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.

📒 Endpoint			_ 🗆 ×
WWH Read:			
Endpoint Name:	Flow		
Data set:	<click s<="" th="" to=""><td>elect data></td><td></td></click>	elect data>	
Attribute:	Mean		•
Highlight Values			
Det	fault Color:	White	
Minim	um Value:	<none></none>	
Color Low	er Values:	DeepSkyBlue	e
Maxim	um Value:	<none></none>	
Color High	er Values:	OrangeRed	
Seasons			
🗖 Only include 🗸	alues in sel	ected	

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.

💒 Select data for endpoint		
File Attributes Select Help		
Select Attribute Values to Filter Av	allable Data	
Scenario 💌	Location	Constituent
OBSERVED	01594526	AGWET
PT-OBS	BELTSVIL	AGWI
SCEN	1:101	AGWO
base	LAUREL	AGWS
	P:101	AIRT
	P:102	
	D 100	J + 00000
Matching Data (4 of 2221)		
SCEN	RCH5	TOTAL-N
SCEN	RCH6	SSED
SCEN	RCH5	TN-LOAD
SCEN	RCH5	FLOW
Selected Data (1 of 2221)	Dour	EL OLU
SCEN	RCH5	FLOW
Dates to Include		
All Com	non	
	01 1005/10/01	
Start 1965/10/01 1985/10/	1303/10/01	
End 1988/09/30 1988/09/	30 1988/09/30	Ok Cancel

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.

Endpoint	
Endpoint Name: Flow	
Data set: SCEN R	CH5 FLOW
Attribute: 1High100	•
☐ Highlight Values	
Default Color:	White
Minimum Value:	<none></none>
Color Lower Values:	DeepSkyBlue
Maximum Value:	<none></none>
Color Higher Values:	OrangeRed
_	
Seasons	
Only include values in se	lected
	Ok Cancel

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.

💒 Climate Assessment Tool	_ 🗆 🗙
File Edit Options Help	
Climate Data Assessment Endpoints Results Table Pivot Table	
C Save All Results	
Show Progress of Each Run	
Add Remove Edit Copy Top ^ v	Bottom
☑ Flow 1High100	
Start Total iterations selected = 1 (0:09)	Plot

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.

💒 Select data for endpoint		
File Attributes Select Help		
Select Attribute Values to Filter Av	ailable Data	
Scenario 💌	Location	Constituent 🗨
OBSERVED	01594526	AGWET
PT-OBS	BELTSVIL	AGWI
SCEN	1:101	AGWO
base	LAUREL	AGWS
	P:101	AIRT
	P:102	
	D 100	J + 00000
Matching Data (4 of 2221)		
SCEN	RCH5	TOTAL-N
SCEN	RCH6	SSED
SCEN	RCH5	TN-LOAD
SCEN	RCH5	FLOW
Selected Data (1)		
SCEN	RCH5	TN-LOAD
Detecto la la clude		
Dates to include		
All Comr	non	
Start 1985/10/01 1985/10/	01 1985/10/01	
End 1988/09/30 1988/09/	30 1988/09/30	Ok Cancol

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.

Endpoint	
Endpoint Name: Total N	
Data set: SCEN RC	H5 TN-LOAD
Attribute: SumAnnue	
Highlight Values	
Default Color:	White
Minimum Value:	<none></none>
Color Lower Values:	DeepSkyBlue
Maximum Value:	<none></none>
Color Higher Values:	OrangeRed
Seasons	ected
	Ok Cancel

7. Click the **Ok** button to complete defining this endpoint. The **Climate Assessment Tool** form now shows both endpoints defined in this exercise.

🕙 Climate Assessment Tool	_ 🗆 🗙
File Edit Options Help	
Climate Data Assessment Endpoints Results Table Pivot Table	
Save All Results Show Progress of Each Run Add Remove Edit Copy Top ^ ✓ Flow 1High100 ✓ Total N SumAnnual	Bottom
Start Total iterations selected = 1 (0:09)	Plot

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.

📒 Endpoint	
Endpoint Name: Flow	
Data set: SCEN RCH	H5 FLOW
Attribute: Mean	~
Highlight Values	
Default Color:	White
Minimum Value:	<none></none>
Color Lower Values:	DeepSkyBlue
Maximum Value:	<none></none>
Color Higher Values:	OrangeRed
Seasons	
🗖 Only include values in sele	ected

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.

Endpoint	
Endpoint Name: Flow	
Data set: SCEN R	CH5 FLOW
Attribute: Mean	•
Highlight Values	
Default Color:	White
Minimum Value:	90
Color Lower Values:	DeepSkyBlue
Maximum Value:	150
Color Higher Values:	OrangeRed
	Jested
Conty include values in se	necieu

3. Click the **Ok** to finish defining this endpoint. The newly created endpoint will be displayed on the **Climate Assessment Tool** form.

Climate Assessment Tool
File Edit Options Help
Climate Data Assessment Endpoints Results Table Pivot Table
 Save All Results Show Progress of Each Run Add Remove Edit Copy Top ^ ∨ Bottom ✓ Flow 1High100 ✓ Total N SumAnnual ✓ Flow Mean from 90 to 150
Start Total iterations selected = 1 (0:09) Plot

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.

📒 Endpoint	
Endpoint Name: Summ	er Flow
Data set: SCEN	RCH5 FLOW
Attribute: Min	•
Highlight Values ———	
Default Col	or: White
Minimum Val	ie: <none></none>
Color Lower Value	es: DeepSkyBlue
Maximum Val	ie: <none></none>
Color Higher Value	es: OrangeRed
Seasons	
C Only include values in	selected

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.

📒 Endpoint					<u> ×</u>
Endpoint Namo:	Summor	low			
Endpoint value.					
Data set:			Ŷ		
Attribute:	Min				_
Highlight ∨alues					
De	efault Color:	White			
Minin	num Value:	<none:< td=""><td>></td><td></td><td></td></none:<>	>		
Color Lov	ver Values:	DeepS	SkyBlue		
Maxin	num Value:	<none:< td=""><td>></td><td></td><td></td></none:<>	>		
Color High	ner Values:	Orang	eRed		
Seasons					
Only include v	alues in sel/	ected	Months		_
Jan			1		
Feb					
Mar Apr					
May					
Jun					
Aug					
Sep					
Nov					
Dec					
All				N	lone
			Ok	C	ancel

3. Click the **Ok** to complete defining of this endpoint. The newly created endpoint will be displayed on the **Climate Assessment Tool** form.

💒 Climate Assessment Tool
File Edit Options Help
Climate Data Assessment Endpoints Results Table Pivot Table
 Save All Results Show Progress of Each Run Add Remove Edit Copy Top ^ v Bottom ✓ Flow 1High100 ☑ Total N SumAnnual ☑ Flow Mean from 90 to 150 ☑ Summer Flow Min Month: Jun Jul Aug
Start Total iterations selected = 1 (0:09)

4. To complete this exercise, save the state of CAT, using the **File:Save Climate and Endpoints** menu option.