Outline – Day 3

DEM PRACTICE

CALIBRATION PRACTICE

- Review calibration strategies
- Practice calibration strategies
- Calibrate Example 3
- Visualize results in Microsoft Excel

DROUGHT

COBB CREEK EXAMPLE
Recall that EF5 has two sets of parameters: water balance (CREST) and routing (kinematic wave).

Water balance parameters adjust the *volume* of water present in the runoff hydrograph.

Routing parameters adjust the *timing* and placement of water in the runoff hydrograph.
The volume of water can be determined by integrating the observed and discharge hydrographs.

Think of this as estimating the *area* underneath each of the hydrographs.

In the calibrated example (right):
- Total water volume is very close.
- But slightly more in observed.
- This is due to lack of warm-up.
Bias can help put a number to this problem of the difference in water volume.

High bias means too much water = need to change water balance parameters to put more water in soil layer.

Low bias implies the opposite.
We use the routing parameters to adjust timing

Note that our water (red) spikes too quickly and then drains away too quickly in the “falling limb” (the boxed-in area)

This suggests the need for slower routing parameters
Below is a tabular summary of the water balance (CREST) parameter names, recommended ranges, and a brief description of their sensitivities:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Effect/Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>WM</td>
<td>5.000</td>
<td>250.00</td>
<td>Increase → soil holds more water → less runoff</td>
</tr>
<tr>
<td>B</td>
<td>0.100</td>
<td>20.00</td>
<td>Increase → less infiltration → more runoff</td>
</tr>
<tr>
<td>IM</td>
<td>0.010</td>
<td>0.50</td>
<td>Increase → less infiltration → more runoff</td>
</tr>
<tr>
<td>KE</td>
<td>0.001</td>
<td>1.00</td>
<td>Increase → use more water for PET → less runoff</td>
</tr>
<tr>
<td>FC</td>
<td>0.000</td>
<td>150.00</td>
<td>Increase → water enters soil easily → less runoff</td>
</tr>
<tr>
<td>IWU</td>
<td>24.999</td>
<td>25.00</td>
<td>Increase → less space for water → more runoff</td>
</tr>
</tbody>
</table>
Routing Parameters

Below is a tabular summary of the routing (kinematic wave) parameter names, recommended ranges, and a brief description of their sensitivities.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Effect/Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>TH</td>
<td>30 km²</td>
<td>300 km²</td>
<td>(convert to grid cell space in control file)</td>
</tr>
<tr>
<td>UNDER</td>
<td>0.0001</td>
<td>3.00000</td>
<td>Increase → faster interflow speed → faster runoff</td>
</tr>
<tr>
<td>LEAKI</td>
<td>0.0100</td>
<td>1.00000</td>
<td>Increase → water leaks from interflow → faster</td>
</tr>
<tr>
<td>ISU</td>
<td>0.0000</td>
<td>0.00001</td>
<td>Increase → immediate runoff → bad early peak</td>
</tr>
<tr>
<td>ALPHA</td>
<td>0.0100</td>
<td>3.00000</td>
<td>Increase → incr. Q for const. A → slower peak</td>
</tr>
<tr>
<td>BETA</td>
<td>0.0100</td>
<td>1.00000</td>
<td>Increase → incr. Q for const. A → slower peak</td>
</tr>
<tr>
<td>ALPHA0</td>
<td>0.0100</td>
<td>5.00000</td>
<td>Increase → incr. Q for const. A → slower peak</td>
</tr>
</tbody>
</table>
Example 3 will be the Nzoia River Basin in Kenya upstream of Lake Victoria

Let’s calibrate EF5 for this example
Preparing the Control File

Open the control file you copied into the EF5_training \examples\nzoia\ folder at the end of Module 3.1

We’ve already checked the Basic block in Module 3.1

The PrecipForcing block should be the same, but we need to unzip our 2006 precip forcing from the data folder (EF5_training\data\TRMM\trmm2006.zip) to the Nzoia example (EF5_training\examples\nzoia\precip\)

You’ll need to copy the PET forcing from the Okavango example to the PET folder in the Nzoia example
Preparing the Control File

We need to make some changes in the Gauge block

- Remember Module 3.1? Our outlet point should be 34.087 degrees longitude and 0.120 degrees latitude
- Our BASINAREA is 12696
- Name the gauge block Nzoia
- Copy the nzoia.csv file from EF5_training\data\Observations\ to EF5_training\examples\nzoia\obs\

You can give the Basin block the same name as the Gauge block (Nzoia) and change the name of GAUGE to Nzoia
Preparing the Control File

Change the name of both parameter sets and both calibration parameter sets to Nzoia, and the GAUGE in all four to Nzoia, as well.

In the Task block, change RunOkavango to RunNzoia and CalibrateOkavango to CalibrateNzoia.

In both Task blocks, change the name of the basin, and all the parameter sets to Nzoia.

Change the TIME_BEGIN and TIME_END to match the 2006 precip instead of the 2007 precip.

Finally, uncomment the TASK=RunOkavango line of the Execute block and comment TASK=CalibrateOkavango.
Running the Example

Let’s run the Nzoia example with the calibrated Okavango parameters and see what happens.

Create a new batch file – do you remember the steps?

Create a new .txt file and type

..\..\software\EF5.exe
Pause

Then “Save As…”, select “All Files (*.*)”, and name it RunEF5.bat in your Nzoia example directory.
EF5 should help you track down the problem...

Here I accidentally tried to run the Nzoia example with my KWParamSet named as CRESTParamSet...

EF5 tells me I have a duplicate parameter set and that the problem is in my control file at line number 70
I’ve also accidentally forgotten to change the name of a gauge or basin, or had the wrong naming structure for precip, or misnamed topographical files, or forgotten to copy observations and forcing, but in each case, I could determine the source of the error from EF5’s main window.
Anyway, let’s run the example!

Open the output data and calculate the bias, NSCE, and correlation coefficient.

My bias is -49%, my correlation coefficient is 0.65, and my NSCE is -0.75.
Calibrating the Example

Let’s calibrate this example using DREAM

Change which task is commented out in the Execute block of your control file

Set `dream_ndraw` to a value of your choice – I will try 1000

At the end of the process, Windows may throw up an error – just “Close the program”
Calibrating the Example

Your calibration output should still be there, despite the error

Open it and take a look at the final NSCE – I got 0.236

Now look at your calibrated parameters and compare to the parameters you were using (remember, you can find these in your control file)

What patterns do you see between the parameters?
WM decreased and B increased – this acts to increase runoff, which helped decrease our bias.

The routing changes aren’t huge, it doesn’t appear – we increased ALPHA and ALPHA₀ but decreased BETA, so these changes probably counteract one another to a certain extent.
Running the Example

Let’s paste these parameters into our control file in the CRESTParamSet and KWParamSet blocks.

Once you’ve completed this process, re-run the example.

Don’t forget to switch your Execute block back!

What bias, CC, and NSCE did you get?

I got a bias of -10% (much better)!
A correlation coefficient of 0.72 (good)!
And a NSCE of 0.236 (this is okay)
Conclusions

How can we do better?

More DREAM iterations (like 10,000)
Better parameter ranges
Manual calibration of the DREAM-calibrated parameters
Warm-up period

![Graph showing discharge and precipitation over time]
Conclusions

How can we do better?

Most importantly, though, is that in this case there might be something weird with our observations. Look closely around “1-Mar”
The next module is
Drought

You can find it in your \EF5_training\presentations directory

Module 3.2 References
EF5 v0.2 Readme, (March 2015).
EF5 Training Doc 4 – EF5 Control File, (March 2015).
EF5 Training Doc 5 – EF5 Parameters, (March 2015).