User's Guide for UK-OPS v.3.12P

February 2021

INTRODUCTION

The Upper Kissimmee Operations Simulation (UK-OPS) model was developed by the South Florida Water Management District (District) as an analysis tool to easily and quickly test a variety of water management and operational strategies. The model is used in many capacities at the District, but it also serves as the regulatory model referenced in the Kissimmee Reservation Rule (40E-10.071, Florida Administrative Code and Subsection 3.11.5 of the Applicant's Handbook for Water Use Permit Applications Within the South Florida Water Management District) which shall be used to evaluate proposed water withdrawals subject to the Kissimmee Reservation Rule. This User's Guide is specific to the model version intended for Regulatory purposes (version 3.12P). The purpose of this User's Guide is to provide general guidance for applicants of Water Use Permits when using this model during the permit application process. This model shall be used during the permit application process to evaluate the effects of the proposed withdrawals in relation to the historical flows through the Upper Kissimmee Basin. To this end, Applicants shall ensure that individual and cumulative withdrawals do not reduce annual average discharges at the S-65 structure by more than 4.18 percent as of the effective date of the Kissimmee Reservation Rule compared to a no-withdrawal condition over the range of hydrologic variability that occurred between 1965 and 2005. Many of the model features that are not relevant to the Regulatory application have been locked for consistency of results, to streamline user experience, and to reduce risk of incidental error. For detailed technical documentation of this model, the user is referred to the technical document entitled "Documentation Report for the Upper Kissimmee – Operations Simulation (UK-OPS) Model", which can be found at https://www.sfwmd.gov/our-work/water-reservations.

DISCLAIMERS

1) The following is a quote from pg. 2 of the "Documentation Report for the Upper Kissimmee – Operations Simulation (UK-OPS) Model", by the model's developer, Cal Neidrauer, P.E.:

> "...because initial development of the UKOPS Model focused on immediate applications, efforts were not spent on making the model user-friendly. The model does not contain limits on parameter values or warnings to caution users when results may not be realistic; therefore, the model should be used with substantial professional judgement." (emphasis added)

2) The model results provided by applicants will be checked and verified by District Regulatory staff to ensure that the proposed values can be duplicated and the model was used correctly.

MODEL SPREADSHEET STRUCTURE

The model comes in the form of a spreadsheet that has a total of 43 tabs across the bottom. Of those 43, only 7 require any kind of user input: GUI, TOHops, ETOops, HMJops, MPJops, ALCops, GENops.

Additionally, several other tabs contain plots and statistics of the model run, but no user entry is required. The remainder of the 43 tabs can be ignored. The functionality of the various tabs is explained below.

GUI Tab

At the top of the GUI (Graphical User Interface) tab under the "Simulation Scenario Manager" are 4 pairs of pushbuttons (**Fig. 1**):
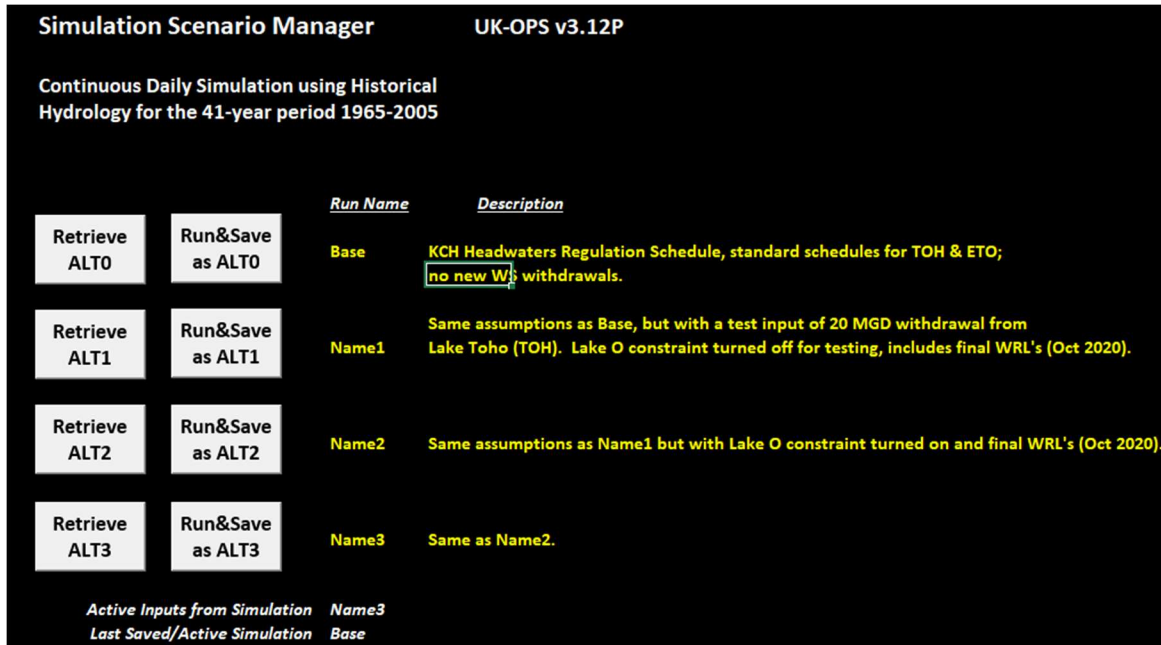

Figure 1- Pushbuttons and descriptions associated with the Simulation Scenario Manager on the GUI tab.

The model comes pre-loaded with 4 model scenarios labeled "ALT0" - "ALT3", and a Description is provided for each. By default the model opens with ALT3 active, because that is a good starting point for permittees (a test input of 20 cubic feet per second (CFS) for Lake Toho, Lake Okeechobee constraint turned on, final Water Reservation lines from Oct. 2020). At any time selecting the "Retrieve ALT#" pushbutton will load the corresponding model scenario. Once a scenario has been retrieved and is active, the user may make adjustments to the input tabs as described below, then push "Run&Save as ALT#" to run the simulation.

At the bottom of the GUI tab, under the "Performance Measures & Indicators" heading are a series of pushbuttons which will take a user to view various model outputs (**Fig. 2**). The "S65 Annual Flow" pushbutton highlighted in blue is particularly useful for v3.12P.

Performance Measures & Indicators			
Hydrographs	Event Table & TS Plot	ETO Stage Percentiles	S59 Flow Percentiles
Stage Duration	Max D-day Inundation	TOH Stage Percentiles	S61 Flow Percentiles
Flow Duration	S65 Annual Flow	KCH Stage Percentiles	S65 Flow Percentiles
Water Budgets	WS Reliability	Mon-Stage BoxWhisker	Mon-Flow BoxWhisker

Figure 2– The pushbuttons associated with the Performance Measures & Indicators at the bottom of the "GUI" tab. Note the blue-highlighted "S65 Annual Flow" tab which directs users to the primary model output.

On the left side of the GUI tab there is an interactive map where users can click on the structure labels to be taken to that structure's operations tab (**Fig. 3**).
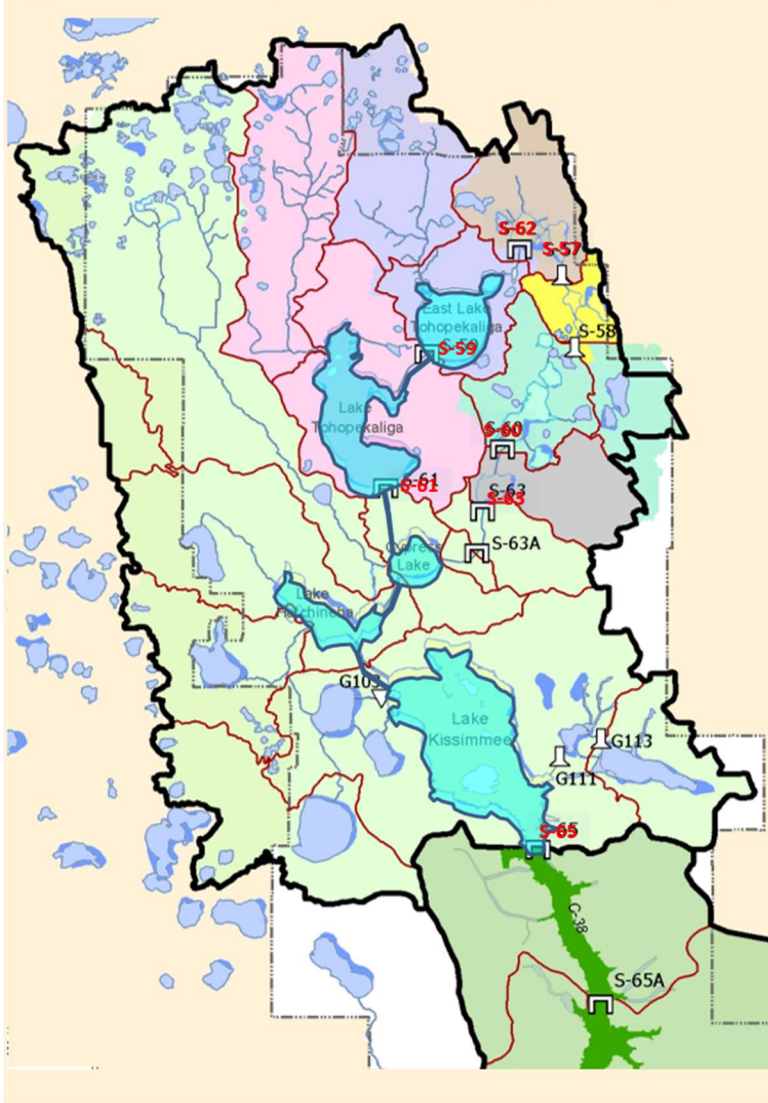
Figure 3- The interactive map at the top of the "GUI" tab.

Additionally, most tabs have a "GoToGUI" pushbutton that directly navigates the user back to the GUI tab (**Fig. 4**).

	A	B	C	D	E	F	G	H	I	J
1	**East Lake Tohopekaliga Regulation Schedule & Discharge Rules**									
2							GoToGUI			
3		**Operating Zones for Lake East Tohopekaliga**								
4			Elevation of Bottom of Operating Zone (feet, NGVD)							
5	d.o.y.	Date	Zone1	Zone2	Zone3	Zone4	Zone5	Zone6	WRL	
6	1	1-Jan	53.00	54.00	55.00	56.00	58.00	58.30	58.00	
7	2	2-Jan	53.00	54.00	55.00	56.00	58.00	58.30	57.98	

Figure 4- An example of the "GoToGUI" pushbutton from the "ETOops" tab.

TOHops, ETOops Tabs

The TOHops and ETOops tabs address operations in Lake Tohopekaliga and East Lake Tohopekaliga, respectively. The tabs are structured identically, and the only cells available for user entry are G39 and G41 (**Fig. 5**). Cell G39 is the lake withdrawal value (CFS), and this is the primary input value for users. Note that the value entered is automatically displayed as million gallons per day (MGD) in Cell H39. Cell G41 is a TRUE/FALSE option about the relationship of the lake stage to the Reservation line. The TRUE setting induces the comparison of stage to the Water Reservation Line to determine if withdrawals are permissible, so that if TRUE, withdrawals will only occur when Lake Okeechobee stage is within or above the Low Sub-band of the Lake Okeechobee Regulation Schedule (LORS2008) and regulatory releases from Lake Okeechobee are being made to either the Caloosahatchee River (S-77 and S-79) or St. Lucie Estuary (S308 and S-80).

◢	A	B	C	D	E	F	G	H	I
36									
37									
38		**Water Supply withdrawal options for Lake Tohopekaliga**							
39		Total Lake Toho WS Withdrawal Capacity (CFS)					20	= 12.93 MGD	
40		Conditions allowing water use withdrawals:							
41		1. Lake Toho Stage > Reservation Line?					TRUE		
42		2. Lake KCH Stage > Reservation Line?					FALSE		
43		3. Lake O discharging excess water to tide?					TRUE		
44									

Figure 5- The "TOHops" tab showing the G39 and G41 input cells.

HMJops, MPJops, ALCops, GENops tabs

The HMJops, MPJops, ALCops, and GENops tabs address operations in the Lake Hart/Mary-Jane system, the Lake Myrtle/Preston/Joel system, the Lake Alligator chain system, and Lake Gentry, respectively. The tabs are structured identically, and the only cells available for user entry are G25 and G27 (**Fig. 6**). Cell G25 is the lake withdrawal value (CFS), and this is the primary input value for users. Note that the value entered is automatically displayed as MGD in Cell H25. Cell G27 is a TRUE/FALSE option about the relationship of the lake stages to the Reservation line and functions with the same logic as described in the TOHops/ETOops section above. Note that the KCHops, TOHops, and ETOops tabs are structurally different than the 4 tabs in this section, because UKOPS models those systems differently. See the UK-OPS Model Documentation Report for details.

◢	A	B	C	D	E	F	G	H	I
23									
24		**Water Supply withdrawal options for Lakes Hart & Mary Jane**							
25		Total Lake HMJ WS Withdrawal Capacity (CFS)					0	= 0.00 MGD	
26		Conditions allowing water use withdrawals:							
27		1. Lakes HMJ > Reservation Line?					TRUE		
28		2. East Lake Toho Stage > Reservation Line?					FALSE		
29		3. Lake Toho Stage > Reservation Line?					FALSE		
30		4. Lake KCH Stage > Reservation Line?					FALSE		
31		5. Lake O discharging excess water to tide?					TRUE		

Figure 6- The "HMJops" tab showing the G25 and G27 input cells.

OUTPUTS

The primary output for users is the "S-65 Annual Flow Stats for 1965-2005" plot on the "S65VolComp" tab (**Fig. 7**). At the bottom of this figure, the % reduction based on the simulated model scenario is quantified. Users can navigate to the "S65VolComp" tab or use the "S65 Annual Flow" shortcut highlighted in blue on the GUI tab. Pursuant to the Applicants Handbook for Water Use Permit Applications Within the South Florida Water Management District, Subsection 3.11.5.B.2, Applicants shall demonstrate that the individual and cumulative withdrawals do not reduce annual average discharges at the S-65 structure by more than 4.18 percent as of the effective date of the Kissimmee Reservation Rule compared to a no-withdrawal condition over the range of hydrologic variability that occurred between 1965 and 2005. The applicant shall use the District's UK-OPS Model (Version 3.12p), which is incorporated by reference in Rule 40E-2.091, F.A.C., to conduct this impact assessment.
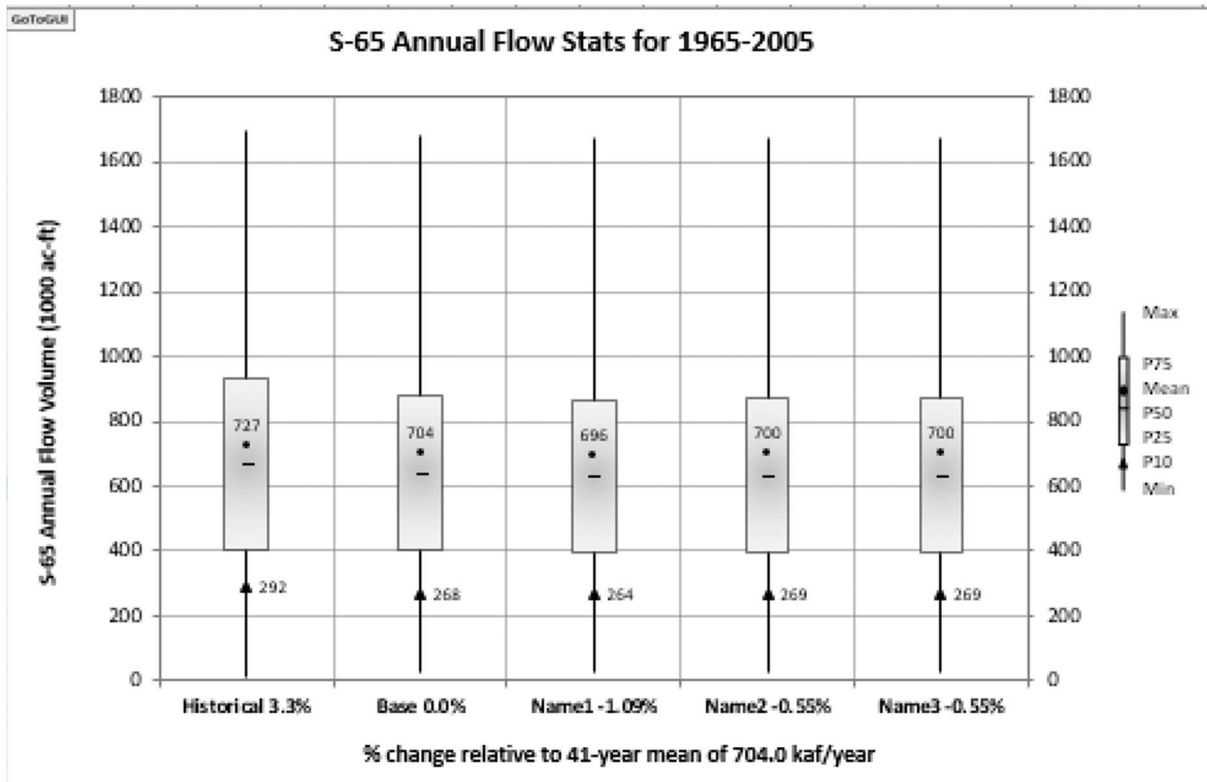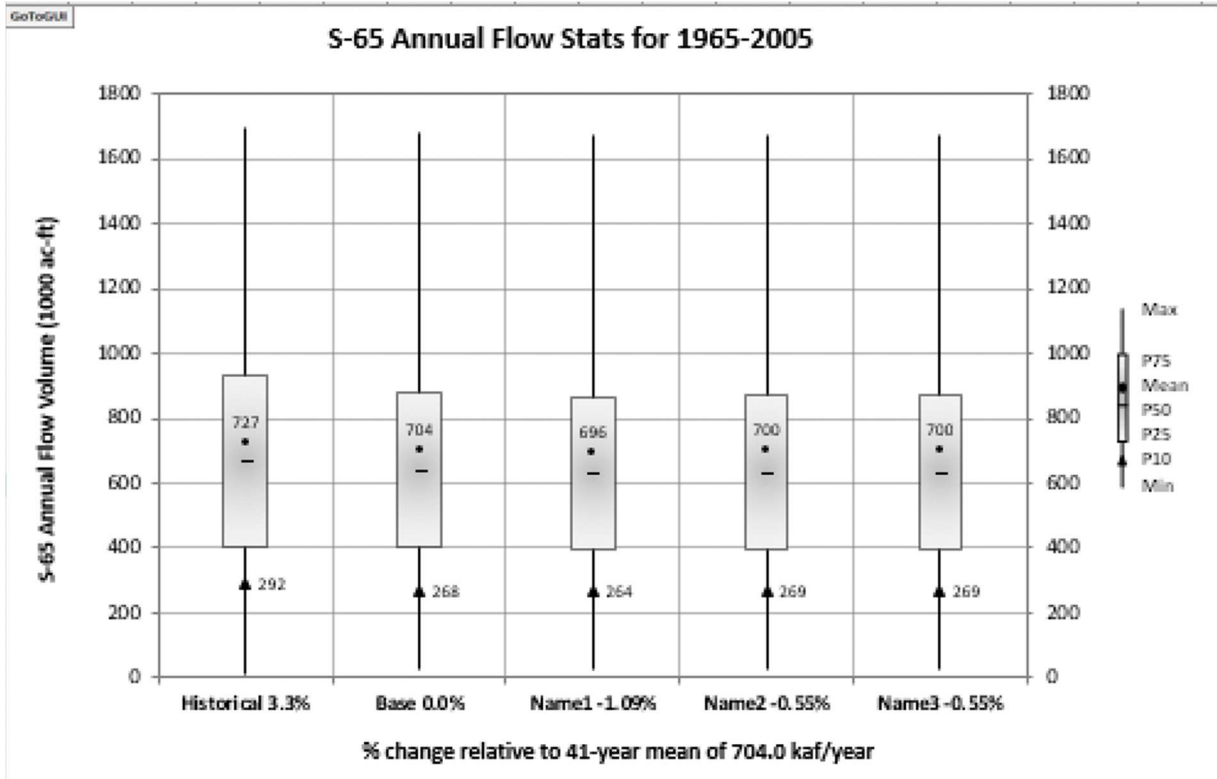
Figure 7- The plot shown on the "S65VolComp" tab with the model scenario percentage reductions at the bottom.

A variety of other model simulation outputs are available to view. For example, the "WatBuds" tab displays the water budgets, the "WS_Table" tab shows water supply information, any tab with "Percs" (e.g. "FlowPercsS59") will contain percentile metrics, and any tab with "ws" (e.g. "HMJws") will show a time series plot of water supply withdrawal effects on a lake. Instead of manually navigating to the above mentioned tabs or any other model output tab, the GUI tab contains shortcuts at the bottom to direct users to the model outputs.

EXAMPLE SIMULATION

1. Open up UK-OPS v3.12P. The active scenario is ALT3 (Run Name "Name3"). Use the "S65 Annual Flow" pushbutton on the bottom of the "GUI" tab to view the pre-set withdrawal percentages. Note that the statistic corresponding to the pre-set withdrawal for ALT3 is –0.55%.

S-65 Annual Flow Stats for 1965-2005

2. ALT3 has a 20 CFS withdrawal from Lake Toho, but this example will add 15 CFS of withdrawals from east Lake Toho and 10 CFS from Lake Gentry. For the model input, the withdrawal rate must be entered in cubic feet per second (CFS) and the flow in million gallons per day (MGD) is automatically shown in the cell to the right. Navigate to the "ETOops" tab and enter 15 into cell G39. Navigate to the "GENops" tab and enter 10 in cell G25. (Note: the conversion is 1 MGD [US] = 1.54723 CFS)

3. Navigate to the "GUI" tab and push "Run&Save as ALT3". The simulation begins with a scenario where withdrawals from Lake Toho, East Lake Toho, and Gentry are 20, 15, and 10 CFS, respectively. The simulation typically takes about 4 minutes.

4. Use the "S65 Annual Flow" pushbutton on the bottom of the "GUI" tab to view the simulation results. The example simulation changed the withdrawal percentage for Name 3 (i.e. ALT3) to -1.15%.

S-65 Annual Flow Stats for 1965-2005