Exercise C3 – Specifying Endpoints Using the BASINS Climate Assessment Tool (CAT)

BASINS CAT provides a post-processing capability for calculating different hydrologic and water quality endpoints based on HSPF output time series data. As used here, an endpoint is any metric or value of concern that the user wishes to compute from the output of an HSPF simulation. Endpoints can range from simple (e.g., mean streamflow, annual sediment load) to complex (e.g., n-day frequency flow values). In this exercise, we will set up endpoints from HSPF output to use in our CAT simulation. We will also demonstrate how to specify value ranges of concern when selecting endpoints, as well as how to specify a subset period of time within the full output data set for computing assessment endpoints.

Questions addressed in this exercise:

  1) How do I specify endpoints from HSPF output for climate change impact analysis?
  2) How do I specify value ranges of concern?
  3) How do I specify time periods of concern (seasonal and/or partial records)?

A. Specifying Hydrologic and Water Quality Endpoints

QUESTION ANSWERED:
1) How do I specify endpoints from HSPF output for climate change impact analysis?

This section shows how assessment endpoints are specified with BASINS CAT. The final result in this section is the specification of two assessment endpoints: one for streamflow, and one for total nitrogen loading.

1.   The defining of endpoints is performed through the **Assessment Endpoints** tab on the BASINS CAT form. Click on this tab. Begin defining a new endpoint by clicking on the **Add** button. The **Endpoint** form will open. This form contains the controls needed to define an assessment endpoint, including the endpoint name, the model output time series data set to be analyzed, and the attribute of the output data to be calculated. The **Endpoint Name** field is used to provide a text label for identifying the assessment endpoint being created. Begin defining this endpoint by entering "Flow" in the **Endpoint Name** field.

2.   Begin defining the output time series data for the endpoint by clicking in the **Data set** box and the **Select data for endpoint** form will open. In the first column, under the **Scenario** label, click on the **SCEN** item and all data sets with a Scenario attribute of SCEN will be added to the **Matching Data** list. In looking at the last column of the **Matching Data** list, note the data set with the **Constituent** name **FLOW**. Click on this data set and it will be added to the **Selected Data** list. Click the **Ok** button to close the form.
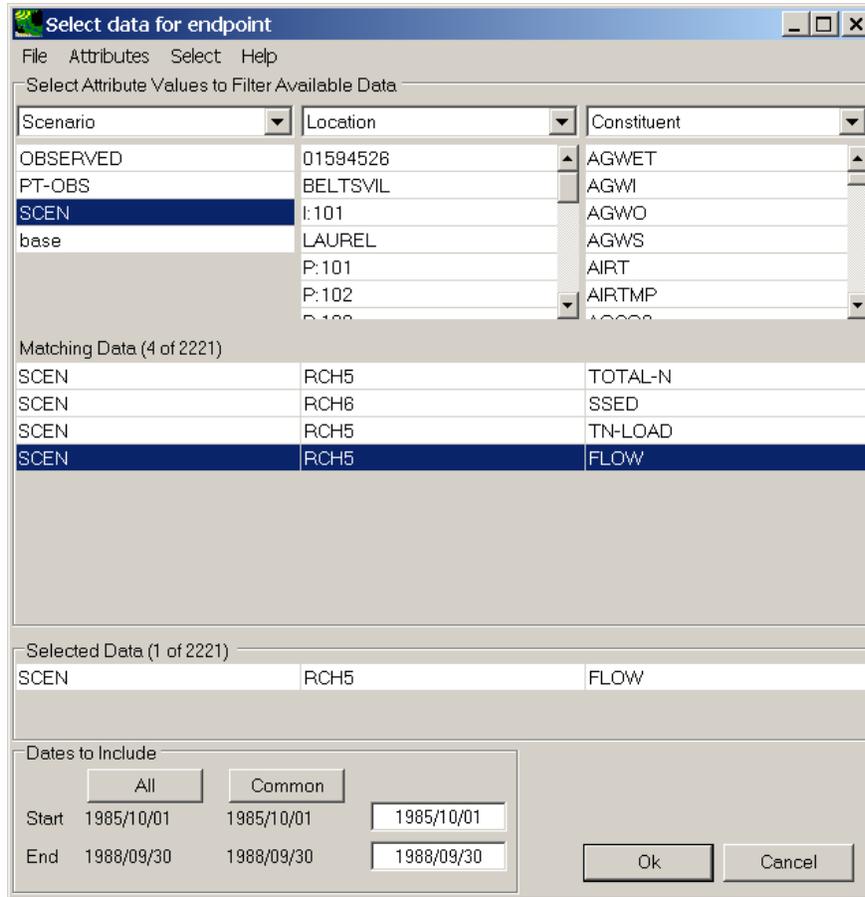
3.   The **Endpoint** form has now been updated with a description of the selected flow
        data in the **Data set** box. The **Attribute** pull-down list contains the attributes
        available for selection as assessment endpoints. BASINS CAT provides a range of
        attributes, from standard statistics (e.g., mean, sum, standard deviation) to
        duration-frequency statistics (e.g., 7Q0, 100-year flood). For this example, we will
        specify an endpoint focused on high flow, so select the **1Hi100** (i.e., 1-day Hi value
        occurring every 100 years or 100 year flood) item from the list.
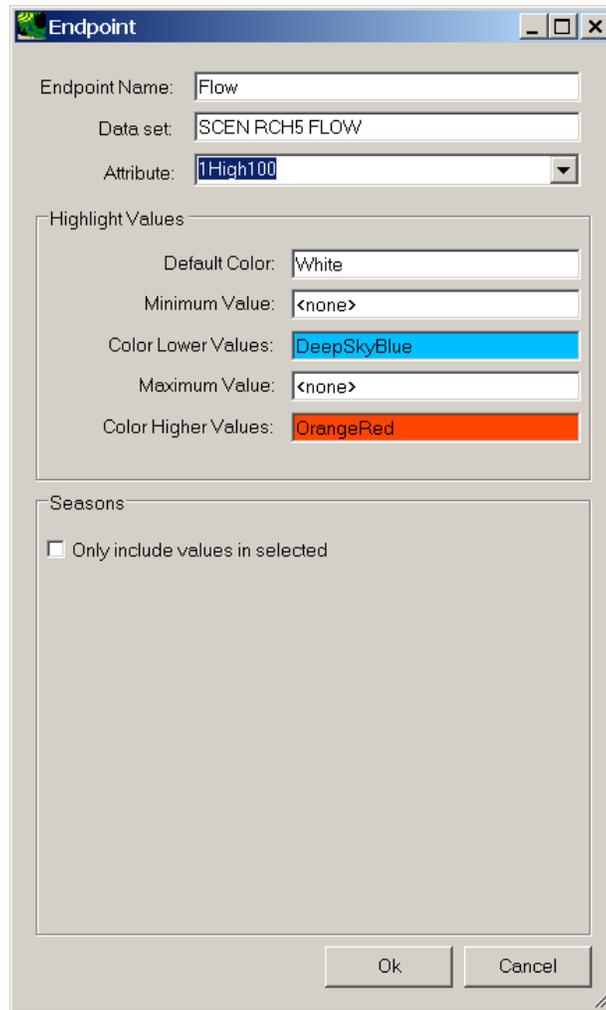
4. Click the **Ok** button to complete defining this endpoint. The **Climate Assessment Tool** form will be updated to show the newly defined end point.
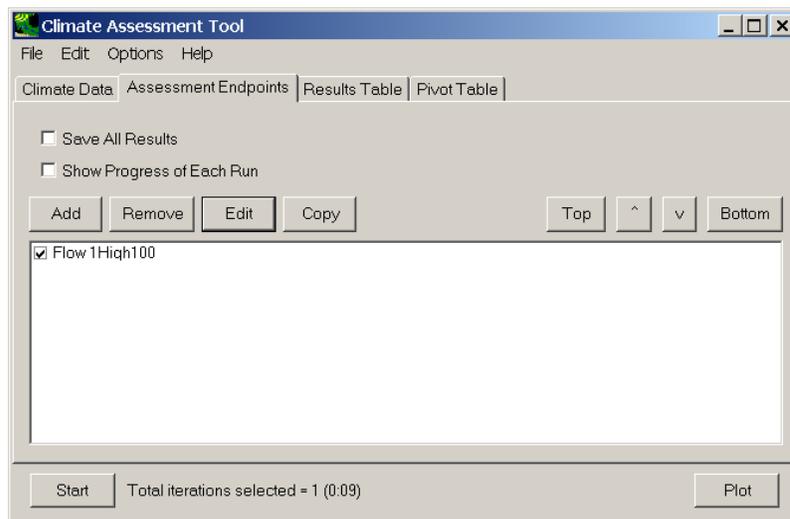
5.   Next we will define a second assessment endpoint, the average annual total nitrogen
load. Begin defining the endpoint by clicking the **Add** button again. Enter "Total N"
in the **Endpoint Name** field and then click in the **Data set** box to select the
appropriate data set. On the **Select data for endpoint** form, again click the **SCEN**
item in the **Scenario** list. From the **Matching Data** list, click on the data set with a
constituent name of **TN-LOAD**. Click the **Ok** button to close the form.

6.   The **Endpoint** form has now been updated with a description of the selected Flow
data in the **Data set** box. As opposed to the previous event selected for the flow
endpoint, this endpoint will assess annual values. In the **Attribute** list, select the
SumAnnual item, resulting in an endpoint that reports the average annual total
Nitrogen load.
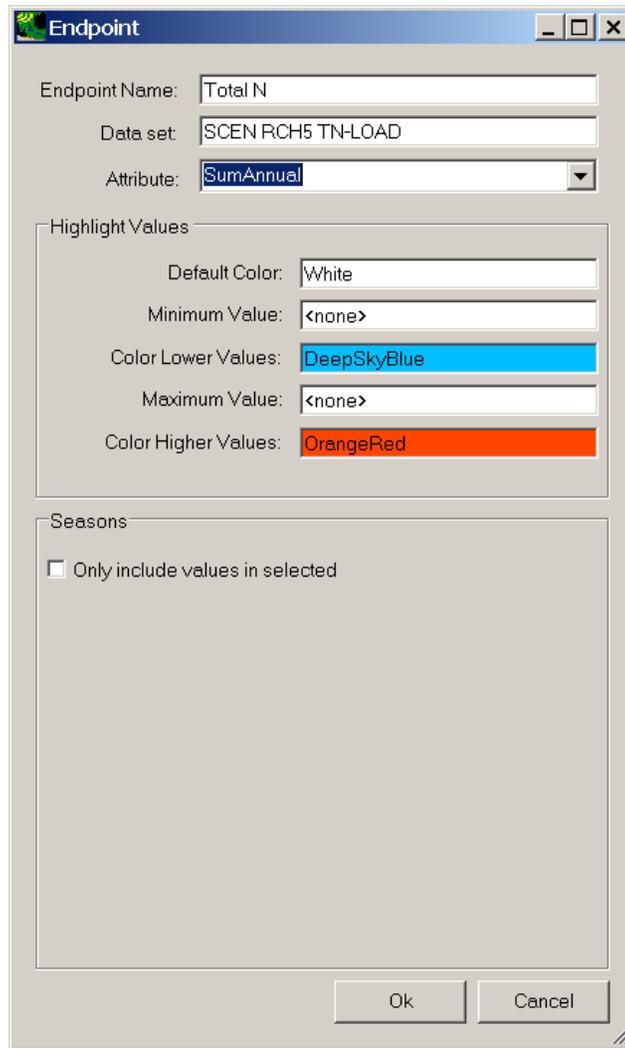
7.   Click the **Ok** button to complete defining this endpoint. The **Climate Assessment Tool** form now shows both endpoints defined in this exercise.
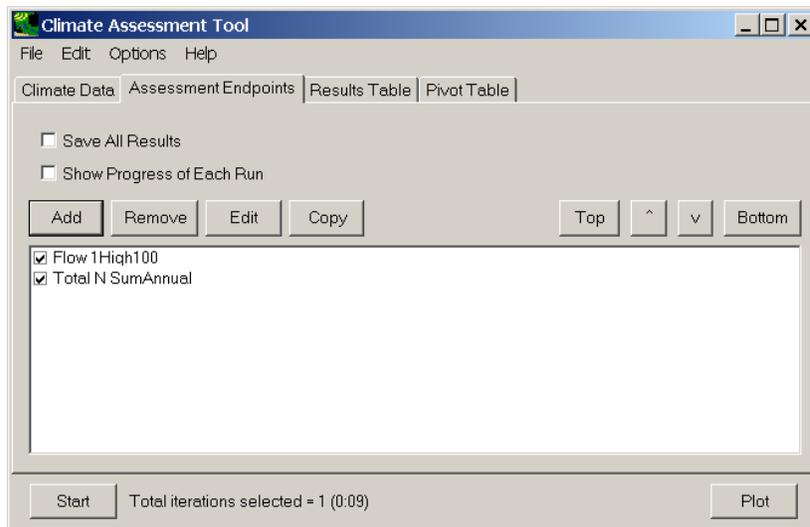
8.   To complete this section, save the state of CAT, using the **File:Save Climate and Endpoints** menu option.

B. Facilitating Visual Inspection of Metrics from CAT Simulations

QUESTION ANSWERED:
2) How do I specify value ranges of concern?

BASINS CAT provides a capability to visually flag endpoint values in the results table falling within specified ranges. Critically low and/or high values can be entered, along with indicator colors, during endpoint definition. Endpoint values that fall outside of the specified critical range will then be highlighted in the specified indicator color on the results display. This section will demonstrate how to specify value ranges of concern when selecting endpoints.

1.   The defining of endpoints is performed through the **Assessment Endpoints** tab on the BASINS CAT form. After clicking on this tab, begin defining a new endpoint by clicking on the **Add** button. The form contains the controls needed to define an assessment endpoint, including the endpoint name, the data set to be analyzed, and the attribute of the data set to be reported. Begin defining this endpoint by entering "Flow" in the **Endpoint Name** field. Click in the **Data set** box to select the data set to be analyzed using the **Select data for endpoint** form. On the **Select data for endpoint** form, select the data set with the attributes **SCEN RCH5 FLOW**. Leave the **Attribute** field as the default of **Mean**. The form should now appear as below.

2.   The highlight feature in BASINS CAT is provided as an aid to visually interpreting model output. Specifications for this feature are found in the **Highlight Values** frame. In this example, we wish to highlight any streamflow values falling outside of the range from 90 to 150 cubic feet per second. Type in "90" for the **Minimum Value** and "150" for the **Maximum Value**. Results within the specified range will be displayed in cells with the **Default Color** background. Results below the **Minimum Value** will be displayed with the **Color Lower Values** background. Results above the **Maximum Value** will be displayed with the **Color Higher Values** background. Colors for all three ranges can be updated by clicking in the **color** fields.
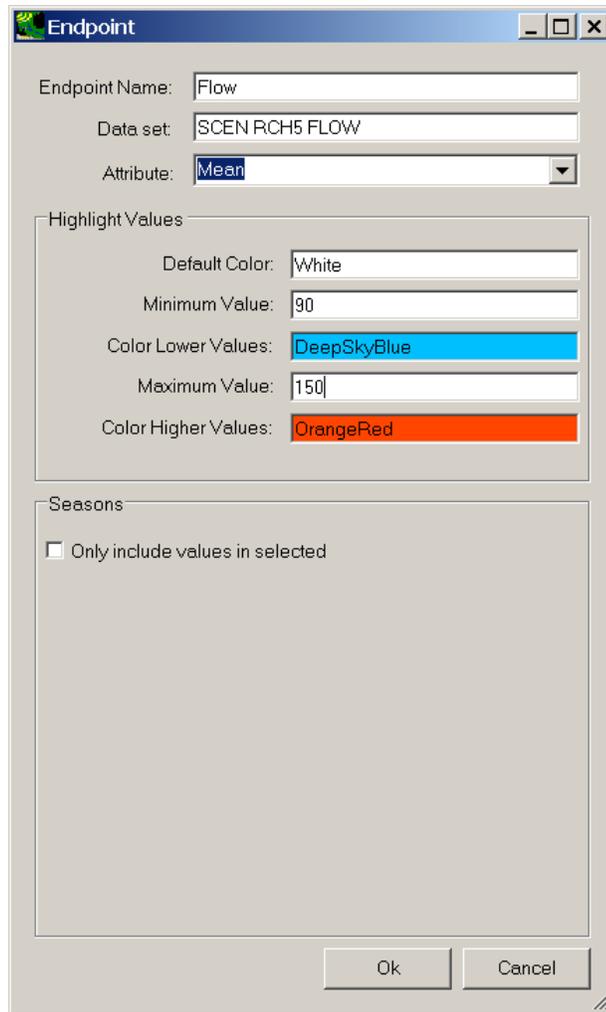
3.   Click the **Ok** to finish defining this endpoint. The newly created endpoint will be displayed on the **Climate Assessment Tool** form.
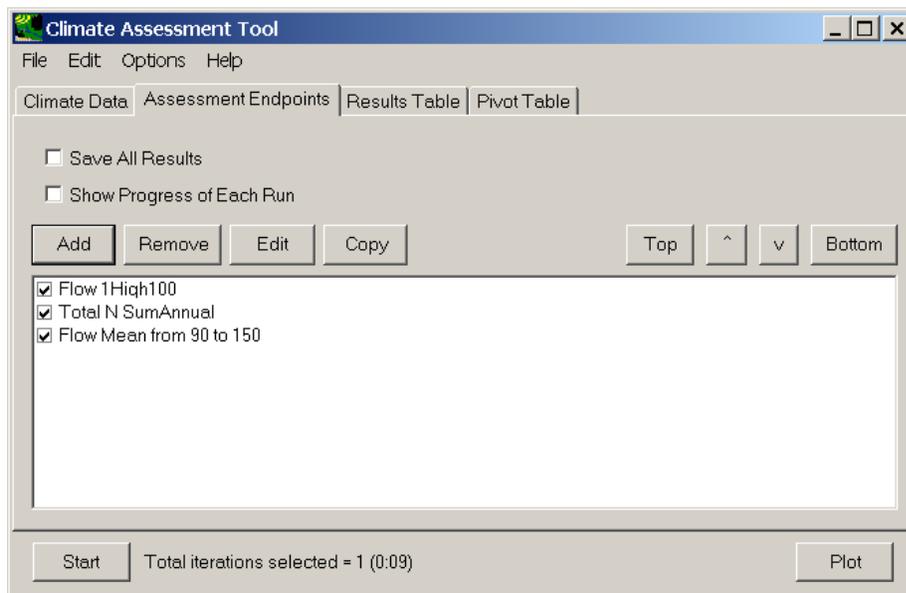
C. Specifying Temporal Range of Concern

QUESTION ANSWERED:
3) How do I specify time periods of concern (seasonal and/or partial records)?

BASINS CAT provides a capability for calculating assessment endpoints based only on model output time series data within a specified period of time in the model output data set. The selected period of time can be either a series of months or seasons within each year, or a selected year or years within the full output data set. Calculating endpoints based only on selected years within a record can be more appropriate when evaluating climate change scenarios where adjustments are made only to selected years within the record, or a partial record. This section shows how to specify a subset period of time within the full output data set for computing assessment endpoints. The final result of this section is the specification of an assessment endpoint for minimum streamflow during the summer months.

1.   The defining of endpoints is performed through the **Assessment Endpoints** tab on the BASINS CAT form. After clicking on this tab, begin defining a new endpoint by clicking on the **Add** button. The **Endpoint** form contains the controls needed to define an assessment endpoint, including the endpoint name, the data set to be analyzed, and the attribute of the data set to be reported. Begin defining this endpoint by entering "Summer Flow" in the **Endpoint Name** field. Click in the **Data set** box to select the data set to be analyzed using the **Select data for endpoint** form. On the **Select data for endpoint** form, select the data set with the attributes **SCEN RCH5 FLOW** from the **Select data for endpoints** form. This endpoint will look at minimum summer flow, so select **Min** from the **Attribute** list. The form should now appear as below.

2.   The **Seasons** frame near the bottom of the form is used for specifying the time period to be used when computing the endpoint value. Begin defining this subset by clicking on the **Only include values in selected** check box and two additional fields will be displayed. The first field is a list of time subset options that includes **Calendar Years**, **Months**, and **Water Years**. The second field will display a list of available time intervals based on the item selected in the first field. For example, selecting **Water Years** from the first field will populate the second field with a list of available water years based on the period of record of the data set. For this example, select the **Months** option and the second field will be populated with the months of the year. Items in the second field can be selected and unselected by clicking on them. Additionally, the buttons below the list can be used to select **All** or **None** of the items. To report endpoint values during summer months, select **Jun**, **Jul**, and **Aug**.
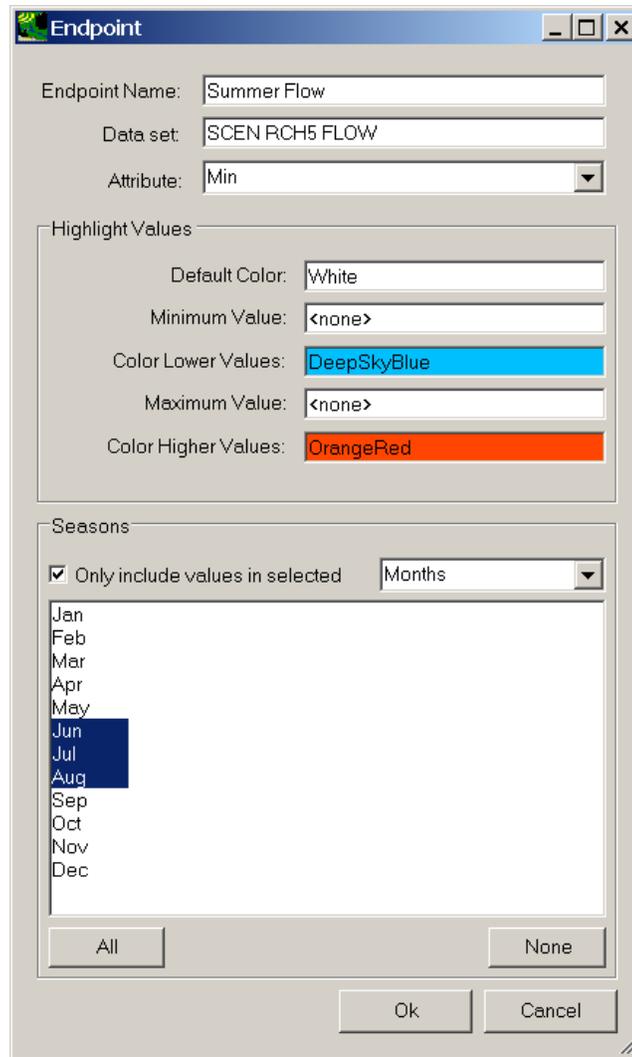
3. Click the **Ok** to complete defining of this endpoint. The newly created endpoint will be displayed on the **Climate Assessment Tool** form.
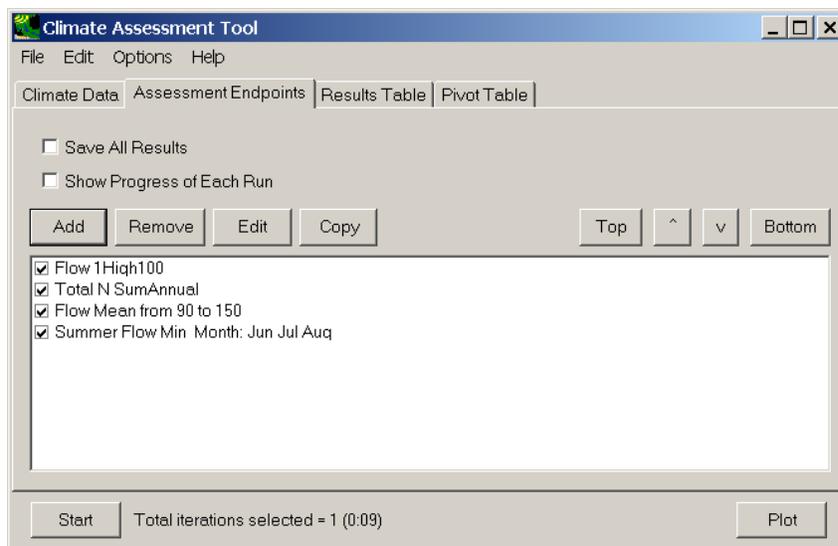
4.   To complete this exercise, save the state of CAT, using the **File:Save Climate and Endpoints** menu option.