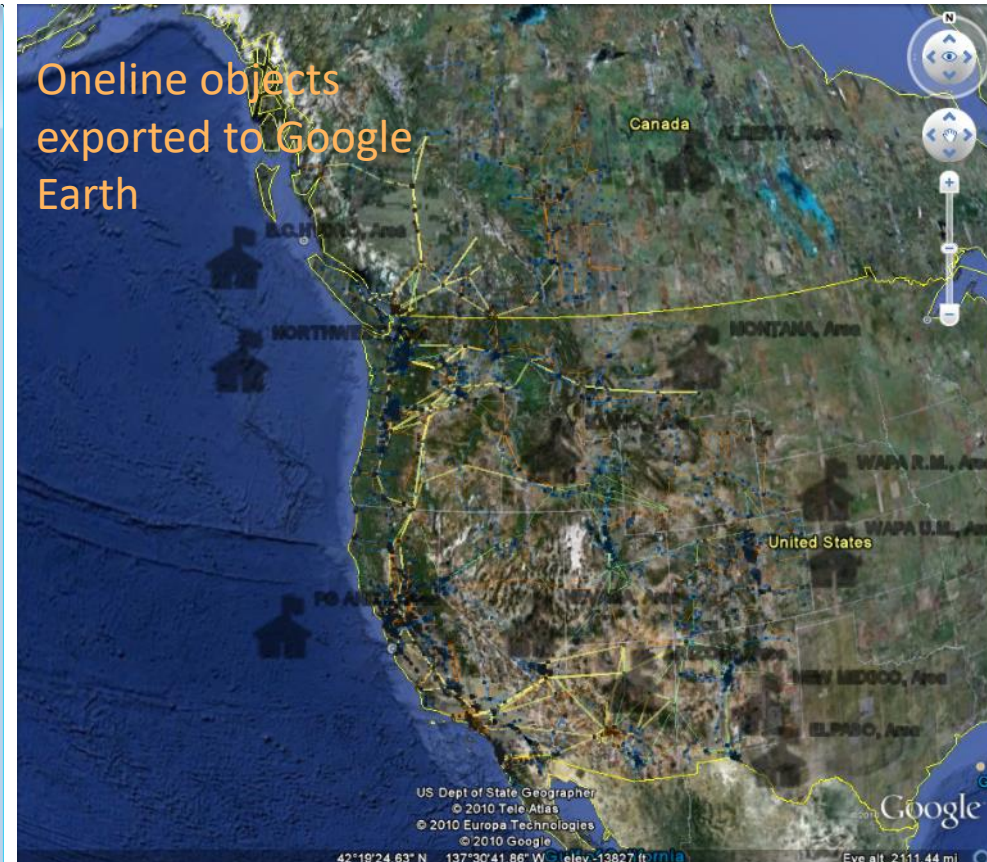
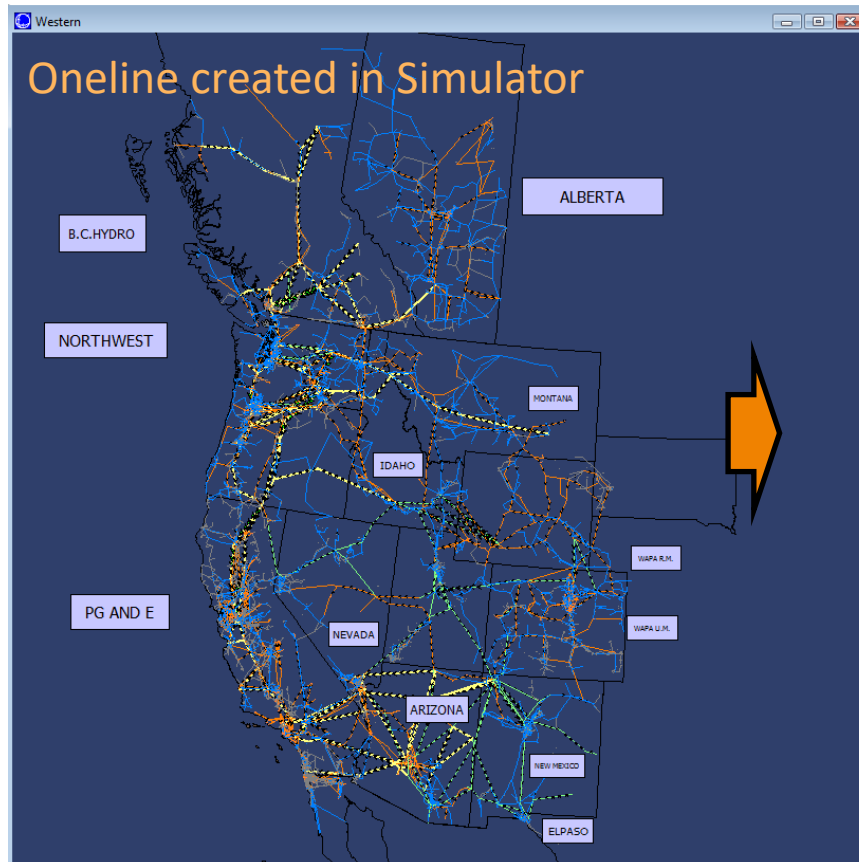


Click to save as a KML file. A prompt will ask you where to save.

Viewing Exported KML Files

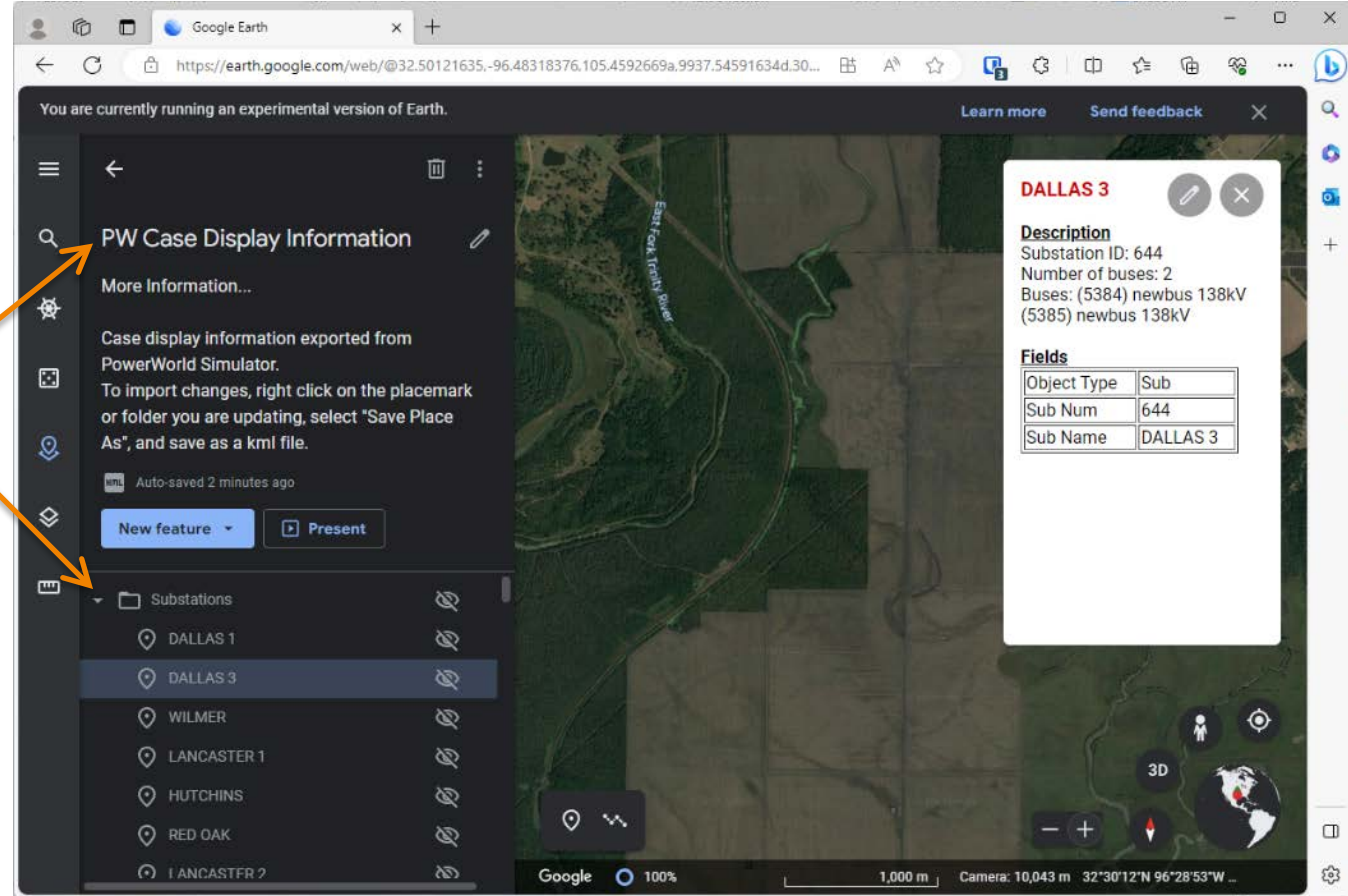


A dialog will appear when the export is complete

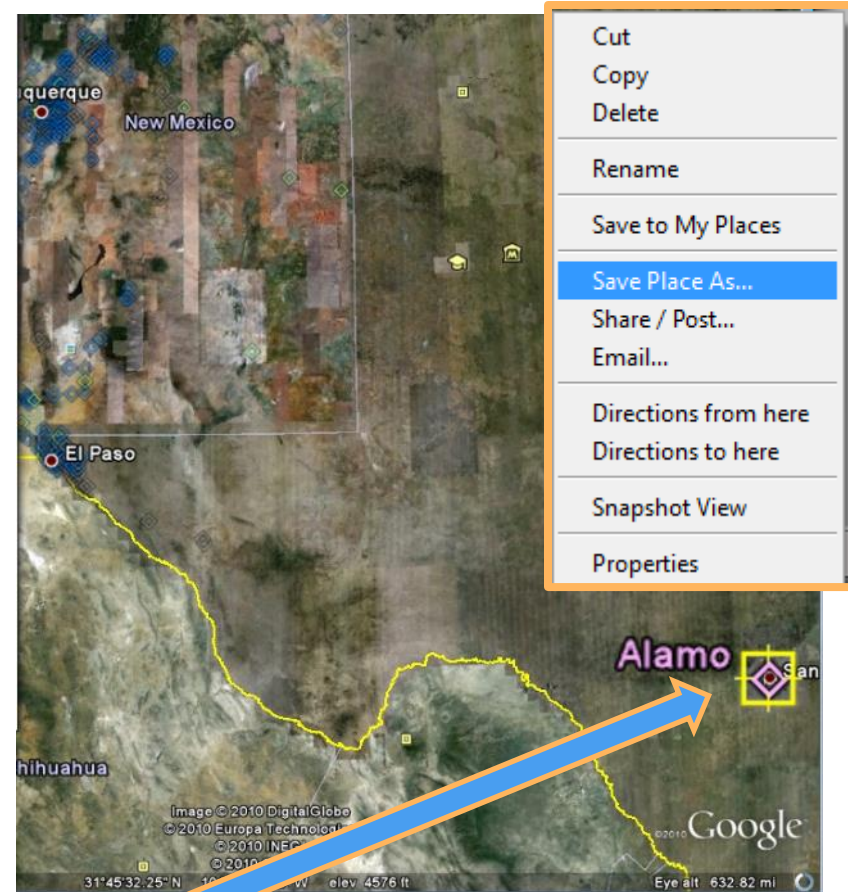
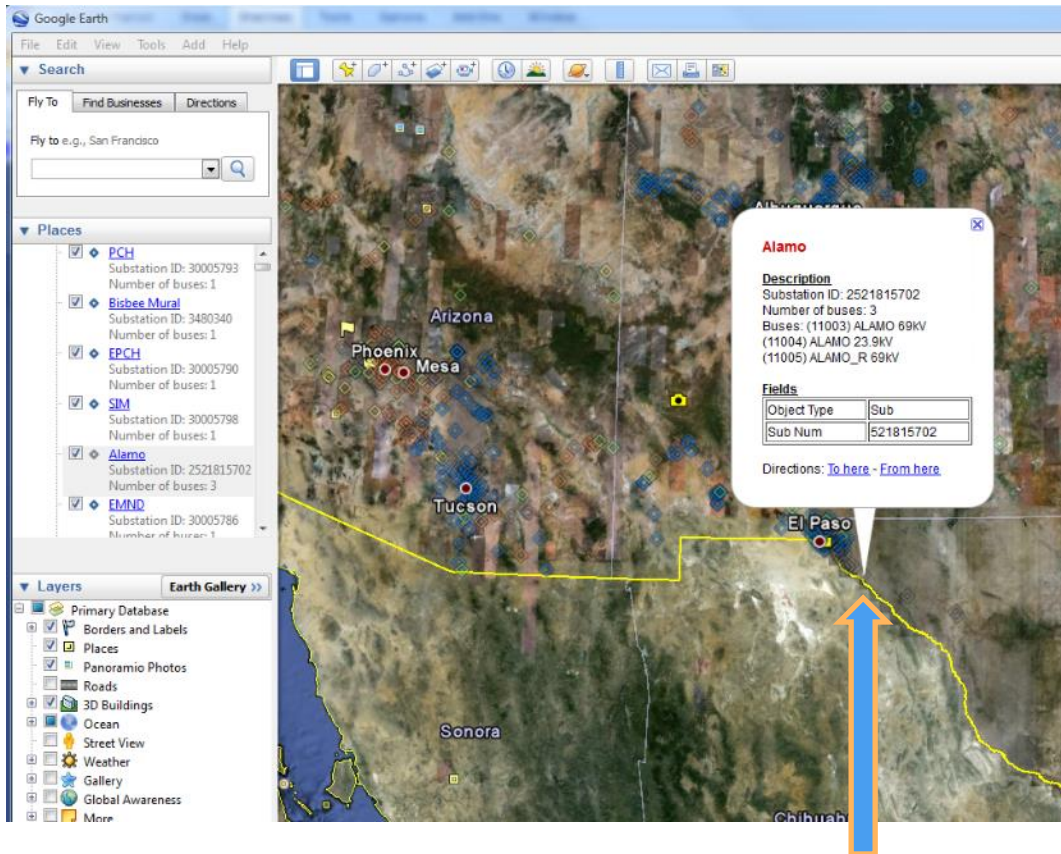


Viewing KML Placemarks

In the KML file, folders appear for each exported object type under the “PW Case Display Information” header



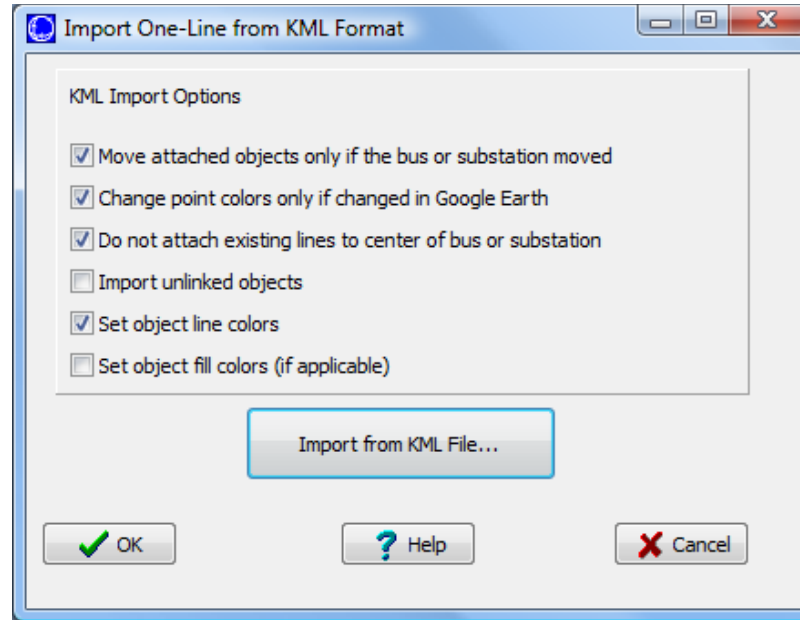
Importing from KML



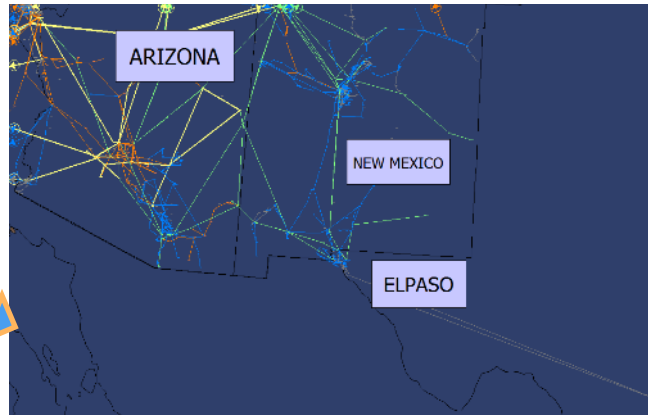
Ex: Move substation to new location and save it as a KML file.

Importing from KML

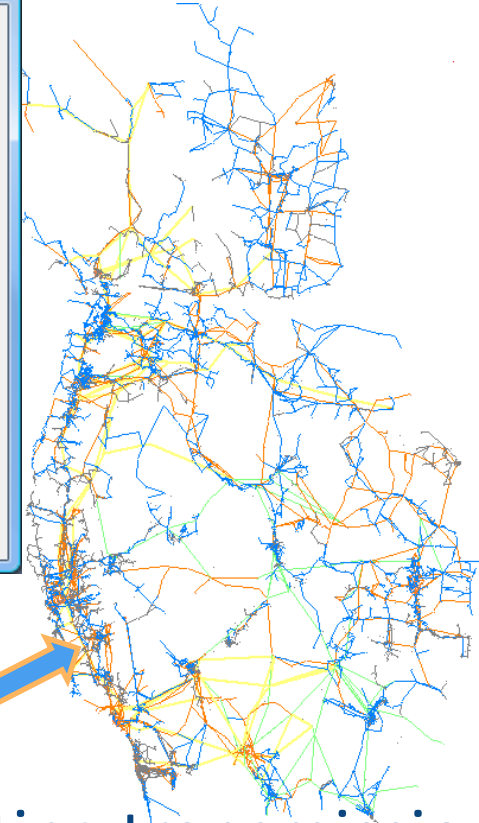
- Import to any oneline
- Objects can be linked or unlinked
- Importing can create objects



Ex: Importing the moved substation



Ex: Importing transmission lines to a new oneline





Additional GIS Tools



- Export Oneline as Shapefile
 - Create shapefile containing a single type of display object from a oneline display
- Closest Facilities to Point
 - Provides a list of closest objects to a selected point on the oneline display
- Great Circle Distance
 - Calculate the distance between two points of longitude, latitude
- Measure Lines
 - Measure the distance between points on the display by drawing a line connecting them
- Populate Lon,Lat with Display X,Y
 - Populate the Longitude and Latitude fields of buses and substations with location of the corresponding object on the oneline display
- Display shapefile database information with object created from shapefile
 - Right-click on object and select local menu option Show Shapefile Fields

Blank Slide