StateDMI Training

Processing StateMod Diversion Data

Version: 3.10.00, 2010-05-06

Duration: Approximately 60 minutes

Level: Introduction

This Presentation

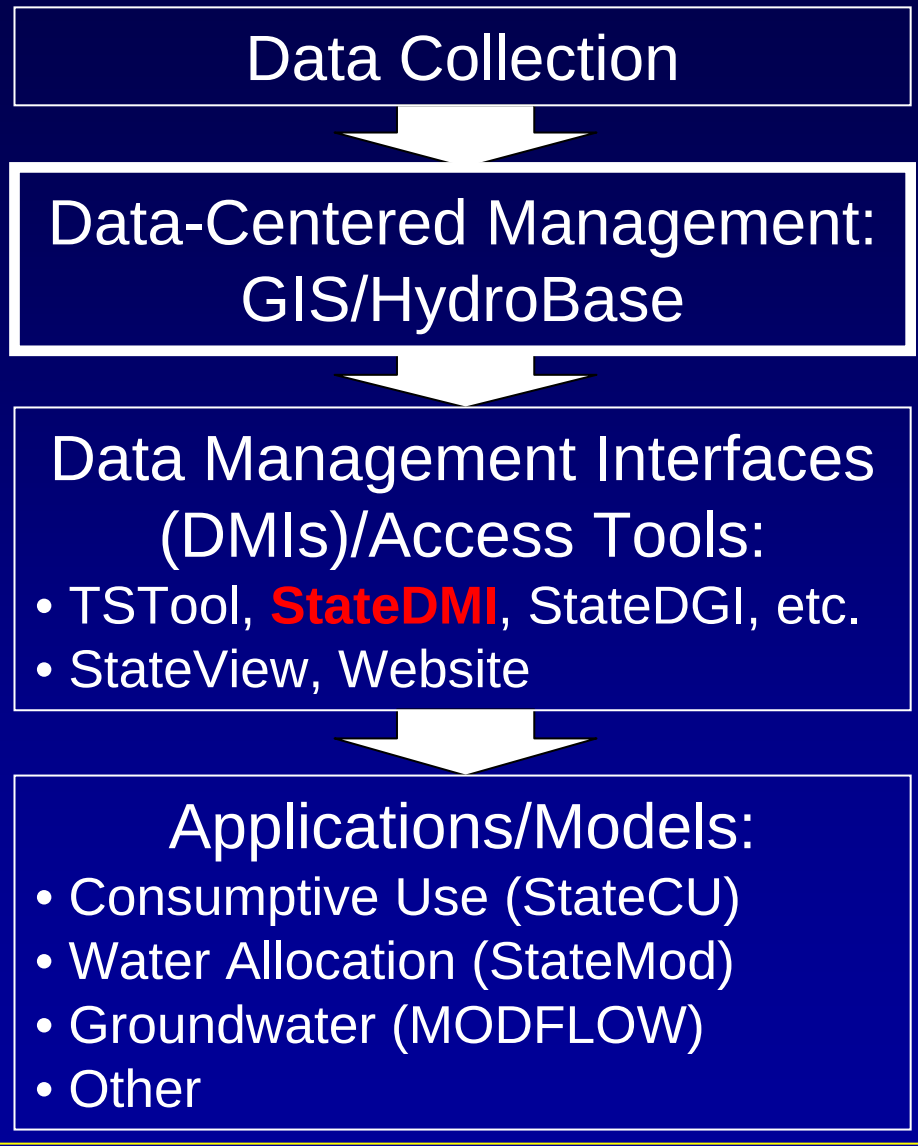
- Builds on the “StateDMI – Getting Started” training presentation
- Focuses on StateMod diversion data – other data types are processed similarly
- Is designed for self-paced training
- Is accompanied by examples, each of which reside in a folder distributed with this presentation
  - See the doc/Training folder under the software installation
  - Full use of StateDMI requires that the HydroBase database is accessible

StateDMI

- Developed for Colorado's Decision Support Systems (CDSS)
- Reads data from HydroBase and files and creates input files for StateCU and StateMod
- Complements TSTool software
  - TSTool processes time series
  - StateDMI processes some time series but focuses on other data files
- Automates processing and quality control

Data-Centered Approach

- Open access to data
- Share data for multiple uses
- Applications focus on analysis and generating results/products

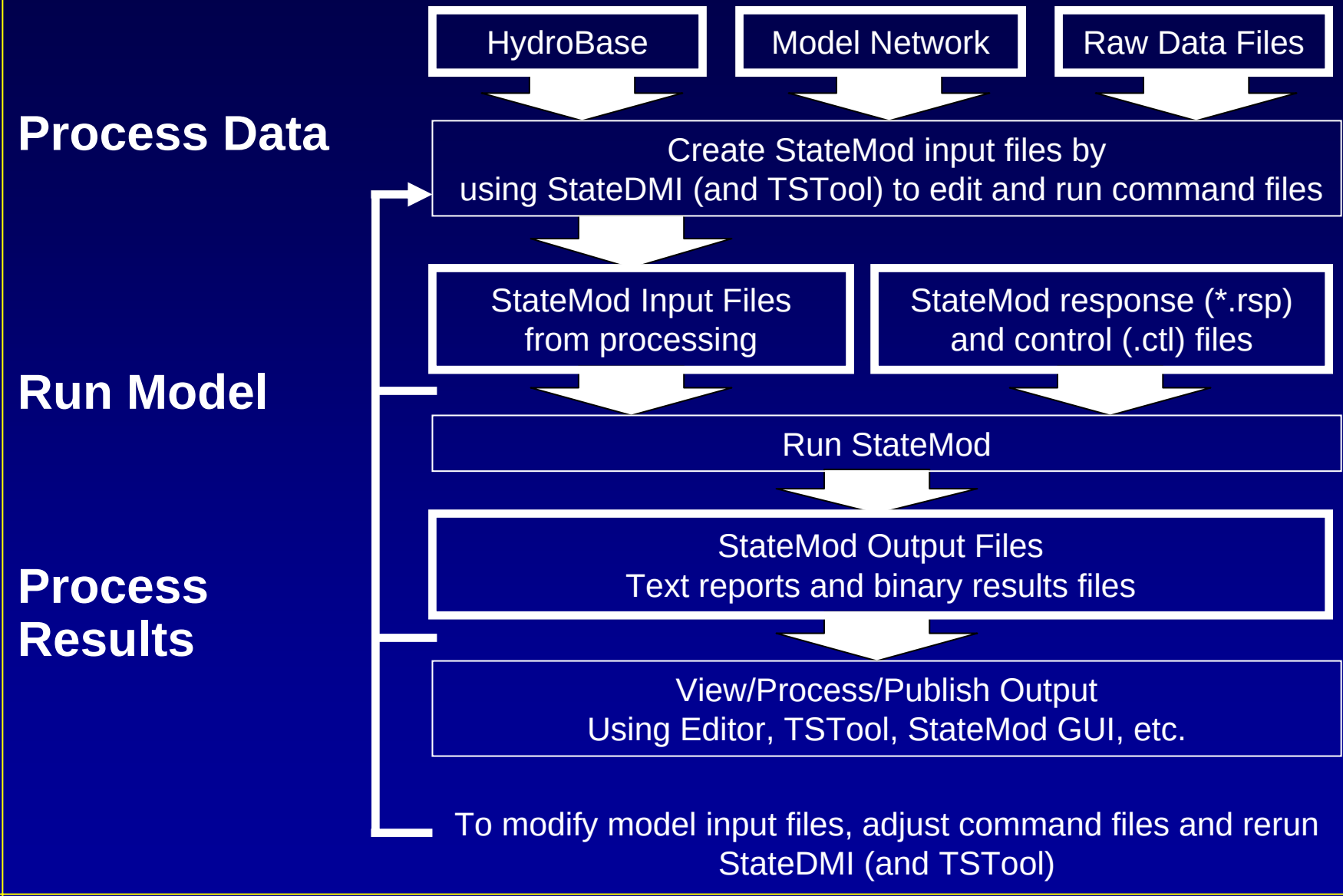


StateMod

Water Allocation Model

- Software and baseline data sets are provided by the State of Colorado (http://cdss.state.co.us – see Products…Surface Water Model)
- Refer to data set documentation
- StateMod software documentation describes model files
- StateDMI documentation describes creation of model files

Automated Data Processing



Benefits of Automation

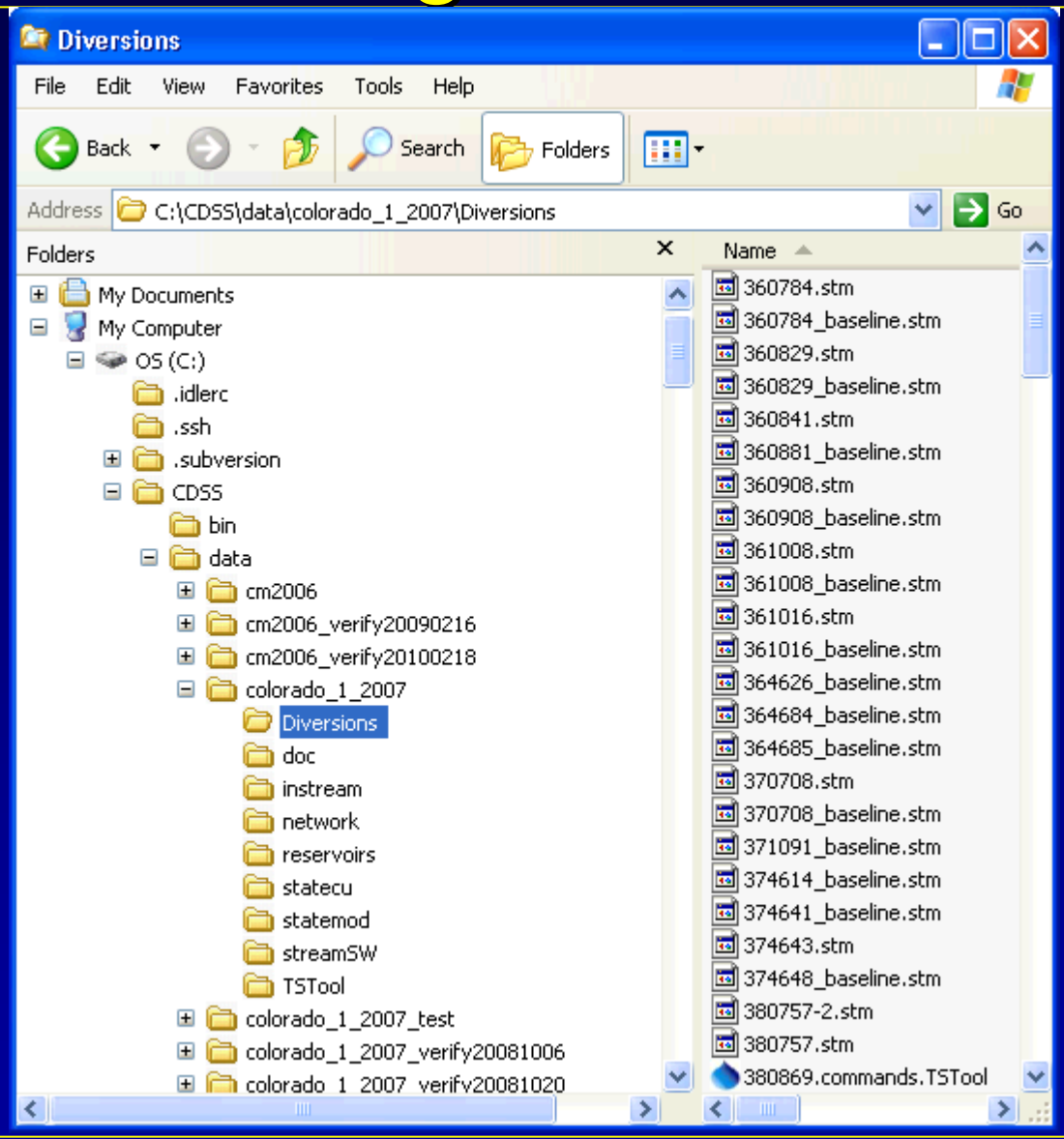
- “Touches” on data are more visible
- Logic is documented by command file
- Troubleshooting is facilitated by sequential processing, logging, and checks
- Processing is repeatable, and automated tests can be implemented
- Overall processing time can be much faster than non-automated processing
- Quality control can be automated

Limitations of Automation

- Automation does not eliminate the need for human insight and review
- Modelers still need to understand model software, representation of the system, and input files
- Modelers still need to understand data processing and limitations of data

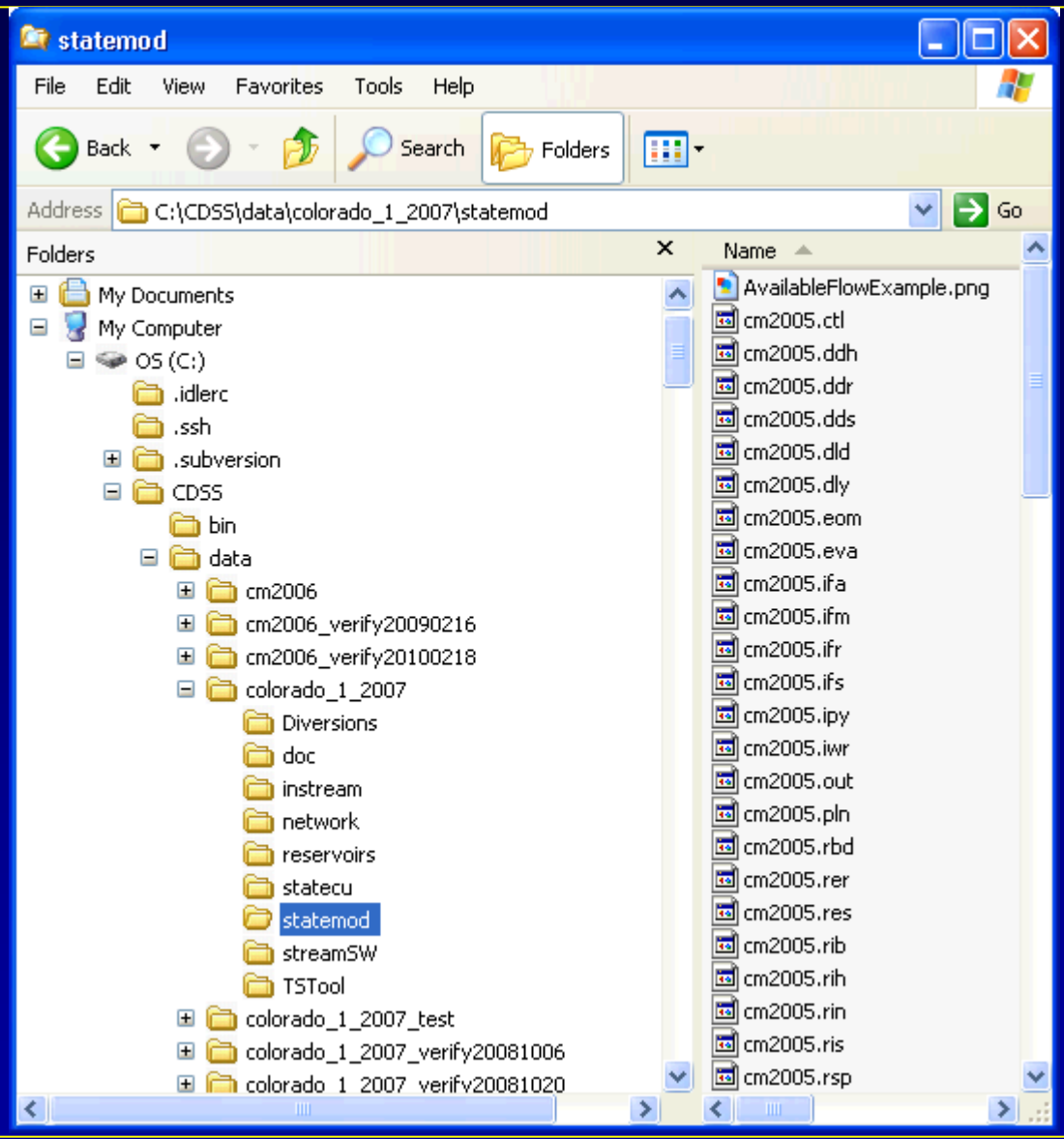
StateMod Data Set Organization

- Data set is saved under CDSS\data
- StateCU and StateMod data sets are usually maintained separately
- Data set is named for the basin and year of update
- The diversions folder (for example) contains work files to produce final StateMod diversion files



Final StateMod Files

- The “statemod” folder contains final model input files and results (can be distributed without other work files)
- Subfolders may be used for different scenarios (historical, calculated demands, etc.)

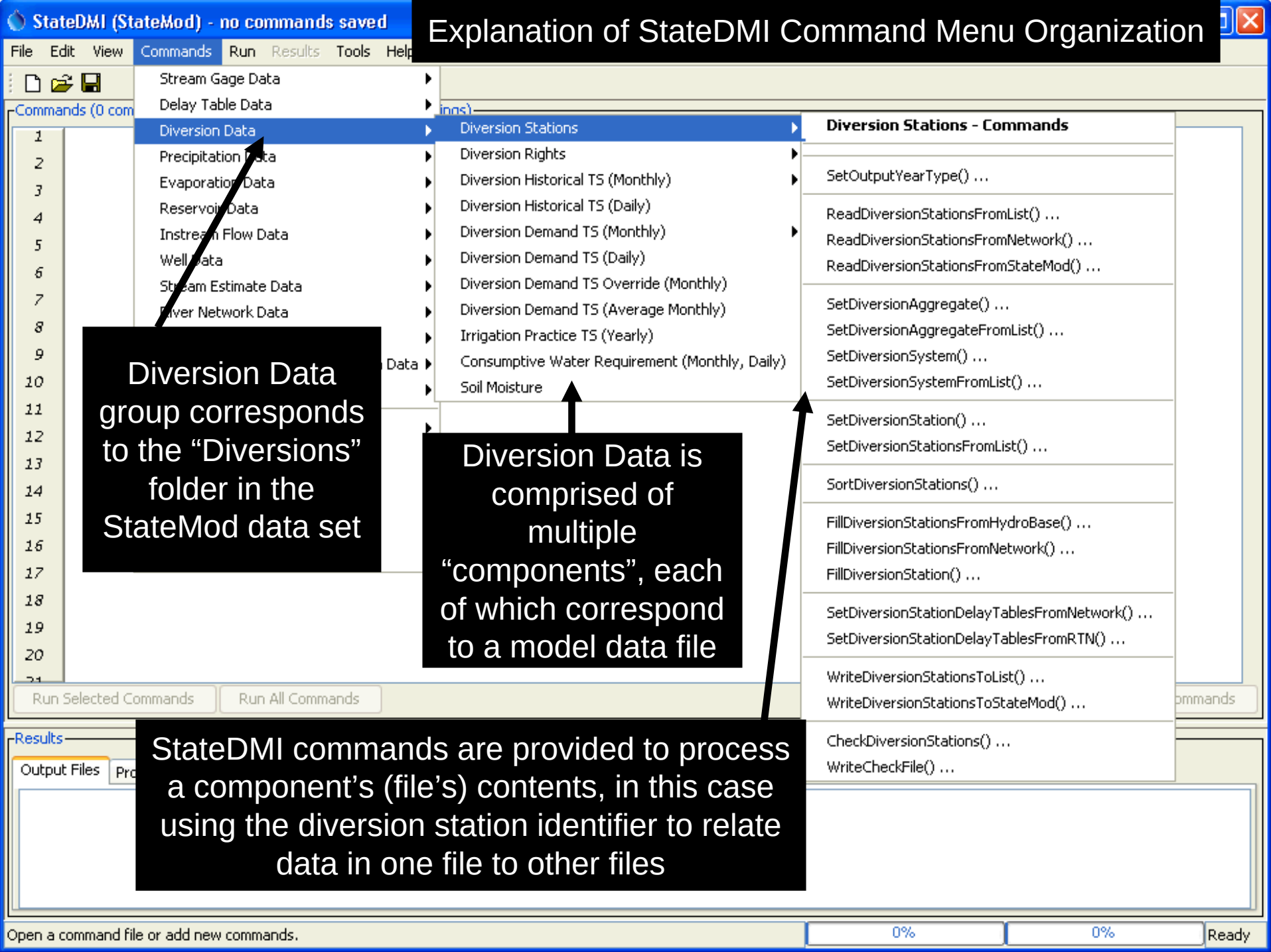


Notes on File Organization

- Does change over time, but has become relatively standardized
- Allows modelers to focus on specific files (e.g., diversions) to “divide and conquer” data processing
- Relies on “..\Diversions” (for example) when using relative paths to reference files in different folders – relative paths allow data sets to be transported to different computers

Processing Diversion Files

- Examples are in the “example1-colorado” folder with this presentation
- These files have been copied from the colorado_1_2007 files from the CDSS web site
- Some of the original files have been changed to use new StateDMI features (see “-updated” in command file names)


Explanation of StateDMI Command Menu Organization
StateDMI (StateMod) - no commands saved
File Edit View Commands Run Results Tools Help
Stream Gage Data
Delay Table Data
Diversion Data
Precipitation Data
Evaporation Data
Reservoir Data
Instream Flow Data
Well Data
Stream Estimate Data
River Network Data
Diversion Stations
Diversion Rights
Diversion Historical TS (Monthly)
Diversion Historical TS (Daily)
Diversion Demand TS (Monthly)
Diversion Demand TS (Daily)
Diversion Demand TS Override (Monthly)
Diversion Demand TS (Average Monthly)
Irrigation Practice TS (Yearly)
Consumptive Water Requirement (Monthly, Daily)
Soil Moisture
Diversion Stations - Commands
SetOutputYearType() ...
ReadDiversionStationsFromList() ...
ReadDiversionStationsFromNetwork() ...
ReadDiversionStationsFromStateMod() ...
SetDiversionAggregate() ...
SetDiversionAggregateFromList() ...
SetDiversionSystem() ...
SetDiversionSystemFromList() ...
SetDiversionStation() ...
SetDiversionStationsFromList() ...
SortDiversionStations() ...
FillDiversionStationsFromHydroBase() ...
FillDiversionStationsFromNetwork() ...
FillDiversionStation() ...
SetDiversionStationDelayTablesFromNetwork() ...
SetDiversionStationDelayTablesFromRTN() ...
WriteDiversionStationsToList() ...
WriteDiversionStationsToStateMod() ...
CheckDiversionStations() ...
WriteCheckFile() ...
Diversion Data group corresponds to the “Diversions” folder in the StateMod data set
Diversion Data is comprised of multiple “components”, each of which correspond to a model data file
StateDMI commands are provided to process a component’s (file’s) contents, in this case using the diversion station identifier to relate data in one file to other files
Run Selected Commands
Run All Commands
Results
Output Files
Open a command file or add new commands.
0%
0%
Ready

Processing Order is Important

- A list of diversion stations is used as input to start diversion data processing
- The station identifiers (State of Colorado Water District Identifiers [WDIDs] or other identifiers) relate data in one file to other files
- The diversion stations list is typically read from:
  - The model network (see the StateDMI network editor and Read*FromNetwork() commands)
  - A delimited “list” file that is created manually, by other software, or is generated from the network by StateDMI (see the Read*FromNetwork() and Write*ToList() commands)
  - The StateMod diversion stations file (after it is created from one of the above lists)

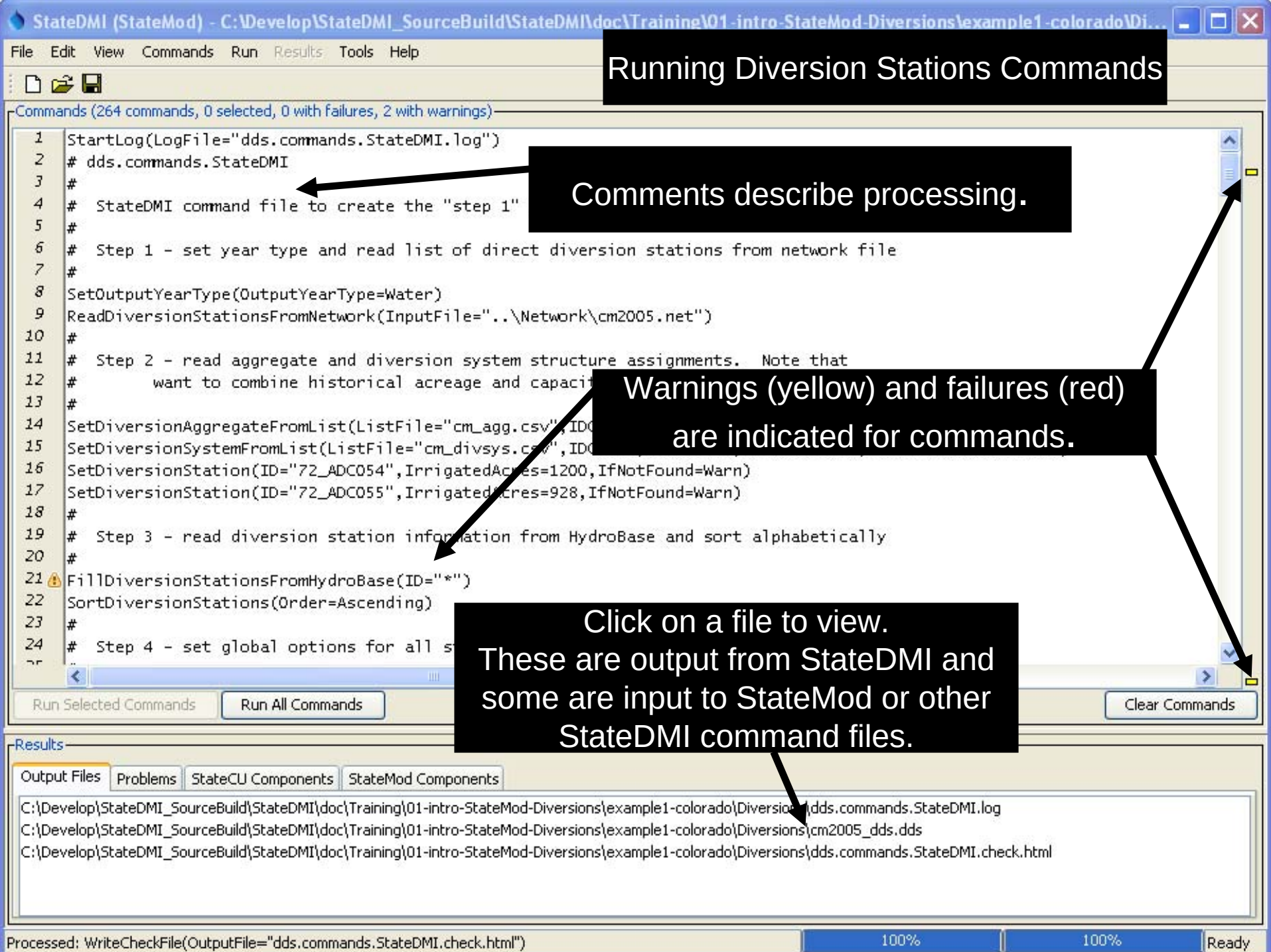
Beware of Circular Data Processing

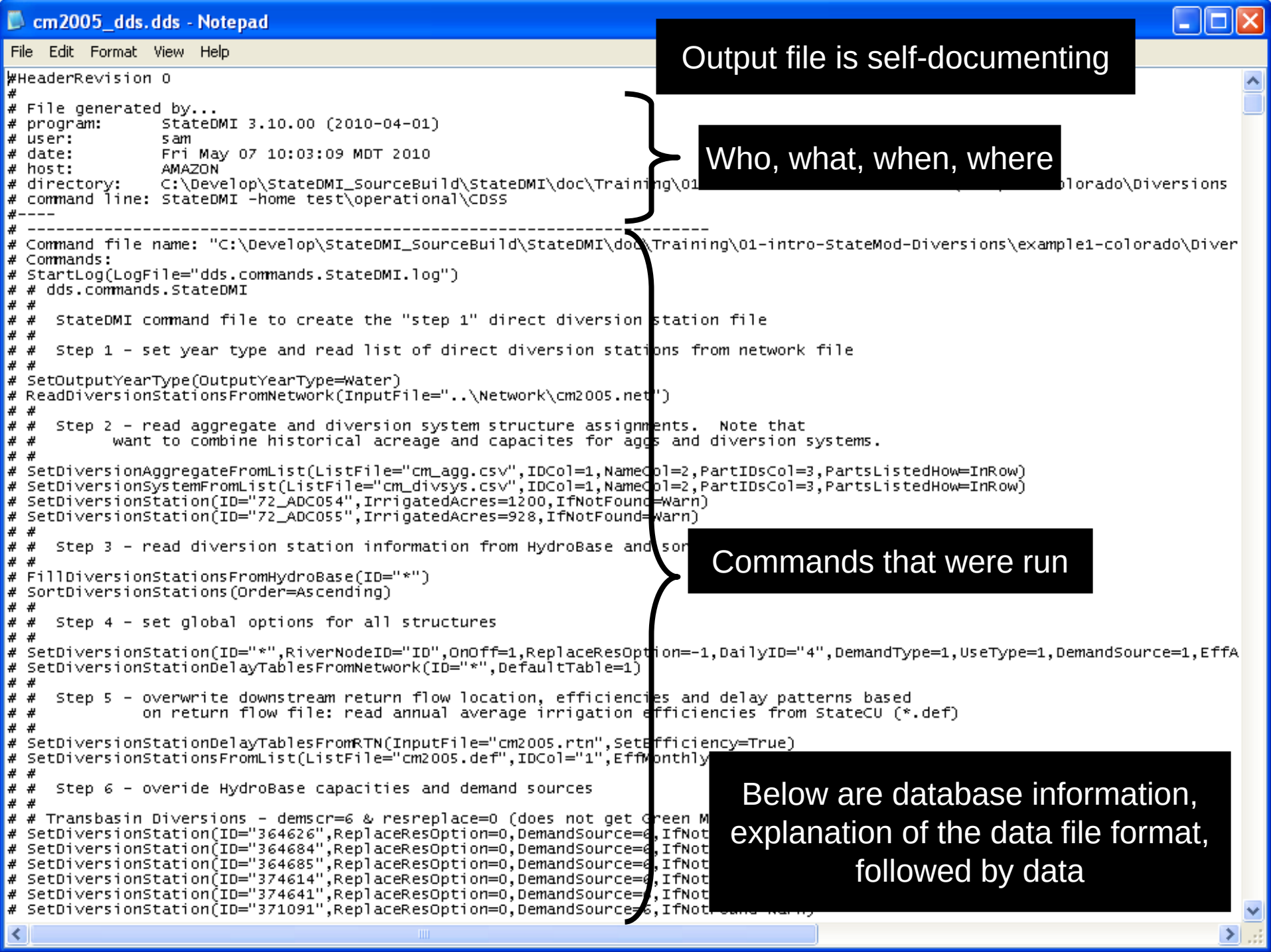
Circular processing is when one file depends on another, which depends on the first. For example, the diversion stations file includes capacity, which can be set to the sum of the water rights, or the maximum historical diversion (from different files). Handle circular dependencies by:

- Processing independent files first, then dependent files (for example, process diversion time series first by reading the station list from the network or list file)
- Creating an initial StateMod diversion stations file and then updating it in later processing (this is the approach used in the colorado_1_2007 data set)

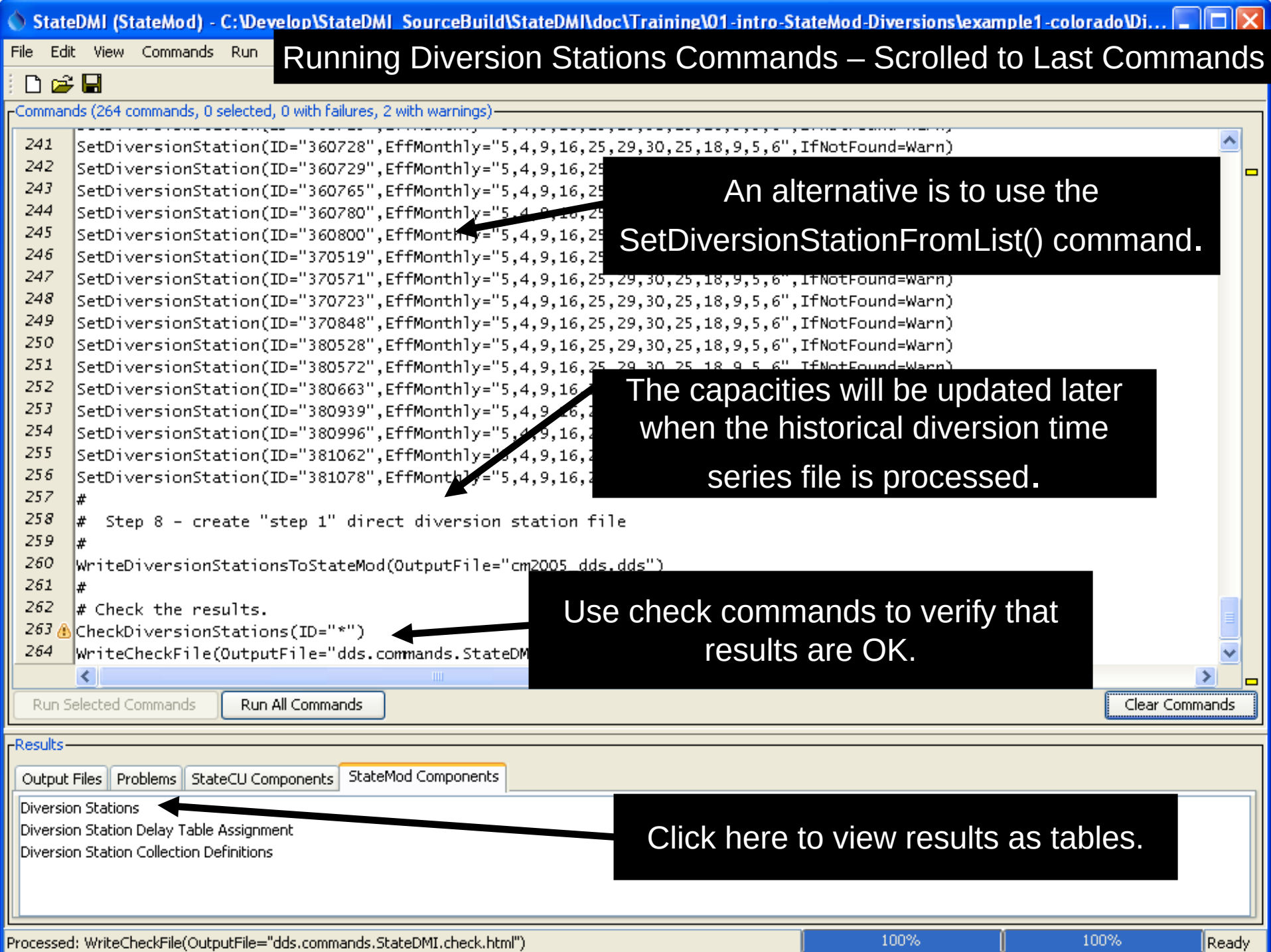
Processing Diversion Stations

- Make sure to connect to HydroBase when starting StateDMI
- File…Open…Command File
- Select example1-colorado\Diversions\dds.commands-updated.StateDMI)
- Press the Run All Commands button under the command list
- View the output files


StateDMI (StateMod) - C:\Develop\StateDMI_SourceBuild\StateDMI\doc\Training\01-intro-StateMod-Diversions\example1-colorado\Di...
File Edit View Commands Run Results Tools Help
Running Diversion Stations Commands
Commands (264 commands, 0 selected, 0 with failures, 2 with warnings)
1 StartLog(LogFile="dds.commands.StateDMI.log")
2 # dds.commands.StateDMI
3 #
4 # StateDMI command file to create the "step 1"
5 #
6 # Step 1 - set year type and read list of direct diversion stations from network file
7 #
8 SetOutputYearType(OutputYearType=Water)
9 ReadDiversionStationsFromNetwork(InputFile="..\Network\cm2005.net")
10 #
11 # Step 2 - read aggregate and diversion system structure assignments. Note that
12 # want to combine historical acreage and capaci
13 #
14 SetDiversionAggregateFromList(ListFile="cm_agg.csv",ID
15 SetDiversionSystemFromList(ListFile="cm_divsys.csv",ID
16 SetDiversionStation(ID="72_ADC054",IrrigatedAcres=1200,IfNotFound=Warn)
17 SetDiversionStation(ID="72_ADC055",IrrigatedAcres=928,IfNotFound=Warn)
18 #
19 # Step 3 - read diversion station information from HydroBase and sort alphabetically
20 #
21 FillDiversionStationsFromHydroBase(ID="*")
22 SortDiversionStations(Order=Ascending)
23 #
24 # Step 4 - set global options for all s
Comments describe processing.
Warnings (yellow) and failures (red) are indicated for commands.
Run Selected Commands
Run All Commands
Clear Commands
Click on a file to view.
These are output from StateDMI and some are input to StateMod or other StateDMI command files.
Results
Output Files
Problems
StateCU Components
StateMod Components
C:\Develop\StateDMI_SourceBuild\StateDMI\doc\Training\01-intro-StateMod-Diversions\example1-colorado\Diversions\dds.commands.StateDMI.log
C:\Develop\StateDMI_SourceBuild\StateDMI\doc\Training\01-intro-StateMod-Diversions\example1-colorado\Diversions\cm2005_dds.dds
C:\Develop\StateDMI_SourceBuild\StateDMI\doc\Training\01-intro-StateMod-Diversions\example1-colorado\Diversions\dds.commands.StateDMI.check.html
Processed: WriteCheckFile(OutputFile="dds.commands.StateDMI.check.html")
100%
100%
Ready

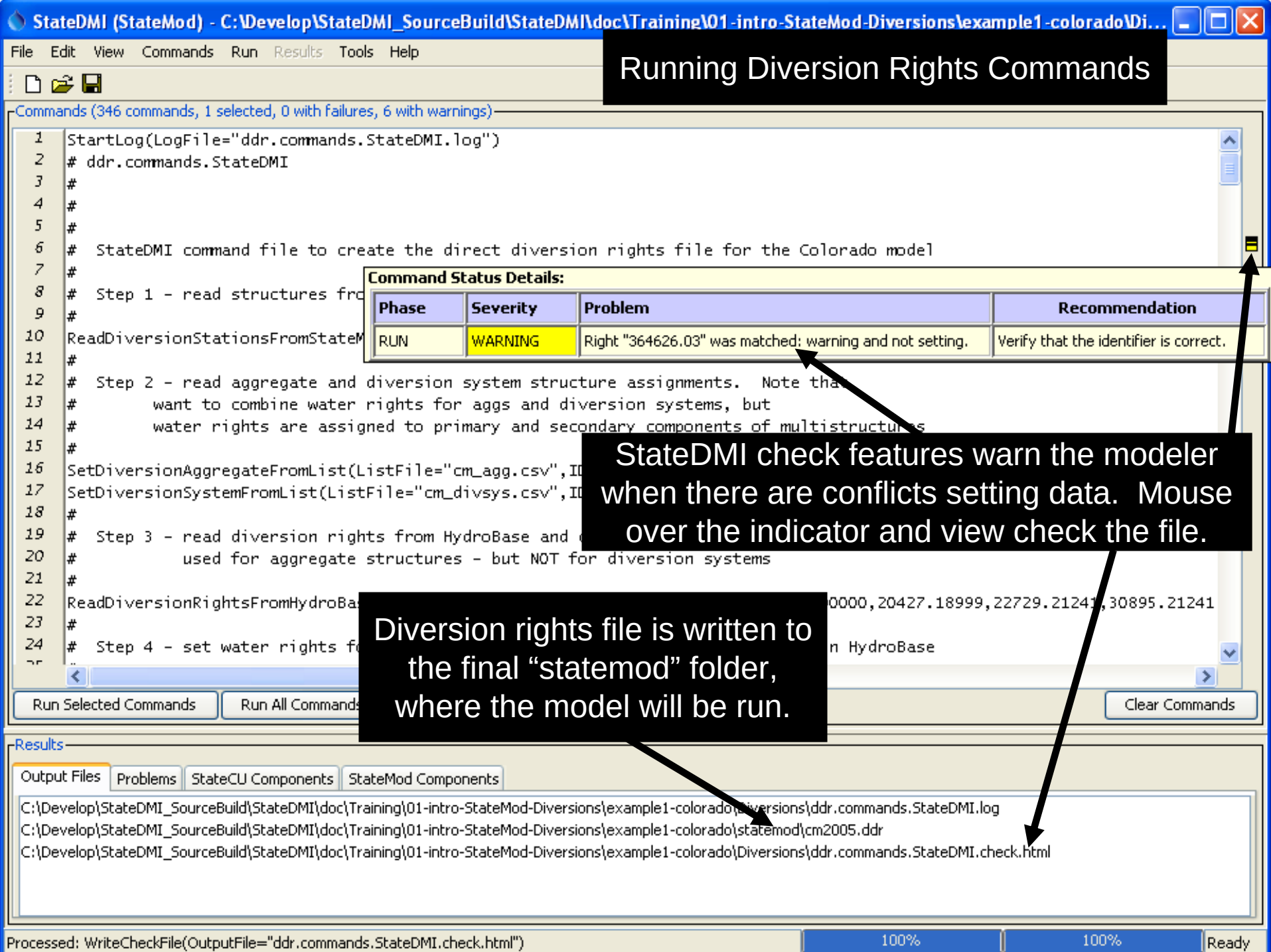

cm2005_dds.dds - Notepad
File Edit Format View Help
#HeaderRevision 0
#
File generated by...
program: StateDMI 3.10.00 (2010-04-01)
user: sam
date: Fri May 07 10:03:09 MDT 2010
host: AMAZON
directory: C:\Develop\StateDMI_SourceBuild\StateDMI\doc\Training\01
olorado\Diversions
command line: StateDMI -home test\operational\CDSS
#----

Command file name: "C:\Develop\StateDMI_SourceBuild\StateDMI\doc\Training\01-intro-StateMod-Diversions\example1-colorado\Diver
Commands:
StartLog(LogFile="dds.commands.StateDMI.log")
dds.commands.StateDMI
# #
StateDMI command file to create the "step 1" direct diversion station file
# #
Step 1 - set year type and read list of direct diversion stations from network file
# #
SetOutputYearType(OutputYearType=Water)
ReadDiversionStationsFromNetwork(InputFile="..\Network\cm2005.net")
# #
Step 2 - read aggregate and diversion system structure assignments. Note that
want to combine historical acreage and capacites for aggs and diversion systems.
# #
SetDiversionAggregateFromList(ListFile="cm_agg.csv",IDCol=1,NameCol=2,PartIDsCol=3,PartsListedHow=InRow)
SetDiversionSystemFromList(ListFile="cm_divsys.csv",IDCol=1,NameCol=2,PartIDsCol=3,PartsListedHow=InRow)
SetDiversionStation(ID="72_ADC054",IrrigatedAcres=1200,IfNotFound=Warn)
SetDiversionStation(ID="72_ADC055",IrrigatedAcres=928,IfNotFound=Warn)
# #
Step 3 - read diversion station information from HydroBase and
# #
FillDiversionStationsFromHydroBase(ID="*")
SortDiversionStations(Order=Ascending)
# #
Step 4 - set global options for all structures
# #
SetDiversionStation(ID="*",RiverNodeID="ID",OnOff=1,ReplaceResOption=-1,DailyID="4",DemandType=1,UseType=1,DemandSource=1,EffA
SetDiversionStationDelayTablesFromNetwork(ID="*",DefaultTable=1)
# #
Step 5 - overwrite downstream return flow location, efficiencies and delay patterns based
on return flow file: read annual average irrigation efficiencies from StateCU (*.def)
# #
SetDiversionStationDelayTablesFromRTN(InputFile="cm2005.rtn",SetEfficiency=True)
SetDiversionStationsFromList(ListFile="cm2005.def",IDCol="1",EffMonthly
# #
Step 6 - overide HydroBase capacities and demand sources
# #
Transbasin Diversions - demscr=6 & resreplace=0 (does not get Green M
SetDiversionStation(ID="364626",ReplaceResOption=0,DemandSource=6,IfNot
SetDiversionStation(ID="364684",ReplaceResOption=0,DemandSource=6,IfNot
SetDiversionStation(ID="364685",ReplaceResOption=0,DemandSource=6,IfNot
SetDiversionStation(ID="374614",ReplaceResOption=0,DemandSource=6,IfNot
SetDiversionStation(ID="374641",ReplaceResOption=0,DemandSource=6,IfNot
SetDiversionStation(ID="371091",ReplaceResOption=0,DemandSource=6,IfNot
Output file is self-documenting
Who, what, when, where
Commands that were run
Below are database information, explanation of the data file format, followed by data


StateDMI (StateMod) - C:\Develop\StateDMI_SourceBuild\StateDMI\doc\Training\01-intro-StateMod-Diversions\example1-colorado\Di...
File Edit View Commands Run
Running Diversion Stations Commands – Scrolled to Last Commands
Commands (264 commands, 0 selected, 0 with failures, 2 with warnings)
241 SetDiversionStation(ID="360728",EffMonthly="5,4,9,16,25,29,30,25,18,9,5,6",IfNotFound=Warn)
242 SetDiversionStation(ID="360729",EffMonthly="5,4,9,16,25
243 SetDiversionStation(ID="360765",EffMonthly="5,4,9,16,25
244 SetDiversionStation(ID="360780",EffMonthly="5,4,9,16,25
245 SetDiversionStation(ID="360800",EffMonthly="5,4,9,16,25
246 SetDiversionStation(ID="370519",EffMonthly="5,4,9,16,25
247 SetDiversionStation(ID="370571",EffMonthly="5,4,9,16,25,29,30,25,18,9,5,6",IfNotFound=Warn)
248 SetDiversionStation(ID="370723",EffMonthly="5,4,9,16,25,29,30,25,18,9,5,6",IfNotFound=Warn)
249 SetDiversionStation(ID="370848",EffMonthly="5,4,9,16,25,29,30,25,18,9,5,6",IfNotFound=Warn)
250 SetDiversionStation(ID="380528",EffMonthly="5,4,9,16,25,29,30,25,18,9,5,6",IfNotFound=Warn)
251 SetDiversionStation(ID="380572",EffMonthly="5,4,9,16,25,29,30,25,18,9,5,6",IfNotFound=Warn)
252 SetDiversionStation(ID="380663",EffMonthly="5,4,9,16,
253 SetDiversionStation(ID="380939",EffMonthly="5,4,9,16,
254 SetDiversionStation(ID="380996",EffMonthly="5,4,9,16,
255 SetDiversionStation(ID="381062",EffMonthly="5,4,9,16,
256 SetDiversionStation(ID="381078",EffMonthly="5,4,9,16,
257 #
258 # Step 8 - create "step 1" direct diversion station file
259 #
260 WriteDiversionStationsToStateMod(OutputFile="cm2005_dds.dds")
261 #
262 # Check the results.
263 CheckDiversionStations(ID="*")
264 WriteCheckFile(OutputFile="dds.commands.StateDM
An alternative is to use the SetDiversionStationFromList() command.
The capacities will be updated later when the historical diversion time series file is processed.
Use check commands to verify that results are OK.
Run Selected Commands
Run All Commands
Clear Commands
Results
Output Files
Problems
StateCU Components
StateMod Components
Diversion Stations
Diversion Station Delay Table Assignment
Diversion Station Collection Definitions
Click here to view results as tables.
Processed: WriteCheckFile(OutputFile="dds.commands.StateDMI.check.html")
100%
100%
Ready

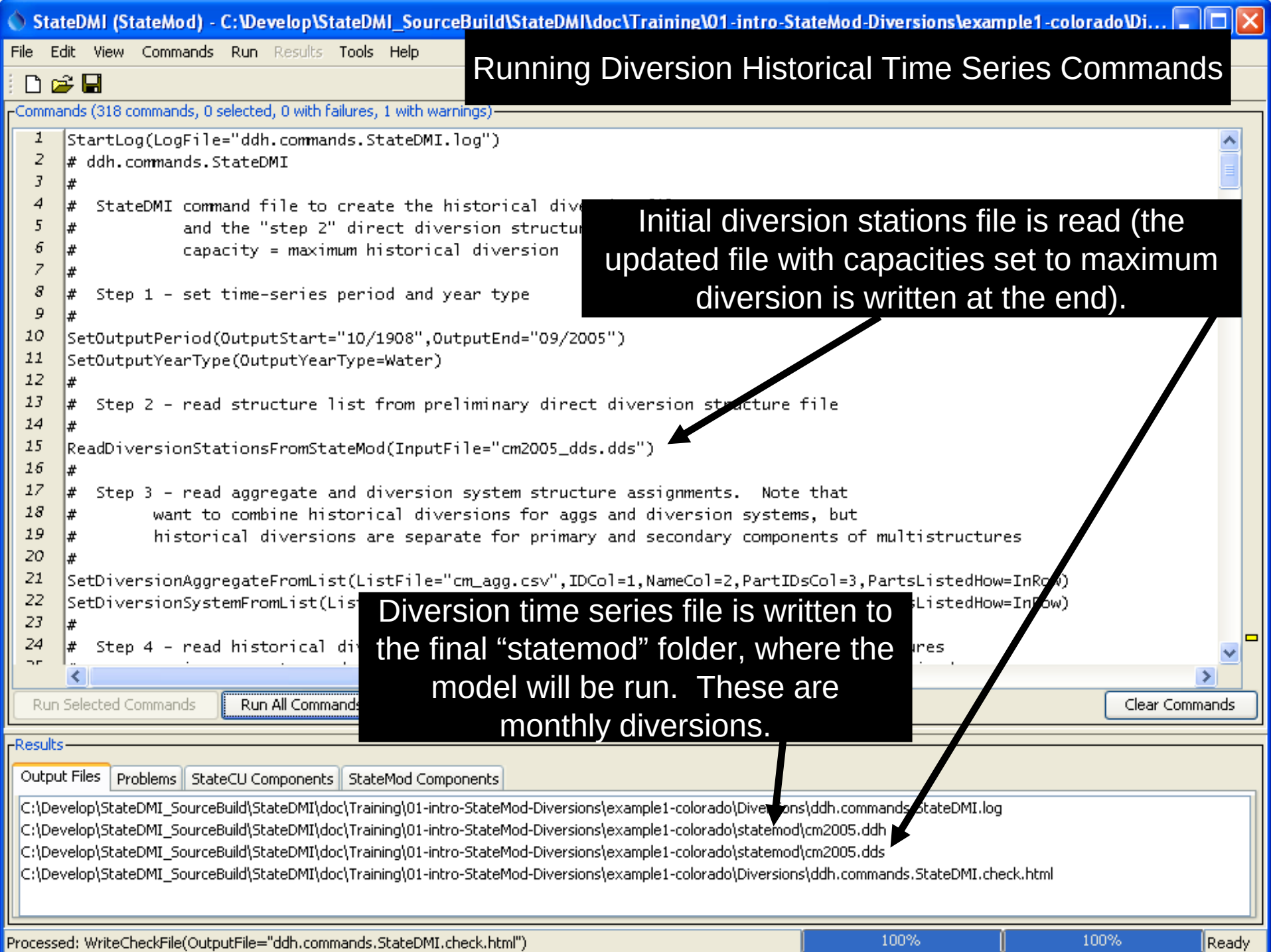
Processing Diversion Rights

- File…Open…Command File
- Select example1-colorado\Diversions\ddr.commands-updated.StateDMI)
- Press the Run All Commands button under the command list
- View the output files

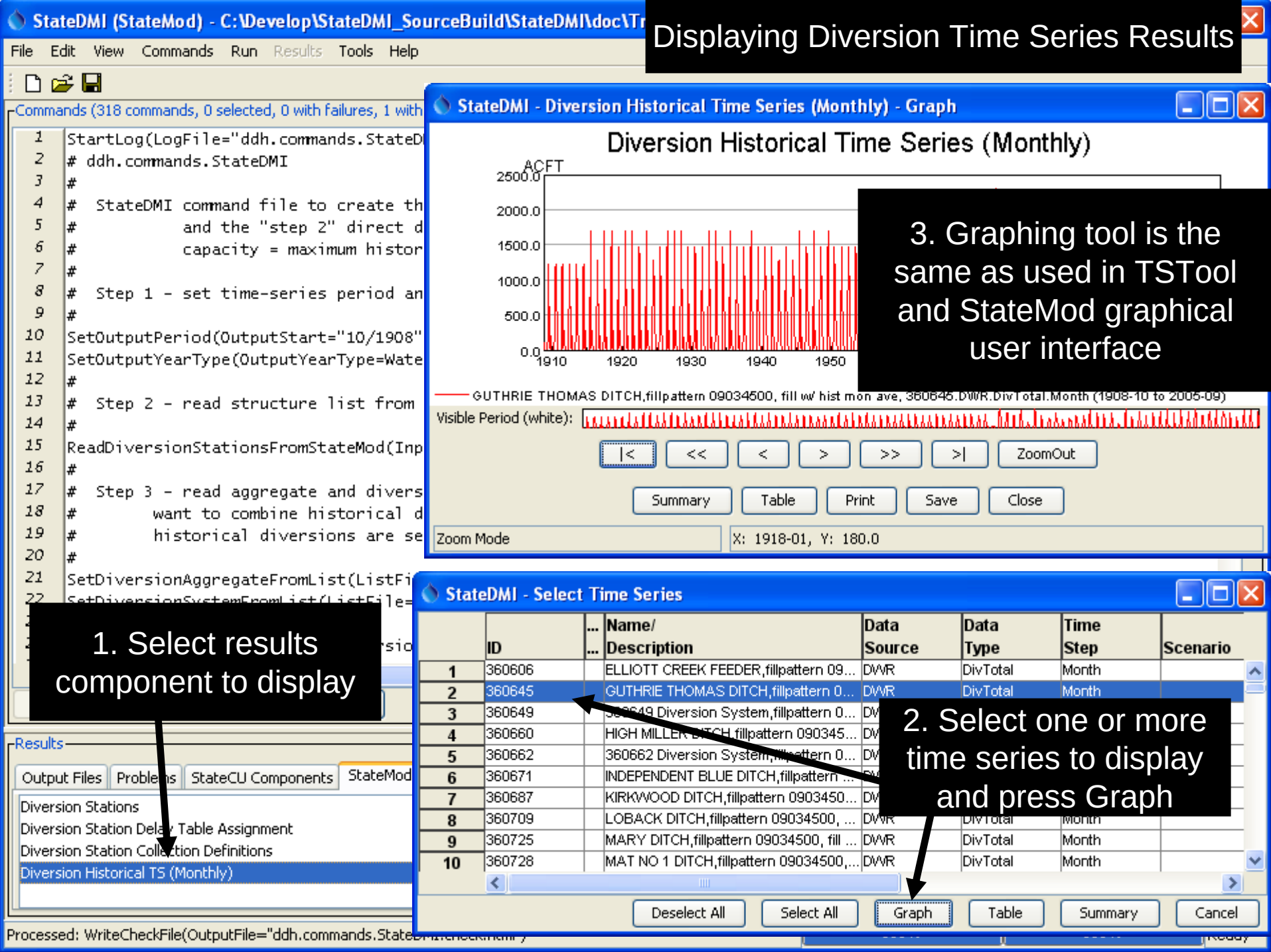

StateDMI (StateMod) - C:\Develop\StateDMI_SourceBuild\StateDMI\doc\Training\01-intro-StateMod-Diversions\example1-colorado\Di...
File Edit View Commands Run Results Tools Help
Running Diversion Rights Commands
Commands (346 commands, 1 selected, 0 with failures, 6 with warnings)
1 StartLog(LogFile="ddr.commands.StateDMI.log")
2 # ddr.commands.StateDMI
6 # StateDMI command file to create the direct diversion rights file for the Colorado model
8 # Step 1 - read structures fr
10 ReadDiversionStationsFromState
12 # Step 2 - read aggregate and diversion system structure assignments. Note tha
13 # want to combine water rights for aggs and diversion systems, but
14 # water rights are assigned to primary and secondary components of multistructures
16 SetDiversionAggregateFromList(ListFile="cm_agg.csv",ID
17 SetDiversionSystemFromList(ListFile="cm_divsys.csv",ID
19 # Step 3 - read diversion rights from HydroBase and
20 # used for aggregate structures - but NOT for diversion systems
22 ReadDiversionRightsFromHydroBa 0000,20427.18999,22729.21241,30895.21241
24 # Step 4 - set water rights f n HydroBase
Command Status Details:
Phase | Severity | Problem | Recommendation
RUN | WARNING | Right "364626.03" was matched; warning and not setting. | Verify that the identifier is correct.
StateDMI check features warn the modeler when there are conflicts setting data. Mouse over the indicator and view check the file.
Diversion rights file is written to the final “statemod” folder, where the model will be run.
Run Selected Commands
Run All Commands
Clear Commands
Results
Output Files
Problems
StateCU Components
StateMod Components
C:\Develop\StateDMI_SourceBuild\StateDMI\doc\Training\01-intro-StateMod-Diversions\example1-colorado\Diversions\ddr.commands.StateDMI.log
C:\Develop\StateDMI_SourceBuild\StateDMI\doc\Training\01-intro-StateMod-Diversions\example1-colorado\statemod\cm2005.ddr
C:\Develop\StateDMI_SourceBuild\StateDMI\doc\Training\01-intro-StateMod-Diversions\example1-colorado\Diversions\ddr.commands.StateDMI.check.html
Processed: WriteCheckFile(OutputFile="ddr.commands.StateDMI.check.html")
100%
100%
Ready

Processing Diversion Historical Time Series

- File…Open…Command File
- Select example1-colorado\Diversions\ddh.commands-updated.StateDMI)
- Press the Run All Commands button under the command list
- View the output files


StateDMI (StateMod) - C:\Develop\StateDMI_SourceBuild\StateDMI\doc\Training\01-intro-StateMod-Diversions\example1-colorado\Di...
File Edit View Commands Run Results Tools Help
Running Diversion Historical Time Series Commands
Commands (318 commands, 0 selected, 0 with failures, 1 with warnings)
1 StartLog(LogFile="ddh.commands.StateDMI.log")
2 # ddh.commands.StateDMI
3 #
4 # StateDMI command file to create the historical div
5 # and the "step 2" direct diversion structu
6 # capacity = maximum historical diversion
7 #
8 # Step 1 - set time-series period and year type
9 #
10 SetOutputPeriod(OutputStart="10/1908",OutputEnd="09/2005")
11 SetOutputYearType(OutputYearType=Water)
12 #
13 # Step 2 - read structure list from preliminary direct diversion structure file
14 #
15 ReadDiversionStationsFromStateMod(InputFile="cm2005_dds.dds")
16 #
17 # Step 3 - read aggregate and diversion system structure assignments. Note that
18 # want to combine historical diversions for aggs and diversion systems, but
19 # historical diversions are separate for primary and secondary components of multistructures
20 #
21 SetDiversionAggregateFromList(ListFile="cm_agg.csv",IDCol=1,NameCol=2,PartIDsCol=3,PartsListedHow=InRow)
22 SetDiversionSystemFromList(Lis ListedHow=InRow)
23 #
24 # Step 4 - read historical di ures
Initial diversion stations file is read (the updated file with capacities set to maximum diversion is written at the end).
Diversion time series file is written to the final "statemod" folder, where the model will be run. These are monthly diversions.
Run Selected Commands
Run All Commands
Clear Commands
Results
Output Files
Problems
StateCU Components
StateMod Components
C:\Develop\StateDMI_SourceBuild\StateDMI\doc\Training\01-intro-StateMod-Diversions\example1-colorado\Div ons\ddh.commands StateDMI.log
C:\Develop\StateDMI_SourceBuild\StateDMI\doc\Training\01-intro-StateMod-Diversions\example1-colorado\statemod\cm2005.ddh
C:\Develop\StateDMI_SourceBuild\StateDMI\doc\Training\01-intro-StateMod-Diversions\example1-colorado\statemod\cm2005.dds
C:\Develop\StateDMI_SourceBuild\StateDMI\doc\Training\01-intro-StateMod-Diversions\example1-colorado\Diversions\ddh.commands.StateDMI.check.html
Processed: WriteCheckFile(OutputFile="ddh.commands.StateDMI.check.html")
100%
100%
Ready

Displaying Diversion Time Series Results



3. Graphing tool is the same as used in TSTool and StateMod graphical user interface

1. Select results component to display

2. Select one or more time series to display and press Graph

Other Diversion Data Files are Processed Similarly

- Demand, irrigation water requirement time series
- Different model scenarios are included in baseline data sets
- Refer to model data set documentation for more information

Recommendations for Modelers

- Use best practices for command files – see Getting Started presentation.
- Define data in one place – use HydroBase and list files.
- When creating a new data set, start with command files from existing data sets and adapt.
- In all cases, understand the processing logic.
- Build quality control into processing.
- Provide feedback on software, data sets, and documentation to foster continued improvement.

More Information

- Help…View Documentation to view the StateDMI documentation.
- See also other StateDMI training presentations on related topics.
- Basin model documentation describes in detail the sources of data, estimates, and processes that were used to create the data sets, and summarizes results.
- Numerous task memoranda, reports, software documentation, and other documents provide technical information and are available on the CDSS web site: http://cdss.state.co.us (see Products…Surface Water Model link)