

1. Legend and Overlay Management.

1.1. Legend collapse controls.

Within AWIPS, legends have been used quite successfully as a user interface device for manipulating the characteristics of overlays.

However, anyone familiar with current D-2D ensemble capabilities will realize that if several ensemble fields are loaded, legend management becomes very difficult. So one of the goals of this prototyping was to improve that.

Ex 1.1.A.

- Open VB.
- Choose SREF-21 source from local, 500MB, height.
- Load it up.
- Note that there is only one legend, and that it has a plus sign on the left end.
- Click on the plus sign with left mouse button, note that a legend appears for each ensemble member.

The individual overlays are still loaded with fewer contours than standard; but now this is done by reducing the density instead of with style info.

Now we want to try more of the legend collapse controls.

For collapsing and expanding legends, the only thing that matters are the plus and minus icons on the left end of the legends.

Ex 1.1.B.

- Click on one minus sign with middle mouse button, note this collapses a group of similarly colored overlays.
- Click on another minus sign with left button, note this collapses all legends again.
- Click on plus sign with middle button, note this shows all groups but leaves the groups collapsed.
- Click on any plus sign with middle button, note this expands that group.
- Click on any plus sign with left button, note this expands all legends again.

1.2. Grouping and Segregation Strategies.

Ex 1.2.A.

- Clear the screen, open the Ensemble Controls tool.
- Choose a different segregation strategy.
- Reload the SREF 500MB height.
- Expand the legend; note the organization and color scheme.

The key point here is that the colors for individual member overlays are now controlled by the segregation strategy, not the standard AWIPS overlay color set. For now these groupings are fairly arbitrary, but the idea is that groupings will be developed where members of the groups behave similarly based on the weather situation.

Ex 1.2.B.

- Clear the screen, choose four panel layout with third button pop-up.
- Reload the SREF 500MB height, note panel organization.
- Hit delete key a few times, note that panel rotate applies here.

Ex 1.2.C.

- Clear the screen.
- Open VB, deselect SREF source, activate RUC, NGM, NAM, and GFS.
- Load, then collapse the legends.

The point here is to note that the new legend collapse controls can apply to non-ensemble data as well.

1.3. Toggling.

In some ways the new toggling functionality is easier than the collapse functionality because it does not usually change the relative position of the legends. However, it is a very important thing to understand, because the toggle state can directly impact many of the ensemble visualization techniques we will cover later.

Note that for everything we are doing with the toggling, one wants to avoid clicking on the + and - icons and click on the main part of the legends.

Ex 1.3.A.

- With SREF 500MB heights loaded, expand the legend.
- Click twice on any legend (not on collapse marker) with right mouse button, note that all legends toggle off and on.
- Click twice on any legend with middle button, note that a group of legends toggles off and on.
- Click twice on any legend with left button, note that one legend toggles off and on.
- Completely collapse legend, repeat last three steps, note the behavior is now the same for all buttons.

Ex 1.3.B.

- With legend completely collapsed, click with middle button on collapse marker.
- Click twice on any legend (not on collapse marker) with right button.
- Click twice on any legend with middle button.
- Click twice on any legend with left button.

The key point here is that when collapsed, all elements of the collapse toggle together, but otherwise the left button does individual members, the middle button groups, and the right button all members.

Ex 1.3.C.

- With legend completely collapsed, overlay SREF 700MB, height.
- Try hitting the number keys on the numeric keypad, note response.
- Completely expand both 500 and 700.
- Again try hitting the number keys on the numeric keypad, note response.

The point here is that the numeric keypad toggles by load order, not overlay order.

1.4. Legend focus and Pop-up Controls.

The little circles at the end of the legend show the overlay or overlays most recently acted on; we say these overlays have legend focus. Some pop-up controls respond to legend focus, some do not.

Ex 1.4.A.

- See to it the SREF 700MB heights are completely expanded.
- Use the third button popup on one 700MB legend to unload that overlay.
- Collapse the SREF 700MB heights.
- Use the third button popup on collapsed 700MB legend and choose Unload, note that this unloads all members.

The point here is that the Unload function does not respond to legend focus, but does respond to the collapse state.

Ex 1.4.B.

- See to it the SREF 500MB heights are completely expanded.
- Toggle all legends off with third button, then toggle one group on with middle button.
- Note focus marker on all members of the group.
- Use third button pop-up on one member of that group to make the lines thicker.
- Note that this changed the line thickness of all members of the group.

The point here is that the line thickness control does respond to legend focus. Line Style, Magnification, and Density also do.

Ex 1.4.C.

- Completely collapse the SREF 500MB height legend.
- Use the third button popup on the legend to change the color.
- Expand the legend and see to it that all are toggled on, note that all the colors were changed, but not to the same thing.
- Pick one of the expanded legends and use the third button popup to change the color, note that just that color changed.

The point here is that the change color function has its own unique rules.

1.5. Hiding empty overlay legends.

Ex 1.5.A.

- See to it the SREF 500MB heights are completely expanded.
- Use the left button to toggle one overlay off.
- Use third button popup on a different overlay to change the density to zero.
- Use third button pop-up over display area away from legends to choose the Hide Empty Legends option.
- Note the toggled off and zero density legends disappear, and the small gray "more" appears on top of the legend.

The reason this capability is there is because at times you do not want the legend space cluttered with non-viewable overlays.

Ex 1.5.B.

- Click on the "more" text, note the empty overlay legends come back.
- Hit the keypad enter key several times. Note that hiding empty legends is now one of the states it cycles to.

Ex 1.5.C.

- Put D-2D in Hide Empty Legends mode, using either non legend popup or keypad enter key.
- Click on some legends with the left button to toggle them off, note that they disappear.
- Click on gray "more" and they come back.

The point here is that when in Hide Empty Legends mode, sometimes toggling can change the relative position of legends.

1.6. New legend related keyboard controls.

Remember that when dealing with keyboard shortcuts, one always needs to give the D-2D keyboard focus, not just for these new controls.

Ex 1.6.A.

- Clear and load SREF Surface Wind Speed from VB.
- Click on the D-2D title bar to get keyboard focus.
- Hit the > key a few times, note the density increases.
- Hit the < key a few times, note the density decreases.
- Adjust the density so some but not many contours are visible.

The main reason this capability was added is that sometimes the automated density reduction can be too aggressive.

Ex 1.6.B.

- Expand the legends and toggle one group on and off with the middle button. Note the focus marker is now on that group only.
- Use the < and > keys, note that only the overlays with focus change density.

The point here is that the < and > keys always respond to legend focus.

Make sure the legend stack is expanded.

Ex 1.6.C.

- Hit the + (plus) key on the main key board. Note that this toggles first overlay off.
- Continue to hit the + key, note that this rotates the toggle state upward through the legend stack.
- Hit the - (minus) key a few times, note that this rotates the toggle state downward.

Ex 1.6.D.

- Toggle all overlays off with the third button.
- Toggle one group on with the middle button.
- Use the + and - keys, note that now the legends are rotated by group.

The point is that if one starts with the toggle state completely segregated by group, the +/- keys will automatically alter their behavior to account for that.

2. Function Overlays.

2.1. Basic Concept.

Ex 2.1.A.

- Clear, load SREF Surface Temperature.
- From Volume menu, open and tear away Function Overlays menu.
- Click on the D-2D title bar to get keyboard focus, hit the < key once to get zero density.
- Select Mean from the top part of the Function Overlays menu.
- Turn on loop, see a loop of the mean value among the members of surface temperature.

Ex 2.1.B.

- Expand the legends, toggle off a couple of groups.
- Select the Mean Function Overlay again.
- Note that the result is slightly different; this is because the toggled off members were excluded from the computation.

Ex 2.1.C.

- Switch VB to Time Series major mode, and load up the SREF surface temperature.
- Use the third button popup to change the line style to dotted.
- Load Mean, Max, Min, and Median, note these work for line graphs as well as plan view.

Ex 2.1.D.

- Clear, switch VB back to Plan View major mode.
- Select RUC80 500MB height in the VB, but do not load it yet.
- Change load mode to Seq Ensemble (last on list).
- Load it up, note that every run loads as a separate overlay.
- Turn looping on, load Mean Function Overlay.
- Use third button pop-up on legend for Mean Function Overlay to load that as an image.

2.2. Measures of Average.

Ex 2.2.A.

- Clear, load SREF Surface Wind Direction.
- Get keyboard focus, hit < once to make overlays empty.
- Load Mean and Mode Function Overlay. Note differences in how they handle a North wind.

2.3. Measures of Limit.

Ex 2.3.A.

- Load Points Extension, place a point on one of the sharp north wind boundaries.
- Switch VB to time series, choose that point for the time series, and load time series of SREF Surface Wind Direction.
- Get keyboard focus, hit < once to make overlays empty.
- Load Max, Min, Mean plus 1 standard deviation, and Mean minus 1 standard deviation.

This probably is not news to anyone here, but this demonstrates how sometimes mathematically correct statistics can give answers that are nonsense in the real world. Wind direction is obviously an extreme case of this.

2.4. Measures of variability.

Ex 2.4.A.

- Put VB back into Plan View, load SREF 500MB Height, get keyboard focus, hit < once to make overlays empty.
- Load Std Dev Function overlay.
- Go into the Ensembles field menu, the GFS Ensembles submenu, and choose Height Std Dev.
- Load, note that this is essentially the same computation.

This demonstrates a big advantage to the function overlay paradigm. In a current default AWIPS, computations across members only work for those fields for which specific table and menu entries have been made. With this approach, if you can load it, you can do computations across members for it.

2.5. Parametric Functions.

Ex 2.5.A.

- Load SREF Surface 6HR precip get keyboard focus, and hit < once to make overlays empty.
- Open Ensemble Controls tool.
- In the first minimum field, click the cursor in there, clear it out, type in 0.03, and hit return.
- If the first maximum field is not empty, clear it out and hit return.
- Choose the Ens Rel Freq Function Overlay in the Images section.

Ex 2.5.B.

- Toggle off the Ens Rel Freq overlay.
- Erase 0.03 from first minimum field in Ensemble Controls tool, replace it with 50, and hit return.
- Load Value of Ens Rel Freq Function Overlay from top section.
- Load Median Function Overlay from top section, note how they compare.

Does everyone understand why these are the same? Did anyone know this is what would happen?

2.6. Functions for Characterizing Distributions.

Ex 2.6.A.

- Use the collapse marker on one of the function overlays and collapse them.
- Use the third button popup on the collapsed function overlay legends to unload them.
- Load the Skewness Image function overlay. Note that the distribution of precip among the members is almost always positively skewed.

Also note that this statistical measure is not very meaningful when all the members have near zero precip. The characterizing of the distribution function could be a huge topic by itself.

2.7. Histogram overlays.

These exercises were designed assuming they were performed in order, so clear and load up the SREF Surface Precip.

Ex 2.7.A.

- Load Color Histogram Function Overlay.
- Start sampling.
- If it is difficult finding non-trivial histograms, try loading the Mean function overlay.

Ex 2.7.B.

- Use third button pop-up over display area (not over legend) to activate continuous sampling.
- Put cursor over somewhere with a non-trivial histogram.
- Start hitting the + key, note what happens in the histogram.
- If this is puzzling, expand the legends and keep hitting the + key.

This is a means of quickly identifying those members that are outliers.

Ex 2.7.C.

- Toggle off color histogram.
- Load mono-color histogram Function Overlay.
- While sampling, try changing the density, either with < > keys or third button popup. Note that this changes the level of detail along the value axis.

2.8. Assigning weights to ensemble members.

Ex 2.8.A.

- Clear screen.
- Open Ensemble Controls tool.
- Make sure Use Weights option button is on.
- Load SREF Surface Temperature, get keyboard focus, hit < key to zero density.
- Open the Edit Weights tool.
- Make all the weights 100 except make two of them 0, Publish.

Ex 2.8.B.

- Load Sample Weights function overlay.
- Sample, note that weights shown should be consistent with weights entered.
- Load Mean function overlay.

Ex 2.8.C.

- In Ensemble Controls tool turn Use Weights option button off.
- Expand the legends for Surface Temperatures, toggle off same members that the weights were set to zero for.
- Load Mean function overlay again, note that the two versions of the mean function overlays should be the same.

Ex 2.8.D.

- Turn Use Weights option button on in Ensemble Controls.
- Change some of the weights, publish.
- Double click on one of the Mean function overlays, note that it should now be different from the other.

2.9. Recomputing Function Overlays.

Ex 2.9.A.

- Clear, load up SREF 500MB Windspeed.
- Open Ensemble Controls tool.
- Enter 50 in the first minimum field and hit return, making sure first maximum is empty.
- Load Ens Rel Freq Function Overlay.
- In Ensemble Controls tool, change 50 to 75, hit return.
- Double click on Ens Rel Freq legend, note that it recomputes with the new parameter.

If one toggles overlays on or off, then double clicks, the computation will be redone only including those overlays toggled on. Remember that Histograms, on the other hand, respond to toggles immediately.

Ex 2.9.B.

- Enter 60 in the first minimum field of the Ensemble Controls tool and hit return.
- Again select the Ens Rel Freq Function Overlay.

This demonstrates a reason why recomputing the function overlays waits for a double click instead of responding instantly to changes in the GUI; if the response were immediate, a comparison of this kind could not be made.

2.10. Multi-loads and Function Overlays.

Ex 2.10.A.

- Toggle off Ens Rel Freq Overlay.
- Load 10/Median/90. Note that this is three overlays; the value for ensemble relative frequencies of 10, 50, and 90 percent.

Ex 2.10.B.

- Clear the screen, turn on looping.
- Select the Fire Wx item on the very bottom of the Function Overlay menu.

Does anyone want to take a crack at describing what just happened?

Ex 2.10.C

- In Ensemble Controls tool, click Inherit From Display.
- Change the 80 to 65 and hit enter.
- Double click on the Fire Wx overlay.

3. Contour Intervals for Ensemble Data.

3.1. New Defaulting of Contour Intervals

Ex 3.1.A.

- Clear, load up SREF Surface Windspeed.
- Hit the > key to produce the desired spaghetti plot density.

This is reviewing something we have seen before, but it is important to keep in mind when loading spaghetti plots and confronted with a blank or mostly blank screen, the most common reason is that the automated density reduction was more aggressive than ideal.

Just because this no longer mainly relies on style entries for adapting spaghetti contour intervals, it doesn't mean one cannot make and use those entries. Those entries will be applied directly to, for example, the mean function overlay, and at reduced density for spaghetti.

3.2. New Change Contours Tool.

Ex 3.2.A.

- With Surface Windspeed loaded, open Change Contours tool.
- Click on the Surface Windspeed legend in the tool to activate contour change for that set of overlays.
- Click in the value: field, hit return, and watch what happens.

You'll note that upon selecting the overlays to apply this to, the user is given a default value, but the user is given a change to change this before it is applied.

Ex 3.2.B.

- Put cursor in value field.
- Clear out the text, type in 15, and hit return.

So this is how you manually choose one specific value to contour.

Ex 3.2.C.

- Hit < key until density is zero.
- Load SREF 500MB heights.
- Click on any button in the bottom of the Change Contours tool.
- Click on the 500MB height button.
- Clear out the value: field.
- Clear out the increment field, type in 20, and hit return.

This is how you can pick a specific contour interval.

Ex 3.2.D.

- Click on ^ or v button, note that this brings back last non empty entry for value: field.
- Change 20 in increment field to 3, hit return.
- Now try ^ and v buttons.

With this, we hope to make it quick and easy to identify the particular contour value that emphasizes the features of interest.

Ex 3.2.E.

- Clear, load 500 heights for RUC, NAM, NGM, and GFS.
- Click on a legend button in the Change Contours tool, note that no overlays are made available.
- Select Change Contours in function overlays menu, and again click on a legend button in the Change Contours tool.
- Click on the newly available legend in the Change Contours tool and use the tool to manipulate the contouring.

By using a Function Overlay to enable the contour editing, it is straightforward to edit in unison overlays that would also be available for using ensemble techniques.