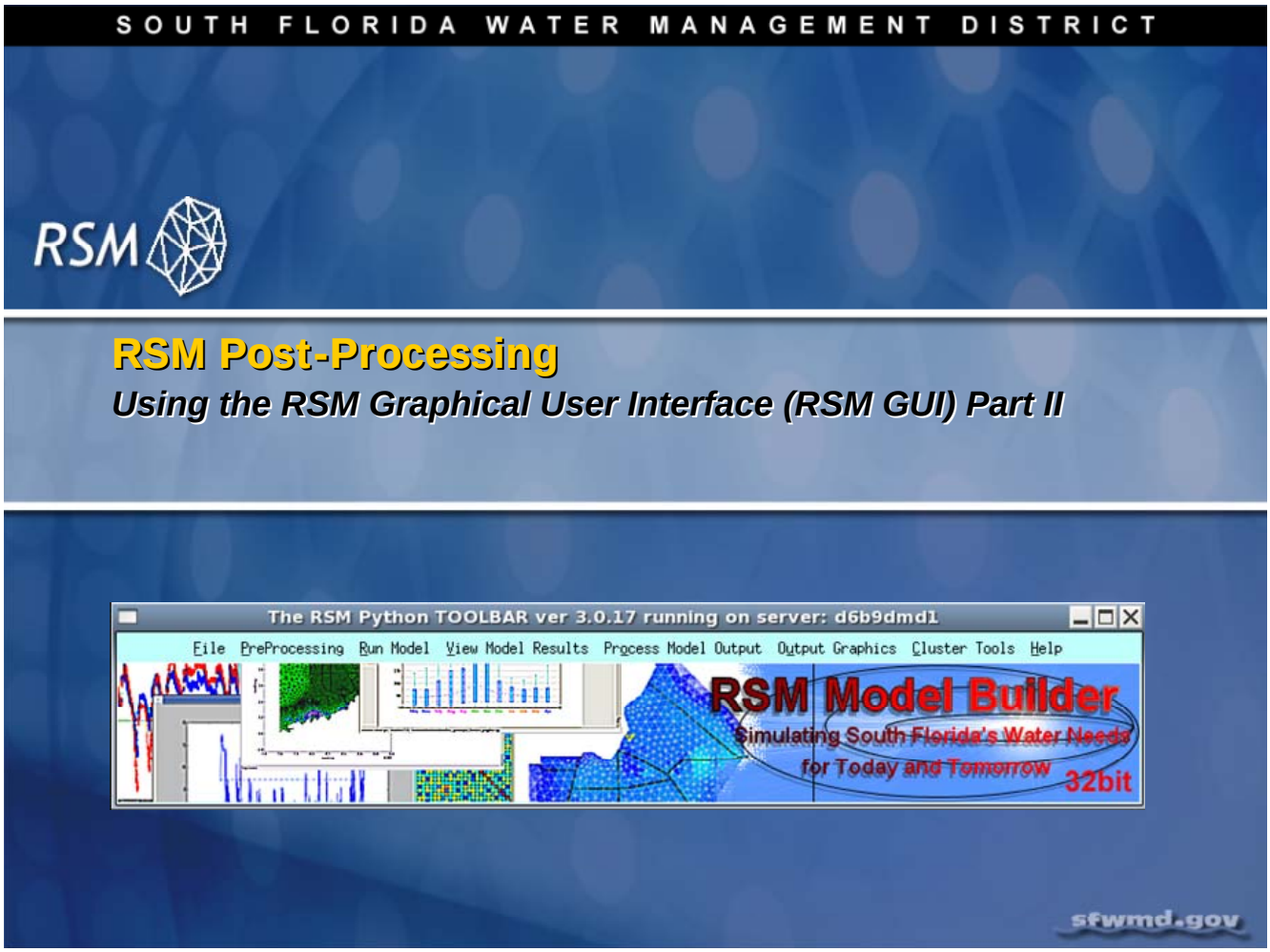


Lecture 8: RSM Post-Processing—Using the RSM Graphical User Interface (RSM GUI) Part II

This Regional Simulation Model (RSM) lecture introduces you to the RSM Graphical User Interface (RSM GUI). The RSM GUI organizes a collection of utilities and applications that make it easier to set up and run the RSM.

After this training session, you will know how to:

- Access the RSM GUI
- Run the model
- Use the post-processing tools

NOTE:

Prerequisite:

This training, and the tools used in this session, requires basic familiarity with the Regional Simulation Model output.

The RSM GUI is designed to work in a Linux Redhat 5.x environment.

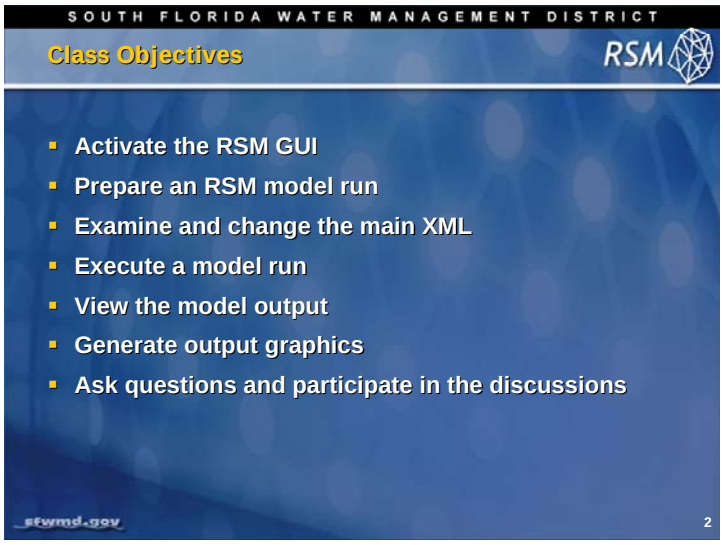
Although some features require access to the South Florida Water Management District's (SFWMD) network server, this documentation explains the features in detail. The screen captures included on the lecture slides will enable you to see many of the features described in this discussion.

Configuration:

Ideally, users will be on the SFWMD network or have remote VPN access. Installing the RSM locally from the training DVDs provides most capabilities to perform the exercises in Lab 8.

Additional Resources

RSM GUI User Manual

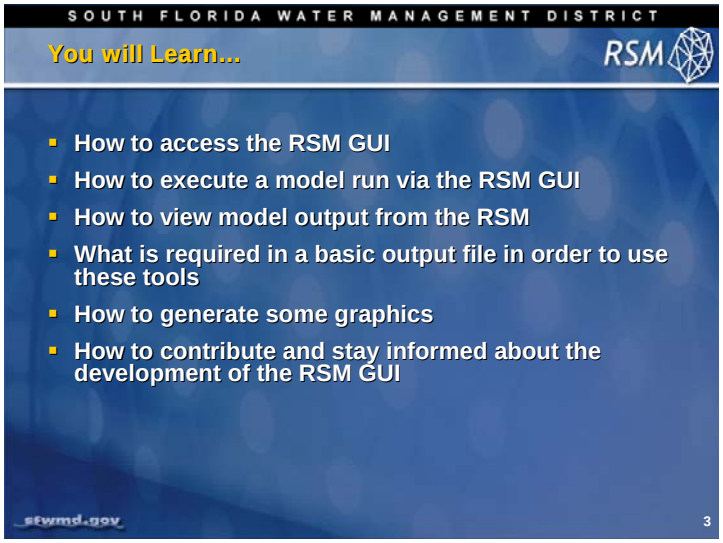


There are a few tools created to support RSM developers and calibrators.

A number of tools are currently available to help visualize the RSM output and other tools that help generate performance measure graphics to support new implementations of the RSM.

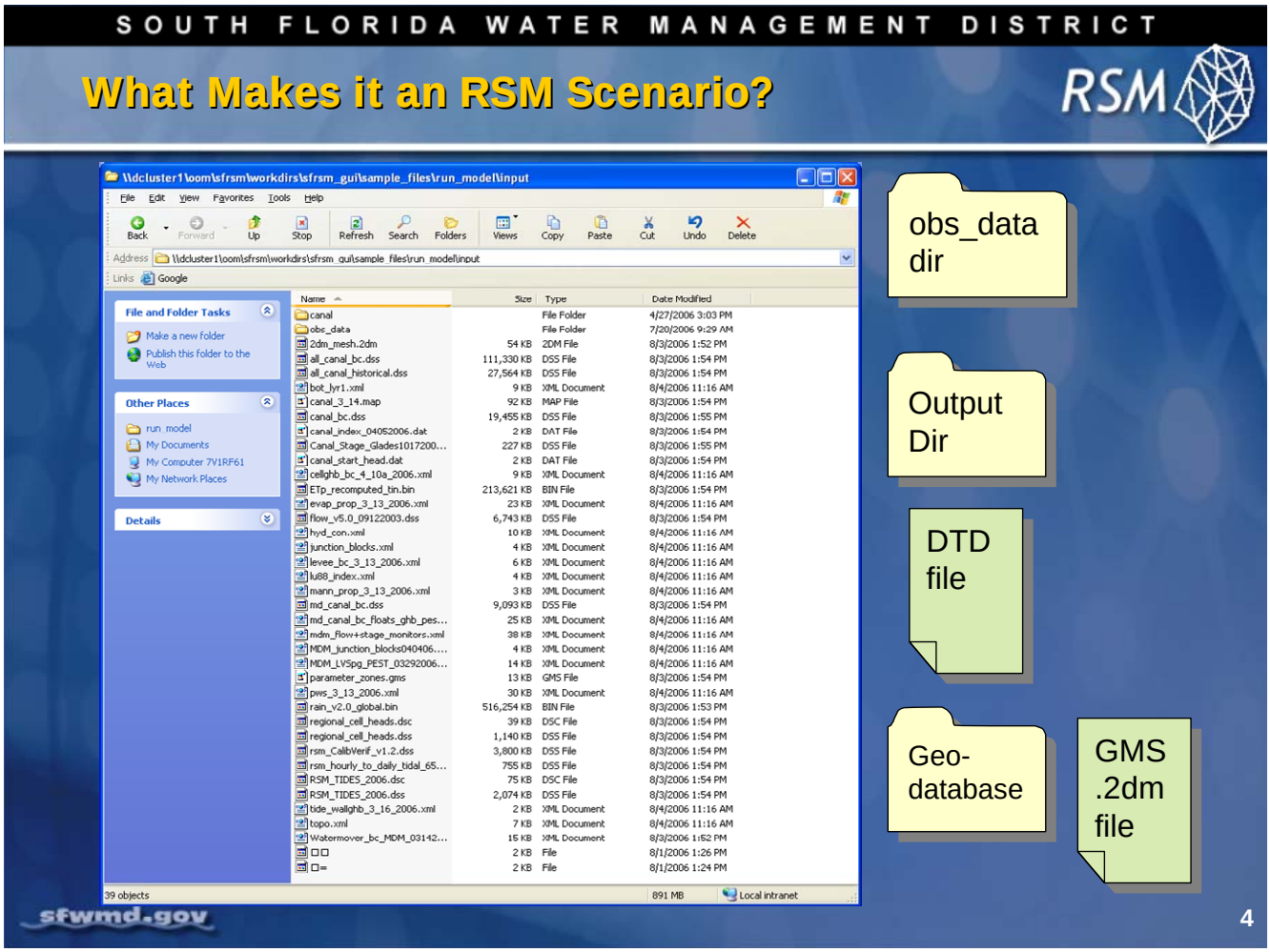
The RSM also includes several output options. Not all model output from the RSM is the same. Some output is suitable for certain tools while some tools will only work with specific elements in the output. The **Help** icon associated with each tool in the RSM GUI, links to additional information about the files necessary to run each tool.

The RSM GUI is an ongoing project. New features are added as new scenarios are implemented.



Although this training module introduces the basic features in the RSM GUI, it does not present every tool in the RSM GUI.

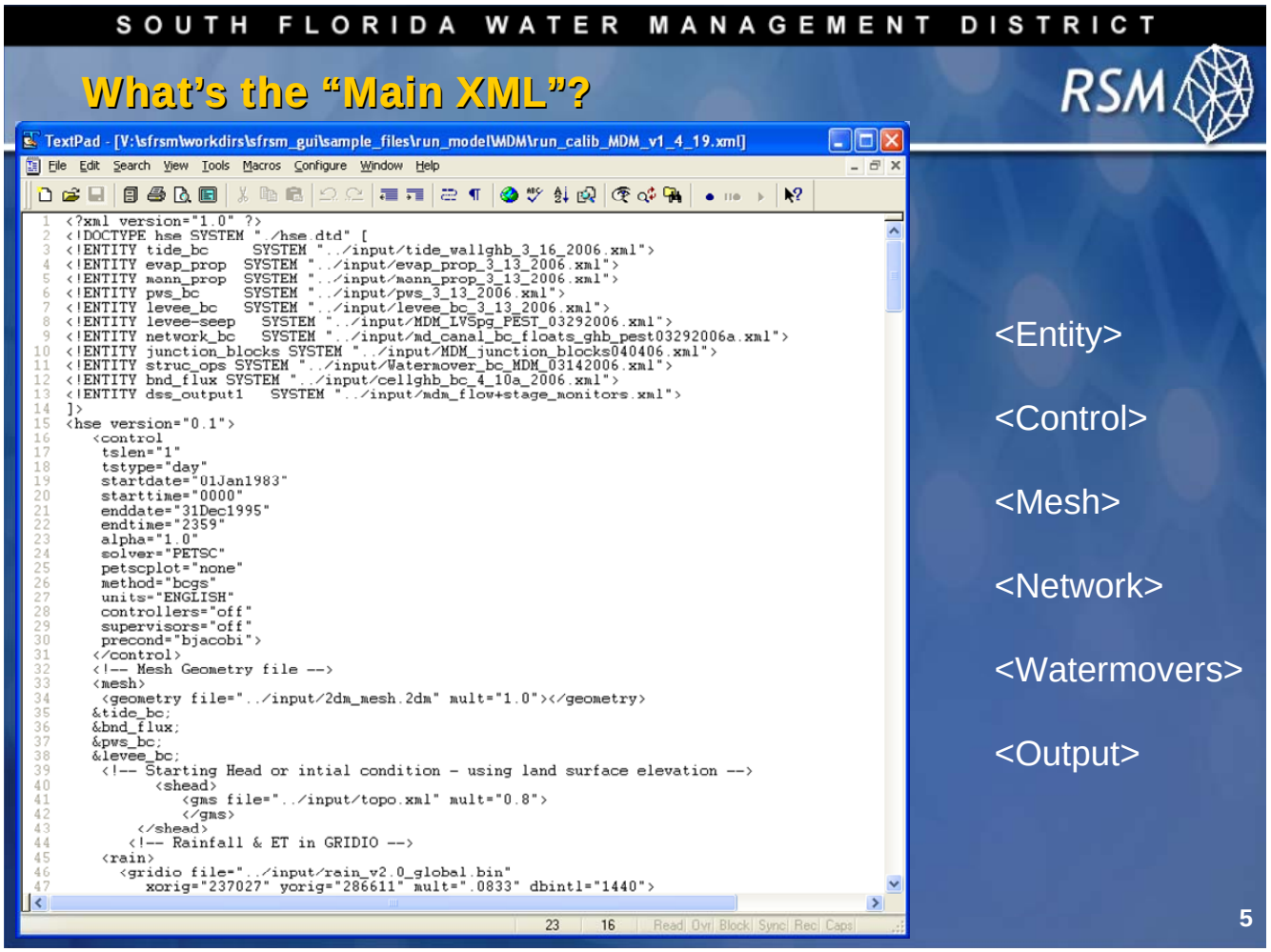
The *RSM GUI User Manual*, available under the **Help** drop-down Menu in the RSM GUI, describes each tool in detail and directs users to sample data to help demonstrate each tool.



An RSM scenario consists of a model input directory containing many files, which typically include:

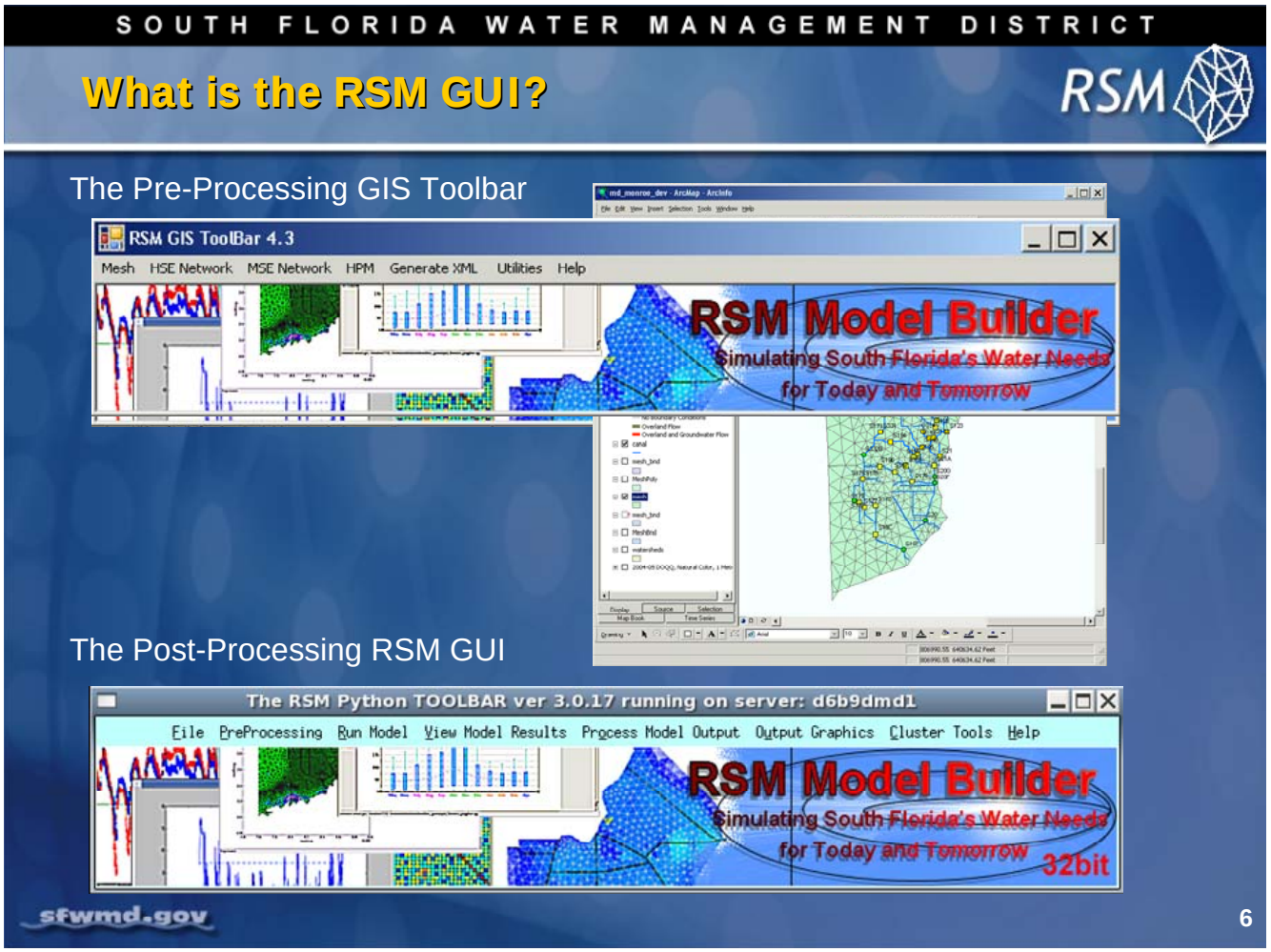
- Boundary condition files
- Topo files
- Historical DSS data files
- Bottom elevation files
- Initial condition files
- Canal index files
- Landuse index files
- Hydrologic conductivity files
- Parameter zone files
- Public water supply files

A scenario also contains an output directory, a copy of the DTD and observation files. Ideally it will contain a GMS .2DM file and a geodatabase.



The RSM Main XML:

- Contains all the information to describe the model parameters and run a scenario, including references to secondary files and paths to output files
- The main XML (usually called run*.xml) documents the run and should be kept as part of the implementation documentation
- Blocks can be copied from another scenario or created from scratch. (The *RSM GUI User Manual* contains instructions on how to create this file and the DTD contains the definition for each parameter.)
- Keeps your specifications for the output choices from the model. (The output files you specify in your model run will be important when you begin using the post-processing tools.)



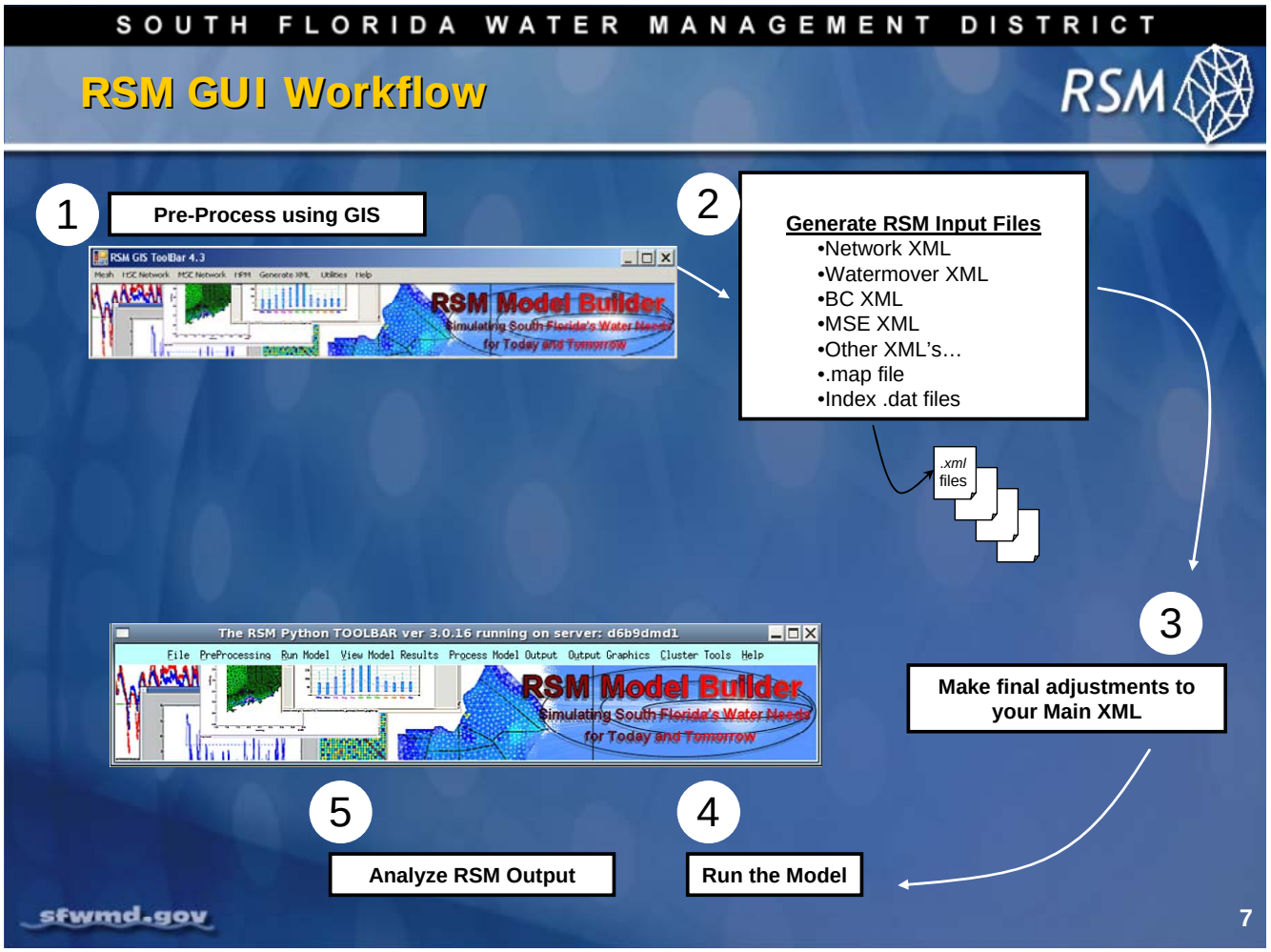
The RSM Graphical User Interface (GUI) currently consists of two toolbars:

1. The GIS ToolBar
2. The RSMGUI Python Toolbar

The Geographic Information System (GIS) ToolBar organizes a set of tools developed to run inside ArcGIS (9.2) to assist with generating input files for the Regional Simulation Model. The ArcGIS software is the South Florida Water Management District HESM's designated (spatial) database for storing RSM geographic features: structures, canals, boundaries, mesh.

The RSMGUI Toolbar organizes a set of tools developed to execute the RSM and post-process the output from the model. The RSMGUI uses Python, a platform independent programming language that can be deployed on any operating system.

Both toolbars are intended to help simplify some of the repetitive steps for setting up an RSM scenario in a self-documenting environment. The HESM team plans to complete a set of tools that will help build a scenario from beginning to end.



Basic workflow for how tools are used to set-up an RSM scenario:

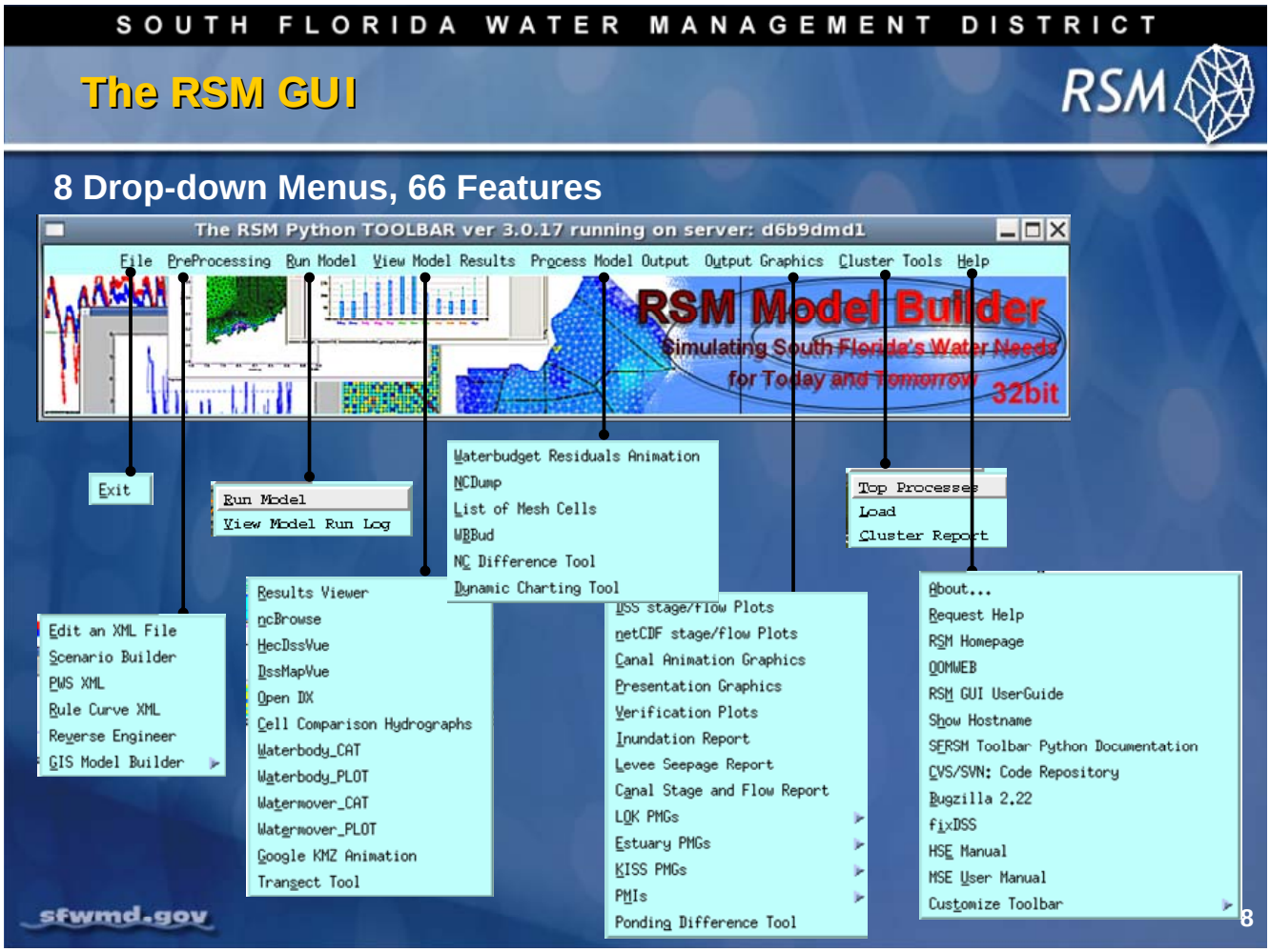
- Generate a mesh using GMS

The GIS Toolbar

- Import the .2DM into the GIS to generate a GIS mesh layer
- Combine the mesh layer with an RSM geodatabase template
- Configure the model features in the GIS
- Generate the RSM input files from the GIS Toolbar

The Python Model Builder RSM GUI

- Make adjustments to the Main XML
- Run the Model
- View the RSM output
- Process the Model output
- Produce graphics for presentations and analysis



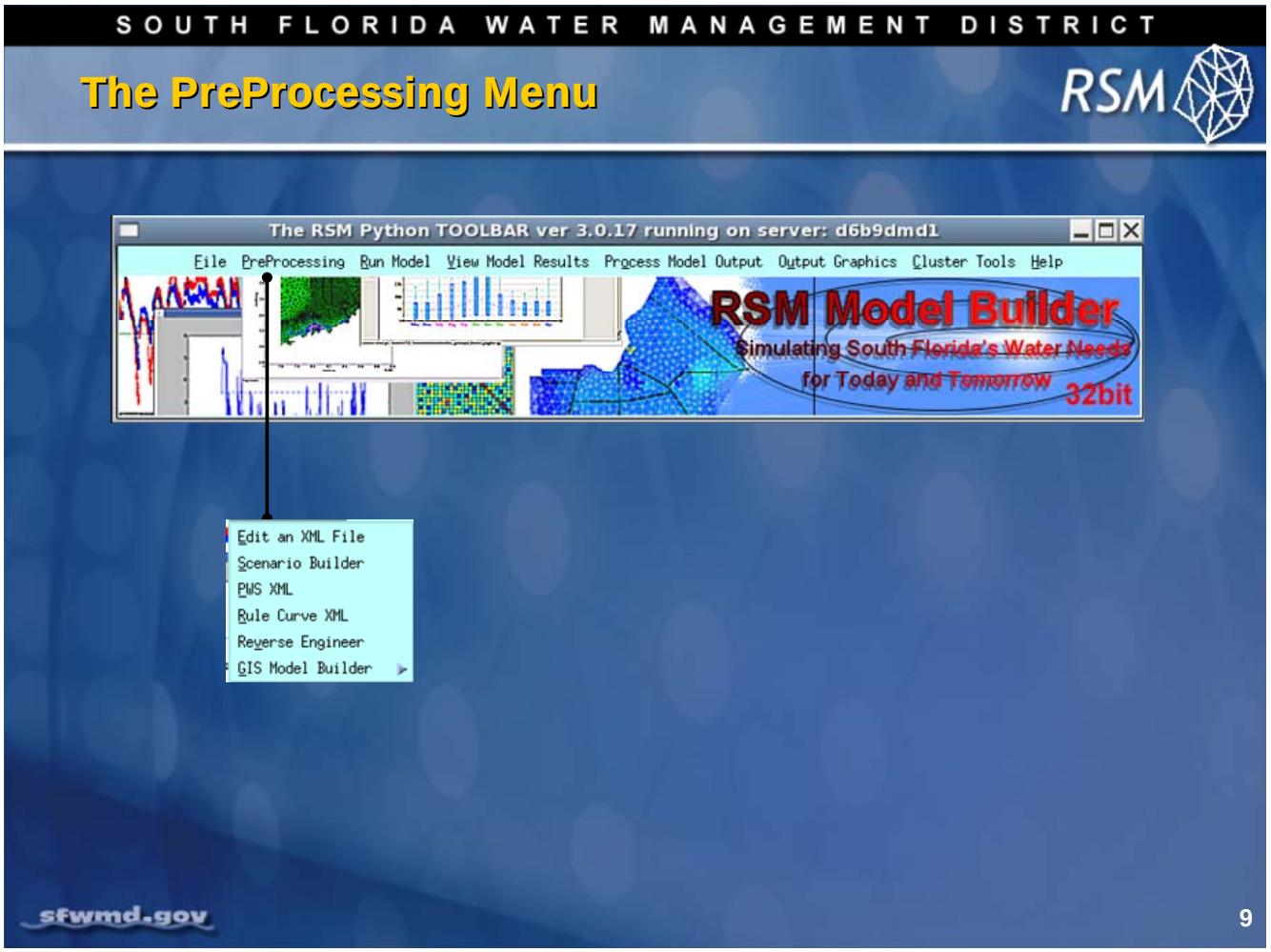
The RSM GIS Toolbar contains tools to:

- Help configure the Main XML
- Run the model that self-documents the run
- View and process the model output
- Generate graphics
- Help monitor the server

The geodatabase is significant because it contains all of the data used to specify the physical features being represented in the model. This helps you to visualize your scenario when you are setting it up and it helps document what was modeled when you are presenting post-processing analysis from your run. Eventually the geodatabase from your run is used for post-processing the model results.

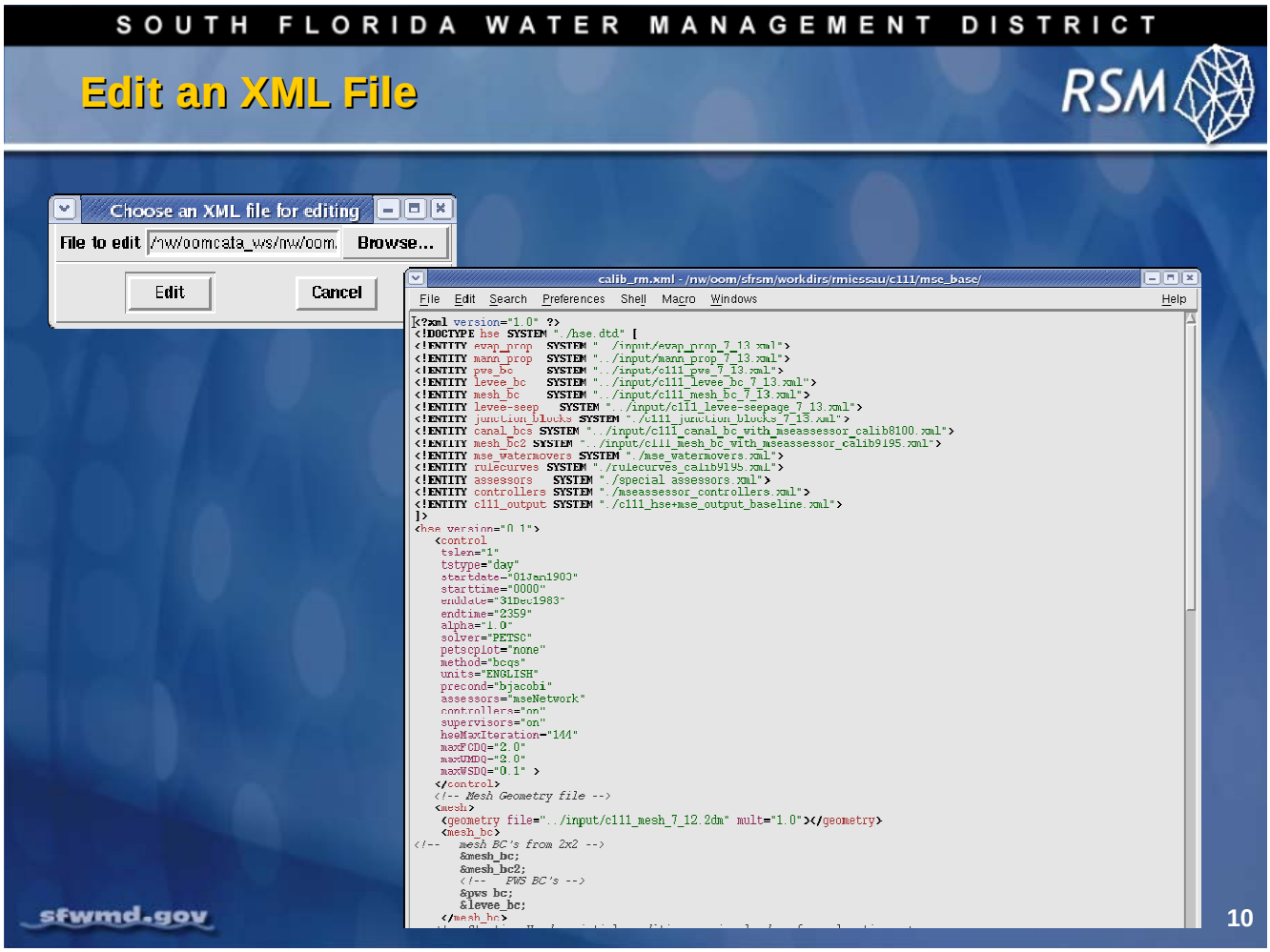
Options available within several of the tools offer some flexibility in how the tool can be used and how the output generated will be formatted. This flexibility enables you use some tools to perform multiple tasks and to generate a variety of output.

The tools are organized in order of the phases you follow preparing, running and analyzing your run.

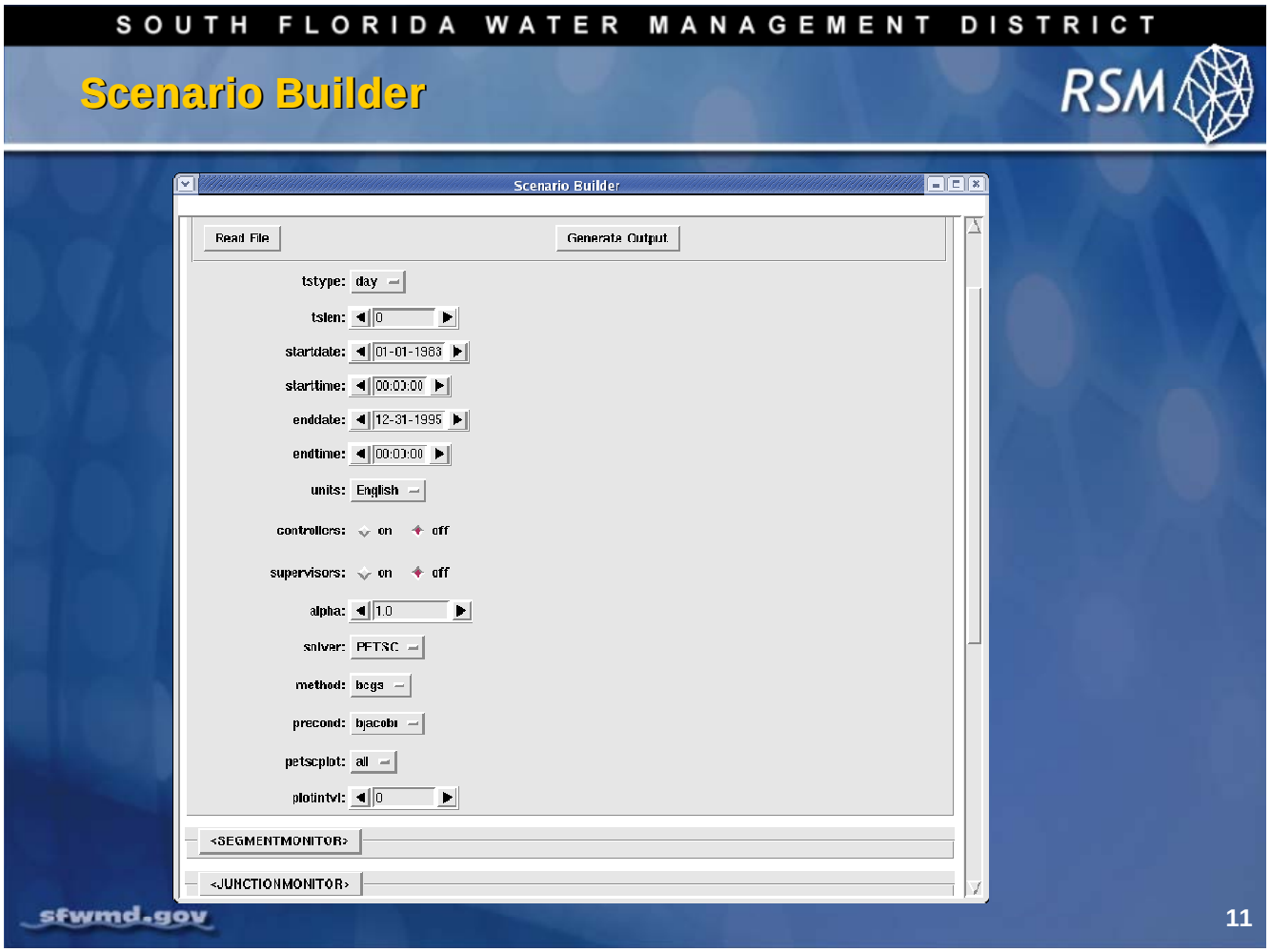


The RSM GUI contains tools to aid in making final changes and help set-up your RSM run. The GUI tools facilitate modifying the XMLs used to configure and execute the model.

Final pre-processing steps are organized under the pre-processing menu on the RSM GUI.



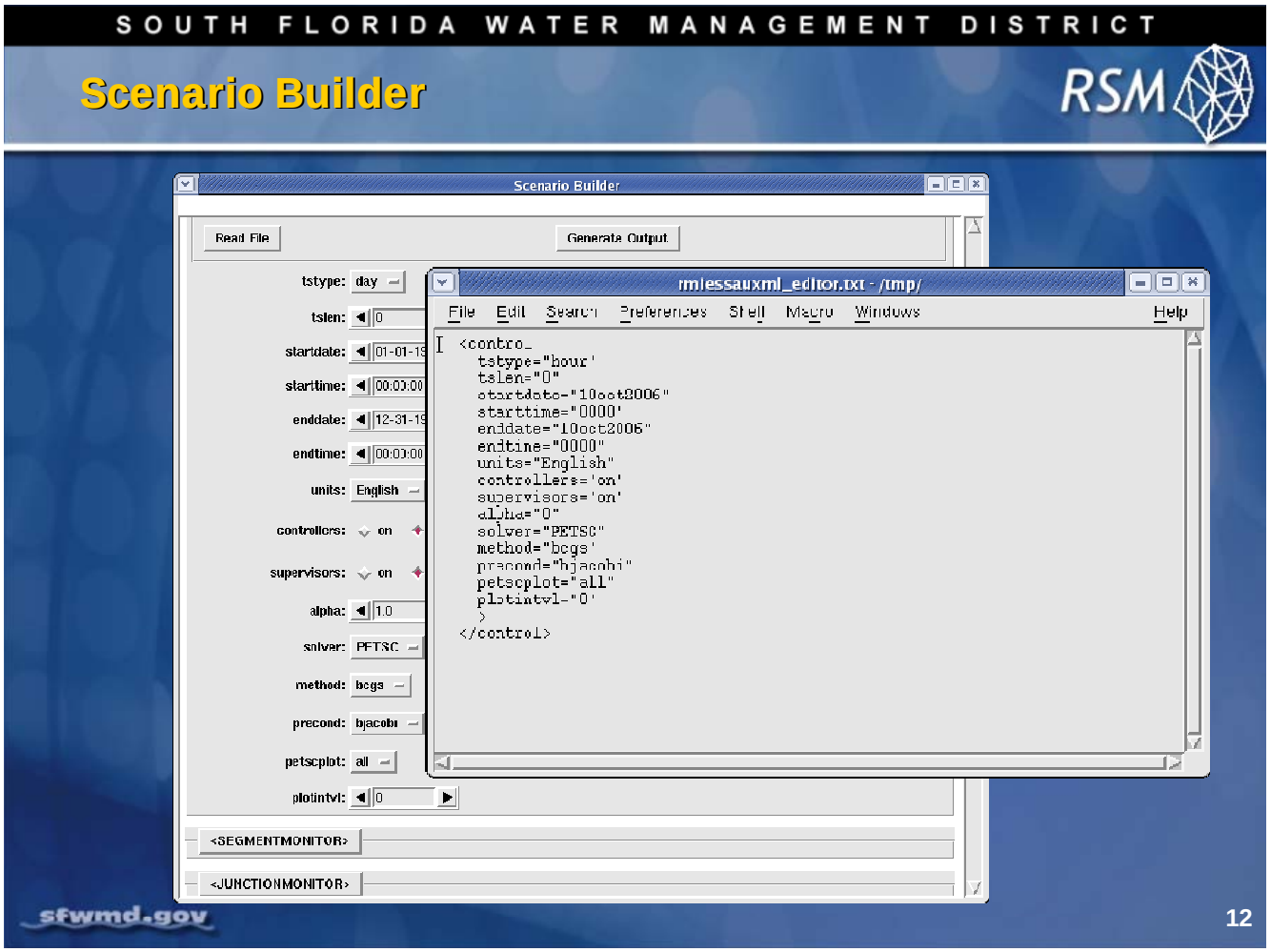
The **Edit** tool offers a method to edit an XML file with XML indenting and syntax recognition. On a Linux desktop an edit window will open displaying colorized XML, making it easier to review the proper syntax.



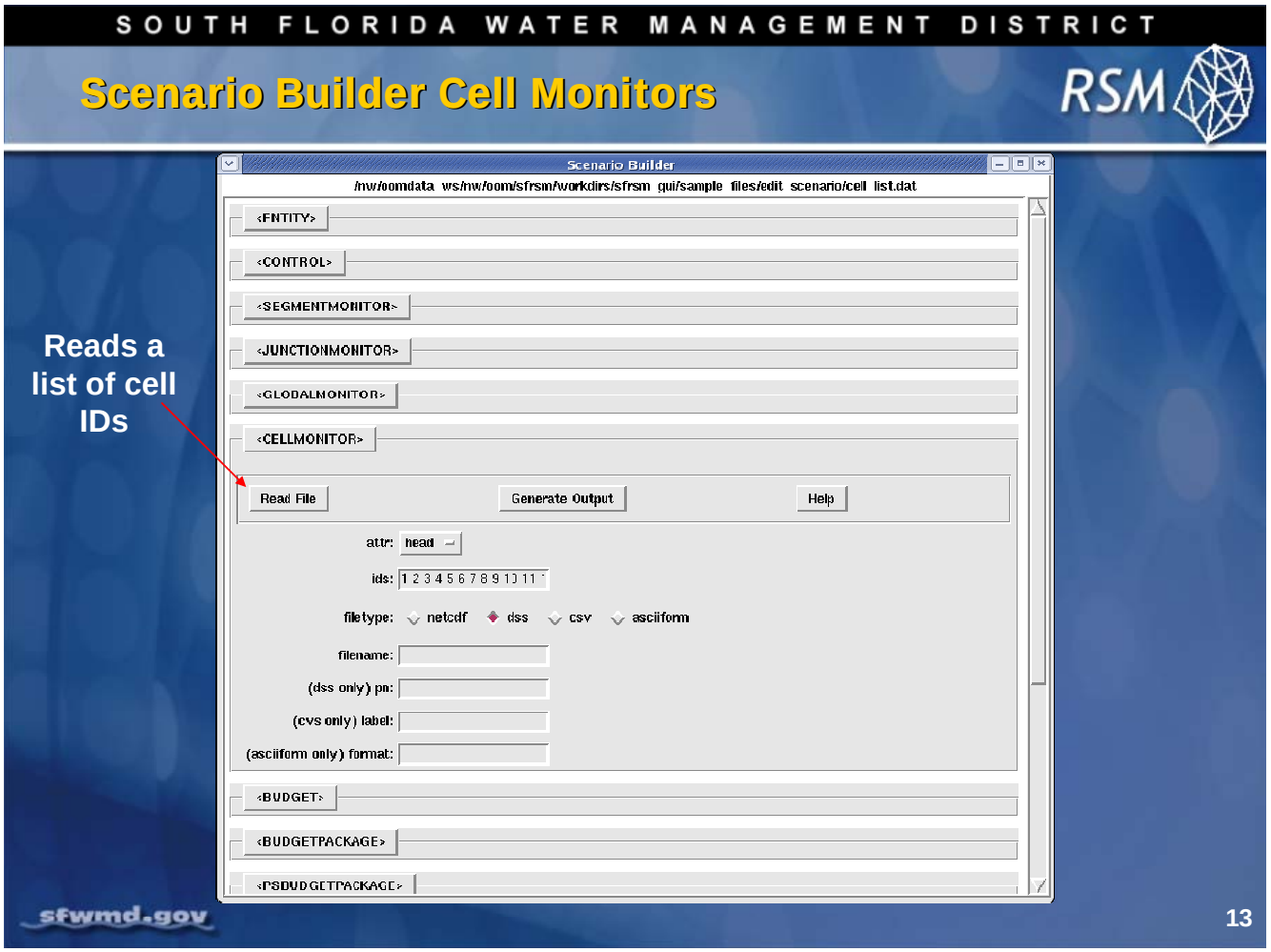
The **Scenario Builder** tool offers several options to help build blocks of XML which then can be inserted into the Main XML to run the RSM. These tools provide some automation for creating consistently formed XML blocks, including the default options often left out to save typing when creating an XML manually. The blocks help generate repetitive portions of the Main XML, such as monitors, conveyance and conductivity sections.

The Entity tool utilizes explicit paths to files referenced in the XML in order to better document the run being made.

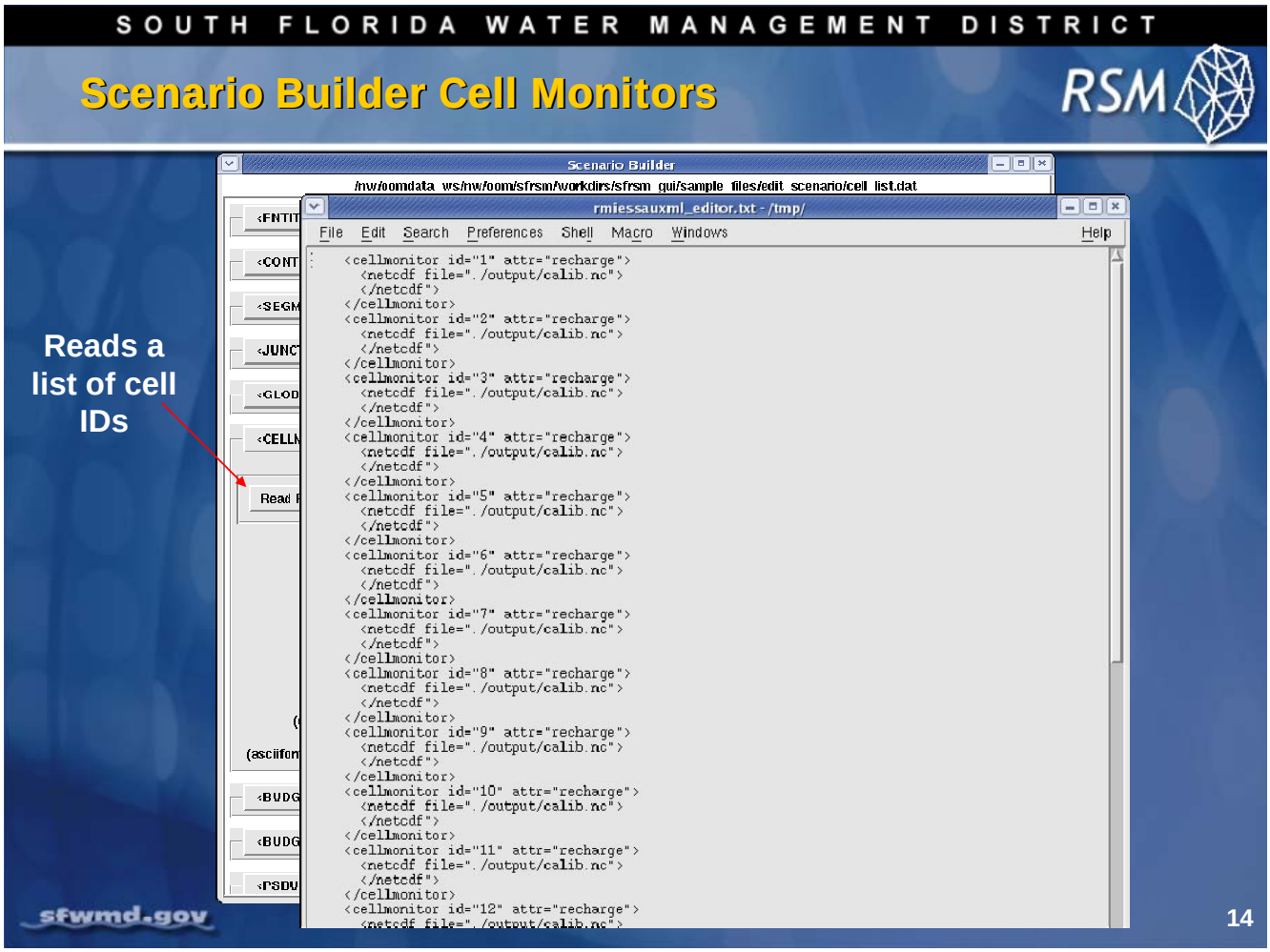
When an XML block is generated it can be saved, or copied and pasted into your Main XML.



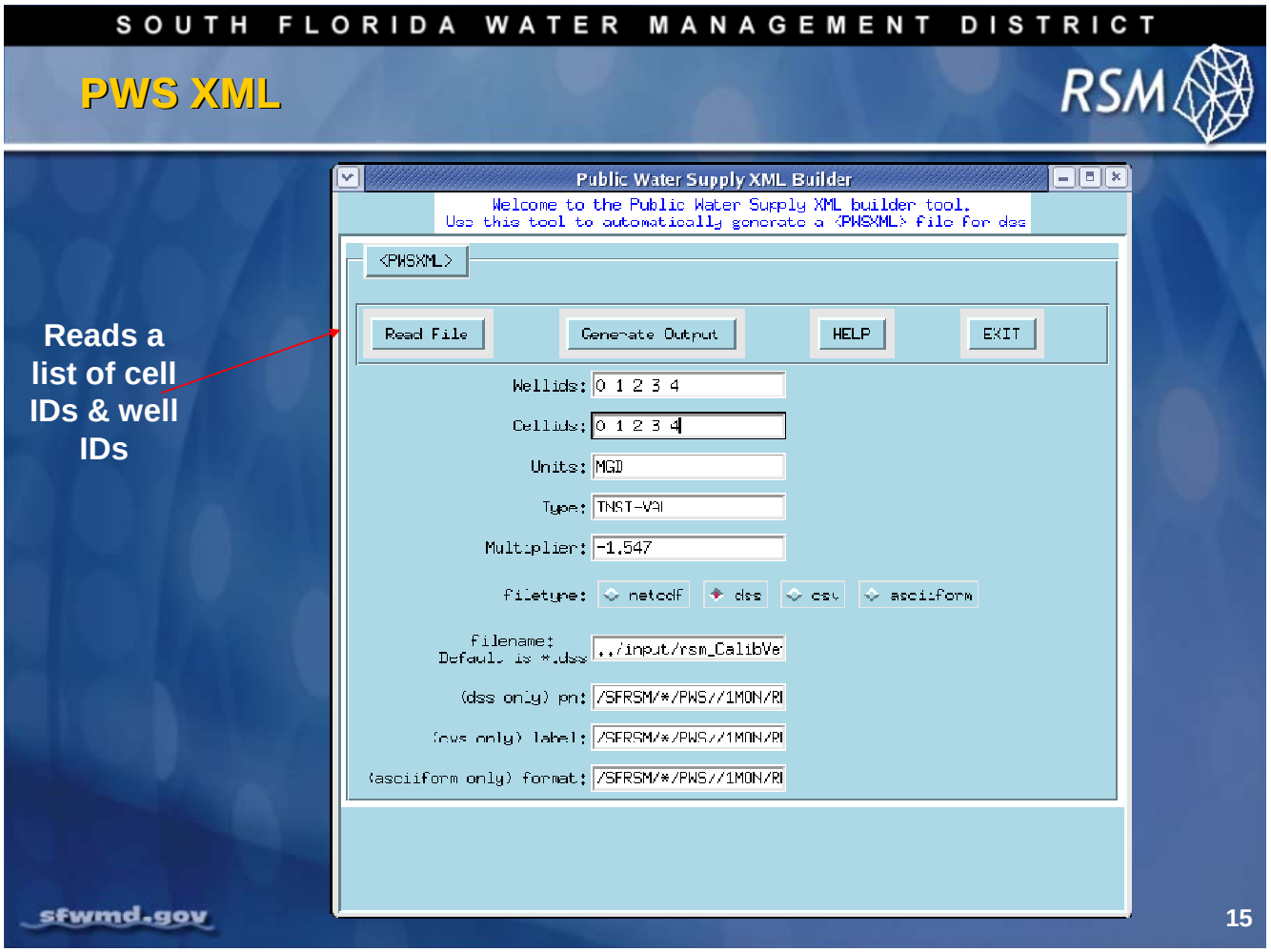
Control Block output from the Scenario Builder.



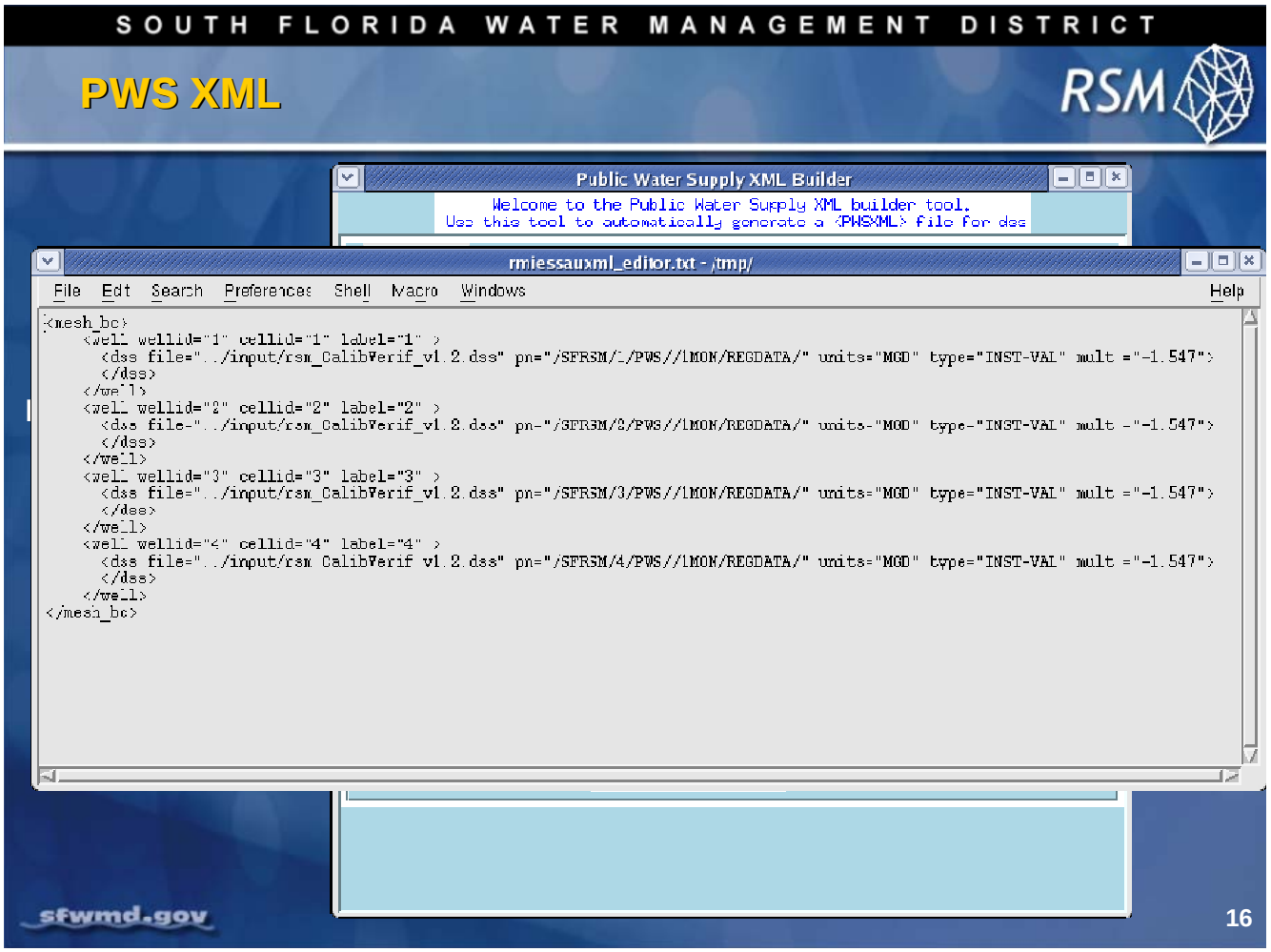
An example of building a **Cell Monitor Block** of XML using the Scenario Builder. A file containing a list of cell IDs can be 'read in' or manually entered.



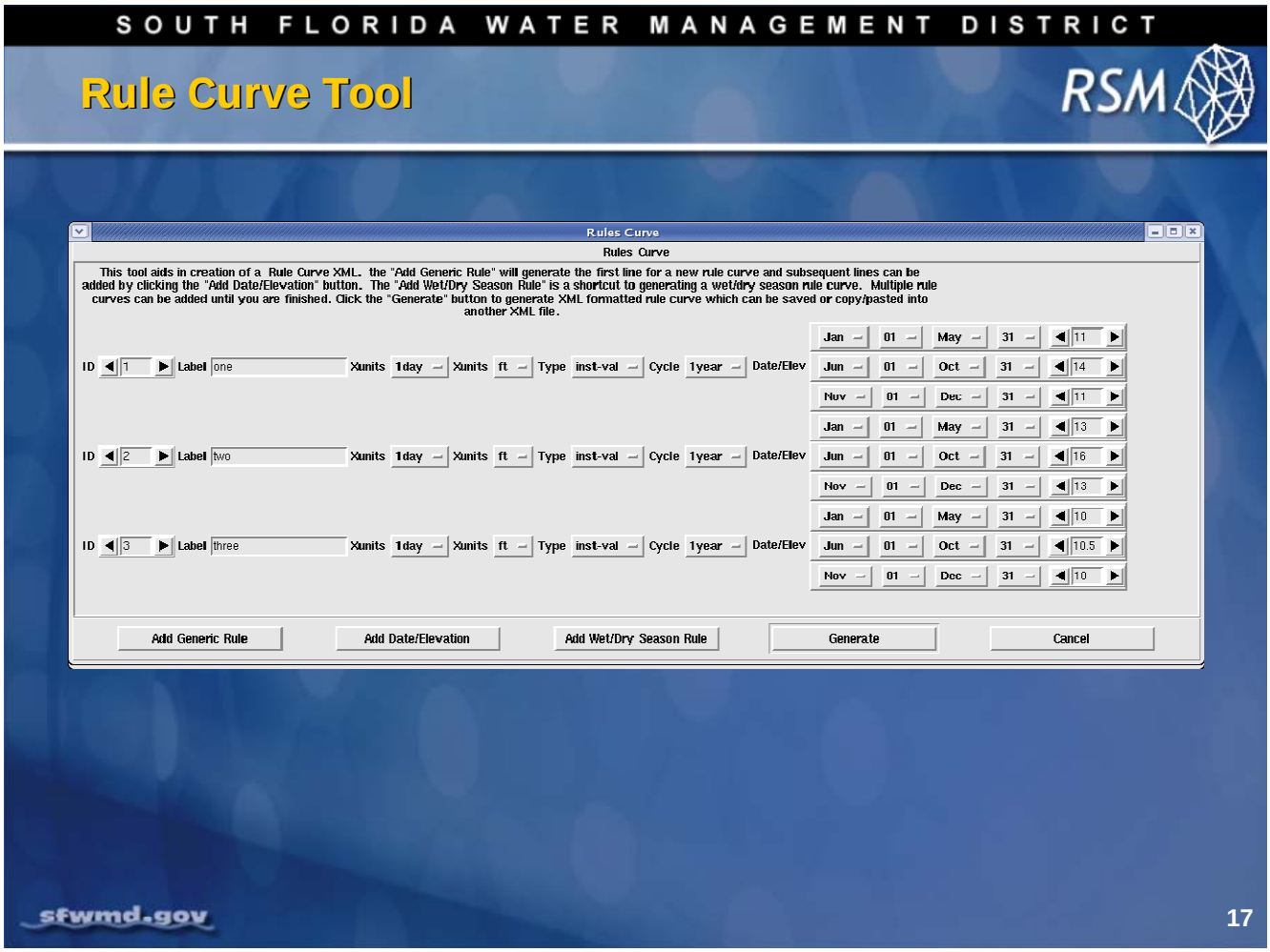
Cell Monitor output from the Scenario Builder.



The **Public Water Supply (PWS)** XML tool offers a means to build a public water supply block of XML. The tool reads in a list of IDs and corresponding labels. Default values are offered to populate the other attributes or they can be edited by the user. And, hints for creating different formatted output types are also provided. The resulting block of XML can then be edited, or copied and pasted into your Main XML. It's important to realize the first ID and label are ignored if the values are entered by hand. When utilizing an input file, a header is expected which also will be ignored when the block of XML is generated.



Output from the **PWS** tool.



The **Rule Curve** tool assists in building the Rule Curve block of XML which can then be copied and pasted into your XML.

Add Generic Rule

- Generates a new generic rule curve and inserts one line of rule curve text (startdate/enddate/elevation), which can then be modified to reflect the values desired
- Generates multiple rule curves in a single XML

Add Date/Elevation

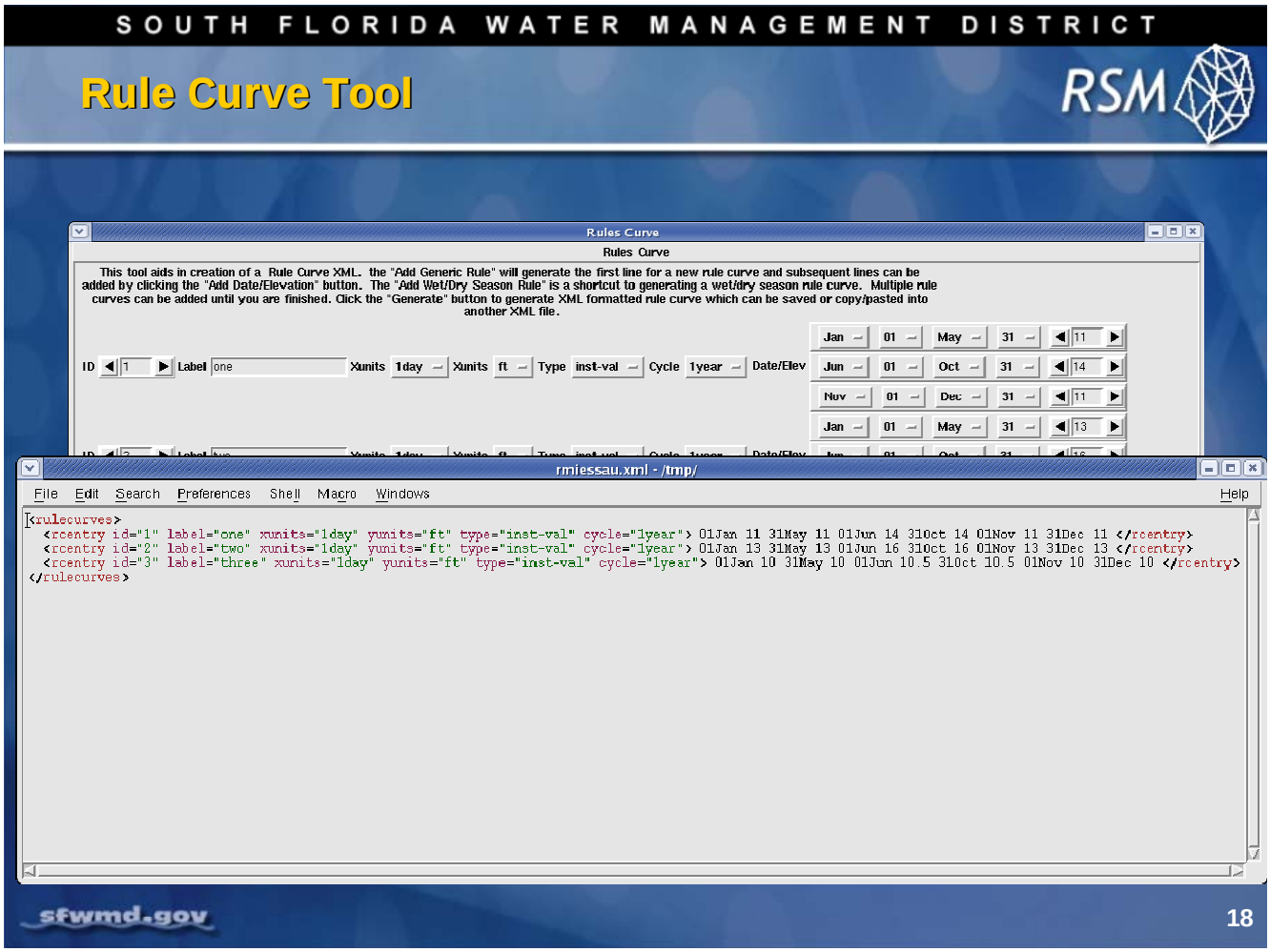
- Adds a new generic line (startdate/enddate/elevation) to the rule curve being created

Add Wet/Dry Season Rule

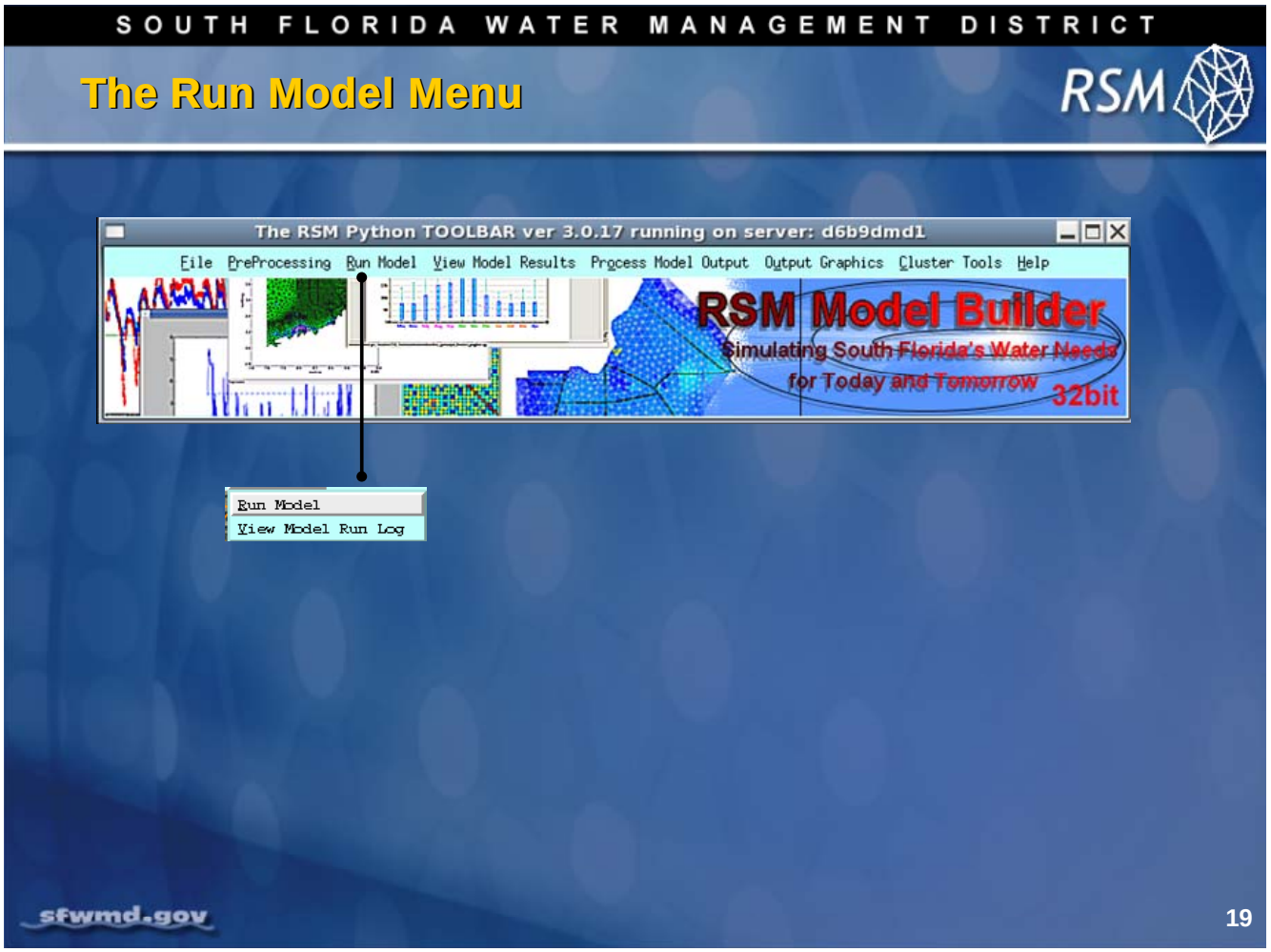
- Generates a new Wet/Dry Season rule curve
- Fields can be modified to reflect the desired values
- Generates multiple rule curves in a single XML

Generate

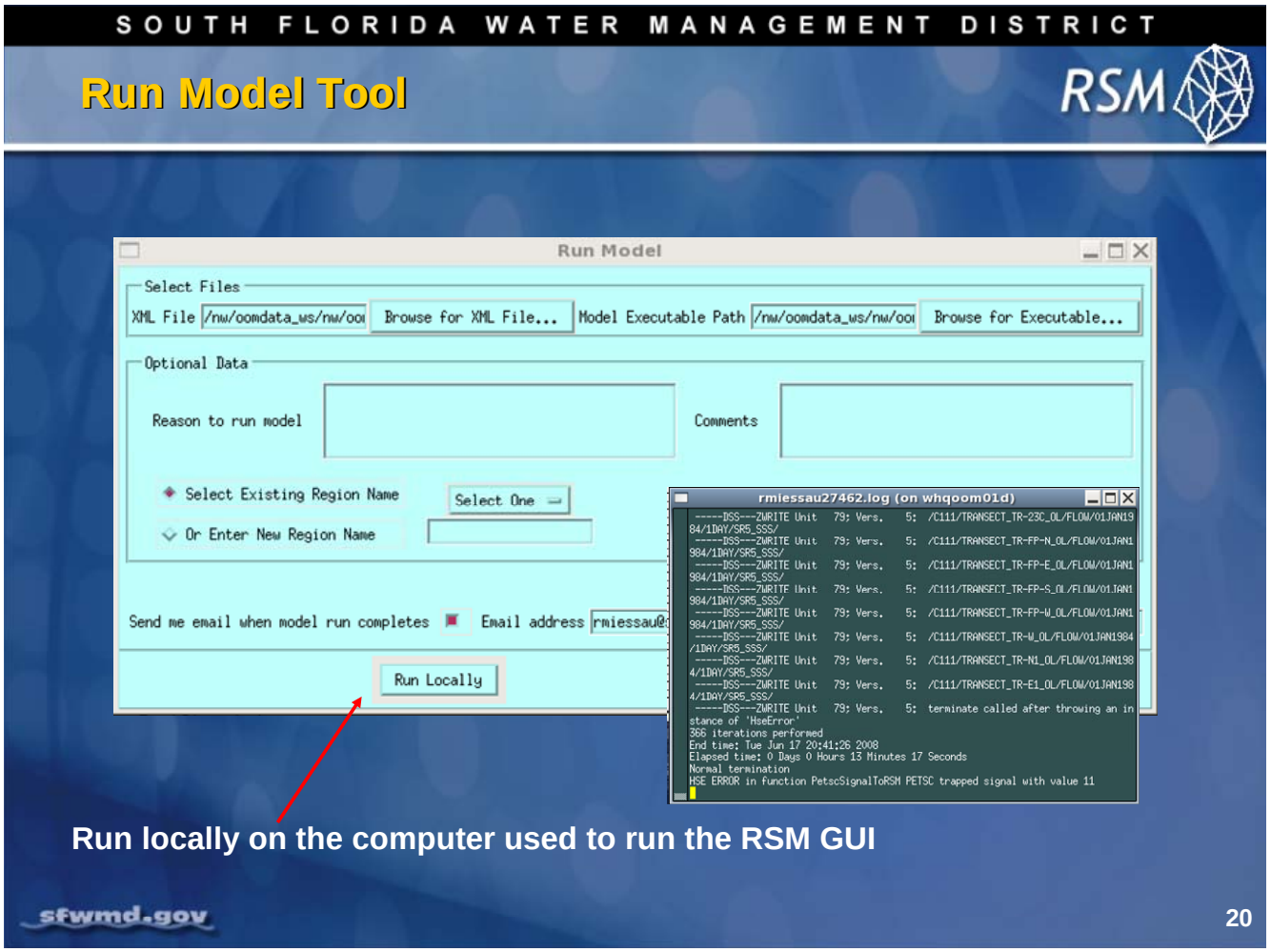
- Produces block of XML which can be copied and pasted into your XML



Output from the **Rule Curve** tool.



The **Run Model** Menu.



The **Run Model** tool offers added value to running the model from the command line. Special features include:

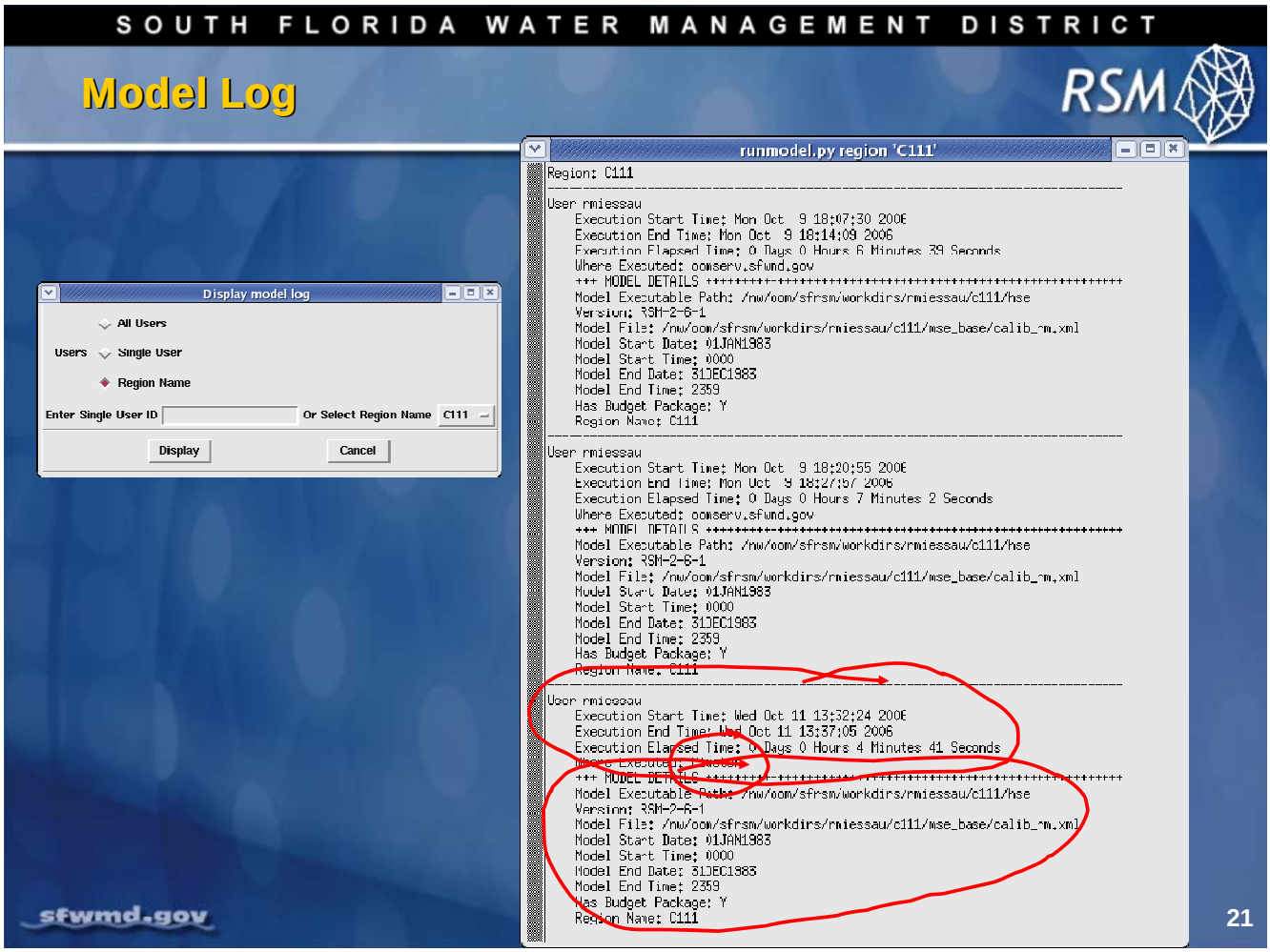
- Fields for the user to browse to the Main XML and Hydrologic Simulation Engine chosen to execute the model.
- Two optional fields collect information about the run and its purpose.
- A drop-down list or text field is used to capture the region name for the run.
- An email option will email one specified recipient when the run is completed.
- Buttons to simplify execution of the RSM on the local server where the RSM GUI has been executed.

These Run Model features provide a means for documenting and cataloging the model run in the **Model Log**. The Model Log captures the information entered by the user and also captures statistics from the server hosting the run.

Run the model by browsing to:

- $RSM/data/C111/hse_test
- $RSM/data/C111/run_c111_mse_sr5_sss.xml

A text window appears showing the model run's progress. The C-111 example run took 13 minutes.



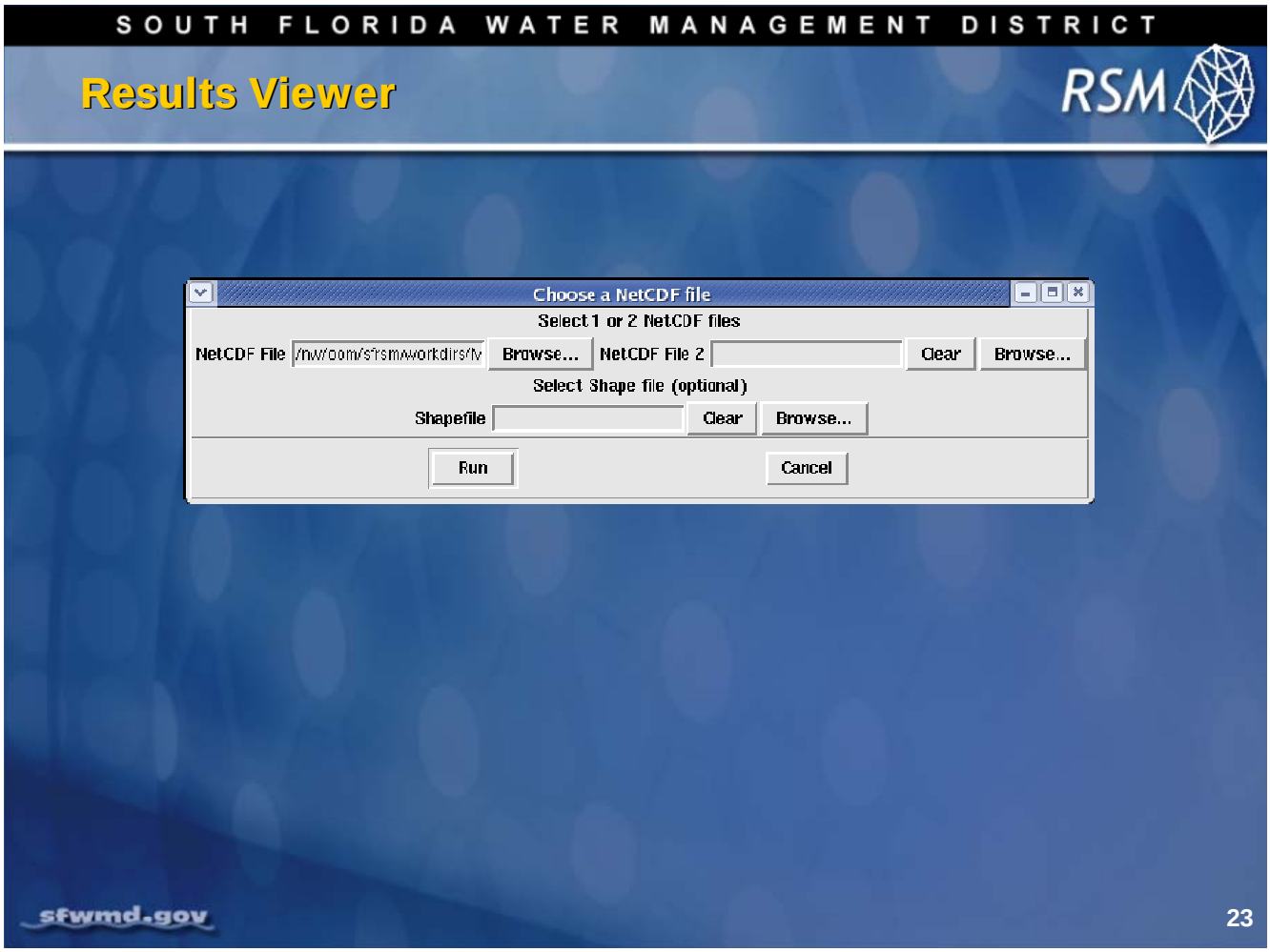
The **Model Log** contains information about each run executed through the RSM GUI. This feature automates documentation of model runs. It can assist with determining:

- When a run was made
- The server the model was run on
- Which HSE version was used
- The location of the input files
- The performance of the server used to make the run

The Main XML can also be parsed to capture settings information from the run, e.g. the duration and which output options where included.

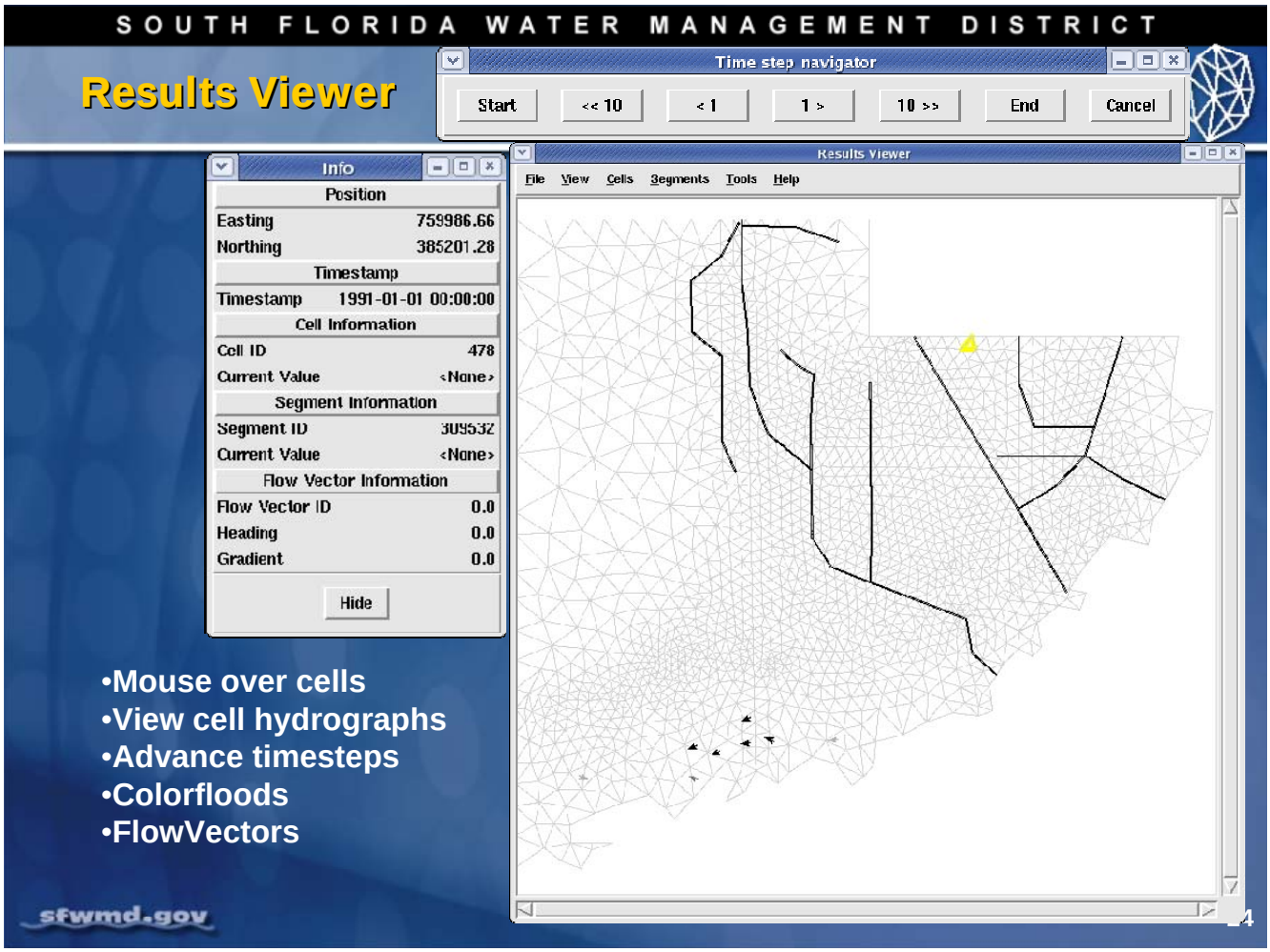
The Model Log can be searched by user name or region name.

The **View Model Results** Menu.



The **Results Viewer** is actually a collection of tools unto itself. The tool offers an option to import two netCDF files from similar model regions (no demo is available at this time). A GIS shapefile can also be imported to be displayed along with the model output.

The file for running the Results Viewer is: $RSM/labs/lab8_RSMtoolbar/c111_base.nc

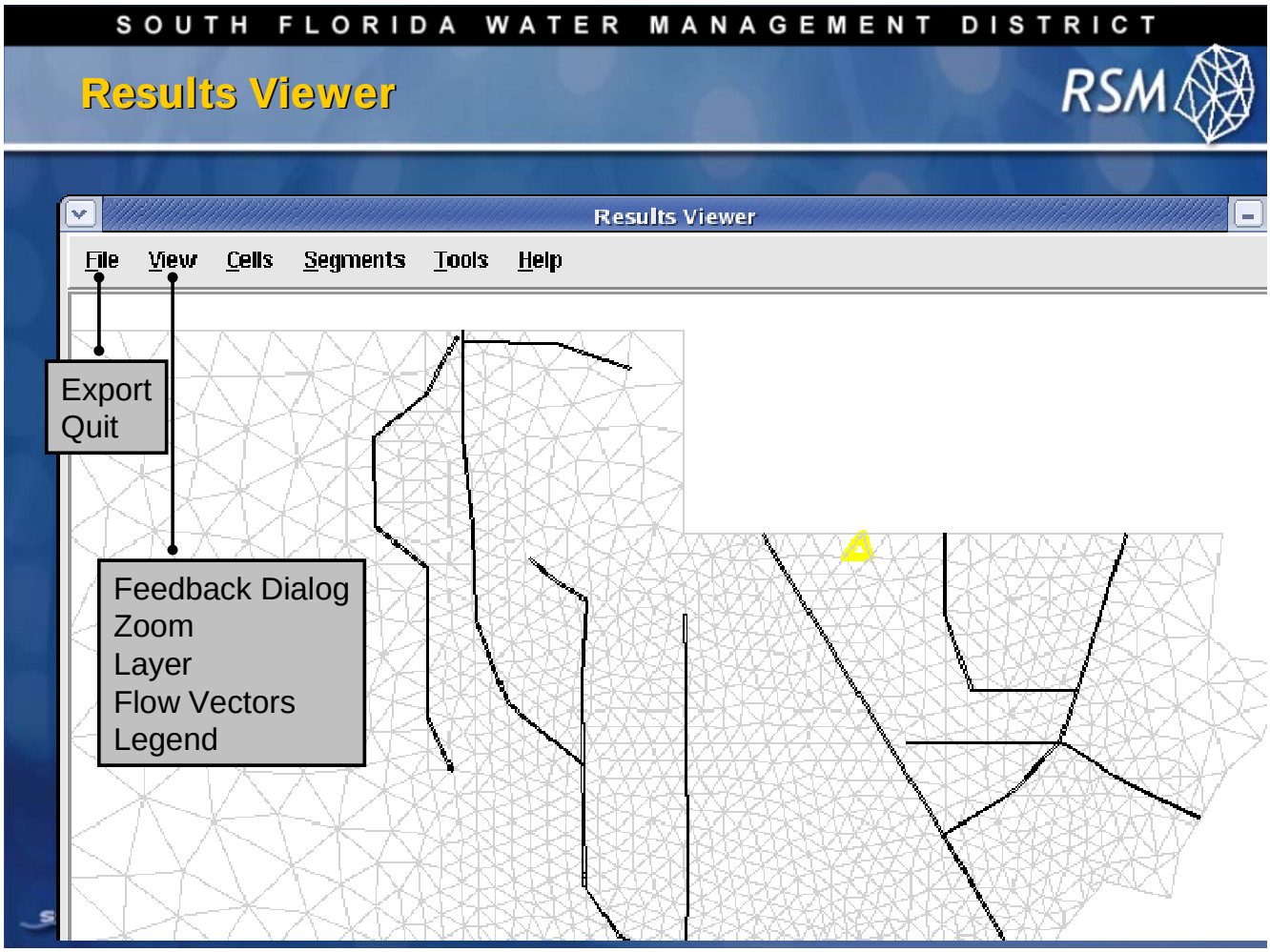


When the netCDF file initially opens, three display windows appear:

- A canvas used to visually display the mesh, waterbodies and optional shapefile
- A timestep window to move forward and backward through the model timesteps
- An INFO window used to display waterbody information for the moused-over cell.

Display options are available by right-clicking a waterbody.

NOTE: Only runs containing mesh cells and canal networks can be visually displayed in the Results Viewer.



Menu choices along the top of the **Results Viewer** offer a variety of features.

The first menu offers options to:

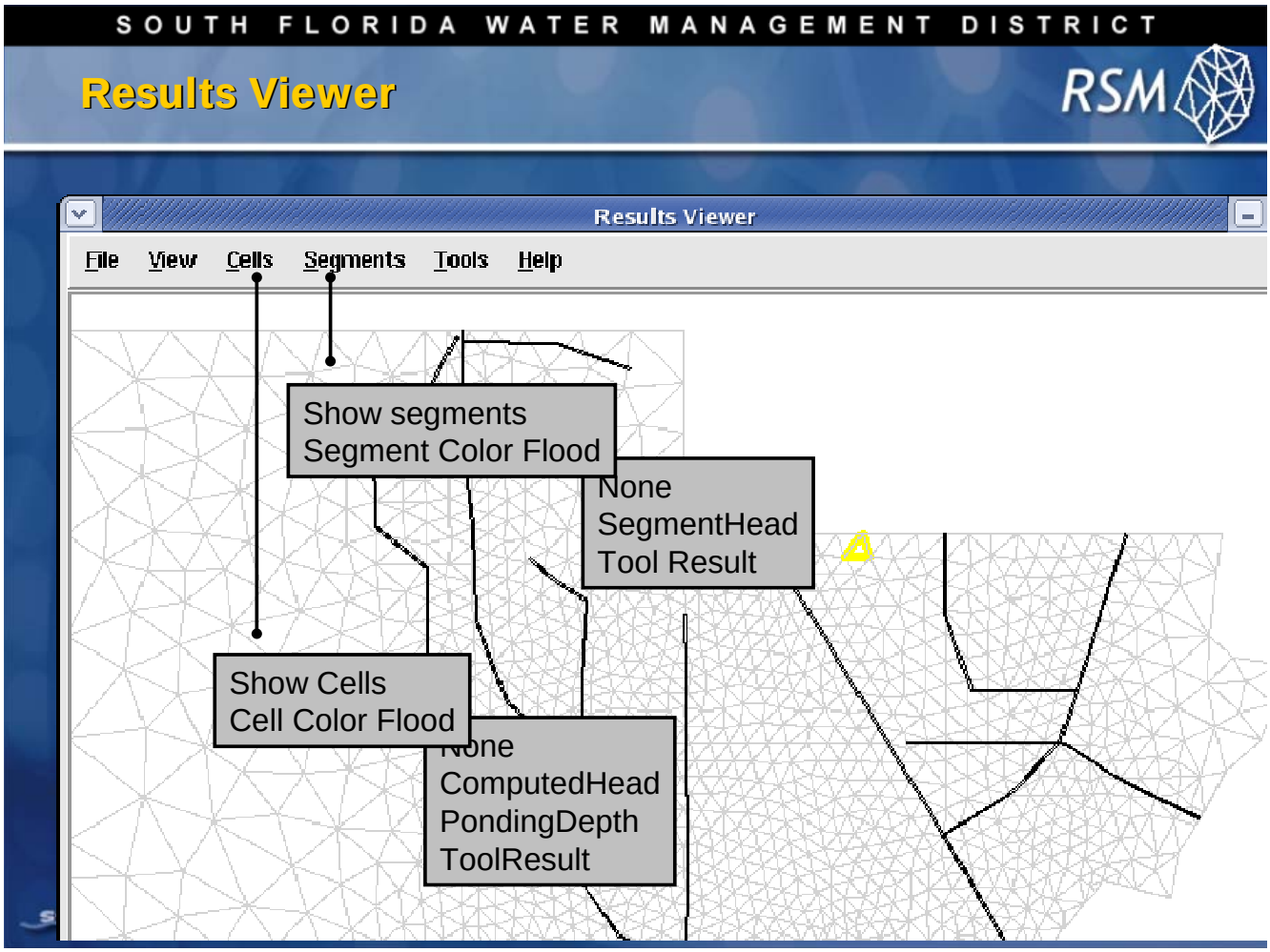
- Exit the tool
- Export the current view to a PNG image file

The second menu offers options to:

- Zoom in and zoom out
- Display or deactivate display of the flow vectors
- Turn-on a legend

Page Up and Page Down also offer zoom capability.

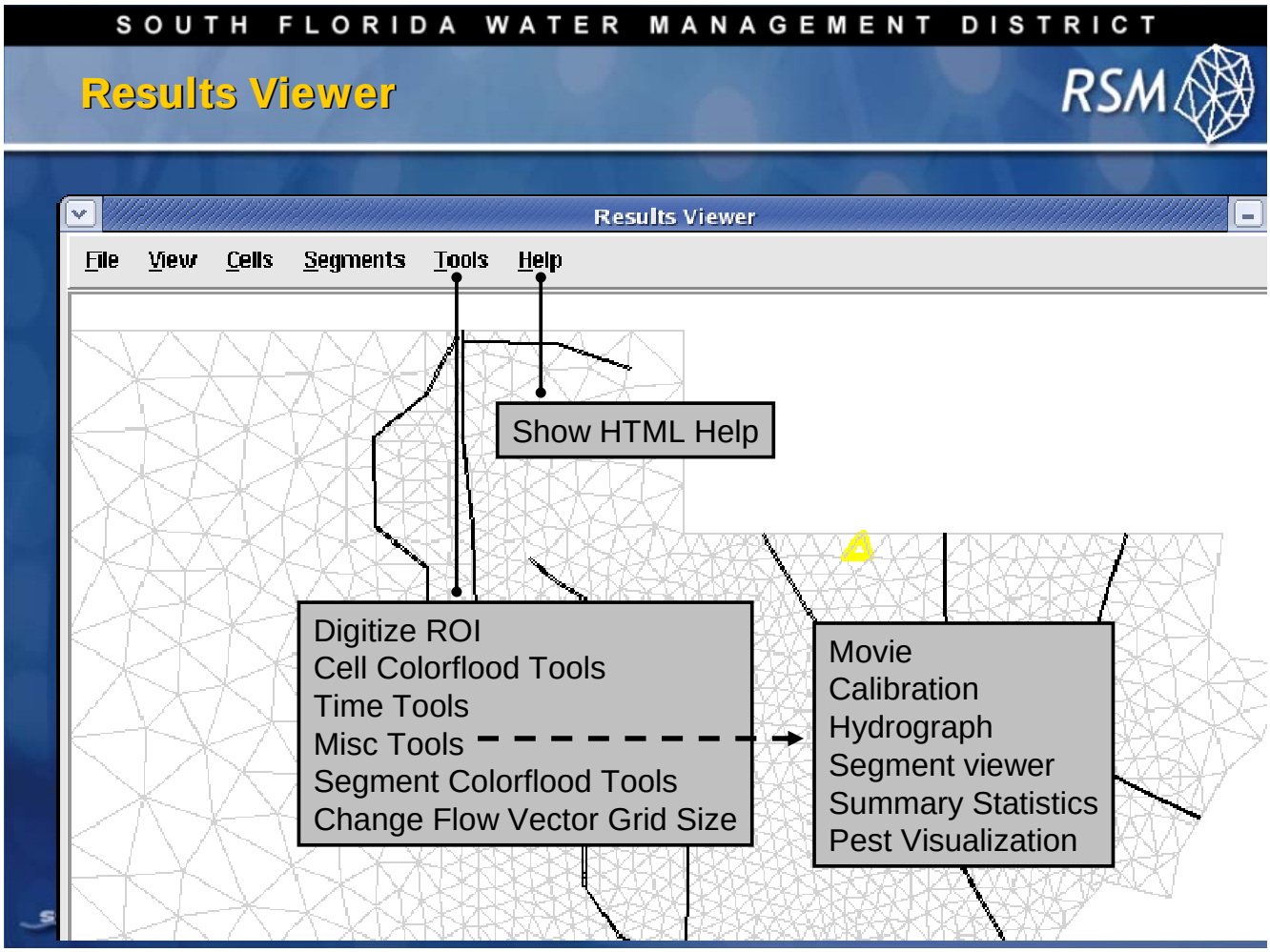
And, waterbodies display yellow highlighting upon mouse over.



The **Cells** Menu offers a means to color-shade the mesh cells. The attribute used to color-flood the cells can be **ComputedHead** or **PondingDepth**. Optional means offer the ability to select other attributes output by each model.

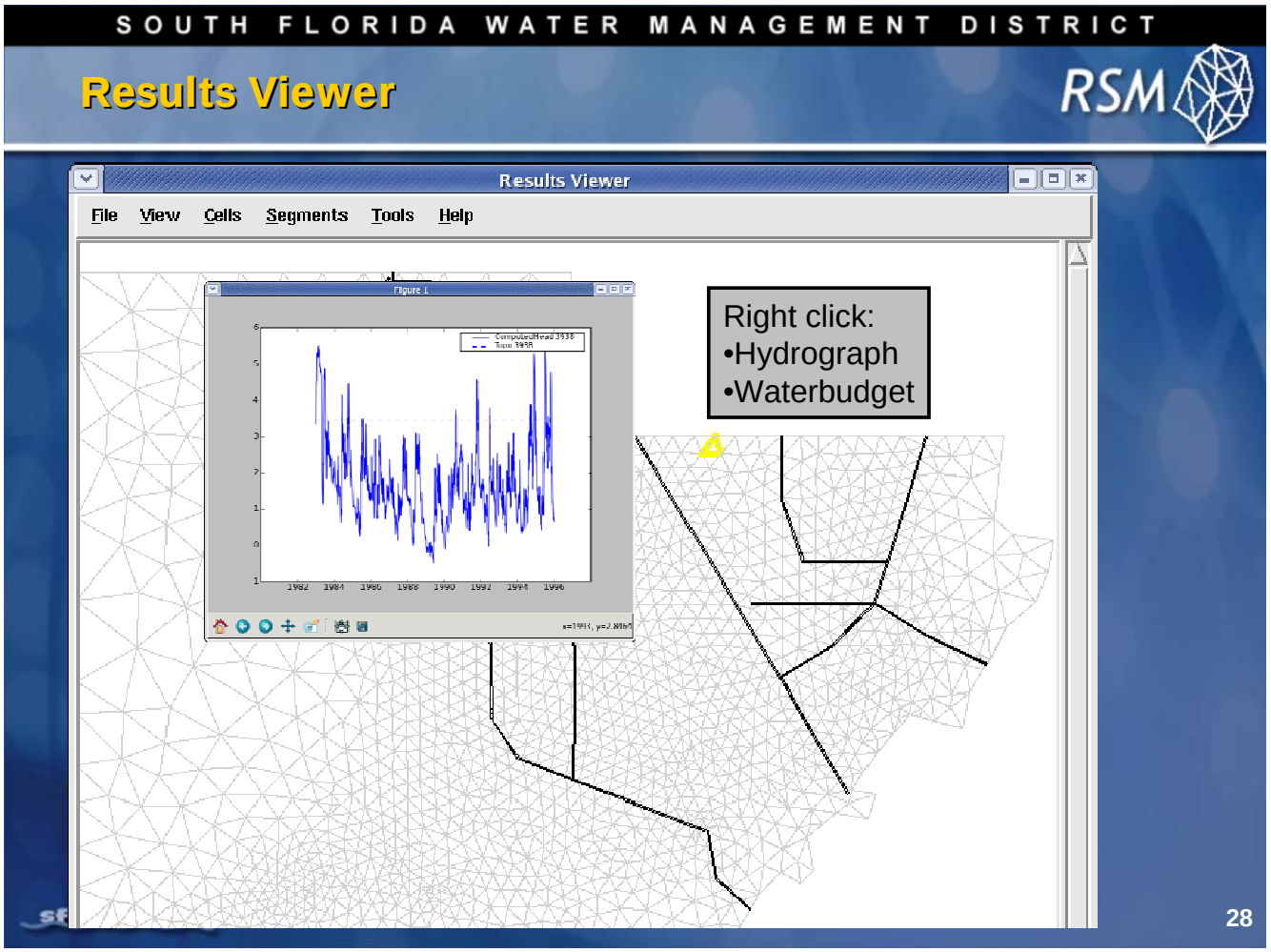
The **Segments** Menu offers a similar means to color-shade the canal segments. The attribute used to color-flood the segments can be **SegmentHead**. Optional means offer the ability to select other attributes output by each model.

After the cells are colorized the **Timeselect** Tool can be used to step through each timestep of the model and the color-floods will update to represent each timestep.



The **Tools** Menu contains a variety of tools to control how the model output is viewed and a variety of visualization tools to view hydrographs and **PEST** results.

- The **Digitize ROI** tool allows you to highlight a collection of cells by clicking and then closing the selection with a double-click. Only the subset of selected cells are colorized when the color-flood tool is activated.
- **Cell Colorflood** tool (no demo available).
- The **Time tools** display the **TimeNavigation** tool if it is ever deactivated.
- The **Hydrograph** tool generates a hydrograph for a select cell or multiple cells.
- **Segment Colorflood** tool (no demo available).
- **Change Flow Vector Grid Size** controls density of the grid used to display the flow vectors. A square grid is placed over the mesh and cells found at the center of each grid cell are then selected to display a flow vector arrow. The default grid size is 25x25 cells, covering the extent of the model region.
- **Movie** automatically steps through the timesteps offering an animation of the color-floods.
- **Summary Statistics** (not being demonstrated).
- **PEST Visualization** is used by model calibrators (not being demonstrated).
- **Show HTML Help** displays an HTML version of the Help documentation for the Results Viewer.

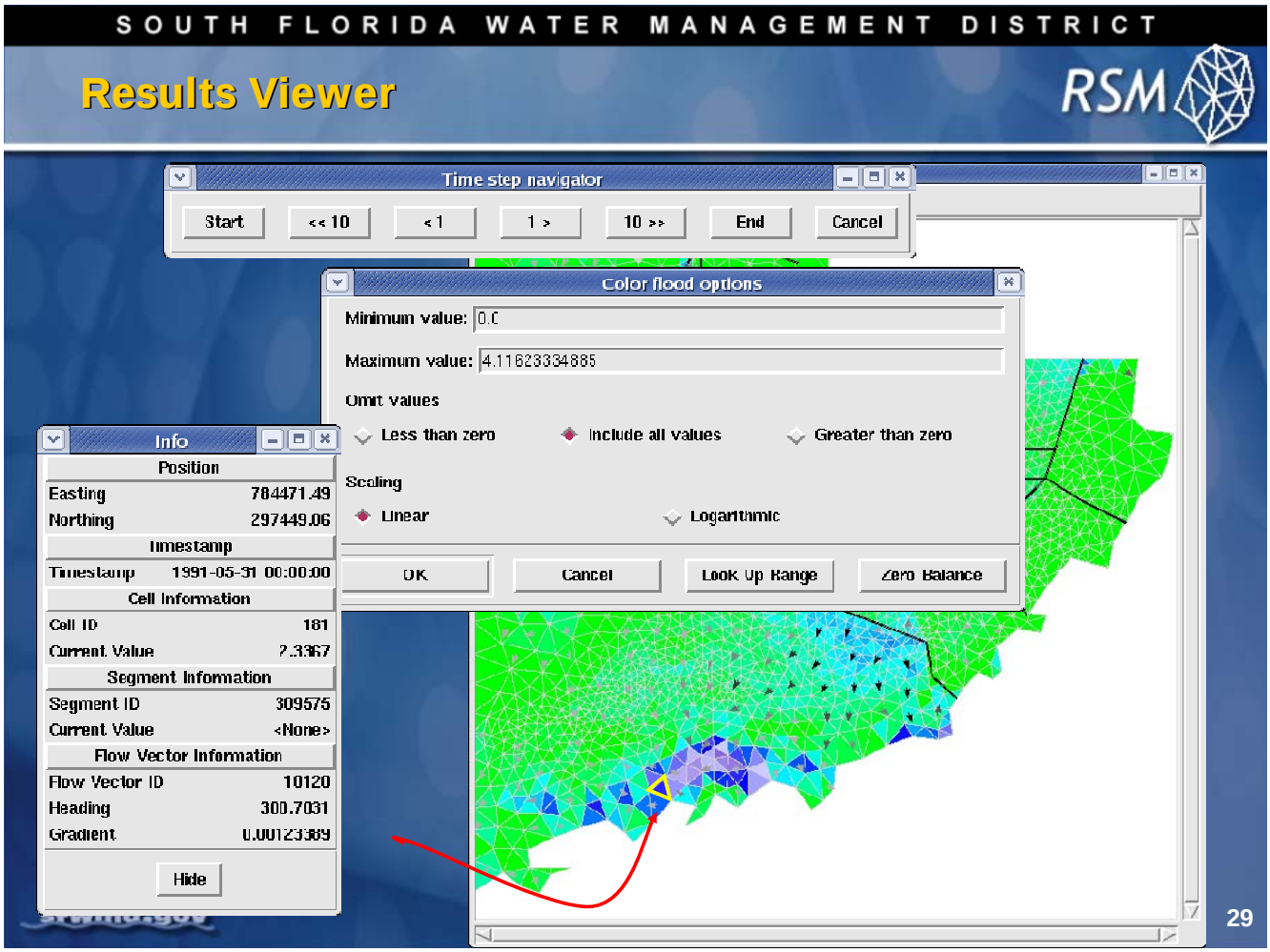


Right-clicking on any waterbody calls up a menu offering a display of a hydrograph or water budget for the selected cell. This feature is new and will be enhanced as requests are made for more features.

The **Hydrograph** tool displays multiple cell hydrographs in one graph. If an attribute is first selected for each additional cell the user can then digitize (left click) on a cell to acquire the cell ID.

The **Waterbudget** tool will automatically generate a cell water budget*.

NOTE: * **Water budgets are currently being configured and new netCDF options are being added to aid with HPM Hubs.**



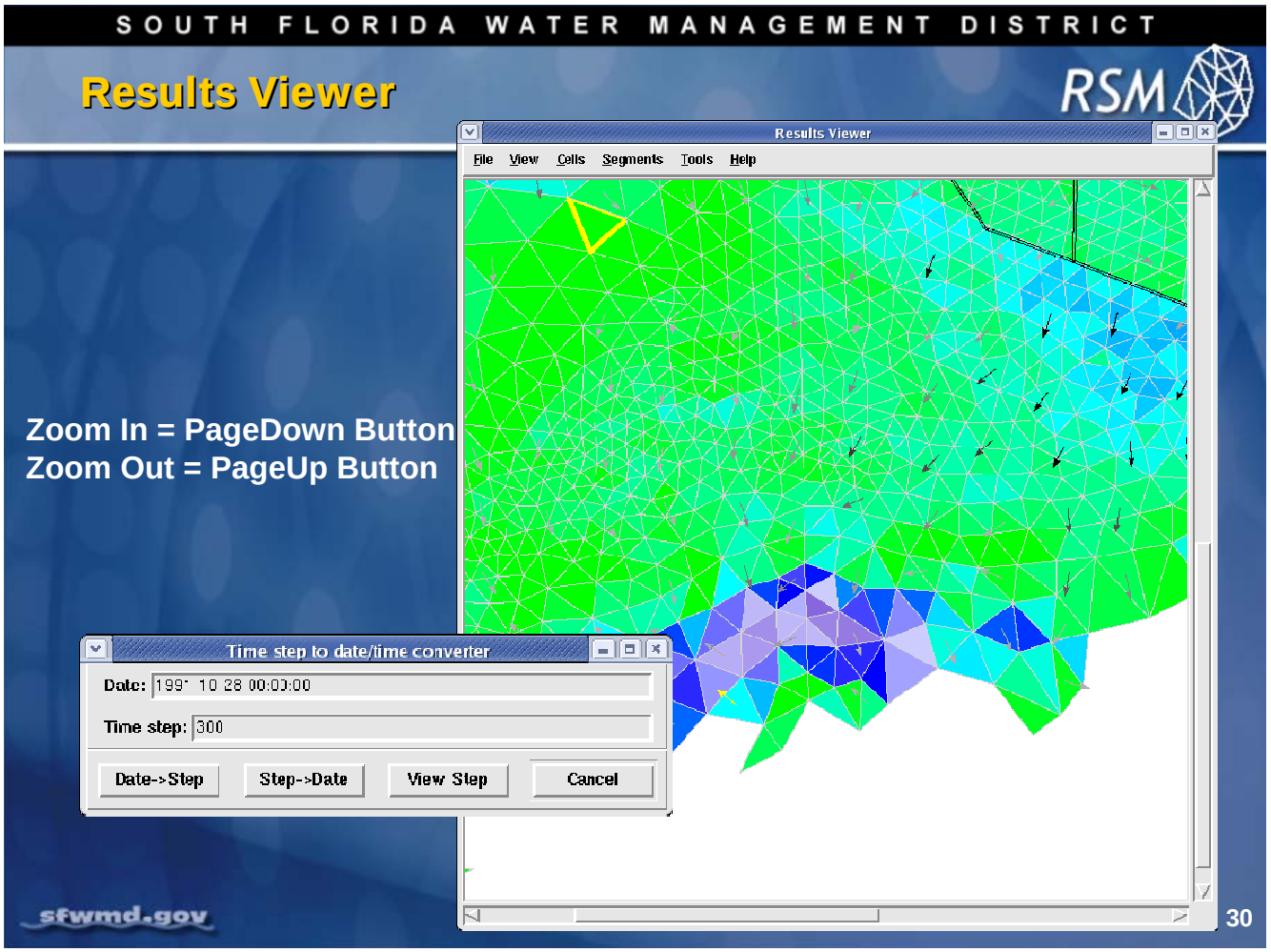
Cell colorfloods can be generated using the **Cell Colorfloods** tool found under the **Cells** menu.

After selecting **PondingDepth** or **ComputedHead**, a secondary menu prompts you for the range of the selected attribute or the range can be acquired by clicking the Look Up Range button.

All values can be displayed, only less than zero values, or greater than zero values can be specified.

The currently displayed timestep is then color-flooded with flow vectors. The flow vectors can be deactivated by selecting the option under the **View** menu.

You can mouse over any waterbody (cell or segment) to highlight and see information about it, in the Info window.

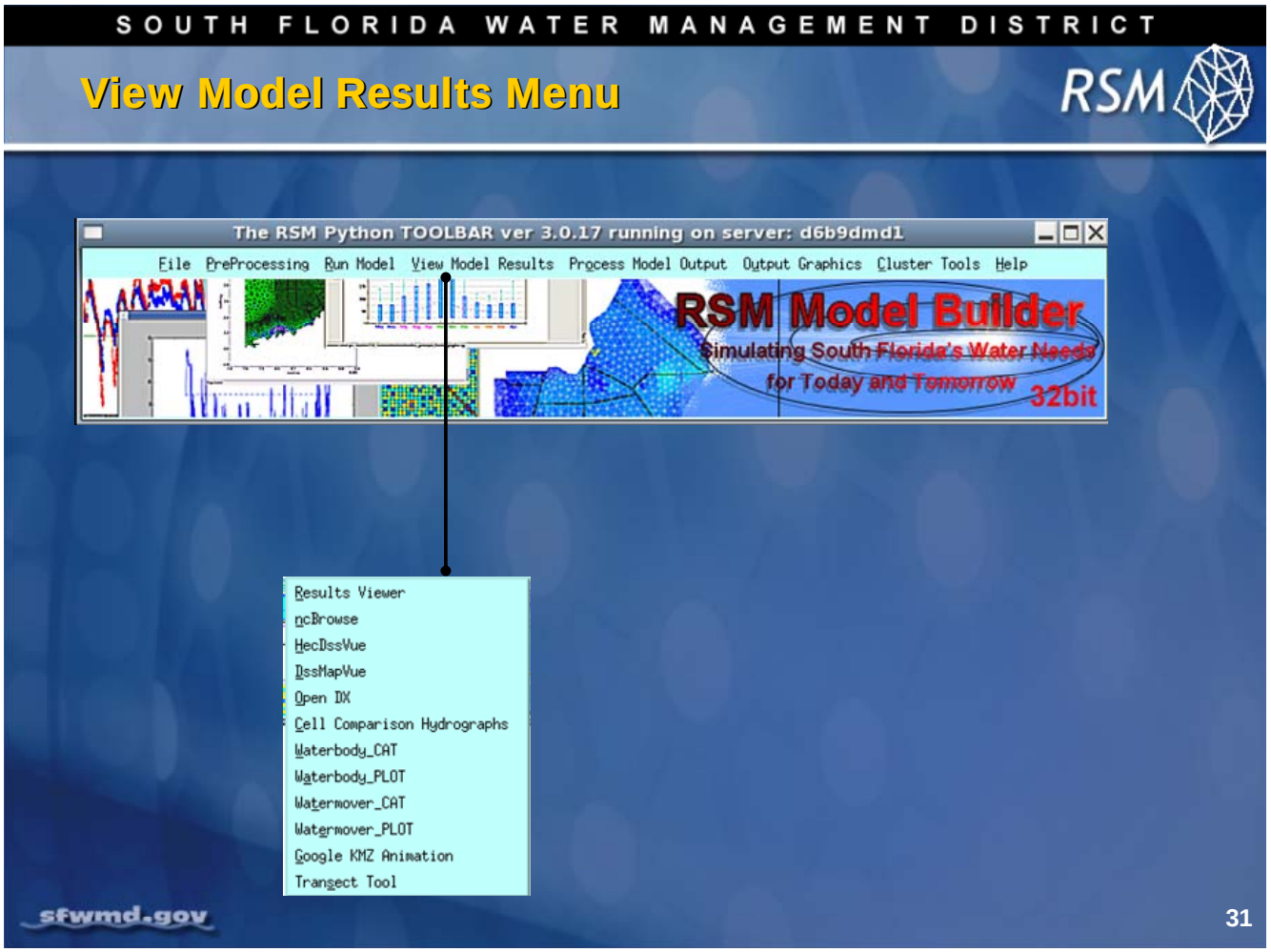


The **PAGE DOWN** key provides zoom-in capabilities and the **PAGE UP** key provides zoom-out capabilities.

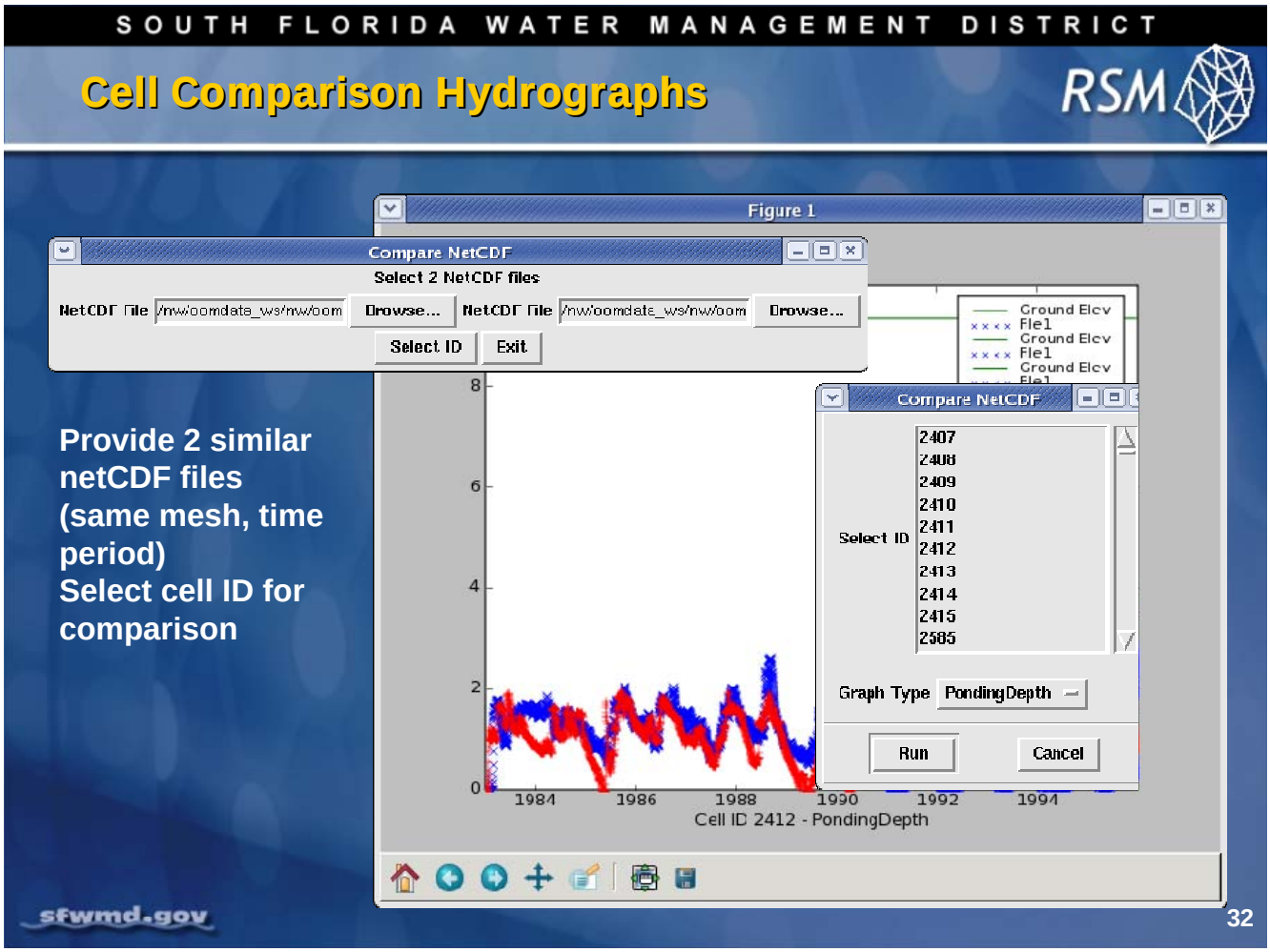
The **arrow** keys pan left or right in the display window.

The **Time Converter** is a useful tool for helping:

- Select a timestep
- Convert the timestep to a date or vice versa
- View that timestep by jumping to it in the viewer



The **View Model Results** Menu offers a collection of tools to view and browse model output files.

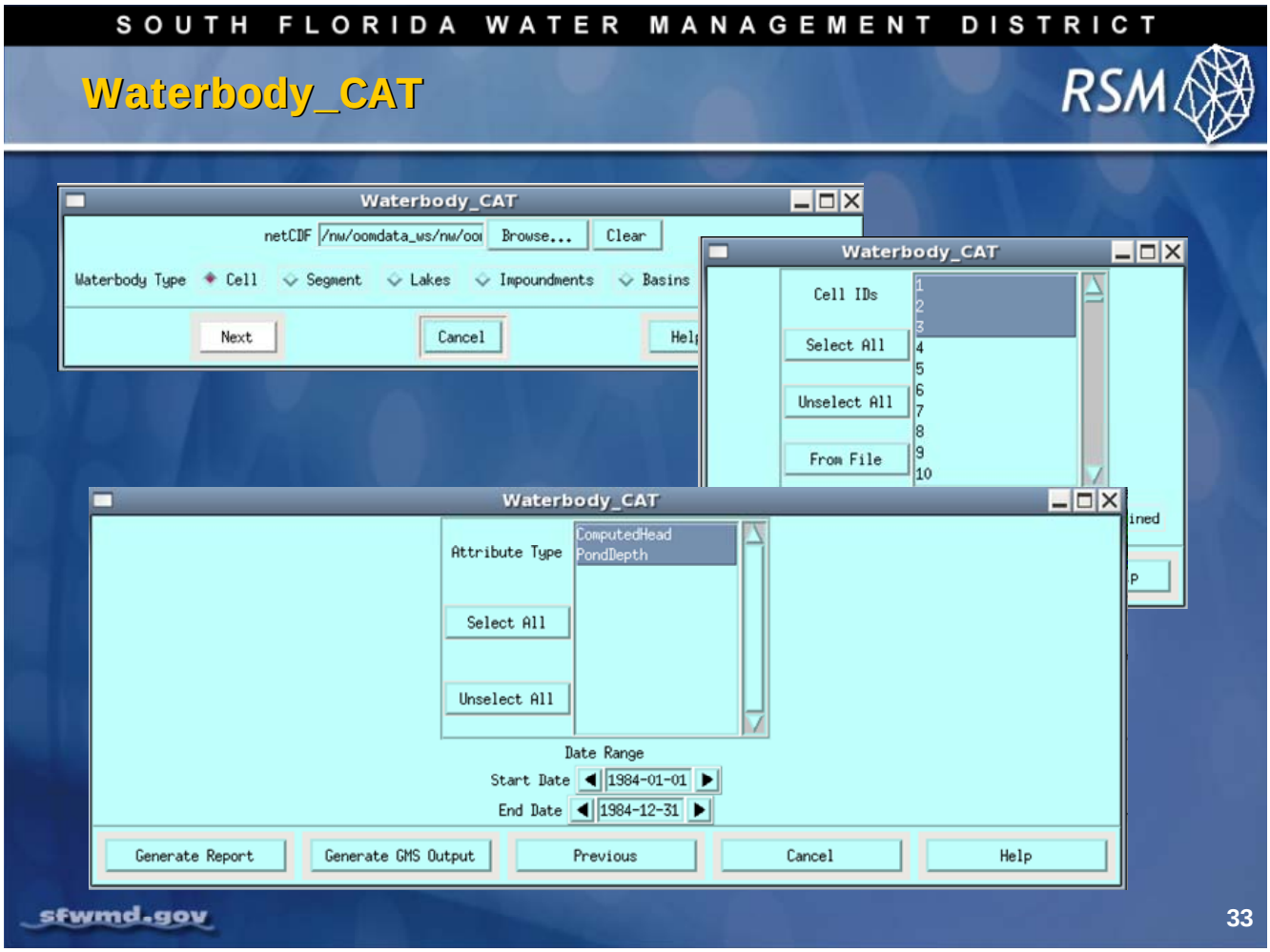


The **Cell Comparison Hydrographs** offer the ability to choose two netCDF model output files and generate a hydrograph comparing two cells. A list of cell IDs is generated from the first file and then corresponding cell information is read from the second file for comparison.

Use these sample files to run this tool:

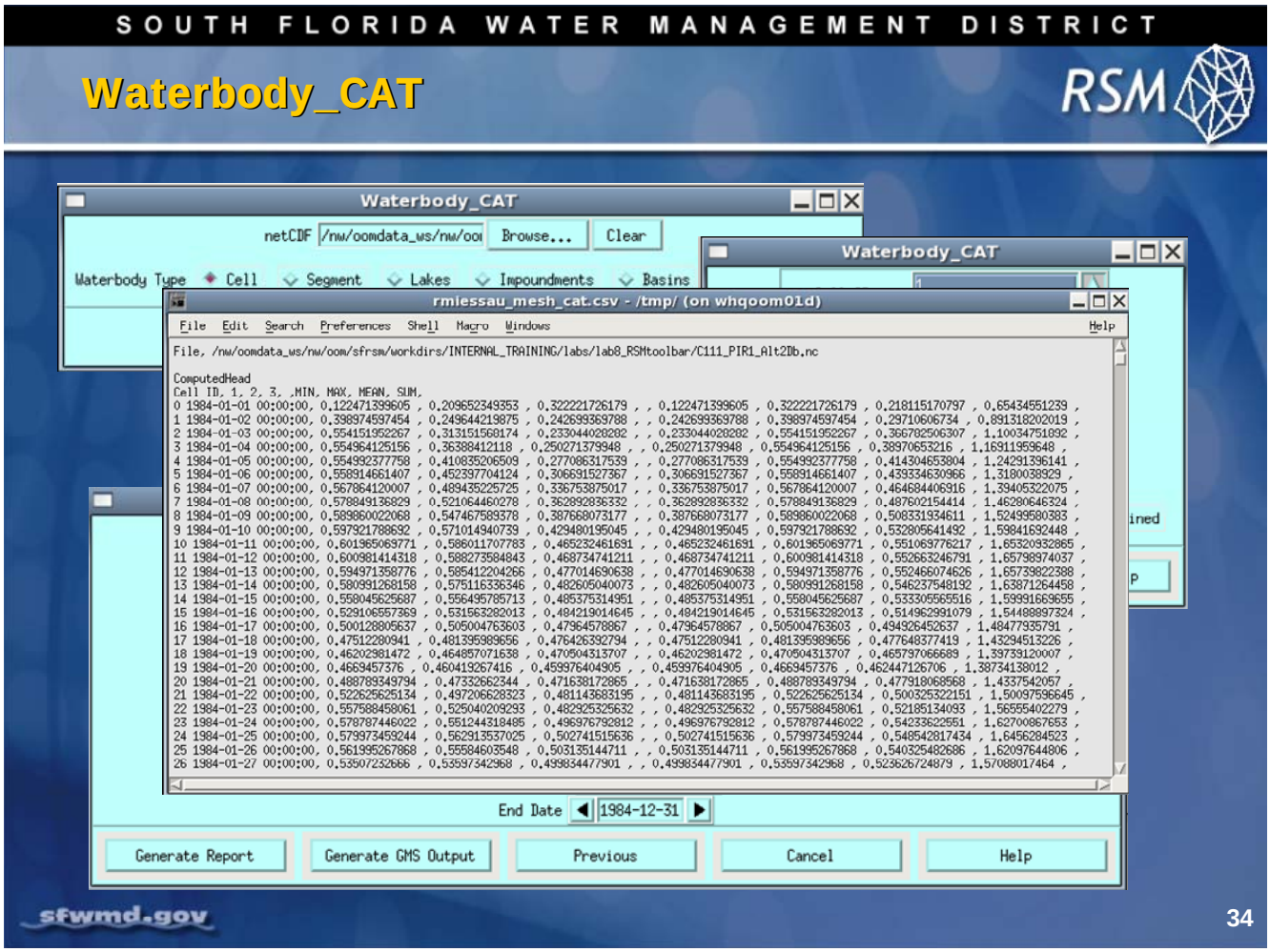
- $RSM/labs/lab8_RSMtoolbar/2005Base_AJ_94-95_global.nc
- $RSM/labs/lab8_RSMtoolbar/C111_CERP_ALT6_94-95.nc

NOTE: The netCDF files being compared must be from runs built on the same mesh.

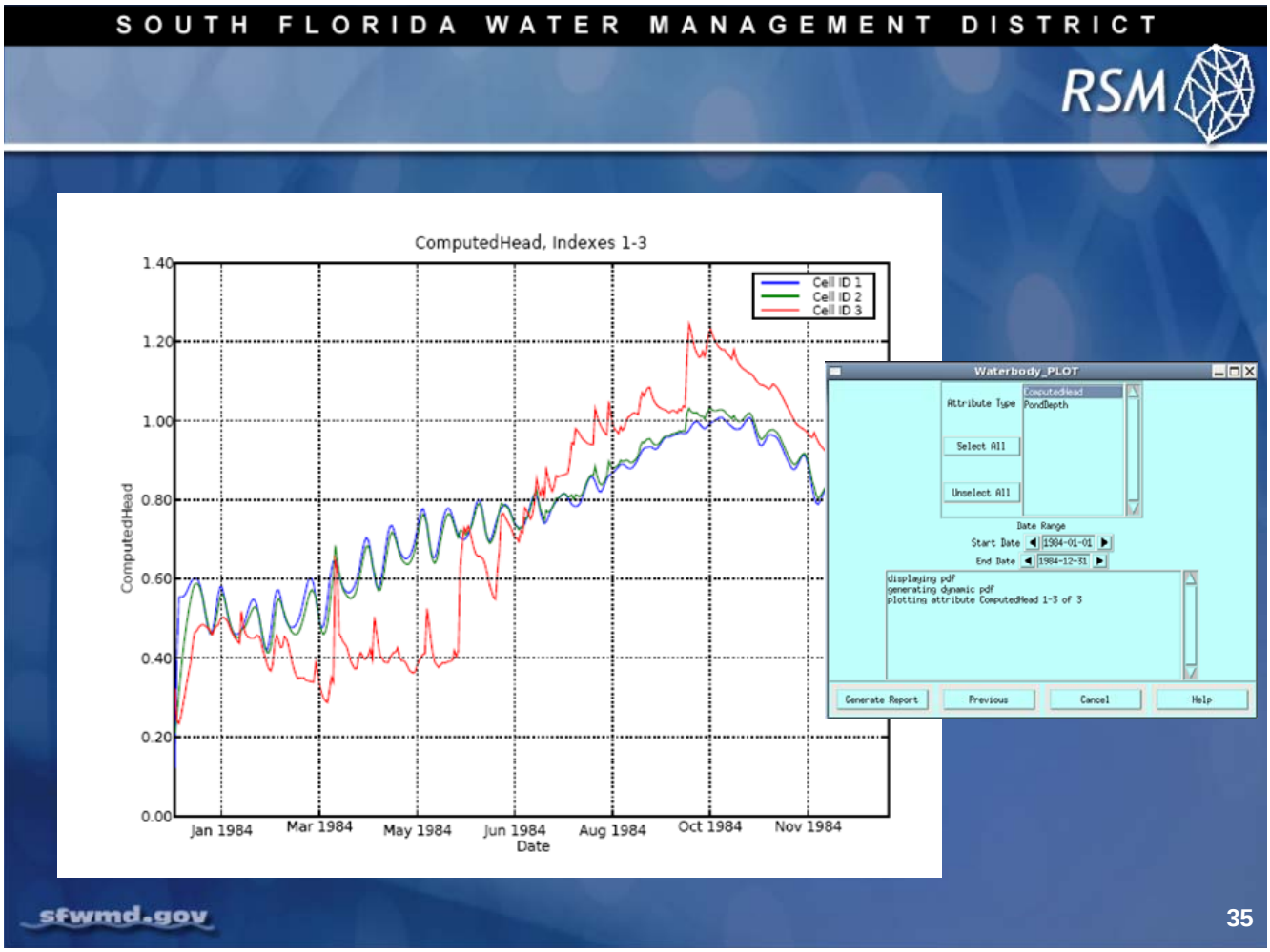


The **Waterbody_CAT** tool provides a means to select portions of the data from a netCDF output file and generate an ASCII comma-delimited file. This example shows how easily the time series data for cells 1, 2, 3 can be extracted and displayed for analysis.

The file for testing this tool is: $RSM/Labs/lab8_RSMtoolbar/C111_PIR1_Alt2Db.nc

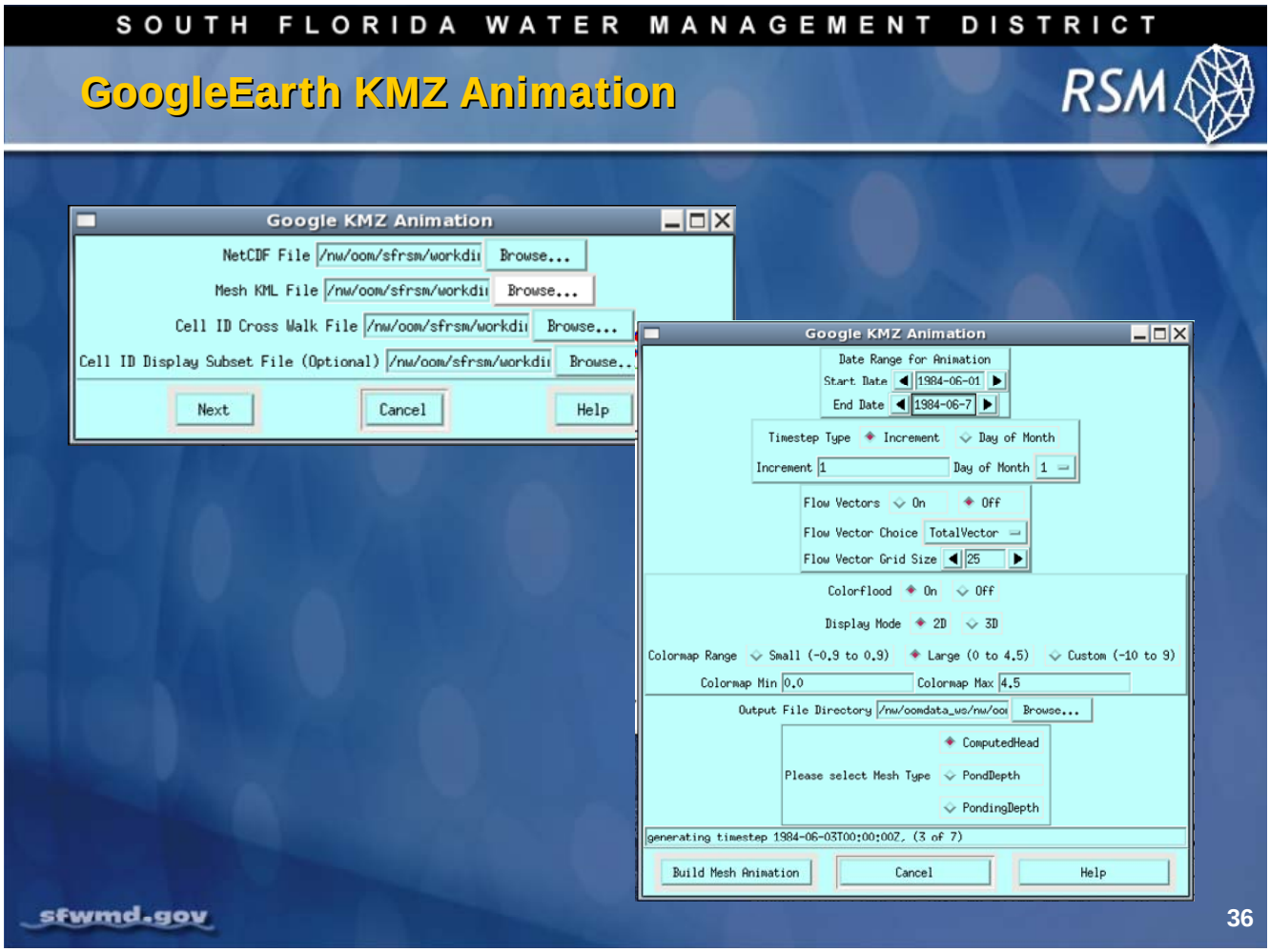


Output from the **Waterbody_CAT** tool.



The **Waterbody_PLOT** tool function is almost identical to the Waterbody_CAT. The **Waterbody_PLOT** tool produces a plot from the data selected from the netCDF file.

The file for testing this tool is: $RSM/labs/lab8_RSMtoolbar/C111_PIR1_Alt2Db.nc

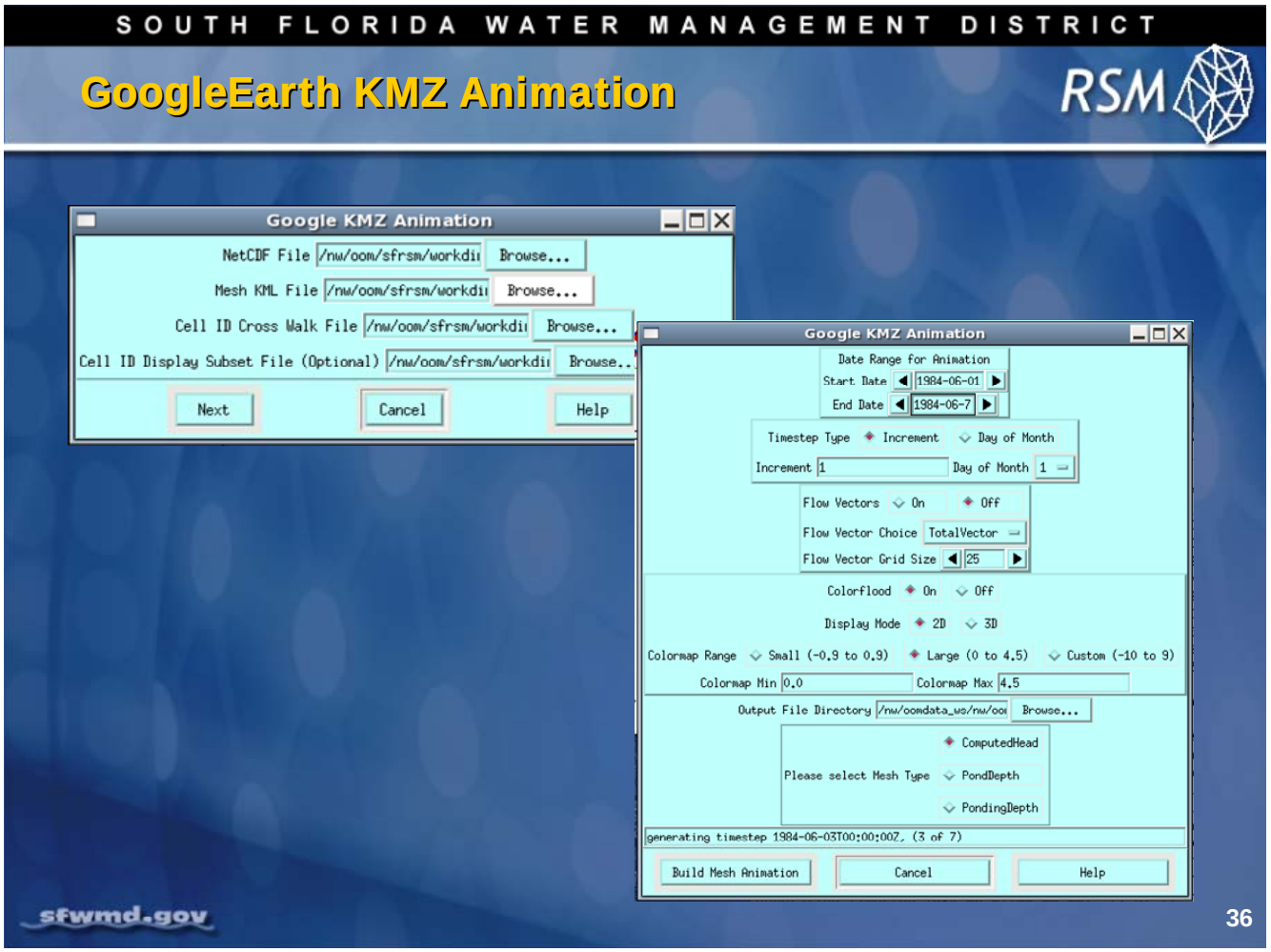


The **Google KMZ Animation** tool utilizes output from the GIS and the RSM netCDF file to produce a time series animation that can be viewed in GoogleEarth. (KMZ files are a variation of XML.)

The files needed to run this tool include:

- GlobalMonitor netCDF file containing Ponding or ComputedHead
- A mesh KML containing the mesh generated from Arc2Earth
- A cell ID crosswalk file. This is a two-column ASCII text file containing the ObjectID in column 1, and the cellID in column 2. The Index Tool from the GIS toolbar can be used to generate this file and then combined with the output in a spreadsheet to make the two-column file.
- Optional subset of cell IDs to be animated. This limits the cells that will be initially made visible in the animation. All cells will be present in the file and can be activated by selecting them in the GoogleEarth layer Table of Contents.

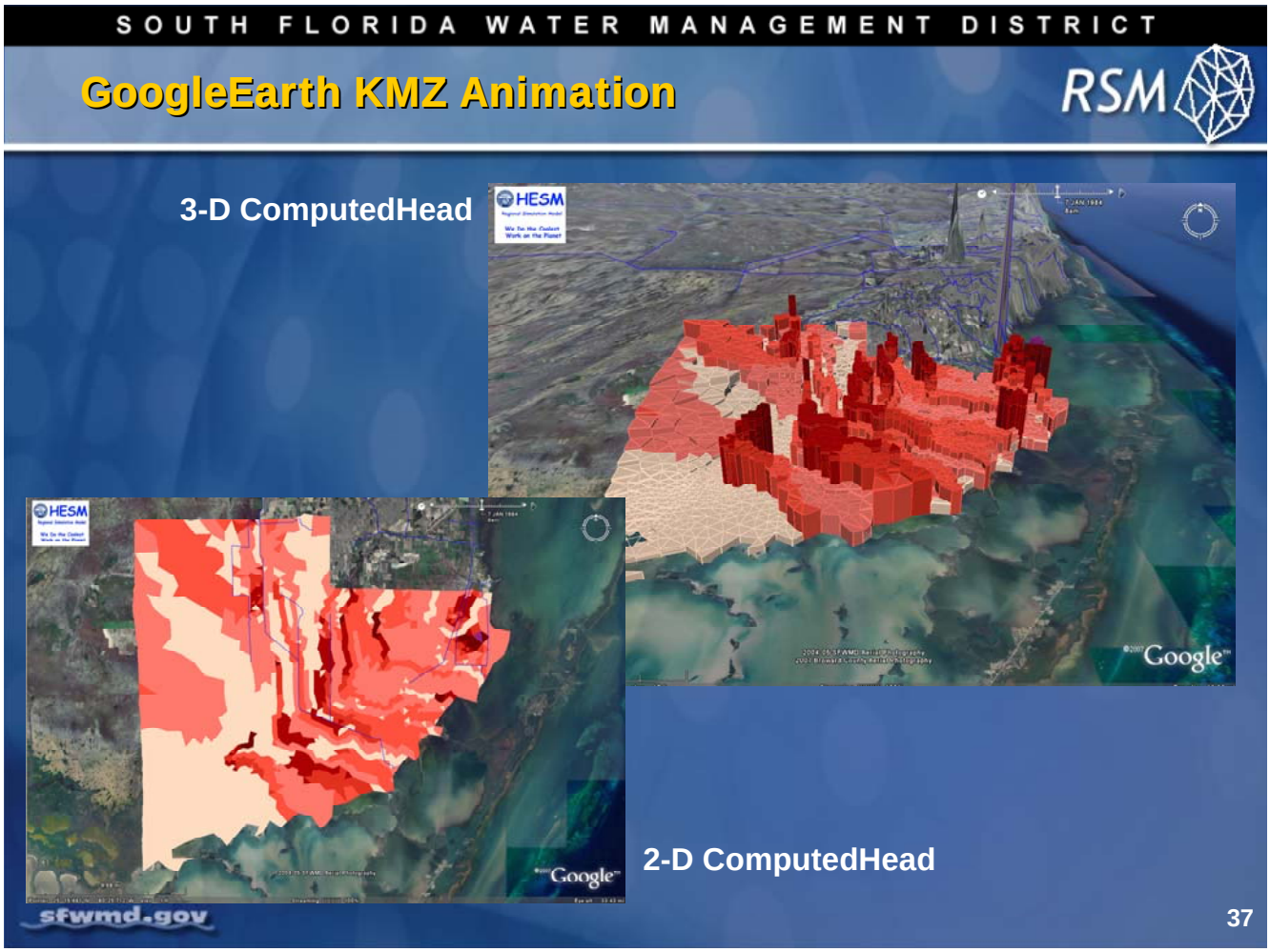
NOTE: To simplify usage of this tool, it is being redesigned to require only the netCDF file.



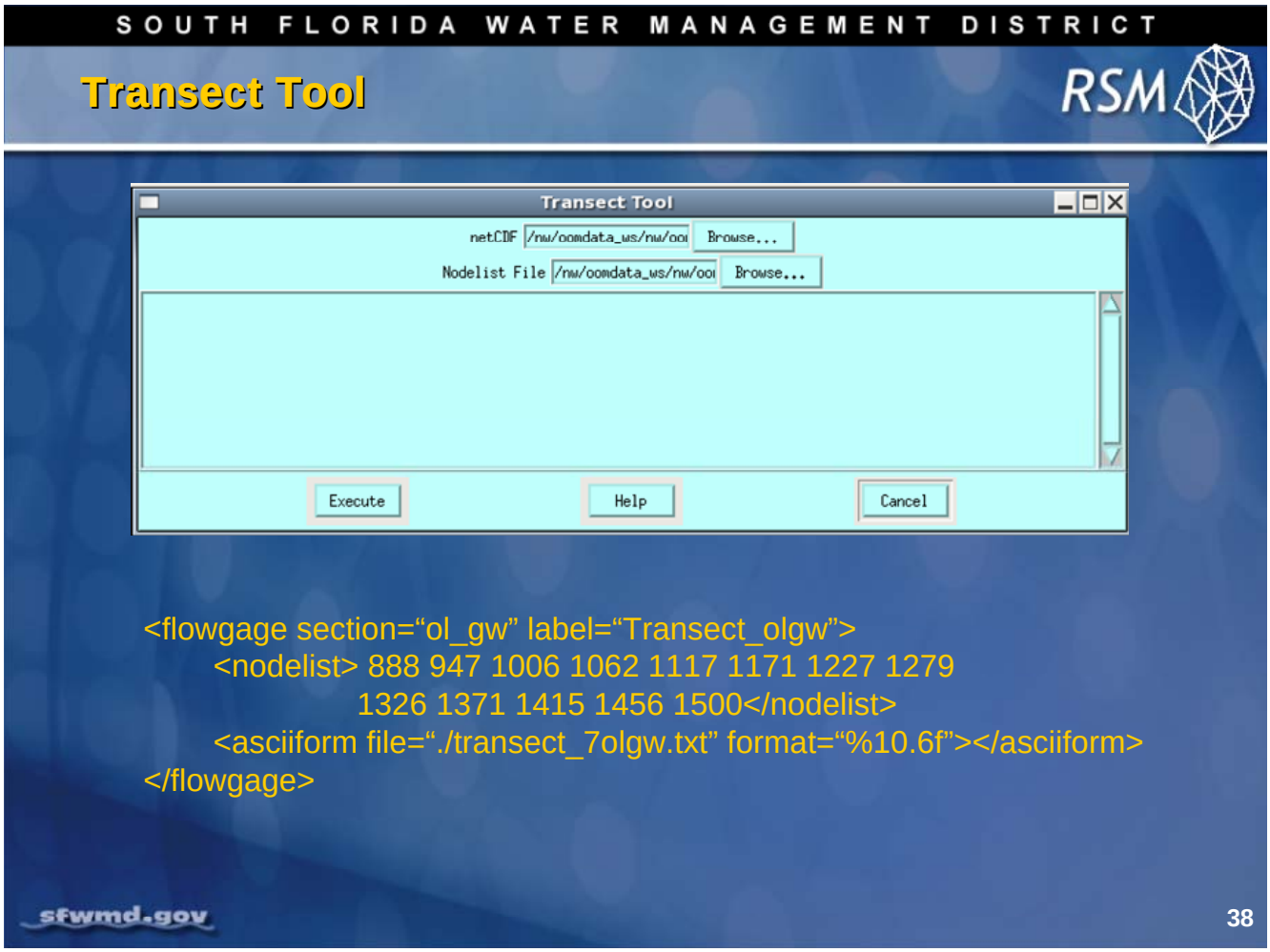
Google KMZ Animation (continued from previous slide):

The second menu offers options for creating the Google KMZ file, including:

- Start/end date
- Timestep incremented by number of days, or day of the month
- Option to include animation of flow vectors, type of vector and control of the density for the square grid which is overlaid on the triangular mesh to generate corresponding flow vectors
- The mesh color-flood can be displayed in 2D or 3D
- Three color-range choices offer different colors and customizable ranges for assigning the colors
- User specified output location
- Choice of the variable to be animated. PondDepth is acquired if Ponding is output from the model otherwise PondingDepth can be calculated if ComputedHead and Topo are output from the model.



The KMZ output file is viewed using GoogleEarth. This slide shows examples of 2D and 3D output from the **Google KMZ Animation** tool showing ComputedHead.



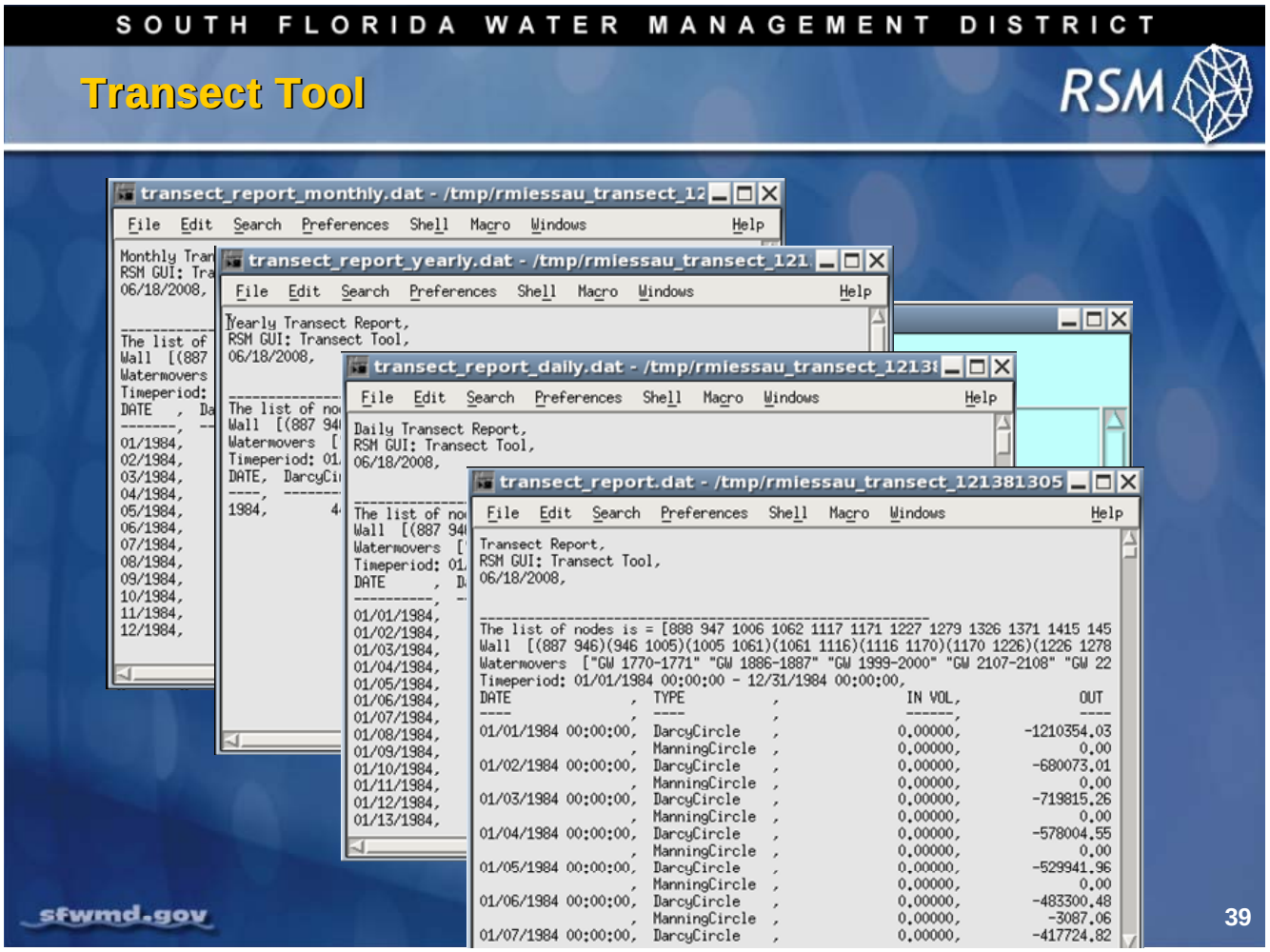
The **Transect** tool calculates flow across any transect in the model.

As input, the tool requires a netCDF file (wbbudgetpackage or budgetpackage composite) and a list of nodes. The list of nodes is a list of mesh nodes used to describe a transect. This same output can be generated from the RSM if this code is specified in the <output> block.

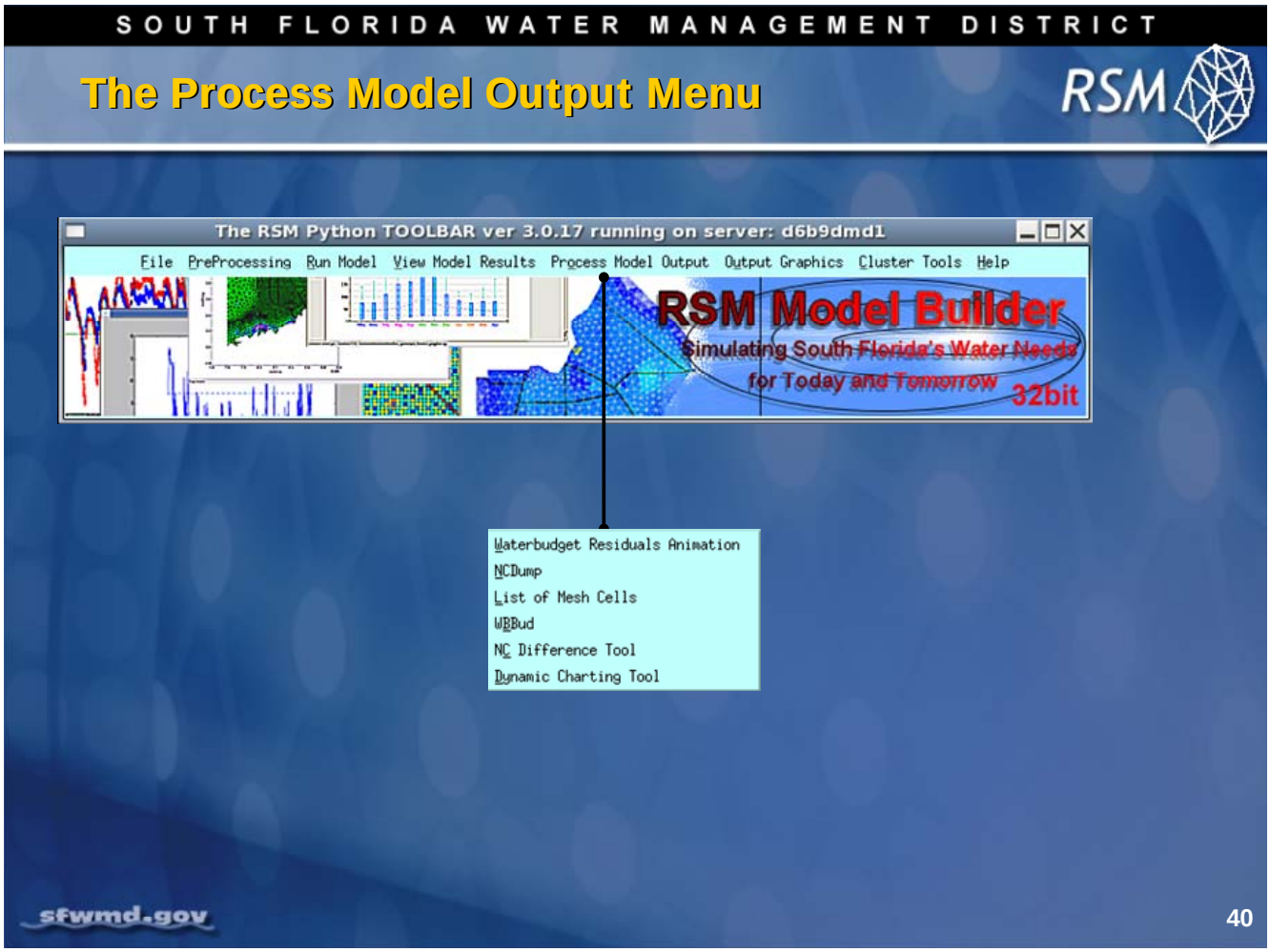
Transect tool sample files are:

- $RSM/labs/lab8_RSMtoolbar/wbbudgetpackage_C111_SR5_sss.nc
- $RSM/labs/lab8_RSMtoolbar/transect/transect7.txt

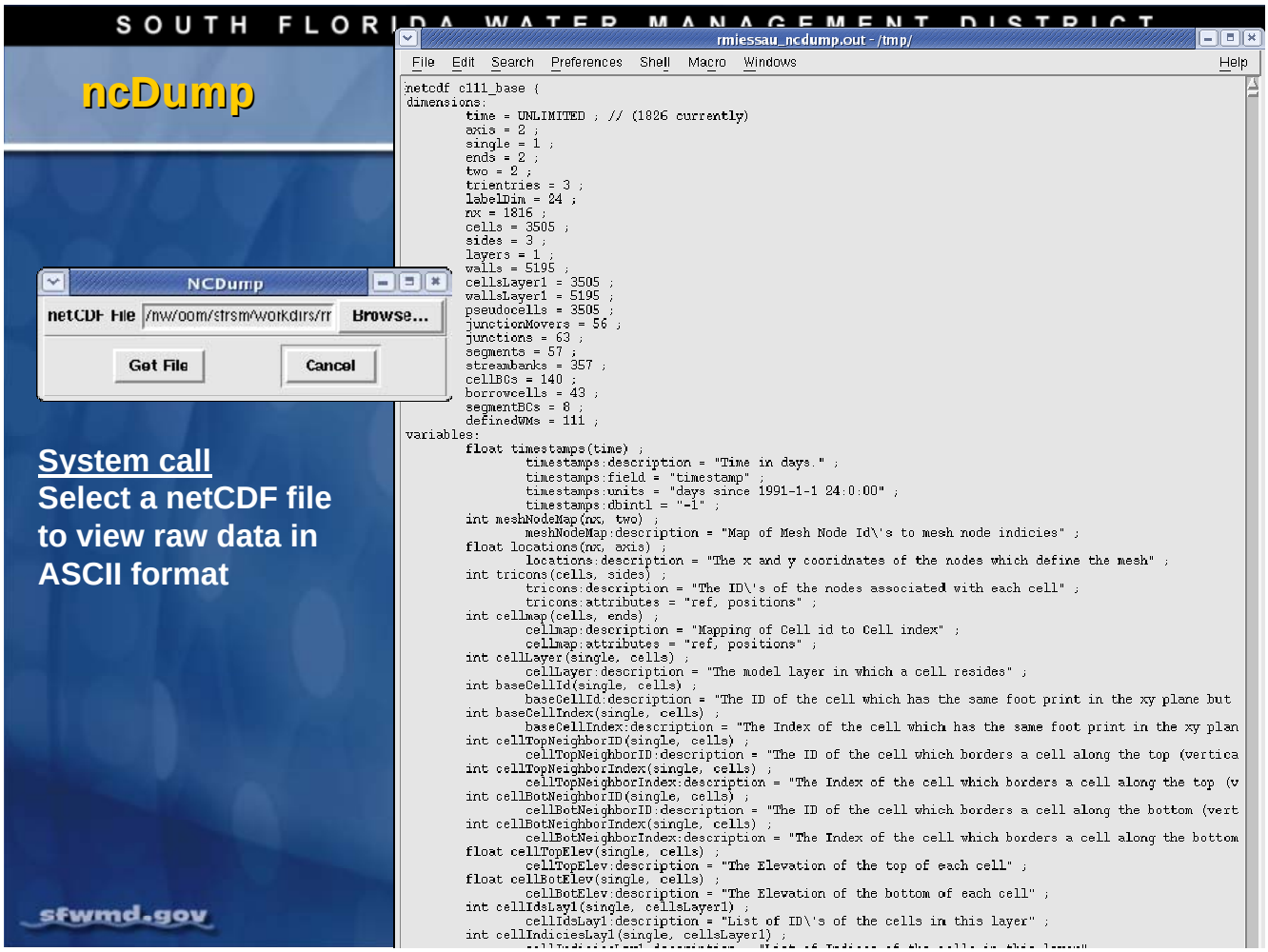
Transect 7 consists of the nodes: 888 947 1006 1062 1117 1171 1227 1279 1326 1371 1415 1456 1500



Output from the **Transect** tool.



The **Process Model Output** Menu contains tools to process the model and view the data in the model output.



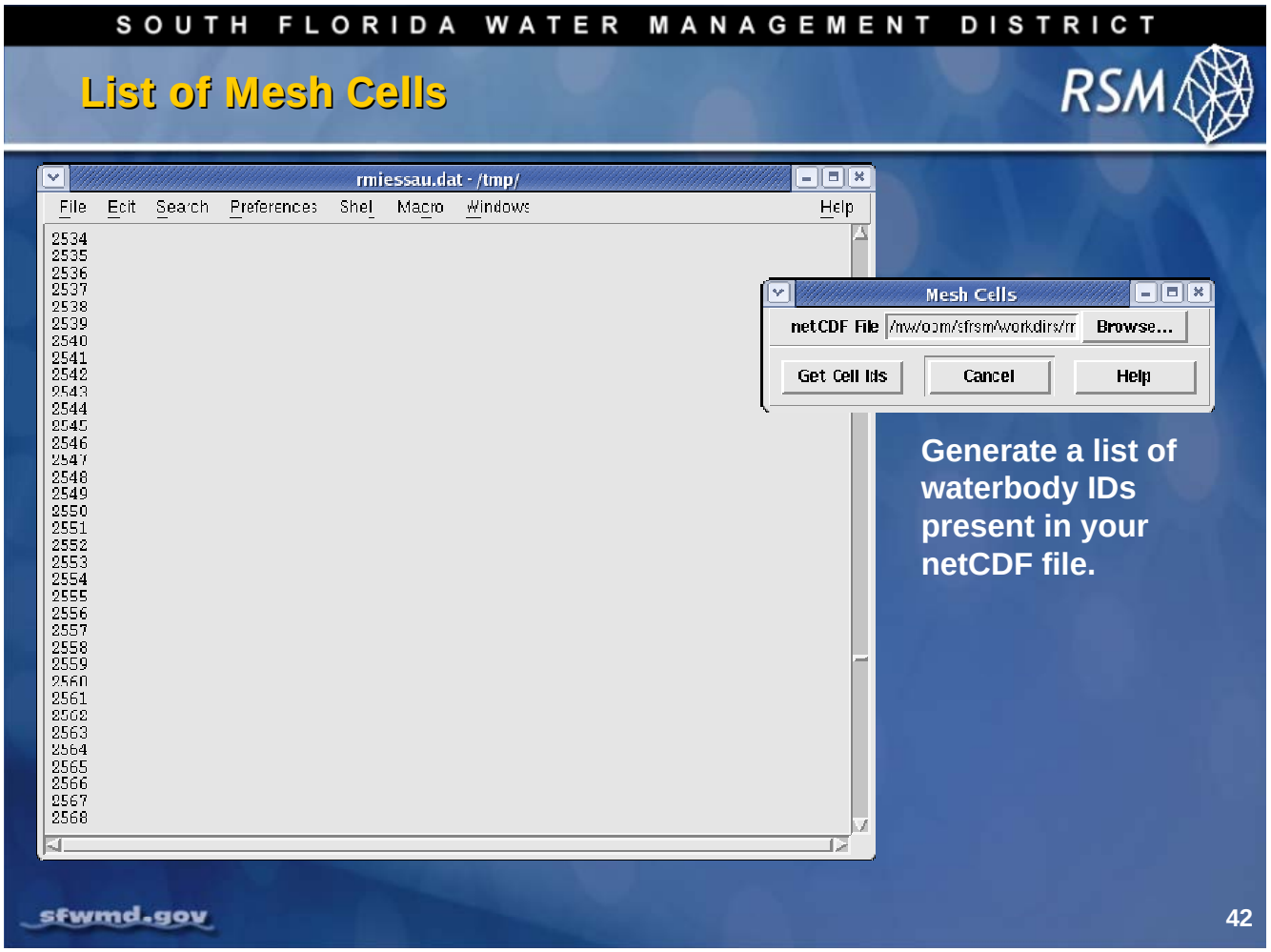
ncDump is a system call that generates an ASCII file from a netCDF. This functionality was added to the RSM GUI to help users running the toolbar via Windows emulating Linux.

ncDump is a quick and easy way to review the content of the model output. The ASCII file opens in a text editor which offers the ability to view, search and save the ASCII file. All output begins with a display of the netCDF file header.

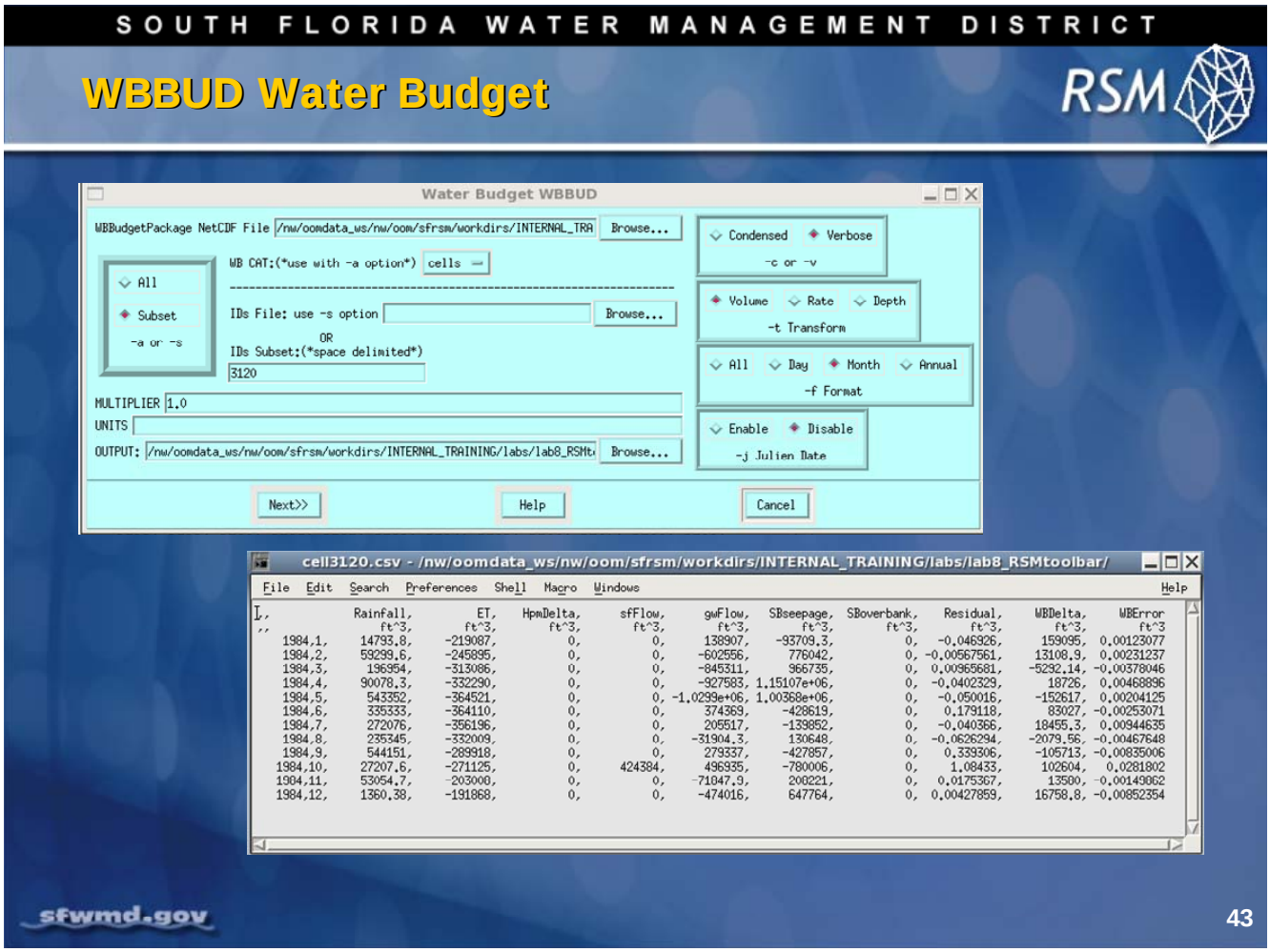
This slide shows example output from ncDump with the header for a typical netCDF file

To view the header and ComputedHead data array, from the $RSM/labs/lab8_RSMToolbar directory type:

- Ncdump wbbudgetpackage_C111_SR5_sss.nc –v ComputedHead | more



The **Cell List** tool is a quick and simple way to generate a list of waterbodies (cells) in the model output. It reads a netCDF and generates a single column ASCII list which can be viewed or saved. This tool was created to help verify the model output matches with other files being used to generate graphics via the GUI.

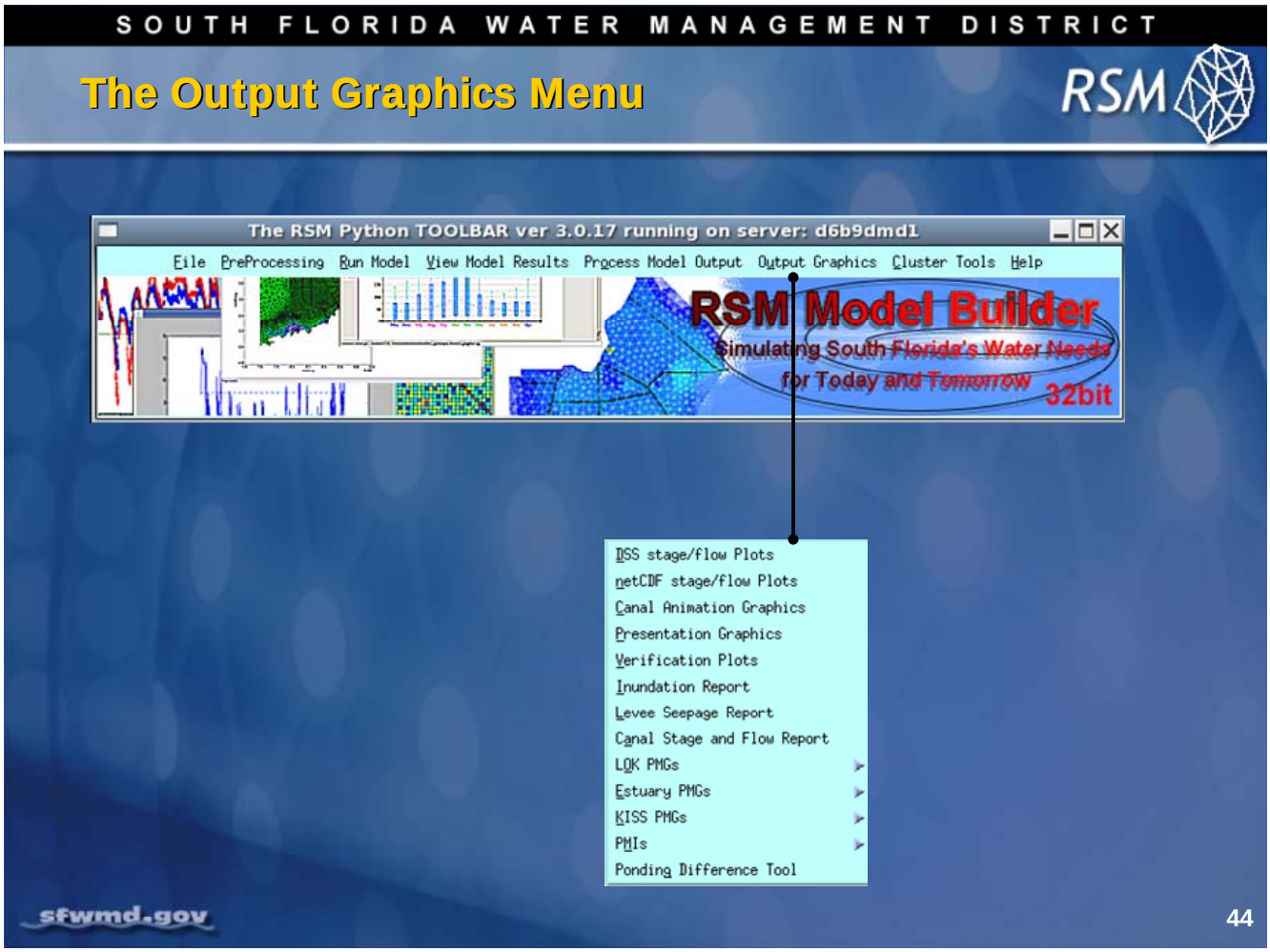


WBBUD is a GUI interface to the WBBUD utility included with the RSM model code. It offers a variety of choices for configuring a wbbud water budget report. The tool requires a wbbudgetpackage netCDF file. Users can specify:

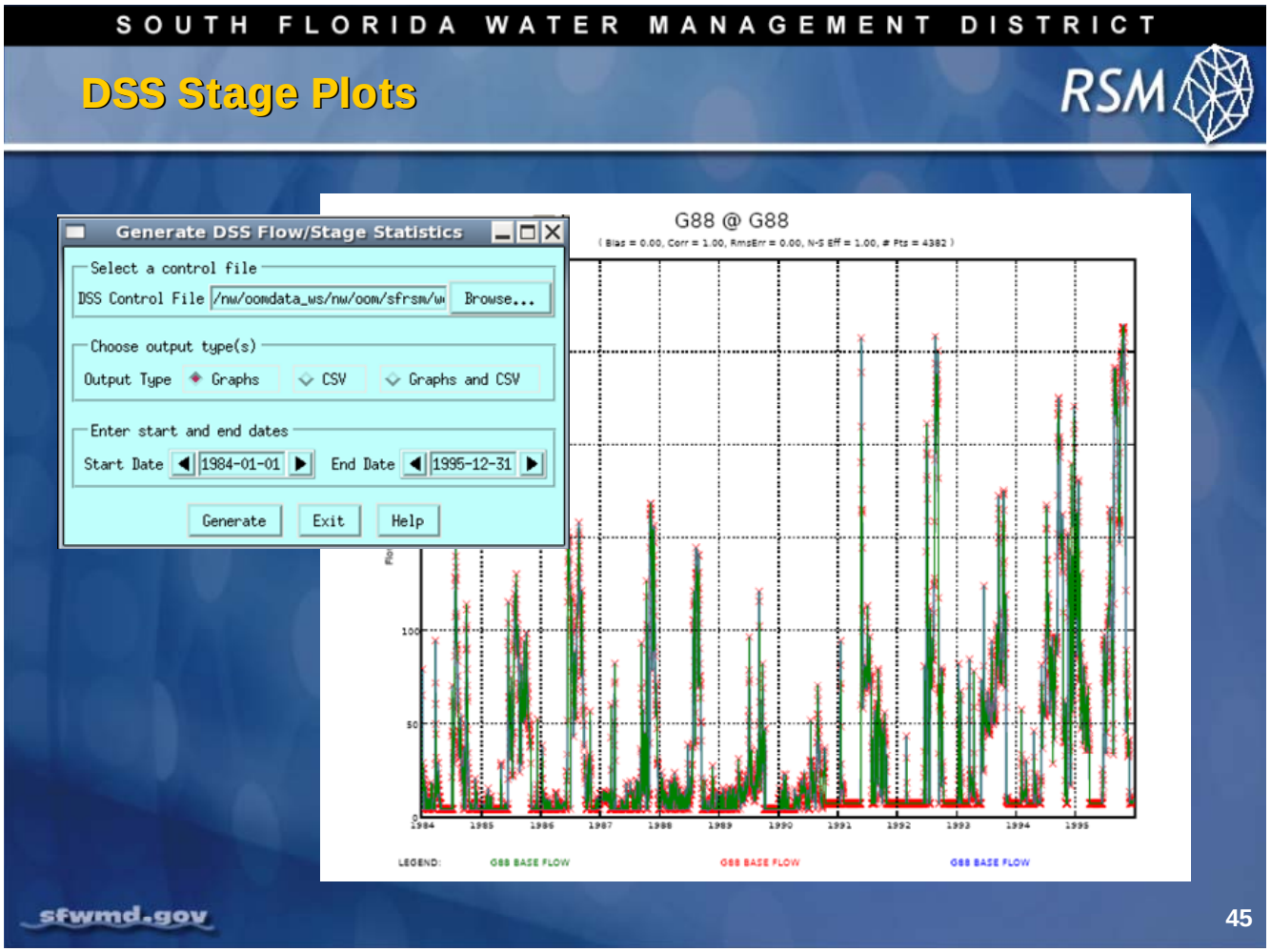
- All waterbodies of a particular type
- A subset of waterbodies from a list of waterbody IDs or a file containing a list of IDs
- A multiplier (e.g., 12 to convert from feet to inches)
- A user-specified label for units when using the multiplier option
- Condensed or verbose output for level of detail
- Volume, rate, depth
- Raw, daily, monthly or annual time step for summarizing the report
- Julian date conversion

The fields included in the output depend on the waterbodies used to generate the report. Residual is calculated by the model. WBDelta is the change in volume for the waterbodies represented in the report. WBError is calculated by adding all volumes and subtracting the sum from the Residual value.

To run this tool, use this file: $RSM/labs/lab8_RSMtoolbar/wbbudgetpackage_C111_SR5_sss.nc



The **Output Graphics** Menu offers tools to present your data in graphical format.



The **DSS Stage/Flow Plot** tool provides an easy means to generate DSS comparison plots and calculate bias statistics.

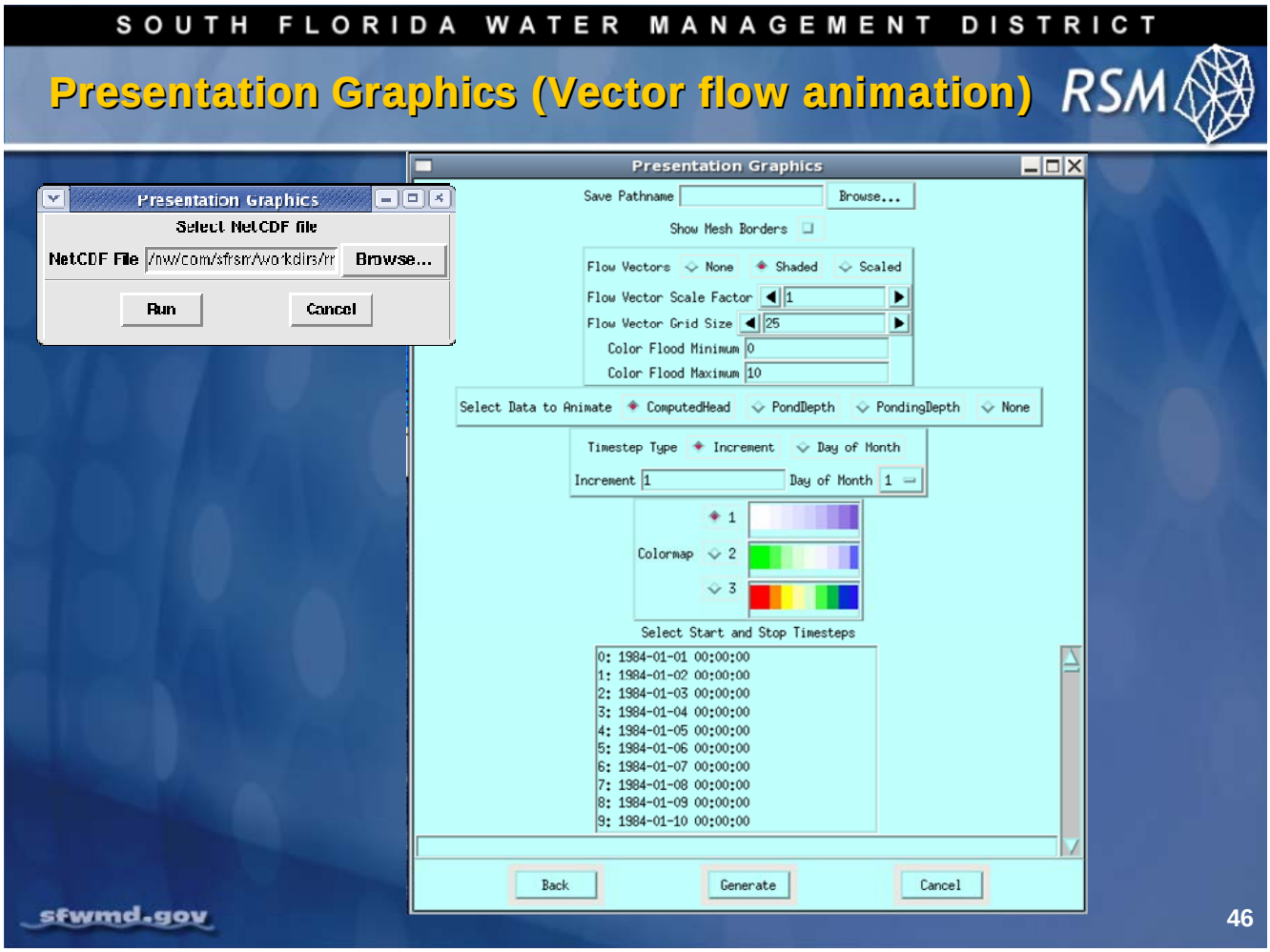
This tool requires a Control file as input. The control file contains references to DSS file locations and DSS data paths to assemble the graph. The control file is expected to provide the RSM simulated output, historical and 2x2 datasets, in that order.

The tool also offers options to produce graphs, CSV data files or both. Users can limit the data range based on the range of data in the DSS files.

The graph label shows the gages to appear on each plot and offers a summary statistics page. The DSS files are expected to contain RSM Calculated, Historical Observations and South Florida Water Management Model (SFWMM) data. One DSS can contain all three datasets or individual files can be specified for each dataset. The resulting output from this tool is an indexed PDF file containing each plot, bias statistics and a summary statistics page at the end of the report.

The sample file for running the **DSS Stage/Flow Plot** tool is:

- $RSM/labs/lab8_RSMtoolbar/dss_plots/sample.ctl

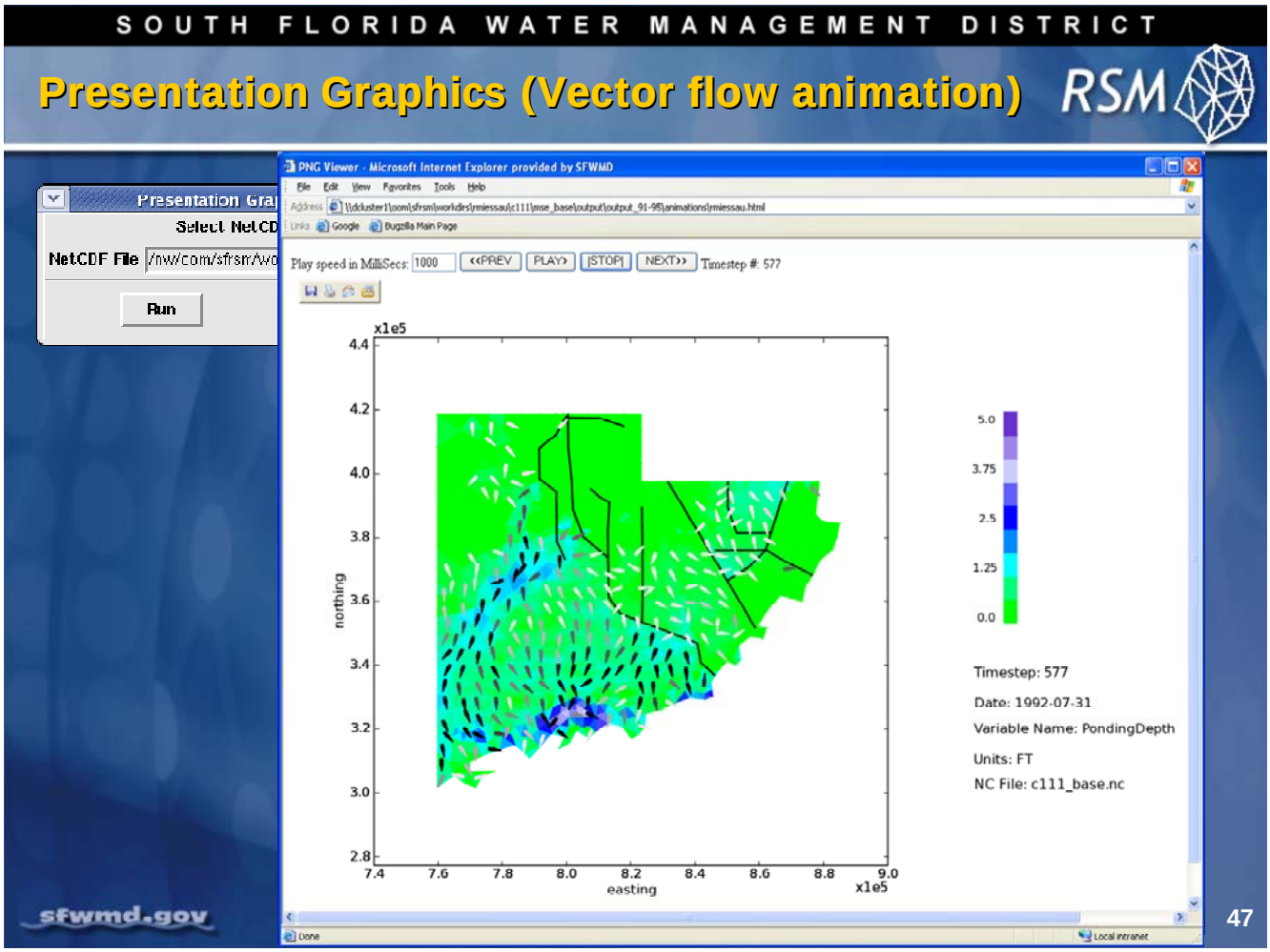


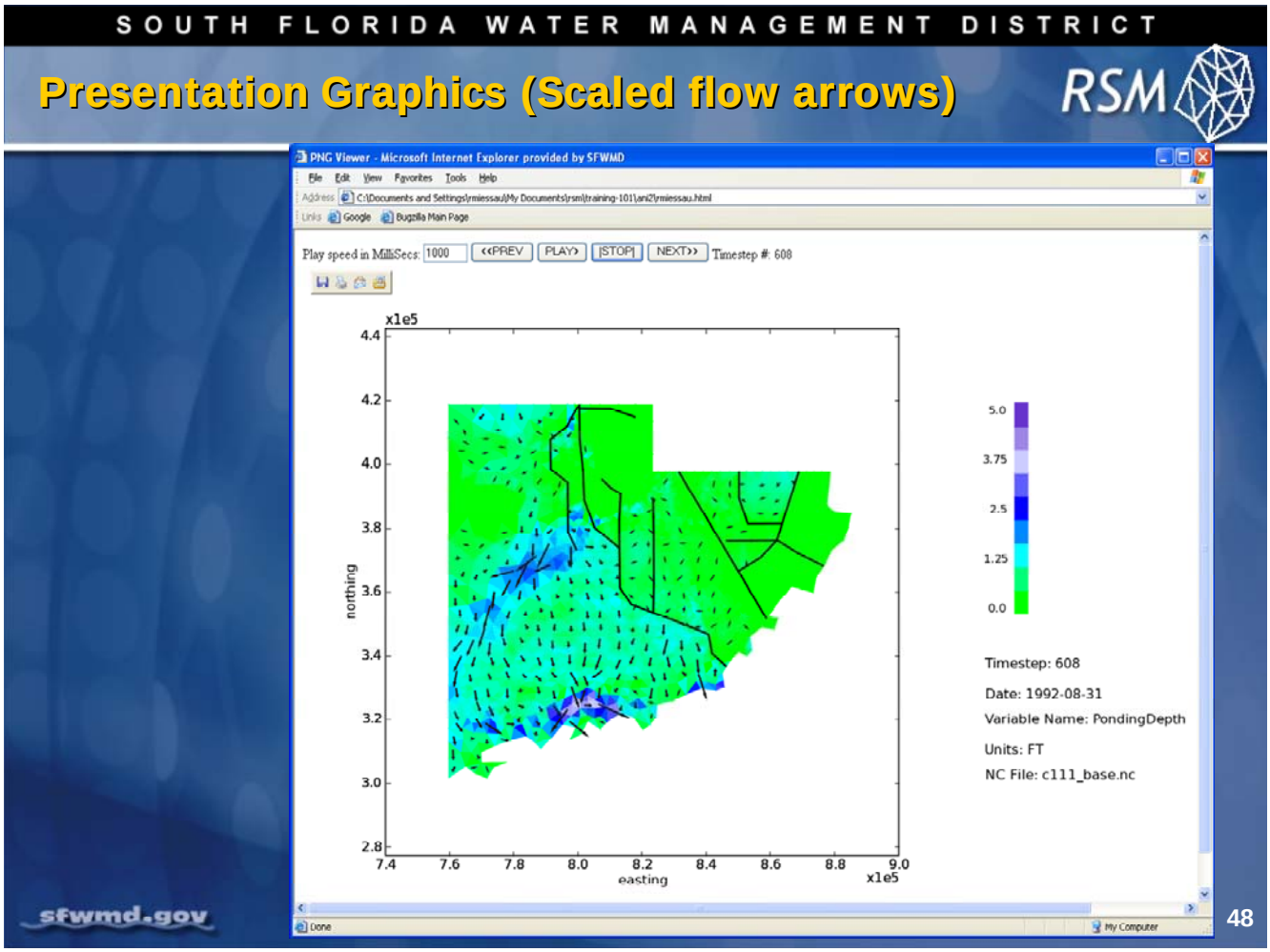
The **Presentation Graphics** tool offers a capability to generate animated time series graphics showing ponding depth or stage along with flow vector arrows. A variety of options offers ways to customize the animations based on the mode being presented.

- The flow vectors are generated based on a square grid overlay of a user-specified size
- The scale of the flow vector arrows can be specified
- Colorized arrows or scaled arrows can be selected to represent the magnitude of the flow.
- The range of the data being animated can be specified to help control the range of color used for the animations.
- The timestep can be specified to select a subset of the data in the netCDF mode (e.g., 10thday, month end, etc.)
- Output can be saved to a directory or generated in the /tamp directory and discarded after viewing
- The animation files include an HTML to play each image generated in the output from the tool

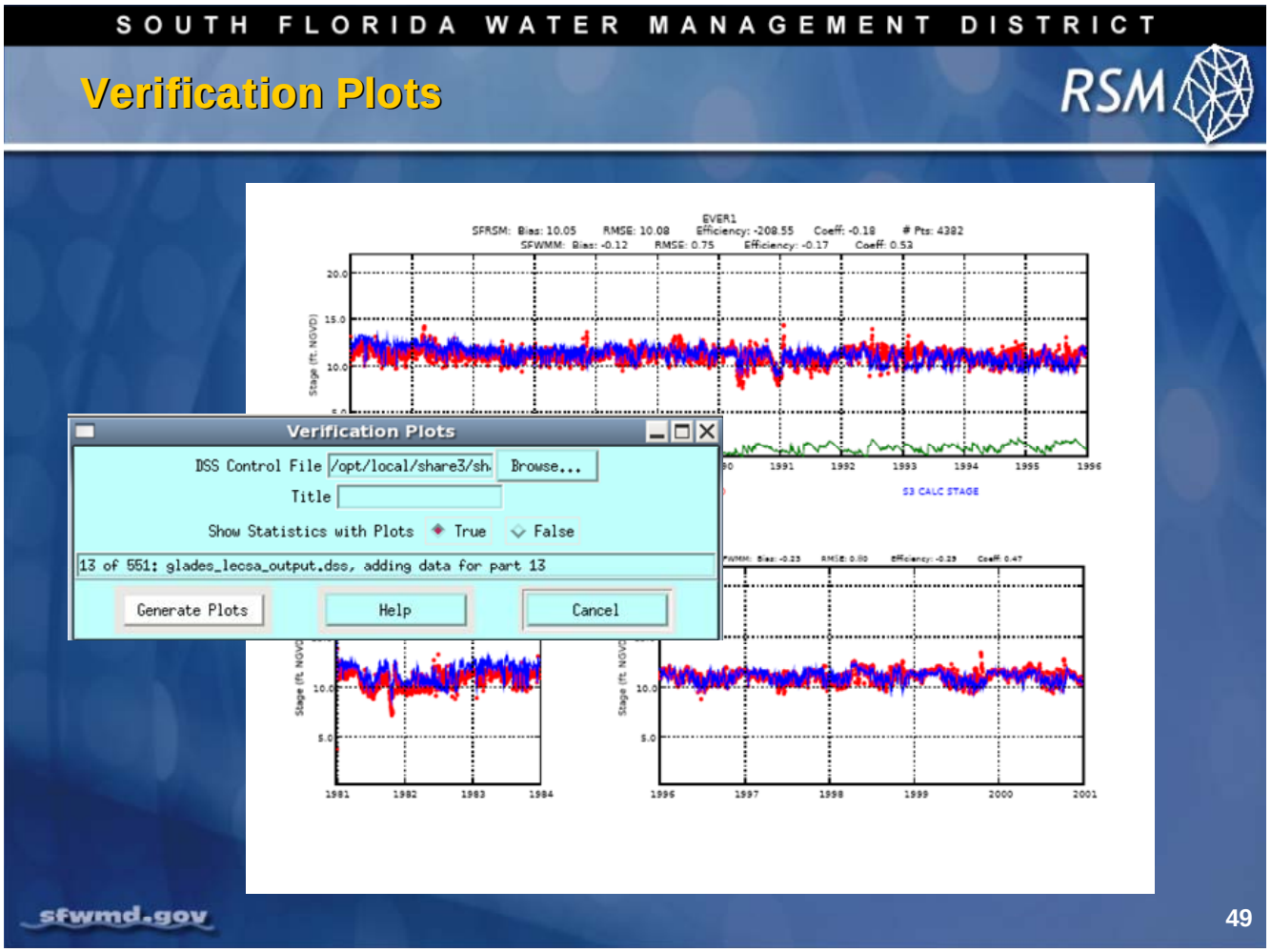
The sample file for running the **Presentation Graphics** tool is:

- $RSM/labs/lab8/c111_base.nc


SOUTH FLORIDA WATER MANAGEMENT DISTRICT
Presentation Graphics (Vector flow animation)
RSM
Presentation Gra
Select NetCD
NetCDF File
Run
PNG Viewer - Microsoft Internet Explorer provided by SFWMD
Play speed in MilliSecs: 1000
<<PREV
PLAY>
|STOP|
NEXT>>
Timestep #: 577
x1e5
northing
easting
Timestep: 577
Date: 1992-07-31
Variable Name: PondingDepth
Units: FT
NC File: c111_base.nc
sfwmd.gov
47



Sample **Presentation Graphics** tool output with scaled arrows.

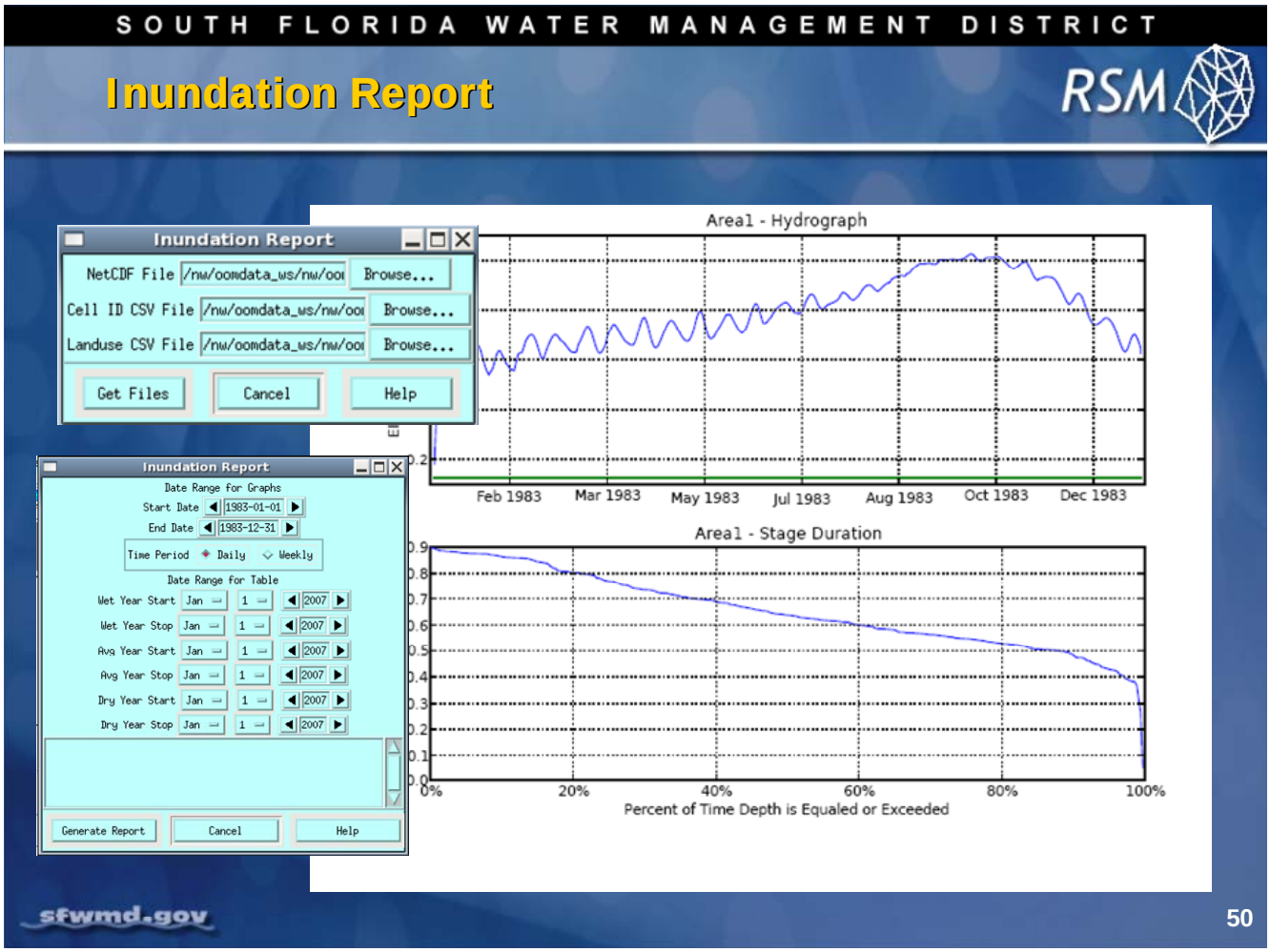


The **Verification Plots** tool generates stage hydrographs showing a calibration and split-validation time period. Statistics accompany each plot comparing the RSM simulations, South Florida Water Management Model (SFWMM) computed, and historical stages.

For input, this tool uses a Control file. The control file contains references to the location of DSS files and DSS data paths for generating each plot.

A sample file to run the **Verification Plots** tool is:

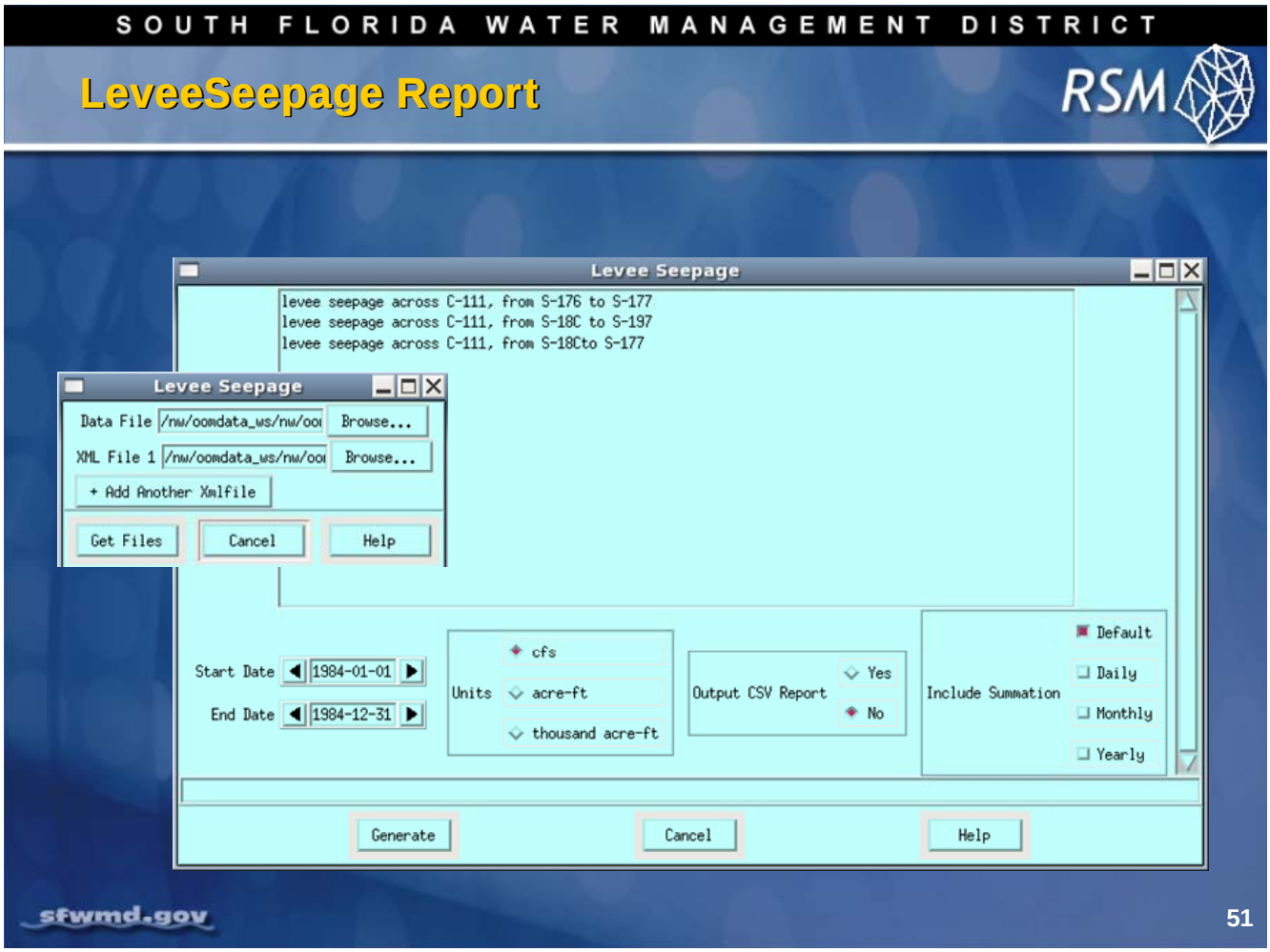
- $RSM/labs/lab8_RSMtoolbar/verification/sample.ctl



The **Inundation Report** tool generates a cell stage hydrograph and stage duration curve showing the percentage of time the depth exceeds the ground elevation in the cell. An added feature has been implemented giving RSM modelers the ability to customize for the RSM average wet/dry season reporting.

The sample files to run the **Inundation Report** tool are:

- $RSM/labs/lab8_RSMtoolbarl/c111_base.nc
- $RSM/labs/lab8_RSMtoolbar/inundation/obs_cells.csv
- $RSM/labs/lab8_RSMtoolbar/inundation/landuse.csv



The **Levee Seepage Report** tool produces a CSV report and a hydrograph showing the seepage across levees in the model. This tool requires a wbbudgetpackage netCDF file and the levee seepage XML file used to run the model.

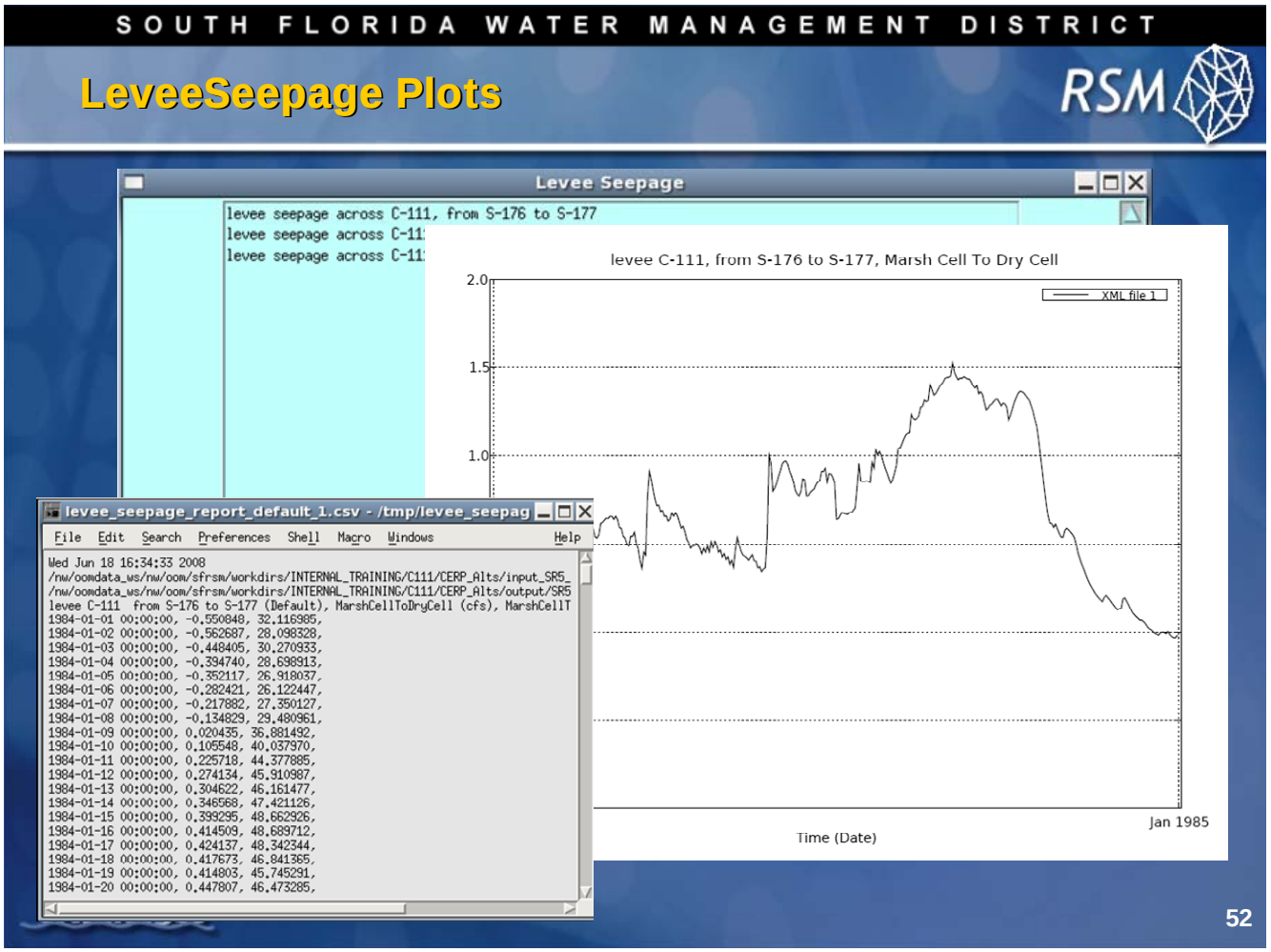
The main menu offers choices for the levees which are present in the XML. After selecting one or more levees to report on, options allow the user to configure the report/graphic.

Options include:

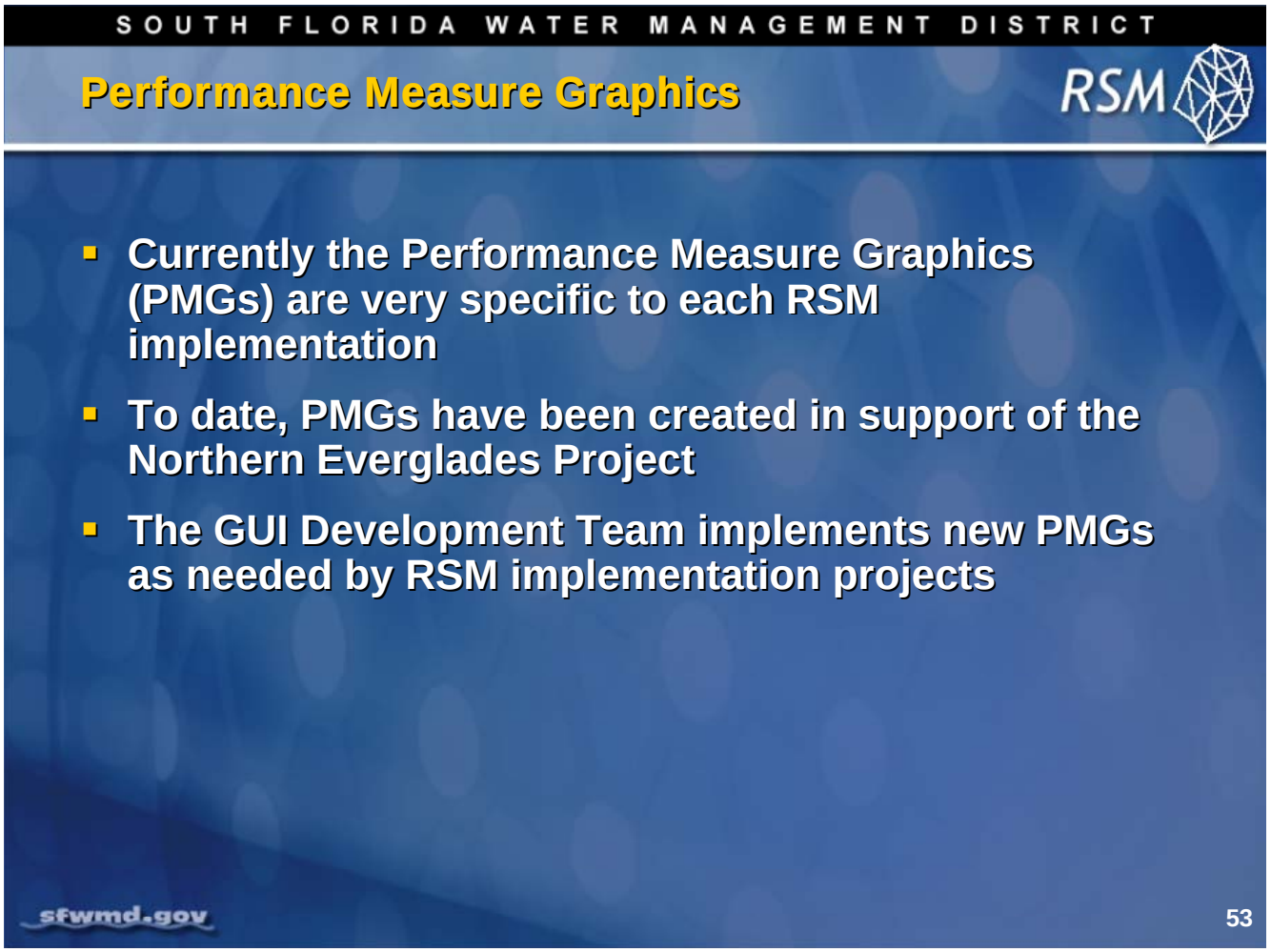
- Specifying start/end dates
- Specifying units (cuffs, acre-feet or acre-feet*1000)
- Inclusion of a CSV output file containing the values in addition to the default hydrograph
- Output by default timestamp of a daily, monthly or annual summation

Files to run the **Levee Seepage Report** tool are found at:

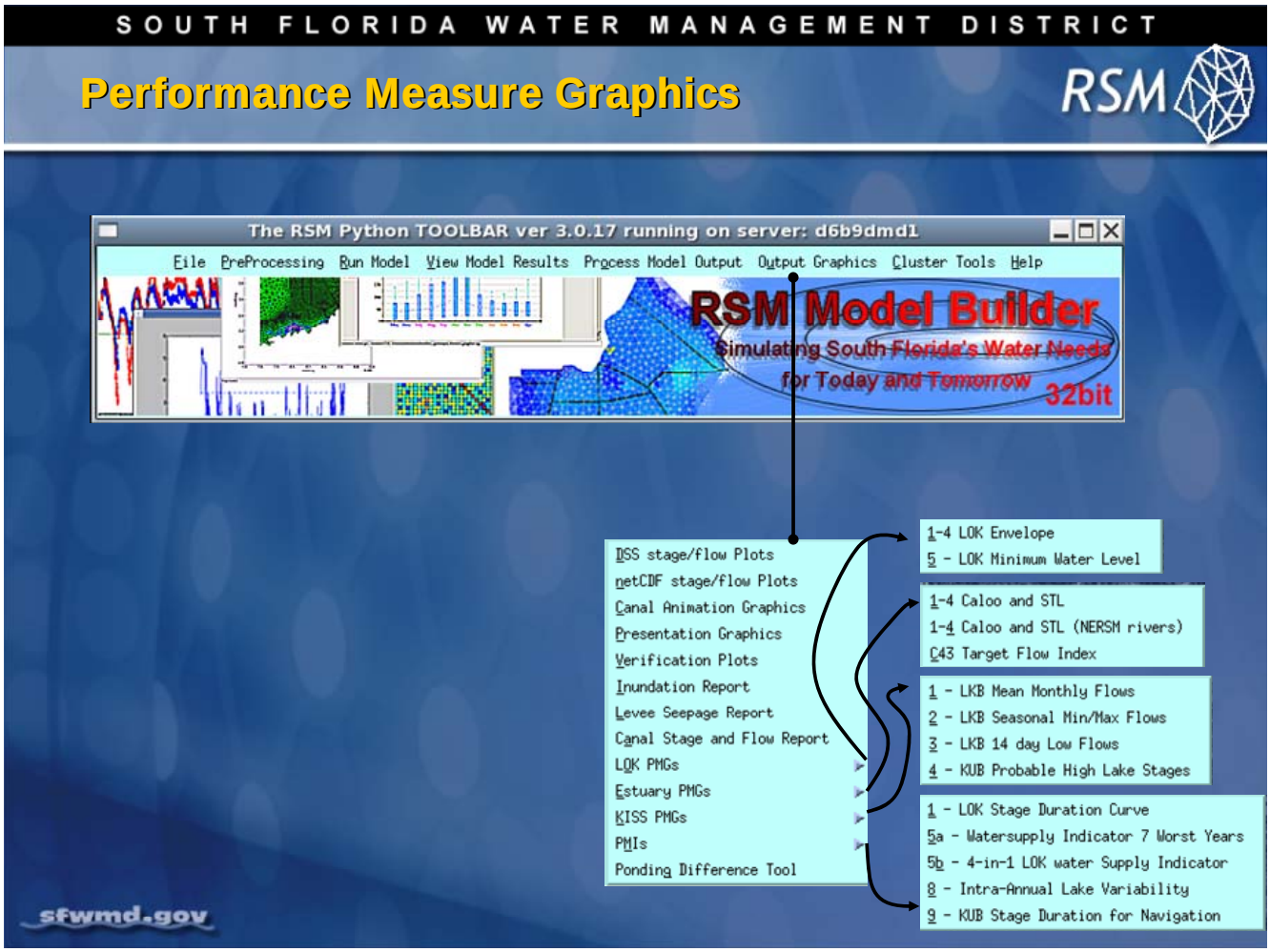
- $RSM/labs/lab8_RSMtoolbar/wbbudgetpackage_C111_SR5_sss.nc
- $RSM/data/C111/input_SR5_ss/PIR1_Alt2Db_levee-seepage.xml



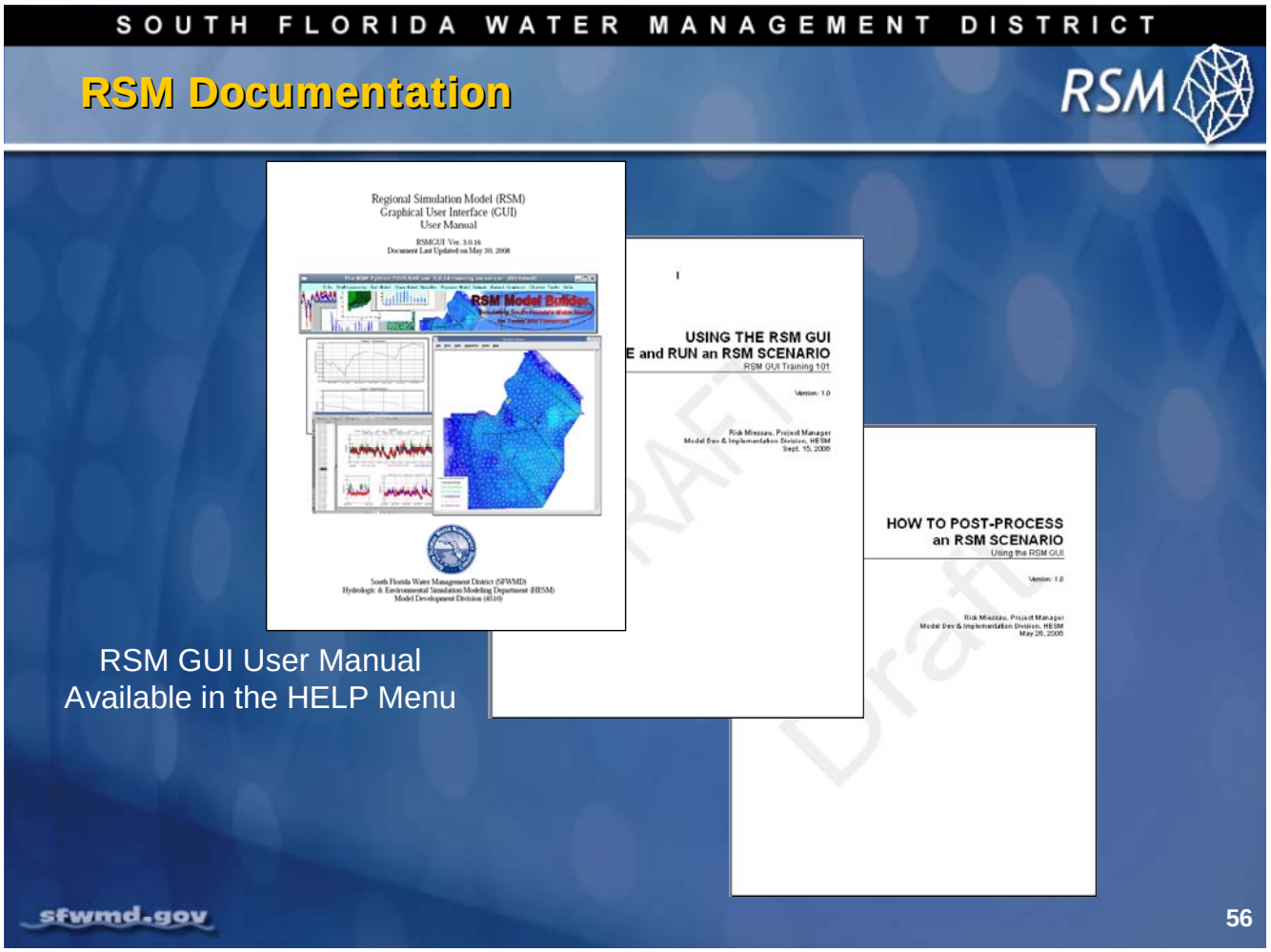
Output from the **Levee Seepage Report** tool.



Subtypes are used for canals and structures. They are useful for Zymology, creating maps showing the unique components of the model. Subtypes maintain certain rules for network connectivity and they provide a basic framework for editing and data validation.


SOUTH FLORIDA WATER MANAGEMENT DISTRICT
Performance Measure Graphics
RSM
The RSM Python TOOLBAR ver 3.0.17 running on server: d6b9dmd1
File PreProcessing Run Model View Model Results Process Model Output Output Graphics Cluster Tools Help
RSM Model Builder
Simulating South Florida's Water Needs
for Today and Tomorrow
32bit
DSS stage/flow Plots
netCDF stage/flow Plots
Canal Animation Graphics
Presentation Graphics
Verification Plots
Inundation Report
Levee Seepage Report
Canal Stage and Flow Report
LOK PMGs
Estuary PMGs
KISS PMGs
PMIs
Ponding Difference Tool
1-4 LOK Envelope
5 - LOK Minimum Water Level
1-4 Caloo and STL
1-4 Caloo and STL (NERSM rivers)
C43 Target Flow Index
1 - LKB Mean Monthly Flows
2 - LKB Seasonal Min/Max Flows
3 - LKB 14 day Low Flows
4 - KUB Probable High Lake Stages
1 - LOK Stage Duration Curve
5a - Watersupply Indicator 7 Worst Years
5b - 4-in-1 LOK water Supply Indicator
8 - Intra-Annual Lake Variability
9 - KUB Stage Duration for Navigation
sfwmd.gov

Cluster tools offer ways to monitor activity on the D Cluster and the computer you are using to run the RSM GUI.



Documentation is available via the **Help** button on the RSM GIS Toolbar and the RSM GUI. The **Help** Menu offers a variety of help options, manuals and a link to request additional help.

KNOWLEDGE ASSESSMENT

(pre- and post-lecture quiz to assess efficacy of training materials)

1. What is the purpose of the RSMGUI?
2. How is the RSMGUI implemented?
3. What is the scenario builder?
4. What is the advantage of using the Run Model Tool?
5. What data are used by the Results Viewer utilities?
6. What data are displayed by the Results Viewer?
7. How does the RSMGUI produce animations?
8. What is in the netCDF file and how can it be viewed?
9. Where do you find the tool to create a water budget?
10. How are flow vector animations created?
11. What are Inundation plots?
12. What Performance Measure graphics are available?

Answers

1. The RSMGUI toolbar provides a means to access the various tools for processing water budgets, creating presentation graphics and Performance Measure graphics.

2. The RSMGUI is implemented at the Linux operating system prompt.

3. The scenario builder is a group of utilities that can be used to build the necessary XML files for creating an RSM implementation.

4. The Run Model Tool documents the model run and captures the statistics of the model run in a model log file.

5. The Results Viewer use a NetCDF file to plot cell and segment heads based on the model geometry.

6. The Results Viewer can be used to visualize hydrographs, hydrograph comparisons, spatial maps, segment profiles, animations, and PEST calibration results.

7. Animations are produced using the Google Earth KMZ animation tool.

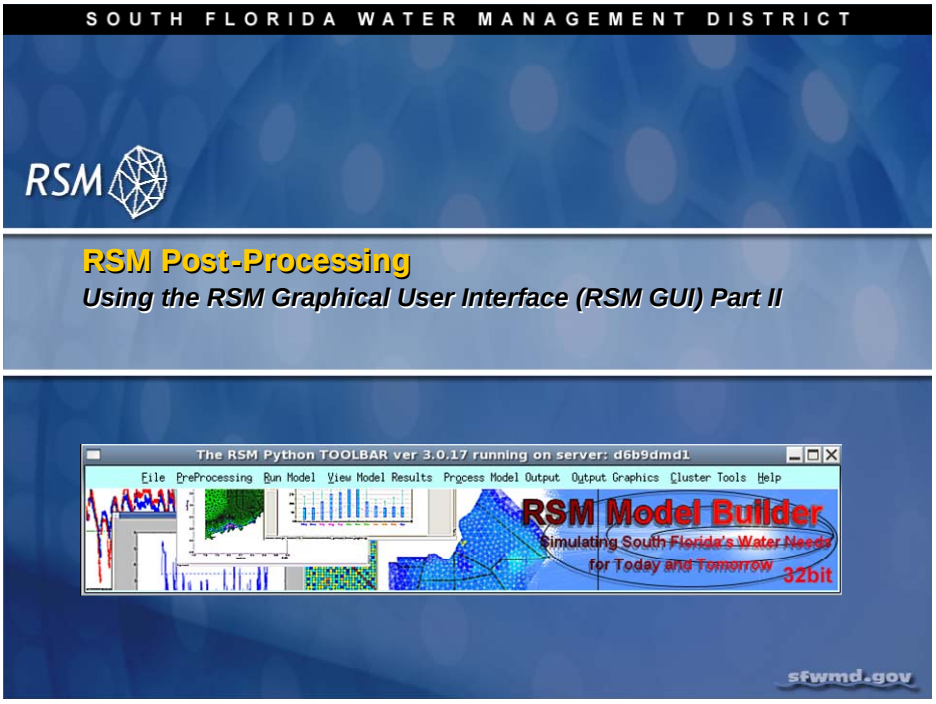
8. The netCDF file is a binary file that contains a series of tables that contain the attributes and selected data for each waterbody. A netCDF file can be viewed using the *ncdump* utility. Viewing the netCDF file is often useful for trouble-shooting problems with model output.

9. The water budget tool *Process Model Output → wbbud.*

10. Vector flow animation plots are created using the *Output Graphics → Presentation Graphics* tool.

11. The inundations plots are the cell hydrograph with the stage duration plot.

12. There are several Performance Measure graphs available for selected RSM implementations as defined by the specific project plan.



Lab 8: Analyze RSM Output

Time Estimate: 2.5 hours

Training Objective: **Demonstrate post-processing features in the RSM Graphical User Interface (RSM GUI) and familiarize users with the different types of output from the Regional Simulation Model.**

Lab 8 reviews Output Monitors and Waterbudget Packages, Global Monitors and Animation Graphics, Flowgages, RSM Plots and Statistics, as well as some additional output. This lab provides the opportunity to create a water budget, global monitors and flow vector animation, and use flowgages to view groundwater flows. Plot calibration statistics, spatial data maps and the Inundation Tool are also examined.

NOTE:

For ease of navigation, you may wish to set an environment variable to the directory where you install the RSM code using the syntax

```
setenv RSM <path>
```

For SFWMD modelers, the path you should use for the NAS is:

```
/nw/oomdata_ws/nw/oom/sfrsm/workdirs/<username>/trunk
```

```
setenv RSM /nw/oomdata_ws/nw/oom/sfrsm/workdirs/<username>/trunk
```

Once you have set the RSM environment variable to your trunk path, you can use $RSM in any path statement, such as:

```
cd $RSM/benchmarks
```

```
INTERNAL_TRAINING
|
|____data
|        |__geographic
|        |__C111
|        |__rain+et
|        |__glades_lecsa
|        |__losa_eaa
|        |__BBCW
|
|____trunk
|        |___benchmarks
|        |___hpmbud
|
|____labs
```

Files for this lab are located in the **`$RSM/labs/lab8_RSMToolbar`** directory.

Activity 8.1: Output Monitors and Waterbudget Packages

Overview

Activity 8.1 This activity includes two exercises:

- **Exercise 8.1.1** Becoming familiar with monitors
- **Exercise 8.1.2** Creating a water budget

The typical output from the RSM is in the form of monitors that report the time series state values of the waterbodies and the flows in the watermovers and water budgets that report the water balance for groups of waterbodies.

Exercise 8.1.1 Becoming familiar with monitors

The outputs from the model are generated from the <output> block of the main XML file. The typical output elements and attributes are provided in **Table 8.1.** The details are found in the **HSE User Manual, Chapter 7**.

The time series data can be output in one of four formats: ASCII_formatted, DSS, netCDF or CSV. The most common form is DSS because of the availability of DSSVue which includes a graphical user interface (GUI) and data processing utilities. The netCDF format is used for several applications in the RSM GUI.

Table 8.1 Commonly used output elements and attributes for the Regional Simulation Model-Hydrologic Simulation Engine (RSM-HSE)

Elements	Attributes
globalmonitor	totalvector, topo, head, segmenthead, olvector,
cellmonitor	head
hpmmonitor	hpm_rain, refET, ps_et, etvol
segmentmonitor	head, levdrytosegflow,levmarshtosegflow
lakemonitor	Head
impoundmentmonitor	head, rain, refET,seepageflow
wcdmonitor	Head
wcumonitor	levdrytosegflow, seepageflow, levmarshtodegflow, overbankflow, sbflow
basinmonitor	head
junctionmonitor	flow
wmmonitor	flow
bcmonitor	flow
flowgage	flow across a transect formed by an ordered set of nodes
	Water budget outputs
budget	ASCII providing all inflow/outflows for all waterbodies
wbbudgetpackage	netCDF for post-processing water budgets

3. Run **`benchmark $RSM/labs/lab8_RSMtoolbar/BM33`** using the RSM GUI. Look at the results for the hpmmonitor:

   - What are the three attributes output from each Hydrologic Process Module (HPM)?
   - What are the differences in irrigation volume for the different HPMs?
   - What are the differences in runoff volume for the different HPMs?
   - Create head monitors for a cell with unsat HPM and citrus-microjet HPM:

```
<cellmonitor id="1" attr="head">
   <dss file="recharge.dss"
   pn="/c1/citrus_micro/head//1day/micro irr1/"></dss>
</cellmonitor>
```

   - Compare the resulting cell heads using **HEC-DSSVue** from the RSM GUI.

Exercise 8.1.2 Creating a water budget

There is a command line post-processing utility for calculating water budgets called WBBud. The WBBud utility is used to calculate water budgets for the waterbodies (cells, segments, lakes, basins, wcds, impoundments or any group of waterbodies).

4. Open the $RSM**`/labs/lab8_RSMToolbar/BM33/run3x3.xml`** file. Add the following statements to the <output> block:

```
<output>
      <wbbudgetpackage file=”wbbudget.nc” />
</output>
```

5. Create a waterbudget using the WBBud utility (see **Fig. 8.1**).

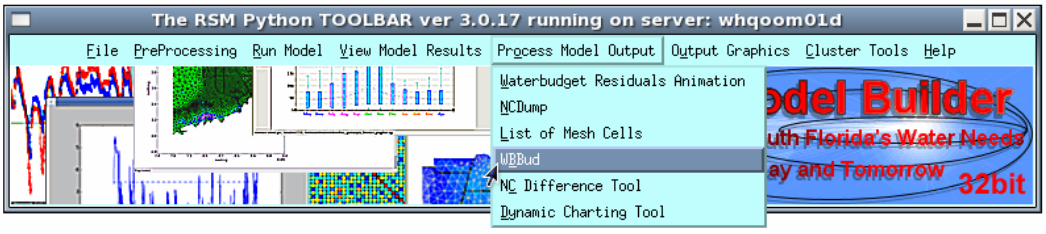


Figure 8.1 Selecting the **WBBud** utility from the **Process Model Output** drop-down menu.

6. Run the **WBBUD** utility of the RSM GUI from the **Process Model Output** drop-down menu (see **Fig. 8.2**).

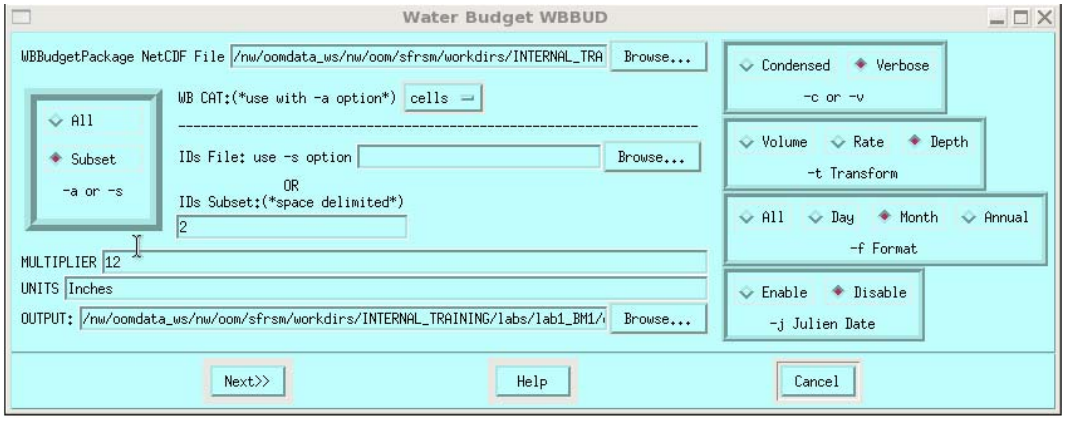


Figure 8.2. Options available in the **WBBud** utility.

Features in **WBBud** include:

a A summed report for all waterbodies of the specified type

s A summed report for a subset (list) of waterbodies either provided in a file or entered manually

m Multiply the output (e.g., –m 12 to convert feet to inches)

u Units to be displayed in the header (required field if using the multiplier option)

v Verbose expanded output

c Condensed report

t Transform output to volume, rate or depth

f Format the report to summarize all (raw) data, daily, monthly or annual

j Julian date conversion

7. Enter these options to run **WBBUD**:

- Select to the file: **[$RSM/../benchmarks/BM1/wbbudget.nc]**
- Select the **Subset** option
- Enter **2** in the IDs Subset input box
- Enter a multiplier of **12** to convert feet to inches
- Enter **Inches** as the label for your output units
- Enter a path in the output box **[$RSM/labs/lab1_BM1]**
- Select the **Verbose** option
- Select the **Depth transform** option
- Select the **Month** format option
- Disable the **Julian** option
- Click **Next>>**

The output will be written to the output file and a window will prompt the user to view the file that has been written.

8. When **WBBud** is complete an alert message will remind you where the output has been written.
9. Click the **View** button to view the output.

The results should look like the output in **Table 8.2**.

Hydrologic Process Modules (HPM) Water Budgets:

The **hpmbud** utility was developed to calculate water budgets for a HPM or group of HPMs. The **hpmbud** is implemented at the command line as follows:

```
$RSM/trunk/hpmbud/hpmbud –n hpmbudget_mo.nc –s 12 –d –m 12
```

The switches are defined in the **hpmbud** directory.

n	List the name of the netCDF file
s	Followed by a list of cell IDs (comma delimited list) or the name of a file that contains the list of cells for the HPMs
d	Provide the results in depth (feet or meter, as defined in the Control block in the run file run3x3.xml) rather than volume
m	Provide a multiplier to the output. (a multiplier of 12 provides results in inches if the default units for the model output are US Standard feet)

Table 8.2 shows two examples of water budget output from Cells 1 and 8 in Benchmark 33.

Table 8.2 Typical WBBud waterbudget output for BM33

Water budget for Cell 1 containing an Agricultural Field Scale Irrigation Requirement Simulation Model (AFSIRS) citrus-microjet HPM:

```
wbbud –n wbbudget.nc –s 1 –f month –t depth –m 12 –u inches –v
```

```
,,            Rainfall,          ET,    HpmDelta,      sfFlow,      gwFlow,    Residual,     WBDelta,     WBError
,,              inches,      inches,      inches,      inches,      inches,      inches,      inches,      inches
    1965,1,    0.158496,   -0.977845,    0.601053,           0,   -0.193361, 4.16175e-10,    0.411657,-4.98968e-08
    1965,2,     0.92964,   -0.583662,   -0.566936,           0,  -0.0586383,-7.59195e-10,    0.279596, 1.03391e-07
    1965,3,    0.371856,   -0.991733,    0.399903,           0,  -0.0998059,-1.65752e-07,     0.31978,  7.7998e-08
    1965,4,    0.417576,   -0.881325,   0.0173389,           0,   0.0764687, 3.03042e-09,    0.369942, 3.03937e-08
    1965,5,    0.301752,    -1.02997,  0.00852279,           0,   -0.248759,-3.28761e-10,     0.96845, 1.01185e-07
    1965,6,     2.58166,    -1.64151,   -0.516328,           0,   -0.101929,-8.54053e-07,   -0.321888, 2.44431e-08
    1965,7,     3.84962,    -2.07101,   -0.161248,           0,   -0.304999,-2.04625e-05,    -1.31234,-2.12382e-07
    1965,8,     2.01473,    -1.92111,     0.4328,           0,   0.0851718,-3.01372e-05,   -0.611563, 1.07531e-07
    1965,9,     1.93548,     -1.6219,   -0.270582, 0.000395873,   0.0386891,  4.8311e-06,   -0.082083, 1.59067e-07
   1965,10,     2.44754,     -1.6765,  -0.0553688,   0.0116014,    0.130426, 6.57778e-06,   -0.857707,-1.07489e-07
   1965,11,    0.432816,    -1.35377,    0.695032, 0.000209728,  -0.0534724, 7.05885e-07,    0.27918,-9.56778e-08
   1965,12,     0.19812,     -0.7412,   -0.109807,-0.000136581,  -0.0343446,  1.8446e-06,    0.687366,-7.15286e-08
```

Water budget for Cell 8:

```
wbbud –n wbbudget.nc –s 8 –f month –t depth –m 12 –u inches -v
```

```
,,            Rainfall,          ET,    HpmDelta,      sfFlow,      gwFlow,    Residual,     WBDelta,     WBError
,,              inches,      inches,      inches,      inches,      inches,      inches,      inches,      inches
    1965,1,    0.158496,   -0.918522,           0, 9.14897e-07,     0.21474, 2.80418e-07,    0.545285, 8.54303e-09
    1965,2,     0.92964,   -0.687172,           0,           0,    0.142944, -1.9053e-08,   -0.385413,-1.38968e-08
    1965,3,    0.371856,   -0.817745,           0, 3.19148e-05,    0.180347, 1.31617e-06,    0.265509, 1.79828e-09
    1965,4,    0.417576,   -0.972007,           0,           0,    0.272552, 3.78592e-08,     0.28188,  2.2342e-09
    1965,5,    0.301752,    -1.27315,           0,           0,    0.452485,-2.67304e-09,    0.518911,-3.63198e-11
    1965,6,     2.58166,     -1.3681,           0,  0.00820946,     0.26383,-1.70912e-06,     -1.4856, 6.15863e-08
    1965,7,     3.84962,    -1.57707,           0,    0.156405,   0.0990012,-3.13073e-05,    -2.52793,-2.60924e-08
    1965,8,     2.01473,    -1.48613,           0,     0.17875,   0.0279432,-4.37428e-05,   -0.735252,-4.71725e-09
    1965,9,     1.93548,    -1.25855,           0,   -0.113746, -0.00538524, 9.31083e-06,   -0.557804, 2.63004e-09
   1965,10,     2.44754,    -1.31072,           0, -0.00691794,  0.00622521, 5.75381e-06,    -1.13614, 5.19337e-08
   1965,11,    0.432816,    -1.21537,           0,  -0.0216731,  0.00425739, 5.92386e-06,    0.799962, 1.56177e-08
   1965,12,     0.19812,    -1.10157,           0,  -0.0251453,   0.0040317, 4.80151e-06,    0.924558, 1.08828e-08
```

Activity 8.2: Global Monitors and Animation Graphics

Overview

Activity 8.2 This activity includes two exercises:

- **Exercise 8.2.1** Creating global monitors
- **Exercise 8.2.2** Creating a flow vector animation

The global monitors produce the output for the display of spatial data and animations. The exercises in this activity will use the C111 Model found in the /data/C111 directory and the /labs/lab8_RSMtoolbar directory.

Exercise 8.2.1 Creating global monitors

10. In the top of the **`$RSM/data/C111/run_c111_mse_SR5_sss.xml`** file check to see that there is an **Entity** for the **`c111_output.xml`** file
11. Check for a reference for the file in the <output> block
12. Look in the <entity> block at the top of the XML to find the reference **&c111_output**

    The <output> block, an included entity, has been used to reference an external XML containing the output portion of the XML.

```
<output>
      &c111_output;
</output>
```

13. If not present, add the following global monitors to the <output> block:

```
<!-- output to netcdf file -->
   <globalmonitor attr="topo">
           <netcdf file="./output/SR5_sss/C111_PIR1_Alt2Db.nc">
</netcdf>
    </globalmonitor>
    <globalmonitor attr="head">
           <netcdf file="./output/SR5_sss/C111_PIR1_Alt2Db.nc">
</netcdf>
    </globalmonitor>
    <globalmonitor attr="segmenthead">
           <netcdf file="./output/SR5_sss/C111_PIR1_Alt2Db .nc">
</netcdf>
    </globalmonitor>
    <globalmonitor attr="olvector" >
          <netcdf file="./output/SR5_sss/C111_PIR1_Alt2Db.nc">
</netcdf>
    </globalmonitor>
```

14. Run the **C111 Model** using the RSM GUI to create the global variables

Exercise 8.2.2 Creating a flow vector animation

15. From the **Output Graphics** menu, select the **Presentation Graphics** Tool (see **Fig. 8.3**)
16. Input the **netCDF** filename:

    `$RSM/labs/lab8_RSMtoolbar/C111_PIR1_Alt2Db.nc`
17. Select **pathname** for output plots **`$RSM/labs/lab8_RSMtoolbar`**
18. Unselect **Show Mesh Borders**
19. Select **vector** and **flooding** options:
    - (**shaded**, **scale=1**, **grid size=25**, **min=0**, **max=4**)
20. Select **data to animate = ComputedHead**
21. Select **Timestep type=Increment**
    - Enter **Increment=1**
    - Select **Colormap=3** (1 is selected by default)
    - Select start and end **timesteps** (**start=0** timestep, **end=12th** timestep)

NOTE: Click start and end dates with the left mouse button. There is a scroll bar on the right side of the window to scroll through more timesteps.

- Click the **Generate** button

Output results will take a minute or two and will open in a browser

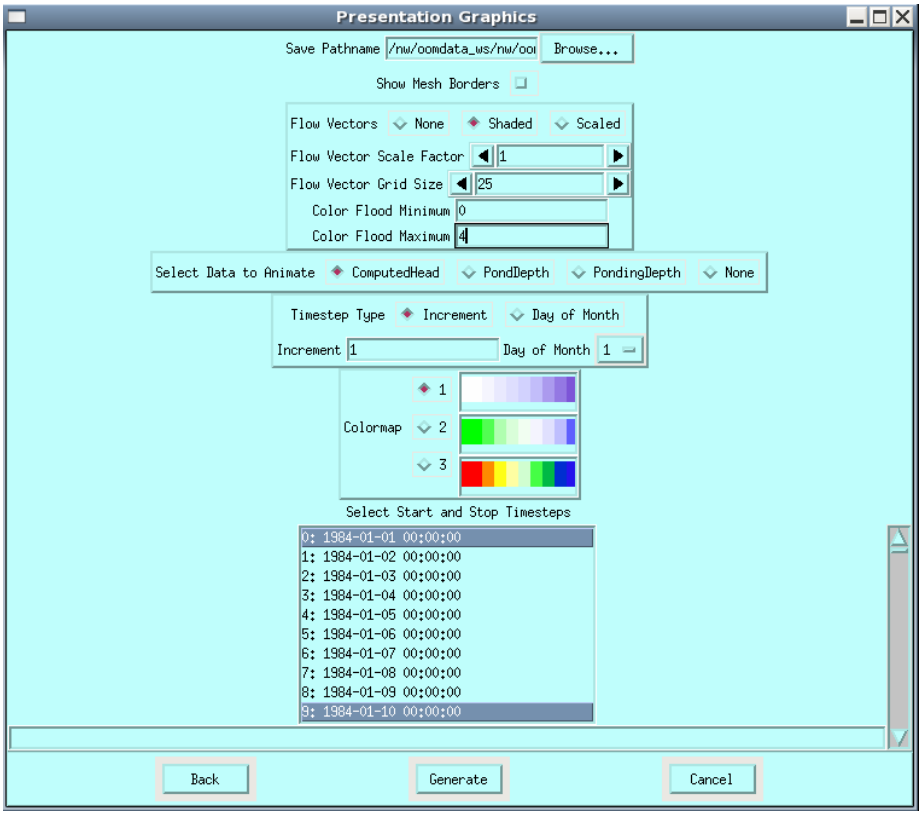


Figure 8.3 Presentation Graphics Tool Main Input Menu

Output from the **Presentation Graphics** Tool is presented in a browser window (**Fig. 8.4**). The animation can be started by clicking the **Play** button. Speed of the animation can be increased by entering a smaller number in the **Play Speed** box, shortening the time each frame is displayed on the screen. **Flow vectors** will be displayed as shaded arrowheads – darker arrowheads indicate greater flow rates.

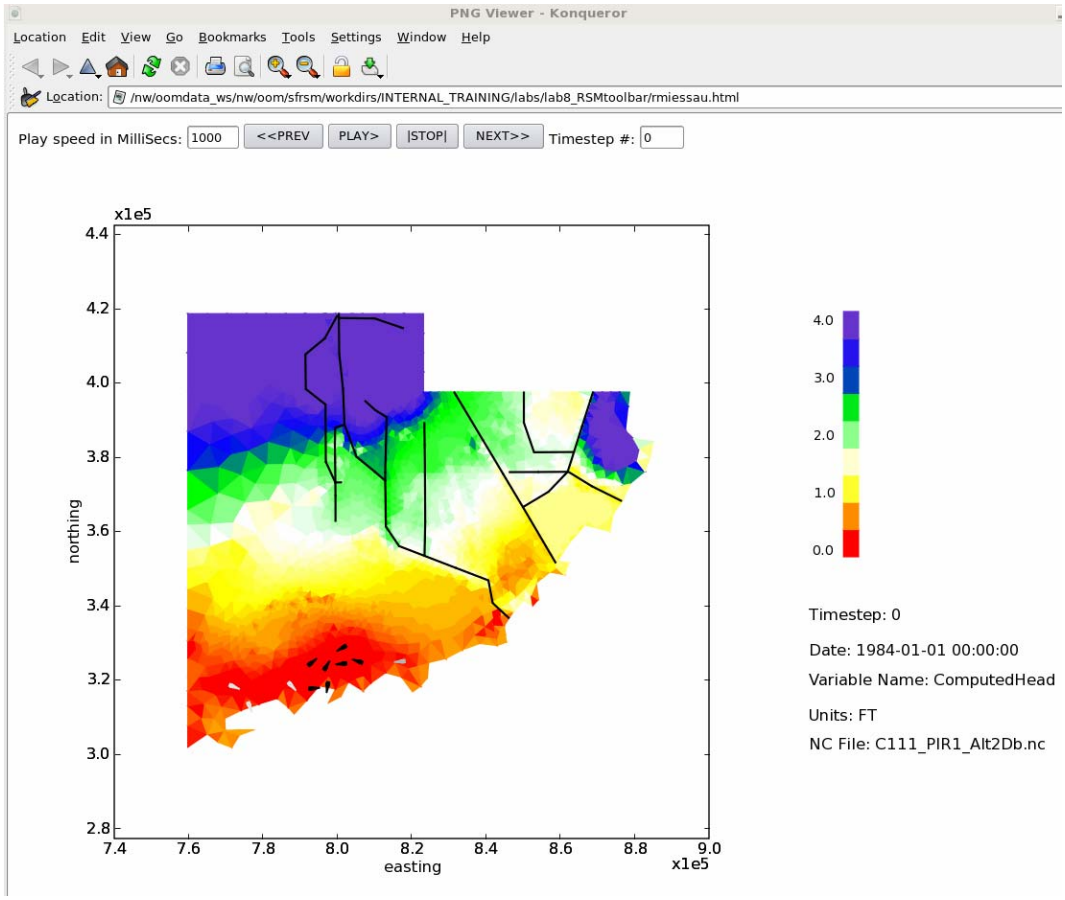


Figure 8.4 Browser window displaying computed heads and flow vectors

Activity 8.3: Flowgages

Overview

Activity 8.3 This activity includes one exercise:

- **Exercise 8.3.1** Use flowgages to view groundwater flows

This activity will investigate the use of flowgages, which are used to calculate the flow across a transect (**Fig 8.5**). This is useful for determining the volume of sheet flow across a marsh. Transects are represented by an ordered list of nodes defining the transect line. Output is directed to a DSS time series file.

Flowgages can be used to determine the groundwater flow as recharge or loss from a marsh.

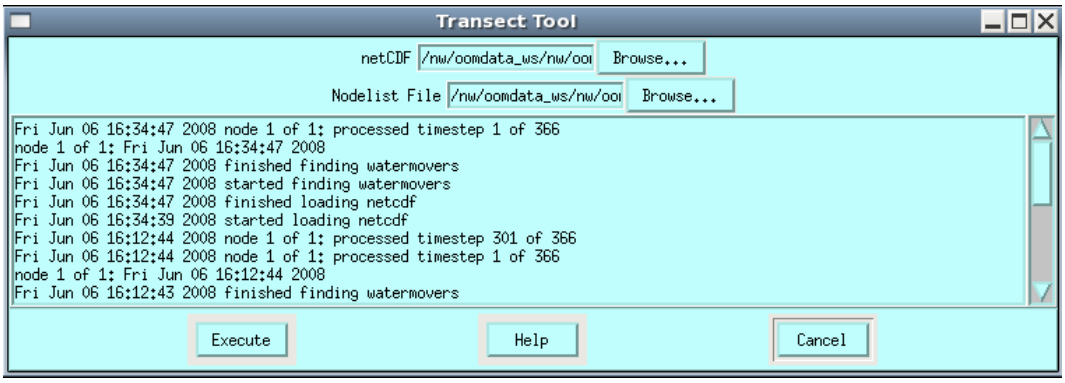


Figure 8.5 Main Interface for the Transect Tool

Exercise 8.3.1 Use flowgages to view groundwater flows

22. In ArcMap9.2, open **`$RSM/labs/lab8_RSMtoolbar/lab8.mxd`**
23. Locate **transect 23b** as defined by the list of nodes:
    (91 90 111 134 164 196 229 263 264 304 305 355 411 471 472 473 474 526 578 577)
24. **Select by Attribute** from the mesh layer: **[mesh_Node1]=91**
25. Determine the order of the list of the nodes. The canal is assumed to be on the left side of the transect traveling in the direction the nodes are given.
26. Create a text file containing the list of nodes called **`transect23b.txt`** (see **Fig. 8.6**)
27. Open the RSM GUI
28. From the **View Model Results** menu, select the **Transect** Tool
29. From the **`$RSM/labs/lab8`** folder run the **Transect tool** using the following files and leaving other options with default values: **`wbbudgetpackage_C111_SR5_sss.nc`** and **`transect23b.txt`**

```
<!--   Flow gauge 2x2 transect 23b -->
<flowgage section="ol" label="2x2 Transect 23b  ">
     <nodelist>  91 90 111 134 164 196 229 263 264 304 305 355
                 411 471 472 473 474 526 578 577  </nodelist>
     <dss file="./output/SR5_sss/transect_flows_2005Baseline.dss"
          pn="/C111/TRANSECT_TR-23B_OL/FLOW//1DAY/SR5_sss/"> </dss>
       </flowgage>
```

```
<!--   Flow gauge transect for tidal model boundary  -->
<flowgage section="ol" label="tidal boundary flow - 1991 to 1995 ">
  <nodelist>  1773 1754 1733 1732 1753 1730 1705 1681 1654 1623 1589
              1552 1514 1474 1430 1387 1341 1295 1245 1195 1244 1193 1139
              1085 1029 1028 972 914 854 793 791 730 674 618 560 506 443
               380 326 325 278 240 204 171 141 140 139 114 92 74 73 56 40
                29 20 12 7 14 21 13 11 6 3 2 </nodelist>
  <dss file="./output/SR5_sss/transect_flows_2005Baseline.dss"
       pn="/C111/TRANSECT_TR-TIDE_OL/FLOW//1DAY/SR5_sss/"> </dss>
</flowgage>
```

Figure 8.6 Example text files with lists of nodes comprising transects.

The **Transect Tool** will produce four reports summarizing flow across a transect, formatted as: **raw data**, **daily (Fig. 8.7)**, **monthly** and **annual**.

30. View the flowgage time series using **HEC-DSSVue (Fig. 8.8)**

- Open the file transect_flows_2005Baseline.dss and look for transect 23b.

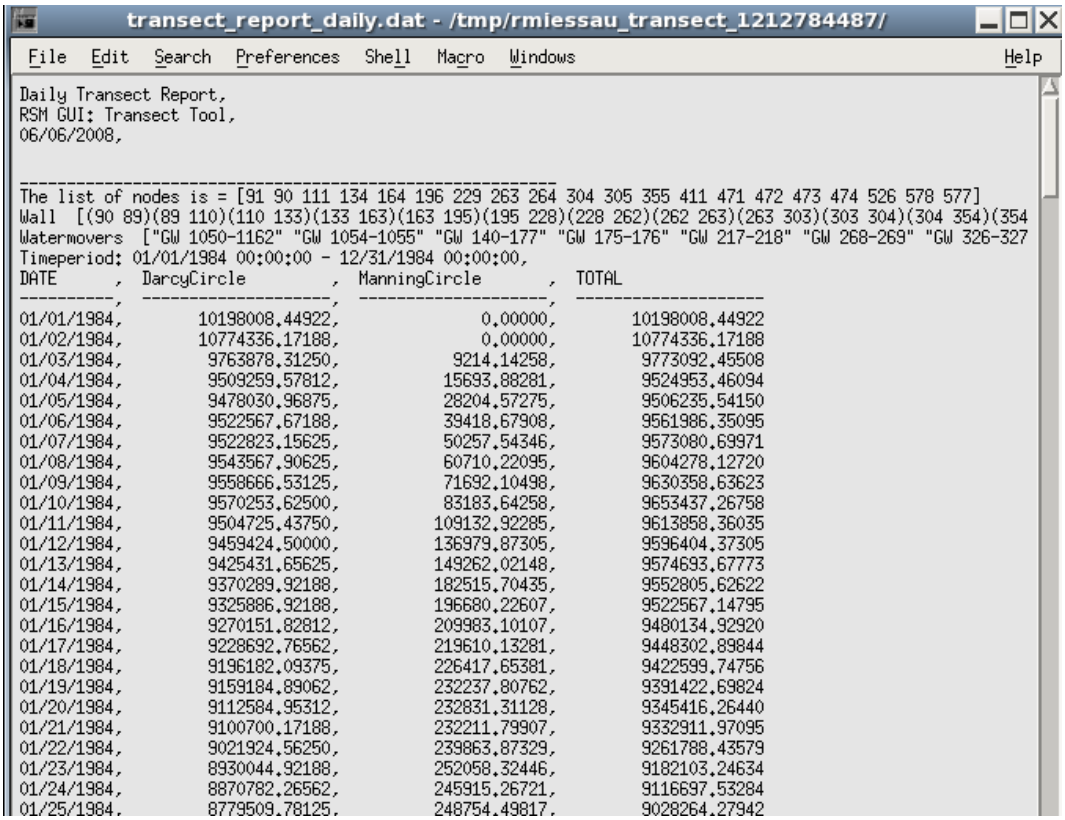


Figure 8.7 Part of the Transect Tool's Daily Transect Report

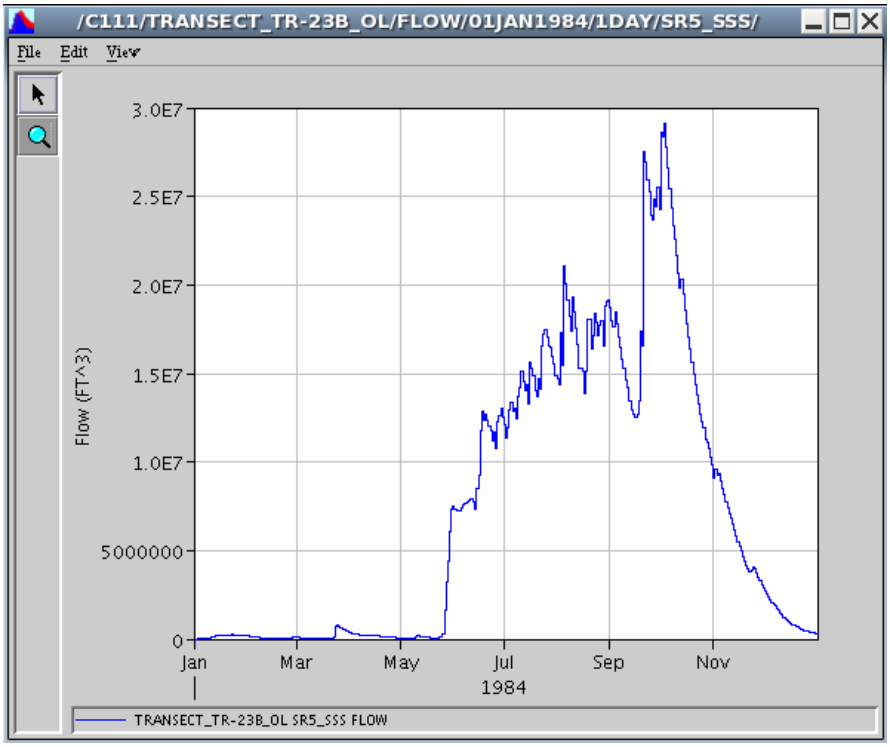


Figure 8.8 Typical output from a transect flowgage

Activity 8.4: RSM Plots, Statistics and Other Output

Overview

Activity 8.4 This activity includes two exercises:

- **Exercise 8.4.1** Review and plot calibration statistics
- **Exercise 8.4.2** Review spatial data maps and Inundation Tool

The objective of this activity is to produce the plots and statistics used to interpret the efficacy of model calibration at selected locations (**Fig. 8.9**). The RSM is calibrated using PEST to minimize the root mean squared error (RMSE) and Bias. PEST will be covered in detail in training modules 13 and 14.

Other statistics, mean squared error and Nash-Sutcliffe efficiency coefficient are also calculated using RSM output. It is useful to review the plots of the simulated versus observed stage or flow time series as well as the calibration statistics. There are two Python scripts for processing the simulated and observed data in DSS file format:

```
./bin/makePlots.py  ./bin/fetch-calib.ctl
./bin/calcStats.py  ./bin/fetch-calib.ctl
```

The **`fetch-calib.ctl`** file contains the location of the files that contain the simulated, historical observed and South Florida Water Management Model (SFWMM) values along with a list of the individual stations and their DSS tags (**Fig. 8.9**). A typical output from the makePlots script is presented in **Fig. 8.10**.

```
file ./output/meas_submodel.dss
     ./input/all_canal_historical.dss
     ./input/2x2_simulated_all.dss
run  CH_EVER1 /SFRSM/EVER1/STAGE//1DAY/COMPUTED/
              /SFWMM/EVER1/STAGE//1DAY/HIST_MOD1/
              /SFWMM/EVER1/STAGE//1DAY/SIMULATED/
run  CH_EVER2B /SFRSM/EVER2B/STAGE//1DAY/COMPUTED/
               /SFWMM/EVER2B/STAGE//1DAY/HIST_MOD1/
               /SFWMM/EVER2B/STAGE//1DAY/SIMULATED/
  ...
```

Figure 8.9 The **`fetch-calib.ctl`** file containing locations of files with simulated, historical observed, and SFWMM values.

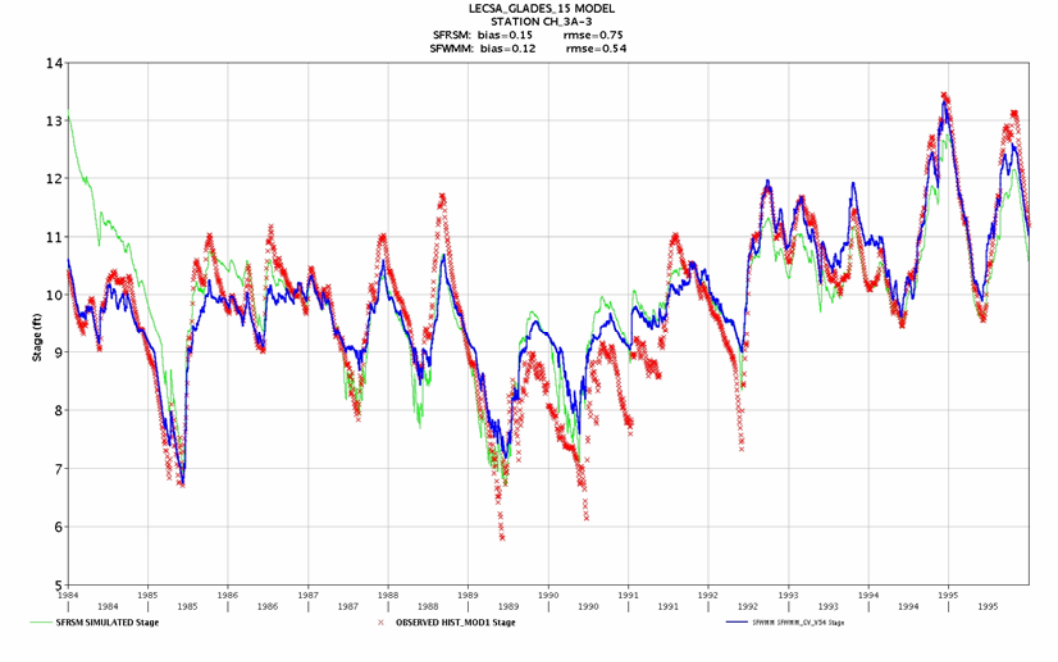


Figure 8.10 Typical output from makePlots.py showing simulated and observed time series and associated bias and mean squared error.

Exercise 8.4.1 Review and plot calibration statistics

31. Calculate statistics using a command line Python script.
    - Go to the **$RSM/data/BBCW/bbcw** directory
    - Run script:

      ```
      /opt/local/share2/bin/dssvue ./bin/calcStats.py
      ./bin/fetch_calib.ctl
      ```
    - Open output file and view results, bias and RMSE for each time series.
32. Create plots using a command line Python script
    - Go to the **$RSM/data/BBCW/pest**
    - Run script:

      ```
      /opt/local/share2/bin/dssvue ./bin/makePlots.py
      ./bin/fetch_calib.ctl
      ```
    - Open **Plots** directory and view graphs

33. Create plots and statistics using the RSM GUI:

- Go to the **$RSM\data\BBCW** directory
- Start the RSM GUI: from the command line type, ***RSMGUI***
- From the **Output Graphics** menu, select **DSS stage/flow Plots** (see **Fig. 8.11**)
- Provide a **Control** file to run the **DSS stage/flow tool** (see **Fig. 8.12**)

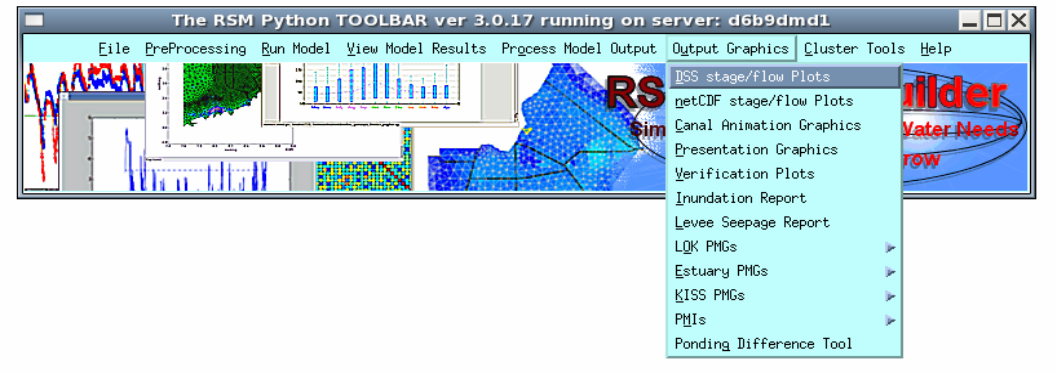


Figure 8.11 Selecting the DSS stage/flow plots.

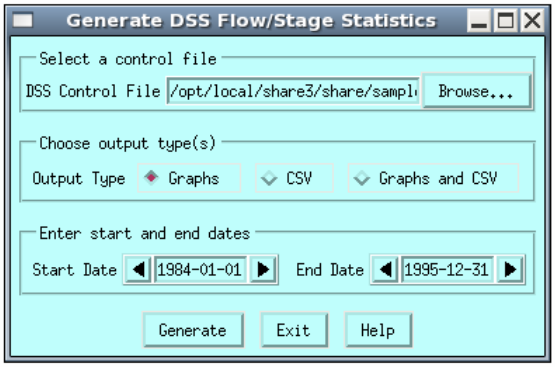


Figure 8.12 Input options menu for the DSS stage/flow tool.

You can use any text editor to create the control file. The first line of the control file contains the path/filename of two or three DSS files. Typically, this is used to show the simulation, corresponding historical data, and results from a different model simulation. The second line contains the DSS path corresponding to the gage being reported for each of the files listed in line 1.

For this example, compare three files. On the first line of the control file, enter the following three DSS path/filenames on one line, in this same order:

- Pick **output DSS** file:
  `./Final_Results_BBW16_sens1/output/bbw_output.dss`
- Pick **historical data**: **`./input/dss_files/all_bbw_historical.dss`**
- Pick **another model's output**:
  `./input/dss_files/sfwmm_cv_v54_gages_lecsaglades.dss`

On the second line of the control file, enter the DSS paths to the CH_EVER4 data sets being compared:

- **Output** gage: **/BBW/EVER4/STAGE//1DAY/COMPUTED**
- **Historical** gage: **/SFWMM/EVER4/STAGE//1DAY/HIST_MOD1**
- **SFWMM** gage: **/C111TIDAL/EVER4_R8C25/STAGE//1DAY/SFWMM_CV_V54**

Create this control file (name it ch_ever4.ctl) and save it to the directory:

$RSM/data/BBCW/Final_Results_BBW16_sens1

Use this control file (see Fig. 8.13) to test the DSS stage/flow tool.

```
file ./output/bbw_output.dss
./input/dss_files/all_bbw_historical.dss
./input/dss_files/sfwmm_cv_v54_gages_lecsaglades.dss
run  CH_EVER4 /BBW/EVER4/STAGE//1DAY/COMPUTED/
/SFWMM/EVER4/STAGE//1DAY/HIST_MOD1/
/C111TIDAL/EVER4_R8C25/STAGE//1DAY/SFWMM_CV_V54
```

Figure 8.13 The **ch_ever4.ctl** file containing locations of files with simulated and historical values, plus results from another model.

The resulting graph is shown in Fig. 8.14.

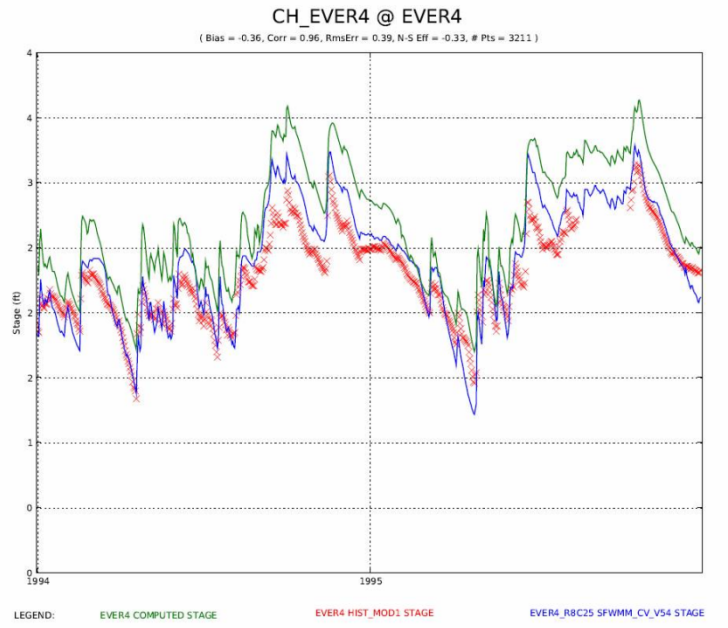


Figure 8.14 Output from the DSS Stage/Flow Plots tool, showing stages at gage CH_EVER4.

HINT

The HELP button on the RSM Python Toolbar offers an example and help for running the tool.

Exercise 8.4.2 Other RSM output: spatial data maps and Inundation tool

For this exercise, work in the **Lab8_RSMToolbar** folder.

34. Start the RSM GUI
35. View results from **`/lab8_RSMtoolbar/C111_PIR1_Alt2Db.nc`** in the

ResultsViewer

- From the **Cells** drop-down menu in the **ResultsViewer**, select "**Cell Colorflood**" and then choose **PondingDepth** to **colorflood** the display
- Use the "**Look Up Range**" feature to auto select the range for the **ponding depth**
- Leave other defaults as they are. Click the **OK** button
- Using the **TimestepNavigator**, advance to the **3rd timestep: (1983-01-03)**
- Under the **File** drop-down menu, **Export a PNG** of the view and save it in your own directory

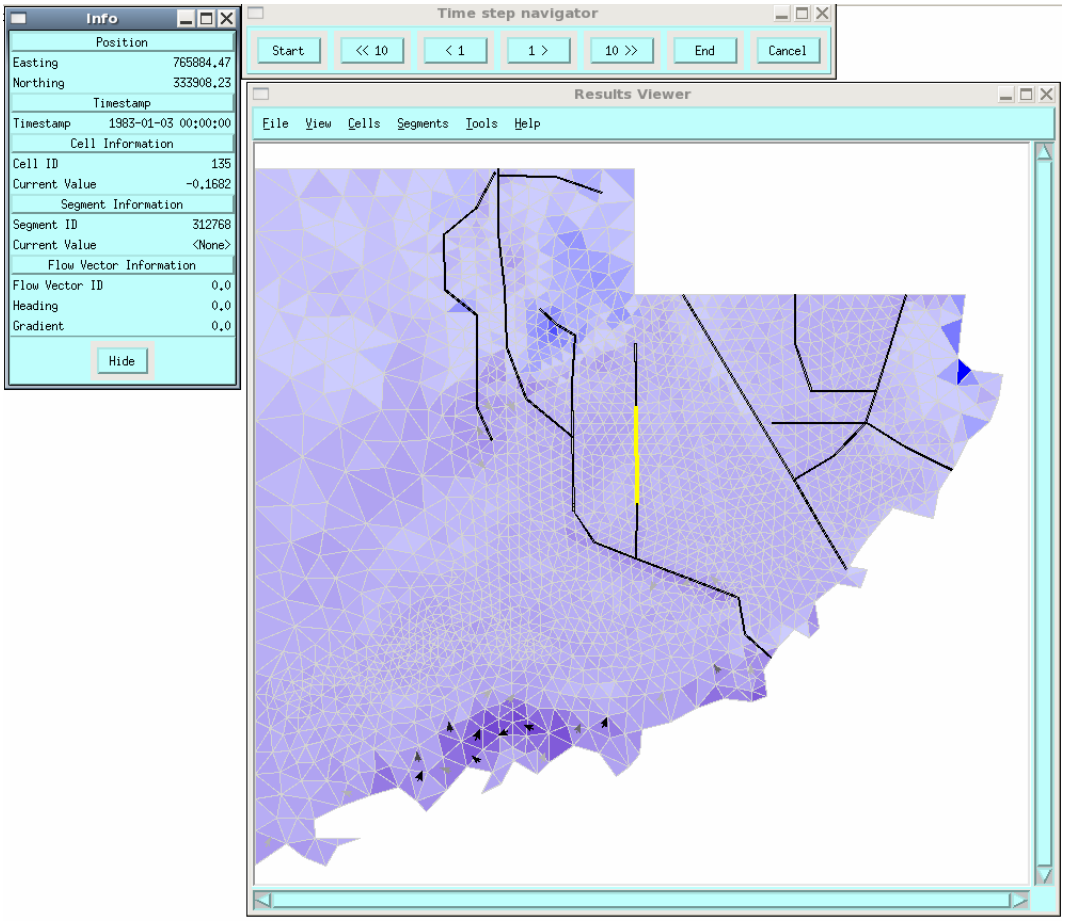


Figure 8.15 RSM animation Cell Colorflood map using Results Viewer

36. Run the **Inundation Report** Tool. The Inundation ReportTool calculates a stage-duration graph.

- Under the **Output Graphics** Menu on the RSM GUI, select the **Inundation Report** Tool
- From inside the **`lab8_RSMtoolbar`** folder, select **`c111_calib.nc`**
- From the inundation subfolder, select **`obs_cells.csv`** and **`landuse.csv`** files as input for running the Inundation tool
- Make sure Jan 1, 1983 is set as start dates and Dec 31, 1983 is set for all end dates. Click the **Generate Report** button to run the tool
- View the ascii report file, quit, do not save it, and then the PDF graphic will be displayed.
- Save the **Adobe PDF** output file to your **`lab8_RSMtoolbar`** folder and call it **`inundation.pdf`** (see **Fig. 8.16**)

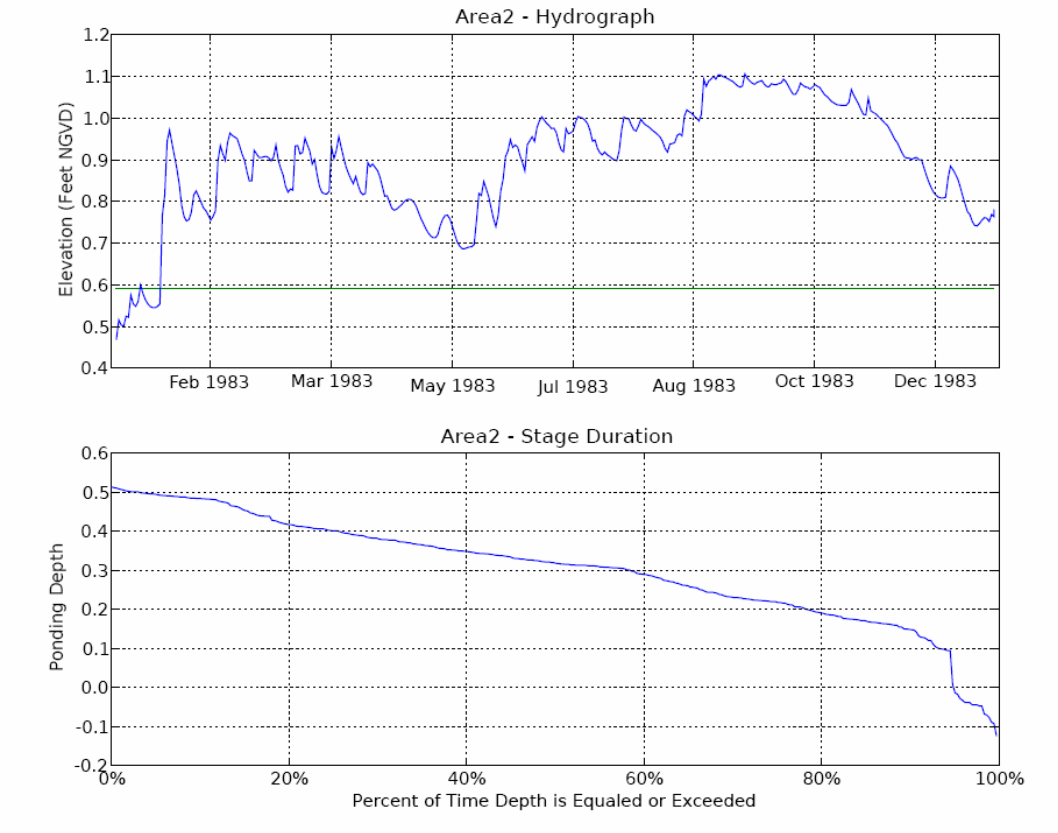


Figure 8.16 Output from the Inundation Report Tool

37. Run **Vector Flow Animation**

- Under the **Output Graphics** Menu, start the **Presentation Graphics** Tool. The first menu will prompt you to browse to a NetCDF file and there is an option to include a flow vector type. The flow vector output must exist in the NetCDF file. Browse to the **lab8_RSMtoolbar** folder and select the **C111_PIR1_Alt2Db.nc** file
- In the Settings menu, select **None** as the **Vector Choice** and click **Next**

- The next menu will appear (see **Fig. 8.17**), offering several settings to create the animation. The first item is to browse to a folder where your output will be saved.
- Make the following additional menu choices:
  - Show Mesh Border: Uncheck box
  - Flow Vectors: Check box for **`None`**
  - Flow Vector Scale Factor: Enter **`1`**
  - Flow Vector Grid Size: Enter **`25`**
  - Color Flood Minimum: Enter **`0`**
  - Color Flood Maximum: Enter **`5`**
  - Select Data to Animate: Check box for **`PondDepth`**
  - Timestep Type: Check box for **`Day of Month`**
  - Day of Month: Select **`31`** (end of month) from dropdown menu
  - Color Ramp: Check box for **`Color Ramp 3`**
- Using the left mouse button, select the first timestep on **`1983-01-01`** and then scroll down to the last timestep on **`1983-12-31`** and select using the left mouse button.
- Click the **Generate** button to generate the animation

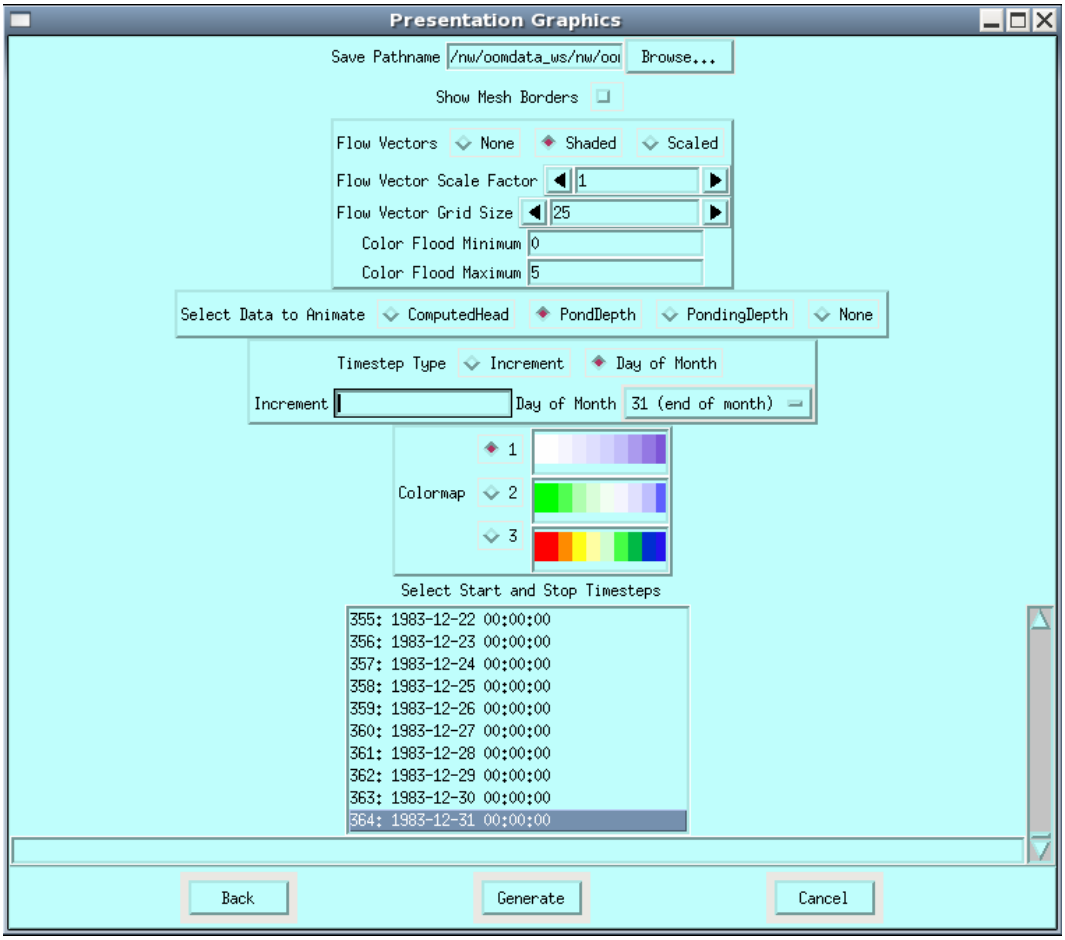


Figure 8.17 Menu for **Presentation Graphics** tool

Output from this tool will display the animation viewer in a browser (**Fig. 8.18**).

- Click the **Play** button to start the animation

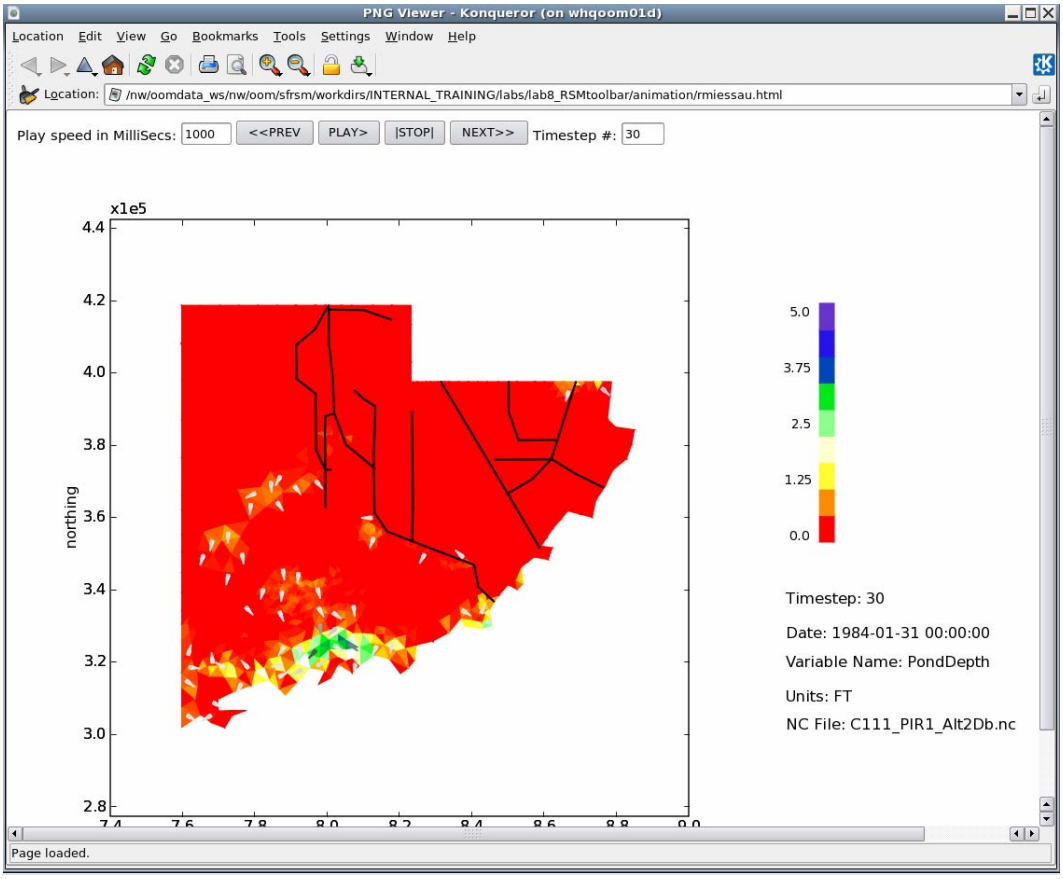


Figure 8.18 Output from RSM GUI **Presentation Graphics** Tool

Answers for Lab 8

Exercise 8.1.1

38. three attributes output from each HPM

- water content
- water supply
- runoff

differences in irrigation volume for different HPMs

- Spring Rice seepage irrigation volume is steady, but in relatively small amounts compared to the other crops. Fall rice is similar but with two large flooding cycles before the fall season.
- Citrus is irrigated periodically (nearly biweekly), with relatively large amounts of water.
- Spring tomatoes have smaller weekly irrigations. Fall tomatoes also seem to follow this pattern.
- Sugar uses a small amount of water

differences in runoff volume for different HPMs

- Generally, most runoff (excess water) occurs in late summer. Also, runoff is generally more sporadic (less steady) than irrigation, and comes in pulses. Rice and citrus have the highest runoff rates of the crops analyzed.

Exercise 8.1.2

Compare results with those in the **`lab8_RSMtoolbar`** directory

Exercise 8.2.1

Compare results with those in the **`lab8_RSMtoolbar`** directory

Exercise 8.2.2

Compare results with those in the **`lab8_RSMtoolbar`** directory

Exercise 8.3.1

Compare results with those in the **`lab8_RSMtoolbar`** directory

Exercise 8.4.1

Compare results with those in the **`lab8_RSMtoolbar`** directory

Exercise 8.4.2

Compare results with those in the **`lab8_RSMtoolbar`** directory

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