Colorado's Decision Support Systems (CDSS)

# TSTool Training

## Introduction to CDSS Data

Version: 10.00.01, 2011-05-09

Duration: 60+ minutes

Level: Introduction

# This Presentation

- Provides an introduction using TSTool with CDSS data
- 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 TSTool requires access to a HydroBase database and internet (ColoradoWaterHBGuest and ColoradoWaterSMS web services)

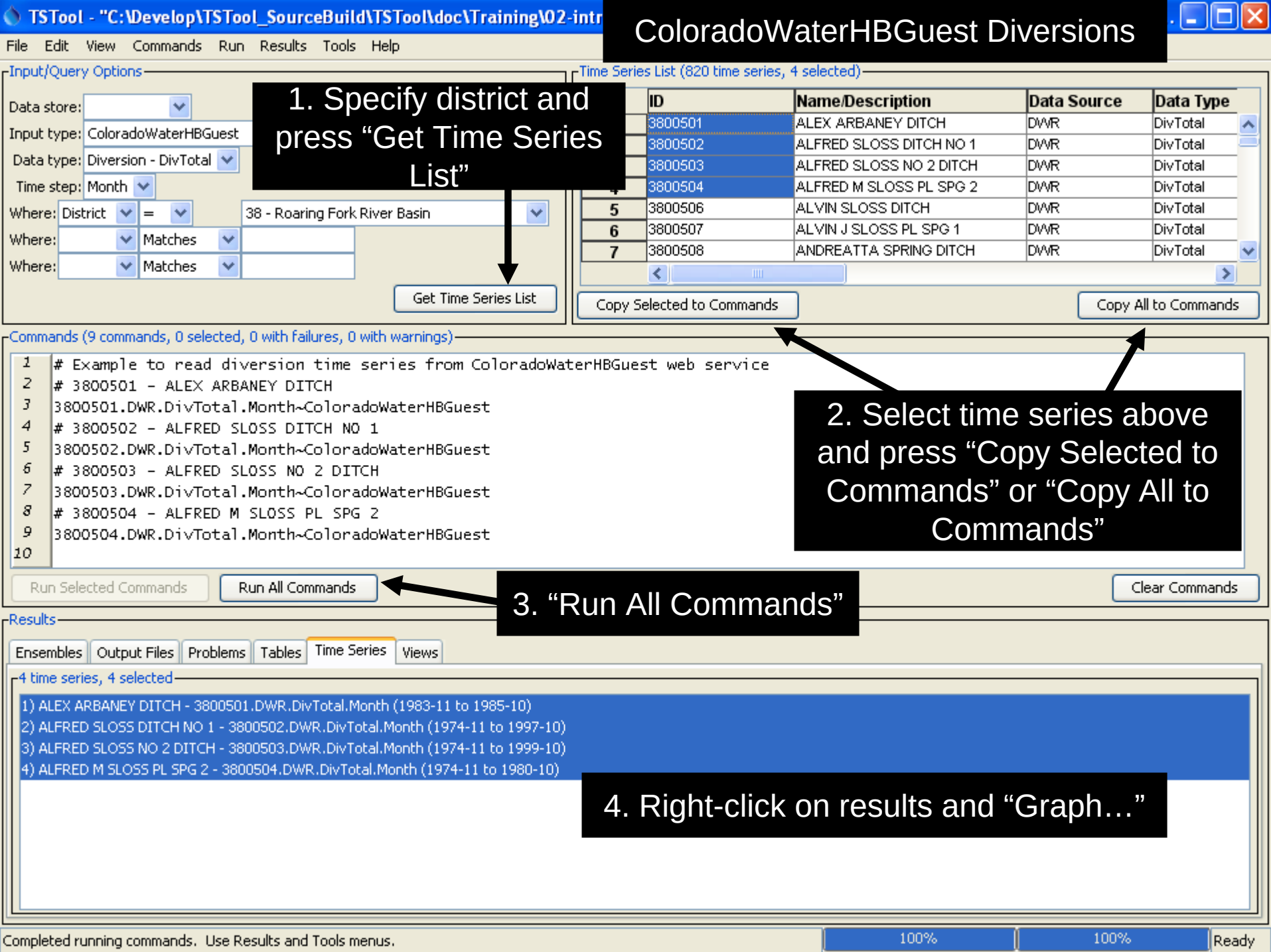
# ColoradoWaterHBGuest Web Service

## Diversion Data

- Requires internet access
- Currently limited to total diversion through structure (DivTotal) data type, but additional data types will be supported in the future
- Performance is impacted by network speed

See example1-ColoradoWaterHBGuest\ ColoradoWaterHBGuest.TSTool

(the following slide illustrates how to create this command file)

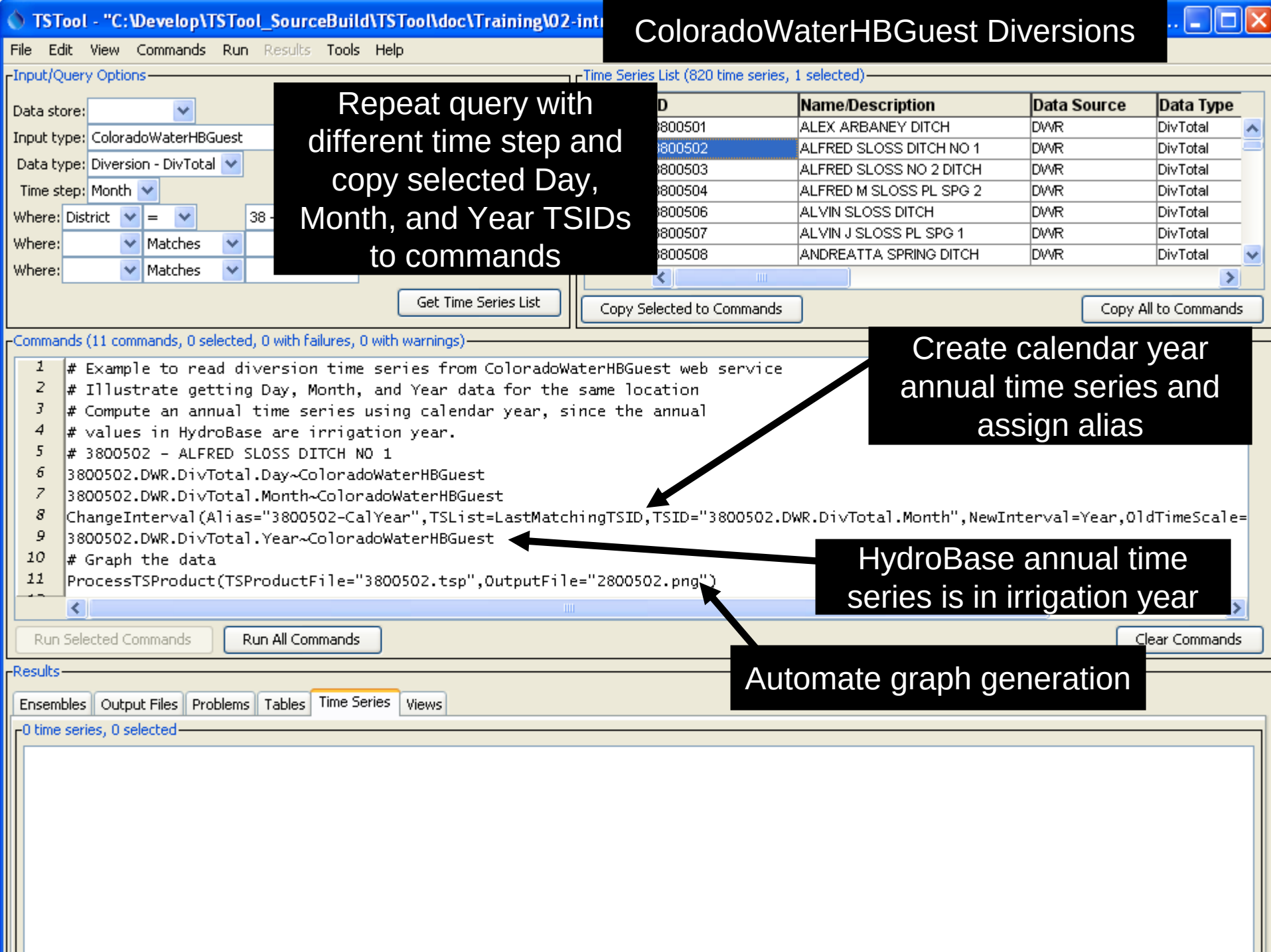

TSTool - "C:\Develop\TSTool_SourceBuild\TSTool\doc\Training\02-intr
ColoradoWaterHBGuest Diversions
File Edit View Commands Run Results Tools Help
Input/Query Options
Data store:
Input type: ColoradoWaterHBGuest
Data type: Diversion - DivTotal
Time step: Month
Where: District = 38 - Roaring Fork River Basin
Where: Matches
Where: Matches
Get Time Series List
1. Specify district and press "Get Time Series List"
Time Series List (820 time series, 4 selected)
ID Name/Description Data Source Data Type
1 3800501 ALEX ARBANEY DITCH DWR DivTotal
2 3800502 ALFRED SLOSS DITCH NO 1 DWR DivTotal
3 3800503 ALFRED SLOSS NO 2 DITCH DWR DivTotal
4 3800504 ALFRED M SLOSS PL SPG 2 DWR DivTotal
5 3800506 ALVIN SLOSS DITCH DWR DivTotal
6 3800507 ALVIN J SLOSS PL SPG 1 DWR DivTotal
7 3800508 ANDREATTA SPRING DITCH DWR DivTotal
Copy Selected to Commands
Copy All to Commands
Commands (9 commands, 0 selected, 0 with failures, 0 with warnings)
1 # Example to read diversion time series from ColoradoWaterHBGuest web service
2 # 3800501 - ALEX ARBANEY DITCH
3 3800501.DWR.DivTotal.Month~ColoradoWaterHBGuest
4 # 3800502 - ALFRED SLOSS DITCH NO 1
5 3800502.DWR.DivTotal.Month~ColoradoWaterHBGuest
6 # 3800503 - ALFRED SLOSS NO 2 DITCH
7 3800503.DWR.DivTotal.Month~ColoradoWaterHBGuest
8 # 3800504 - ALFRED M SLOSS PL SPG 2
9 3800504.DWR.DivTotal.Month~ColoradoWaterHBGuest
10
2. Select time series above and press "Copy Selected to Commands" or "Copy All to Commands"
Run Selected Commands
Run All Commands
3. "Run All Commands"
Clear Commands
Results
Ensembles Output Files Problems Tables Time Series Views
4 time series, 4 selected
1) ALEX ARBANEY DITCH - 3800501.DWR.DivTotal.Month (1983-11 to 1985-10)
2) ALFRED SLOSS DITCH NO 1 - 3800502.DWR.DivTotal.Month (1974-11 to 1997-10)
3) ALFRED SLOSS NO 2 DITCH - 3800503.DWR.DivTotal.Month (1974-11 to 1999-10)
4) ALFRED M SLOSS PL SPG 2 - 3800504.DWR.DivTotal.Month (1974-11 to 1980-10)
4. Right-click on results and "Graph…"
Completed running commands. Use Results and Tools menus.
100%
100%
Ready

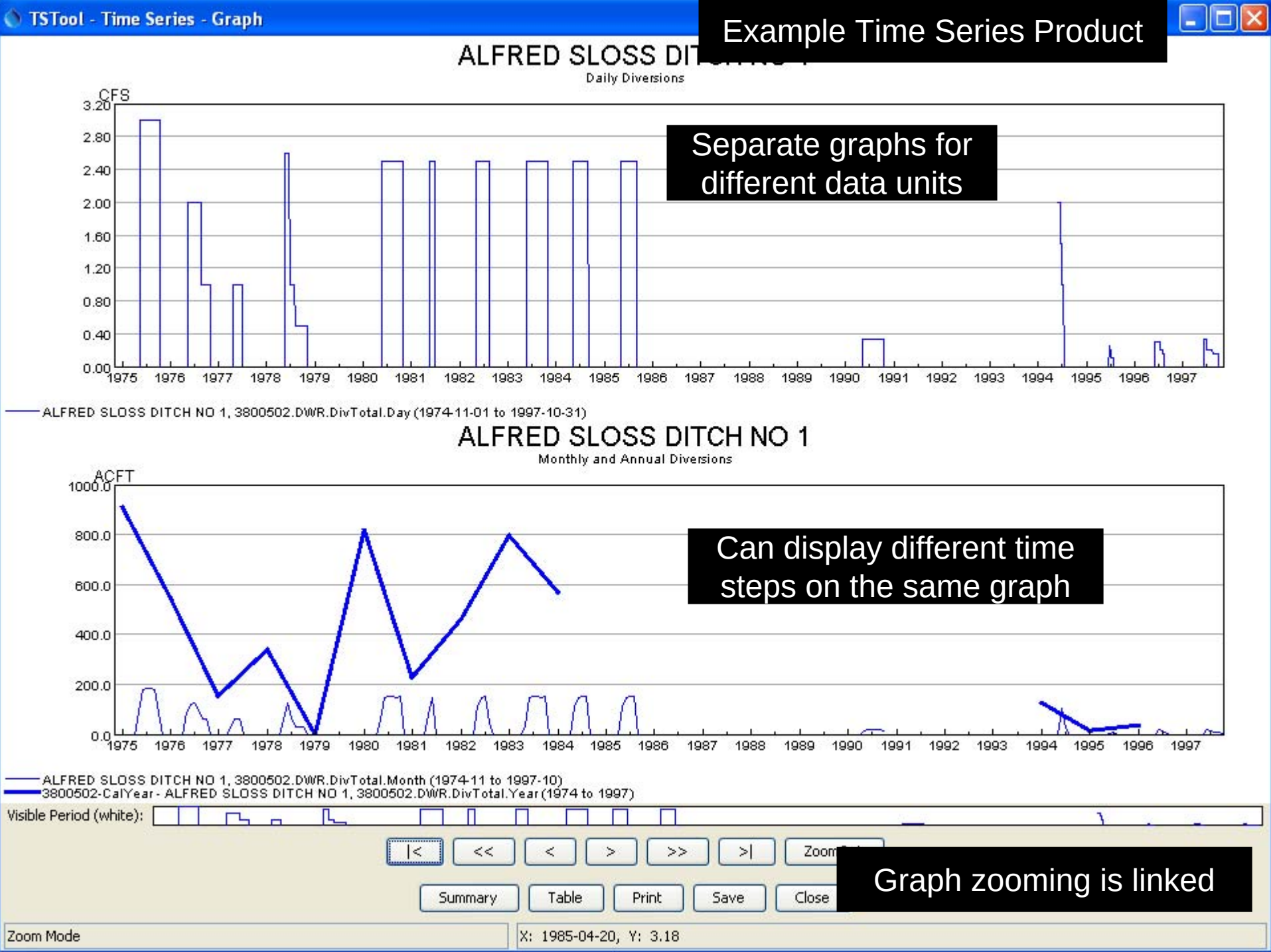
# ColoradoWaterHBGuest Web Service

## Diversion Data

- Day, Month, and Irrigation Year (November to October) data available
- Can convert monthly data to calendar year using the ChangeInterval() command

See example1-ColoradoWaterHBGuest\ ColoradoWaterHBGuest-3800502.TSTool

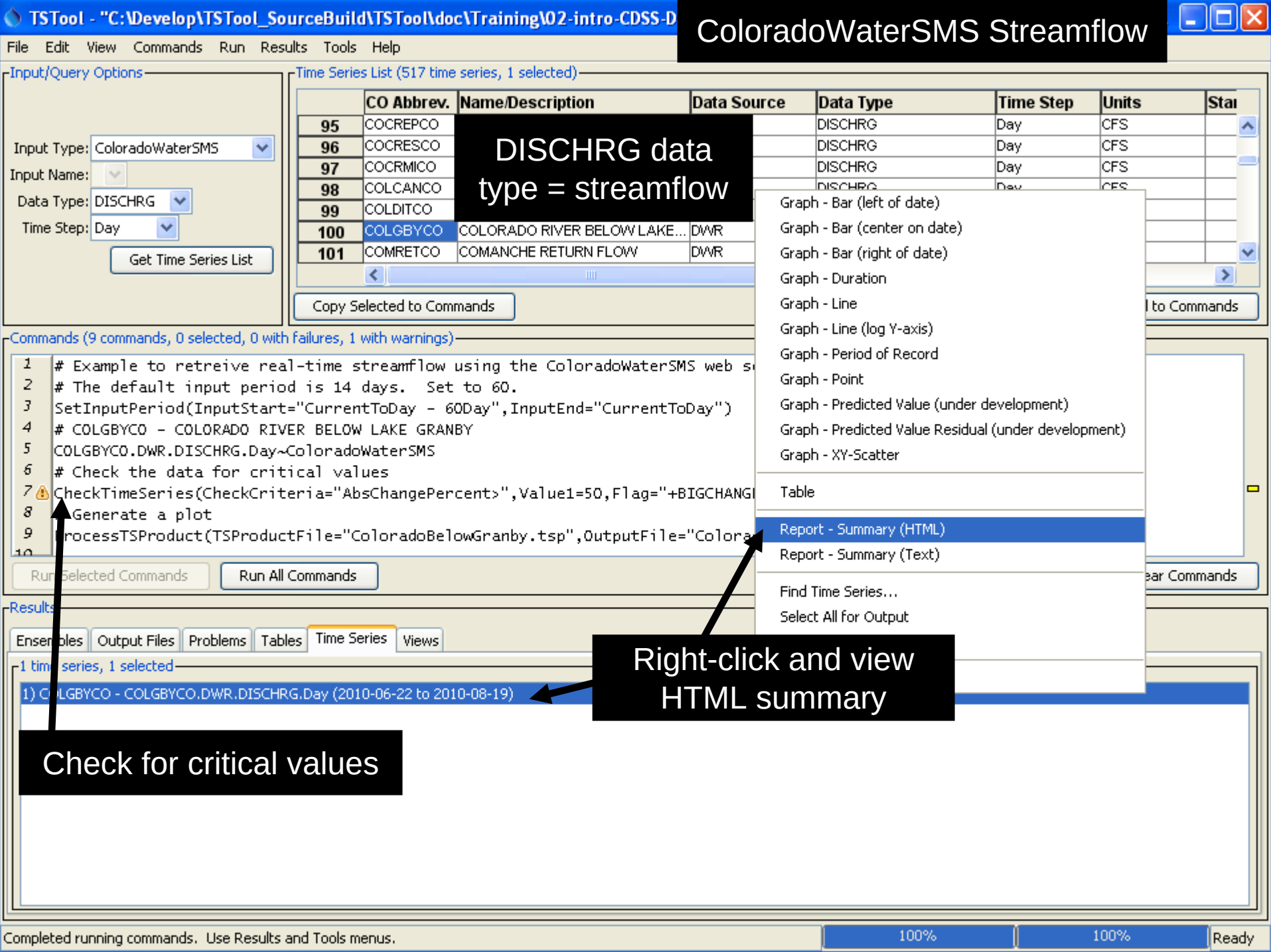

TSTool - "C:\Develop\TSTool_SourceBuild\TSTool\doc\Training\02-int
ColoradoWaterHBGuest Diversions
File Edit View Commands Run Results Tools Help
Input/Query Options
Data store:
Input type: ColoradoWaterHBGuest
Data type: Diversion - DivTotal
Time step: Month
Where: District = 38
Where: Matches
Where: Matches
Get Time Series List
Repeat query with different time step and copy selected Day, Month, and Year TSIDs to commands
Time Series List (820 time series, 1 selected)
D
Name/Description
Data Source
Data Type
800501 ALEX ARBANEY DITCH DWR DivTotal
800502 ALFRED SLOSS DITCH NO 1 DWR DivTotal
800503 ALFRED SLOSS NO 2 DITCH DWR DivTotal
800504 ALFRED M SLOSS PL SPG 2 DWR DivTotal
800506 ALVIN SLOSS DITCH DWR DivTotal
800507 ALVIN J SLOSS PL SPG 1 DWR DivTotal
800508 ANDREATTA SPRING DITCH DWR DivTotal
Copy Selected to Commands
Copy All to Commands
Commands (11 commands, 0 selected, 0 with failures, 0 with warnings)
1 # Example to read diversion time series from ColoradoWaterHBGuest web service
2 # Illustrate getting Day, Month, and Year data for the same location
3 # Compute an annual time series using calendar year, since the annual
4 # values in HydroBase are irrigation year.
5 # 3800502 - ALFRED SLOSS DITCH NO 1
6 3800502.DWR.DivTotal.Day~ColoradoWaterHBGuest
7 3800502.DWR.DivTotal.Month~ColoradoWaterHBGuest
8 ChangeInterval(Alias="3800502-CalYear",TSList=LastMatchingTSID,TSID="3800502.DWR.DivTotal.Month",NewInterval=Year,OldTimeScale=
9 3800502.DWR.DivTotal.Year~ColoradoWaterHBGuest
10 # Graph the data
11 ProcessTSProduct(TSProductFile="3800502.tsp",OutputFile="2800502.png")
Create calendar year annual time series and assign alias
HydroBase annual time series is in irrigation year
Automate graph generation
Run Selected Commands
Run All Commands
Clear Commands
Results
Ensembles Output Files Problems Tables Time Series Views
0 time series, 0 selected

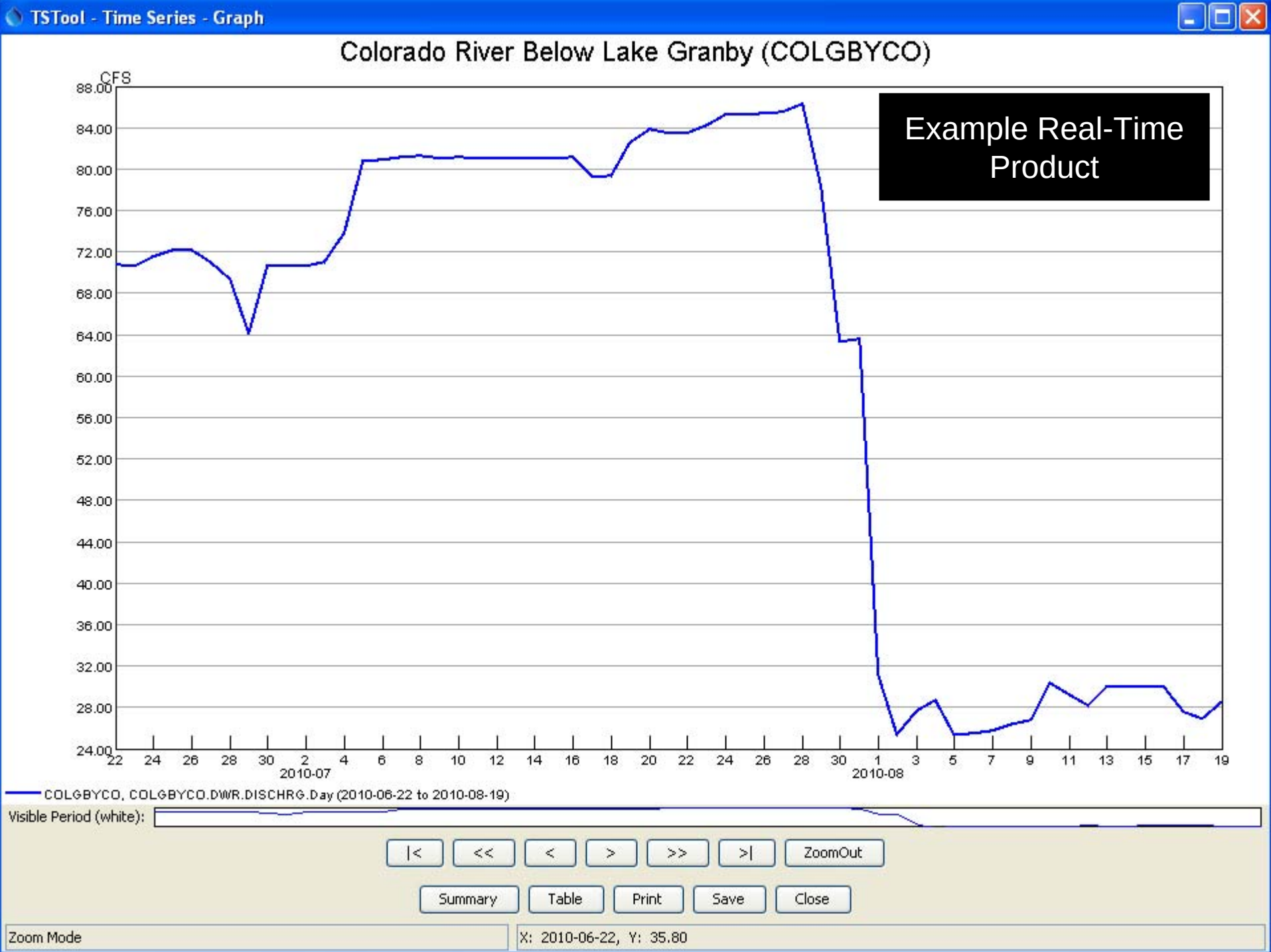

TSTool - Time Series - Graph
Example Time Series Product
ALFRED SLOSS DI
Daily Diversions
CFS
3.20
2.80
2.40
2.00
1.60
1.20
0.80
0.40
0.00
1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997
Separate graphs for different data units
ALFRED SLOSS DITCH NO 1, 3800502.DWR.DivTotal.Day (1974-11-01 to 1997-10-31)
ALFRED SLOSS DITCH NO 1
Monthly and Annual Diversions
ACFT
1000.0
800.0
600.0
400.0
200.0
0.0
1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997
Can display different time steps on the same graph
ALFRED SLOSS DITCH NO 1, 3800502.DWR.DivTotal.Month (1974-11 to 1997-10)
3800502-CalYear - ALFRED SLOSS DITCH NO 1, 3800502.DWR.DivTotal.Year (1974 to 1997)
Visible Period (white):
|<
<<
<
>
>>
>|
Zoom
Graph zooming is linked
Summary
Table
Print
Save
Close
Zoom Mode
X: 1985-04-20, Y: 3.18

# ColoradoWaterSMS Web Service Real-Time Data

- Requires internet access
- Preliminary implementation (there are some rough edges and additional optimization is needed)
- Performance is impacted by network speed

See example2-ColoradoWaterSMS\ ColoradoBelowGranby.TSTool


TSTool - "C:\Develop\TSTool_SourceBuild\TSTool\doc\Training\02-intro-CDSS-D
ColoradoWaterSMS Streamflow
File Edit View Commands Run Results Tools Help
Input/Query Options
Input Type: ColoradoWaterSMS
Input Name:
Data Type: DISCHRG
Time Step: Day
Get Time Series List
Time Series List (517 time series, 1 selected)
CO Abbrev. Name/Description Data Source Data Type Time Step Units
95 COCREPCO DISCHRG Day CFS
96 COCRESCO DISCHRG Day CFS
97 COCRMICO DISCHRG Day CFS
98 COLCANCO
99 COLDITCO
100 COLGBYCO COLORADO RIVER BELOW LAKE... DWR
101 COMRETCO COMANCHE RETURN FLOW DWR
DISCHRG data type = streamflow
Copy Selected to Commands
Graph - Bar (left of date)
Graph - Bar (center on date)
Graph - Bar (right of date)
Graph - Duration
Graph - Line
Graph - Line (log Y-axis)
Graph - Period of Record
Graph - Point
Graph - Predicted Value (under development)
Graph - Predicted Value Residual (under development)
Graph - XY-Scatter
Table
Report - Summary (HTML)
Report - Summary (Text)
Find Time Series...
Select All for Output
Commands (9 commands, 0 selected, 0 with failures, 1 with warnings)
# Example to retreive real-time streamflow using the ColoradoWaterSMS web s
# The default input period is 14 days. Set to 60.
SetInputPeriod(InputStart="CurrentToDay - 60Day",InputEnd="CurrentToDay")
# COLGBYCO - COLORADO RIVER BELOW LAKE GRANBY
COLGBYCO.DWR.DISCHRG.Day~ColoradoWaterSMS
# Check the data for critical values
CheckTimeSeries(CheckCriteria="AbsChangePercent>",Value1=50,Flag="+BIGCHANG
# Generate a plot
ProcessTSProduct(TSProductFile="ColoradoBelowGranby.tsp",OutputFile="Colora
Run Selected Commands
Run All Commands
Results
Output Files Problems Tables Time Series Views
1) COLGBYCO - COLGBYCO.DWR.DISCHRG.Day (2010-06-22 to 2010-08-19)
Right-click and view HTML summary
Check for critical values
Completed running commands. Use Results and Tools menus.
100%
100%
Ready


TSTool - Time Series - Graph
Colorado River Below Lake Granby (COLGBYCO)
CFS
88.00
84.00
80.00
76.00
72.00
68.00
64.00
60.00
56.00
52.00
48.00
44.00
40.00
36.00
32.00
28.00
24.00
22 24 26 28 30 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 1 3 5 7 9 11 13 15 17 19
2010-07
2010-08
Example Real-Time Product
COLGBYCO, COLGBYCO.DWR.DISCHRG.Day (2010-06-22 to 2010-08-19)
Visible Period (white):
|<
<<
<
>
>>
>|
ZoomOut
Summary
Table
Print
Save
Close
Zoom Mode
X: 2010-06-22, Y: 35.80

# Time Series List

| # | TSID | Alias | Description | Start | End |
|---|---|---|---|---|---|
| 1 | COLGBYCO.DWR.DISCHRG.Day | | COLGBYCO | 2010-06-22 | 2010-08-19 |

Example Time Series HTML Summary

## Time series COLGBYCO.DWR.DISCHRG.Day (COLGBYCO)

### Calendar Year 2010 (Jan 2010 to Dec 2010)

| Day | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | 70.60 | 31.10 BIGCHANGE | | | | |
| 2 | | | | | | | 70.60 | 25.30 | | | | |
| 3 | | | | | | | 71.00 | 27.60 | | | | |
| 4 | | | | | | | 73.80 | 28.70 | | | | |
| 5 | | | | | | | 80.70 | 25.40 | | | | |
| 6 | | | | | | | 80.90 | 25.50 | | | | |
| 7 | | | | | | | 81.20 | 25.70 | | | | |
| 8 | | | | | | | 81.30 | 26.40 | | | | |
| 9 | | | | | | | 81.00 | 26.70 | | | | |
| 10 | | | | | | | 81.10 | 30.40 | | | | |
| 11 | | | | | | | 81.00 | 29.20 | | | | |
| 12 | | | | | | | 81.00 | 28.20 | | | | |
| 13 | | | | | | | 81.00 | 29.90 | | | | |
| 14 | | | | | | | 81.00 | 29.90 | | | | |
| 15 | | | | | | | 81.00 | 29.90 | | | | |
| 16 | | | | | | | 81.10 | 29.90 | | | | |
| 17 | | | | | | | 79.20 | 27.50 | | | | |
| 18 | | | | | | | 79.30 | 26.90 | | | | |
| 19 | | | | | | | 82.60 | 28.60 | | | | |
| 20 | | | | | | | 83.80 | | | | | |
| 21 | | | | | | | 83.50 | | | | | |
| 22 | | | | | | 70.70 | 83.50 | | | | | |
| 23 | | | | | | 70.60 | 84.20 | | | | | |
| 24 | | | | | | 71.50 | 85.20 | | | | | |

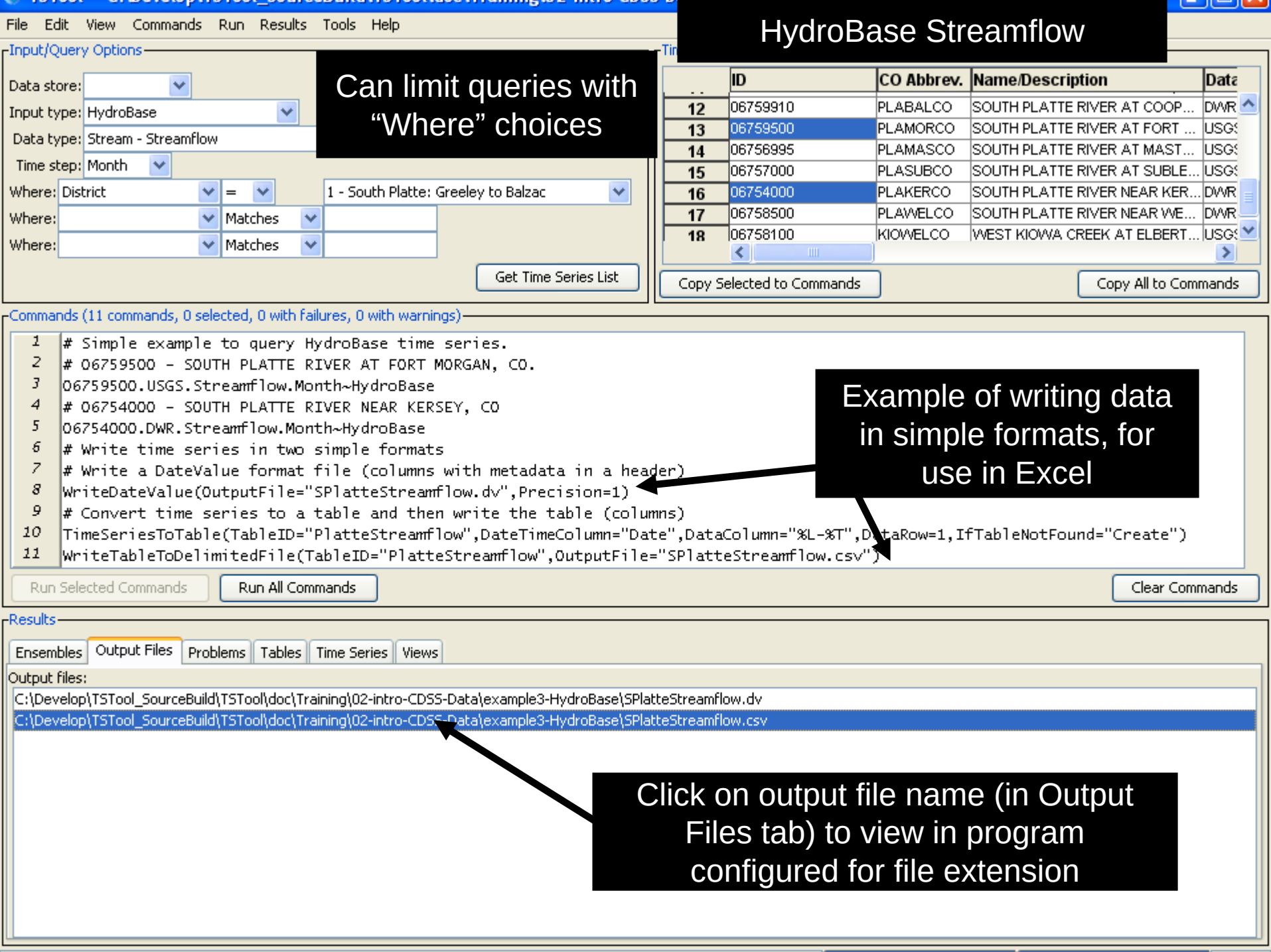
Annotation from CheckTimeSeries()

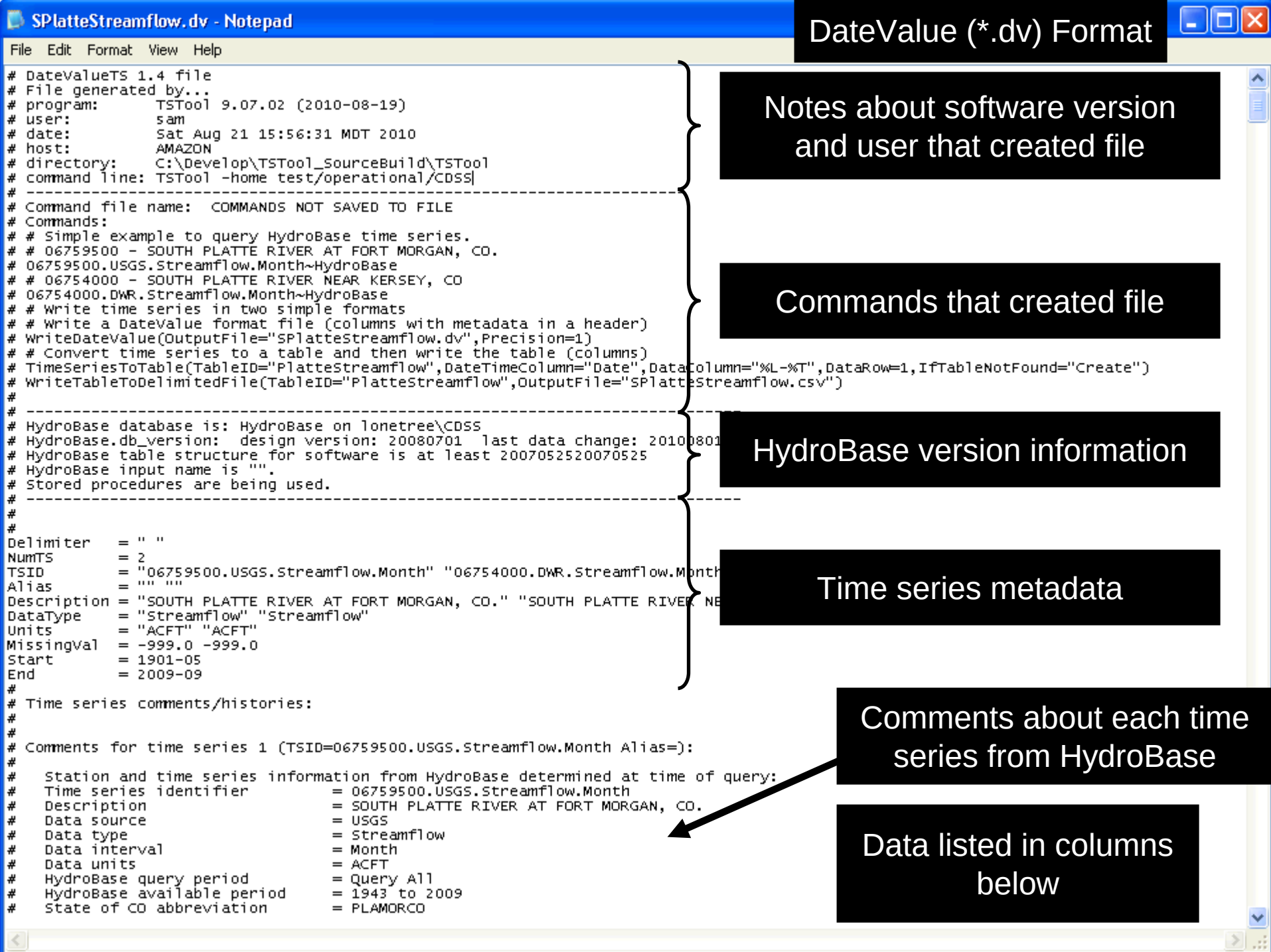
See also notes in the legend at the bottom of the page

# HydroBase

- Contains many time series data types
- Requires a local installation of the database (available on DVD) or server installation at bigger organizations like the State
- Provides fastest access to the State's data
- Can have different versions of the database

See example3-HydroBase\
SPlatteStreamflow.TSTool


File Edit View Commands Run Results Tools Help
HydroBase Streamflow
Input/Query Options
Data store:
Input type: HydroBase
Data type: Stream - Streamflow
Time step: Month
Where: District = 1 - South Platte: Greeley to Balzac
Where: Matches
Where: Matches
Get Time Series List
Can limit queries with "Where" choices
ID CO Abbrev. Name/Description Data
12 06759910 PLABALCO SOUTH PLATTE RIVER AT COOP... DWR
13 06759500 PLAMORCO SOUTH PLATTE RIVER AT FORT ... USGS
14 06756995 PLAMASCO SOUTH PLATTE RIVER AT MAST... USGS
15 06757000 PLASUBCO SOUTH PLATTE RIVER AT SUBLE... USGS
16 06754000 PLAKERCO SOUTH PLATTE RIVER NEAR KER... DWR
17 06758500 PLAWELCO SOUTH PLATTE RIVER NEAR WE... DWR
18 06758100 KIOWELCO WEST KIOWA CREEK AT ELBERT... USGS
Copy Selected to Commands
Copy All to Commands
Commands (11 commands, 0 selected, 0 with failures, 0 with warnings)
1 # Simple example to query HydroBase time series.
2 # 06759500 - SOUTH PLATTE RIVER AT FORT MORGAN, CO.
3 06759500.USGS.Streamflow.Month~HydroBase
4 # 06754000 - SOUTH PLATTE RIVER NEAR KERSEY, CO
5 06754000.DWR.Streamflow.Month~HydroBase
6 # Write time series in two simple formats
7 # Write a DateValue format file (columns with metadata in a header)
8 WriteDateValue(OutputFile="SPlatteStreamflow.dv",Precision=1)
9 # Convert time series to a table and then write the table (columns)
10 TimeSeriesToTable(TableID="PlatteStreamflow",DateTimeColumn="Date",DataColumn="%L-%T",DataRow=1,IfTableNotFound="Create")
11 WriteTableToDelimitedFile(TableID="PlatteStreamflow",OutputFile="SPlatteStreamflow.csv")
Example of writing data in simple formats, for use in Excel
Run Selected Commands
Run All Commands
Clear Commands
Results
Ensembles Output Files Problems Tables Time Series Views
Output files:
C:\Develop\TSTool_SourceBuild\TSTool\doc\Training\02-intro-CDSS-Data\example3-HydroBase\SPlatteStreamflow.dv
C:\Develop\TSTool_SourceBuild\TSTool\doc\Training\02-intro-CDSS-Data\example3-HydroBase\SPlatteStreamflow.csv
Click on output file name (in Output Files tab) to view in program configured for file extension


SPlatteStreamflow.dv - Notepad
File Edit Format View Help
# DateValueTS 1.4 file
# File generated by...
# program: TSTool 9.07.02 (2010-08-19)
# user: sam
# date: Sat Aug 21 15:56:31 MDT 2010
# host: AMAZON
# directory: C:\Develop\TSTool_SourceBuild\TSTool
# command line: TSTool -home test/operational/CDSS
# Command file name: COMMANDS NOT SAVED TO FILE
# Commands:
# # Simple example to query HydroBase time series.
# # 06759500 - SOUTH PLATTE RIVER AT FORT MORGAN, CO.
# 06759500.USGS.Streamflow.Month~HydroBase
# # 06754000 - SOUTH PLATTE RIVER NEAR KERSEY, CO
# 06754000.DWR.Streamflow.Month~HydroBase
# # Write time series in two simple formats
# # Write a DateValue format file (columns with metadata in a header)
# WriteDateValue(OutputFile="SPlatteStreamflow.dv",Precision=1)
# # Convert time series to a table and then write the table (columns)
# TimeSeriesToTable(TableID="PlatteStreamflow",DateTimeColumn="Date",DataColumn="%L-%T",DataRow=1,IfTableNotFound="Create")
# WriteTableToDelimitedFile(TableID="PlatteStreamflow",OutputFile="SPlatteStreamflow.csv")
# HydroBase database is: HydroBase on lonetree\CDSS
# HydroBase.db_version: design version: 20080701 last data change: 20100801
# HydroBase table structure for software is at least 2007052520070525
# HydroBase input name is "".
# Stored procedures are being used.
Delimiter = " "
NumTS = 2
TSID = "06759500.USGS.Streamflow.Month" "06754000.DWR.Streamflow.Month
Alias = "" ""
Description = "SOUTH PLATTE RIVER AT FORT MORGAN, CO." "SOUTH PLATTE RIVER NE
DataType = "Streamflow" "Streamflow"
Units = "ACFT" "ACFT"
MissingVal = -999.0 -999.0
Start = 1901-05
End = 2009-09
# Time series comments/histories:
# Comments for time series 1 (TSID=06759500.USGS.Streamflow.Month Alias=):
# Station and time series information from HydroBase determined at time of query:
# Time series identifier = 06759500.USGS.Streamflow.Month
# Description = SOUTH PLATTE RIVER AT FORT MORGAN, CO.
# Data source = USGS
# Data type = Streamflow
# Data interval = Month
# Data units = ACFT
# HydroBase query period = Query All
# HydroBase available period = 1943 to 2009
# State of CO abbreviation = PLAMORCO
DateValue (*.dv) Format
Notes about software version and user that created file
Commands that created file
HydroBase version information
Time series metadata
Comments about each time series from HydroBase
Data listed in columns below

SPlatteStreamflow.csv - Notepad

File Edit Format View Help

Delimited (*.csv) Format

```
# File generated by...
# program:      TSTool 9.07.02 (2010-08-19)
# user:         sam
# date:         Sat Aug 21 15:56:31 MDT 2010
# host:         AMAZON
# directory:    C:\Develop\TSTool_SourceBuild\TSTool
# command line: TSTool -home test/operational/CDSS
# ------------------------------------------------------------------------
# Command file name:  COMMANDS NOT SAVED TO FILE
# Commands:
# # Simple example to query HydroBase time series.
# # 06759500 - SOUTH PLATTE RIVER AT FORT MORGAN, CO.
# 06759500.USGS.Streamflow.Month~HydroBase
# # 06754000 - SOUTH PLATTE RIVER NEAR KERSEY, CO
# 06754000.DWR.Streamflow.Month~HydroBase
# # Write time series in two simple formats
# # Write a DateValue format file (columns with metadata in a header)
# WriteDateValue(OutputFile="SPlatteStreamflow.dv",Precision=1)
# # Convert time series to a table and then write the table (columns)
# TimeSeriesToTable(TableID="PlatteStreamflow",DateTimeColumn="Date",DataColumn="%L-%T",DataRow=1,IfTableNotFound="Create")
# WriteTableToDelimitedFile(TableID="PlatteStreamflow",OutputFile="SPlatteStreamflow.csv")
#
# ------------------------------------------------------------------------
# HydroBase database is: HydroBase on lonetree\CDSS
# HydroBase.db_version:  design version: 20080701  last data change: 2010080
# HydroBase table structure for software is at least 2007052520070525
# HydroBase input name is "".
# Stored procedures are being used.
# ------------------------------------------------------------------------
#
# Column headings are first line below, followed by data lines.
"Date","06759500-Streamflow","06754000-Streamflow"
1901-05,,85800.26
1901-06,,108435.96
1901-07,,19299.46
1901-08,,18188.70
1901-09,,23478.69
1901-10,,28044.71
1901-11,,31319.46
1901-12,,36901.04
1902-01,,36893.10
1902-02,,39983.39
1902-03,,29873.49
1902-04,,7033.49
1902-05,,5910.83
1902-06,,9415.67
1902-07,,7640.44
1902-08,,5216.60
1902-09,,21594.37
1902-10,,15290.80
1902-11,,19878.64
1902-12,,32725.77
1903-01,,32198.16
1903-02,,32174.35
1903-03,,56472.23
1903-04,,30803.76
1903-05,,13688.13
1903-06,,76116.81
```

Notes about software version and user that created file

Commands that created file

HydroBase version information

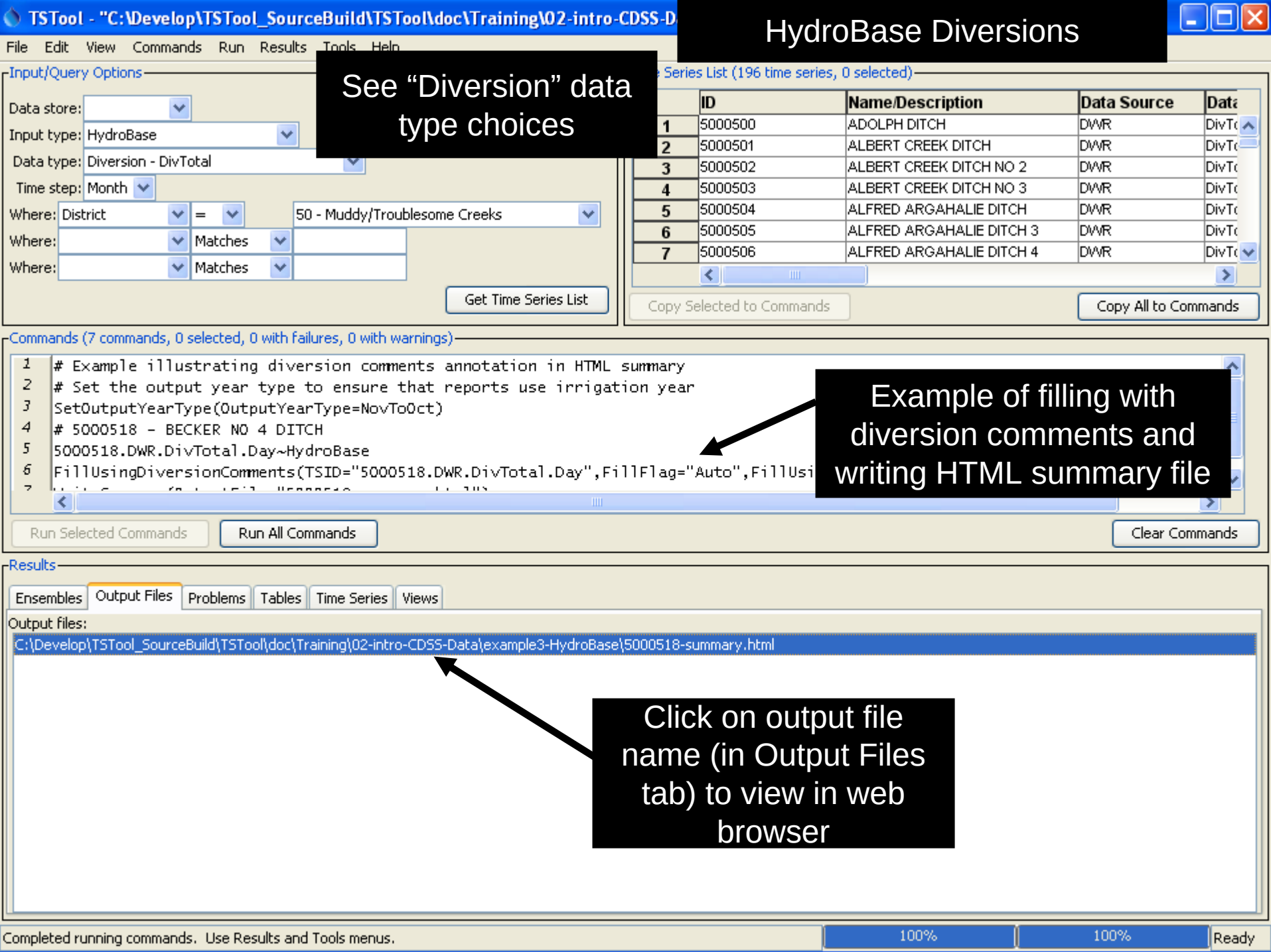
Columns defined by command parameter

Data listed in columns with blanks for missing values

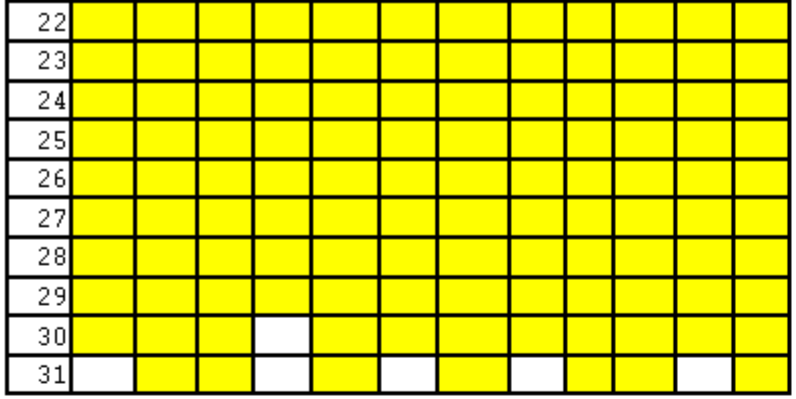
# HydroBase – Diversion Records

- Total diversions (DivTotal) or classes (SFUT=Source, From, Use, Type)
- Infrequent diversions
- Day, Month, and Year interval

See example3-HydroBase\ 5000518.TSTool


TSTool - "C:\Develop\TSTool_SourceBuild\TSTool\doc\Training\02-intro-CDSS-D
HydroBase Diversions
File Edit View Commands Run Results Tools Help
See “Diversion” data type choices
Input/Query Options
Data store:
Input type: HydroBase
Data type: Diversion - DivTotal
Time step: Month
Where: District = 50 - Muddy/Troublesome Creeks
Where: Matches
Where: Matches
Get Time Series List
Series List (196 time series, 0 selected)
ID
Name/Description
Data Source
1 5000500 ADOLPH DITCH DWR
2 5000501 ALBERT CREEK DITCH DWR
3 5000502 ALBERT CREEK DITCH NO 2 DWR
4 5000503 ALBERT CREEK DITCH NO 3 DWR
5 5000504 ALFRED ARGAHALIE DITCH DWR
6 5000505 ALFRED ARGAHALIE DITCH 3 DWR
7 5000506 ALFRED ARGAHALIE DITCH 4 DWR
Copy Selected to Commands
Copy All to Commands
Commands (7 commands, 0 selected, 0 with failures, 0 with warnings)
1 # Example illustrating diversion comments annotation in HTML summary
2 # Set the output year type to ensure that reports use irrigation year
3 SetOutputYearType(OutputYearType=NovToOct)
4 # 5000518 - BECKER NO 4 DITCH
5 5000518.DWR.DivTotal.Day~HydroBase
6 FillUsingDiversionComments(TSID="5000518.DWR.DivTotal.Day",FillFlag="Auto",FillUsi
Example of filling with diversion comments and writing HTML summary file
Run Selected Commands
Run All Commands
Clear Commands
Results
Ensembles Output Files Problems Tables Time Series Views
Output files:
C:\Develop\TSTool_SourceBuild\TSTool\doc\Training\02-intro-CDSS-Data\example3-HydroBase\5000518-summary.html
Click on output file name (in Output Files tab) to view in web browser
Completed running commands. Use Results and Tools menus.
100%
100%
Ready

HydroBase Daily Diversions



Irrigation year (NovToOct) 1980 has no daily data or diversion comments.

**NovToOct Year 1981 (Nov 1980 to Oct 1981)**

| Day | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C |
| 2 | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C |
| 3 | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C |
| 4 | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C |
| 5 | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C |
| 6 | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C |
| 7 | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C |
| 8 | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C |
| 9 | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C |
| 10 | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C |
| 11 | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C |
| 12 | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C |
| 13 | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C |
| 14 | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C |
| 15 | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C |
| 16 | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C |
| 17 | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C | 0.00C |

Irrigation Year 1981 is all zeros because the HydroBase “not_used” flag is “C”, meaning “Water available but not taken”

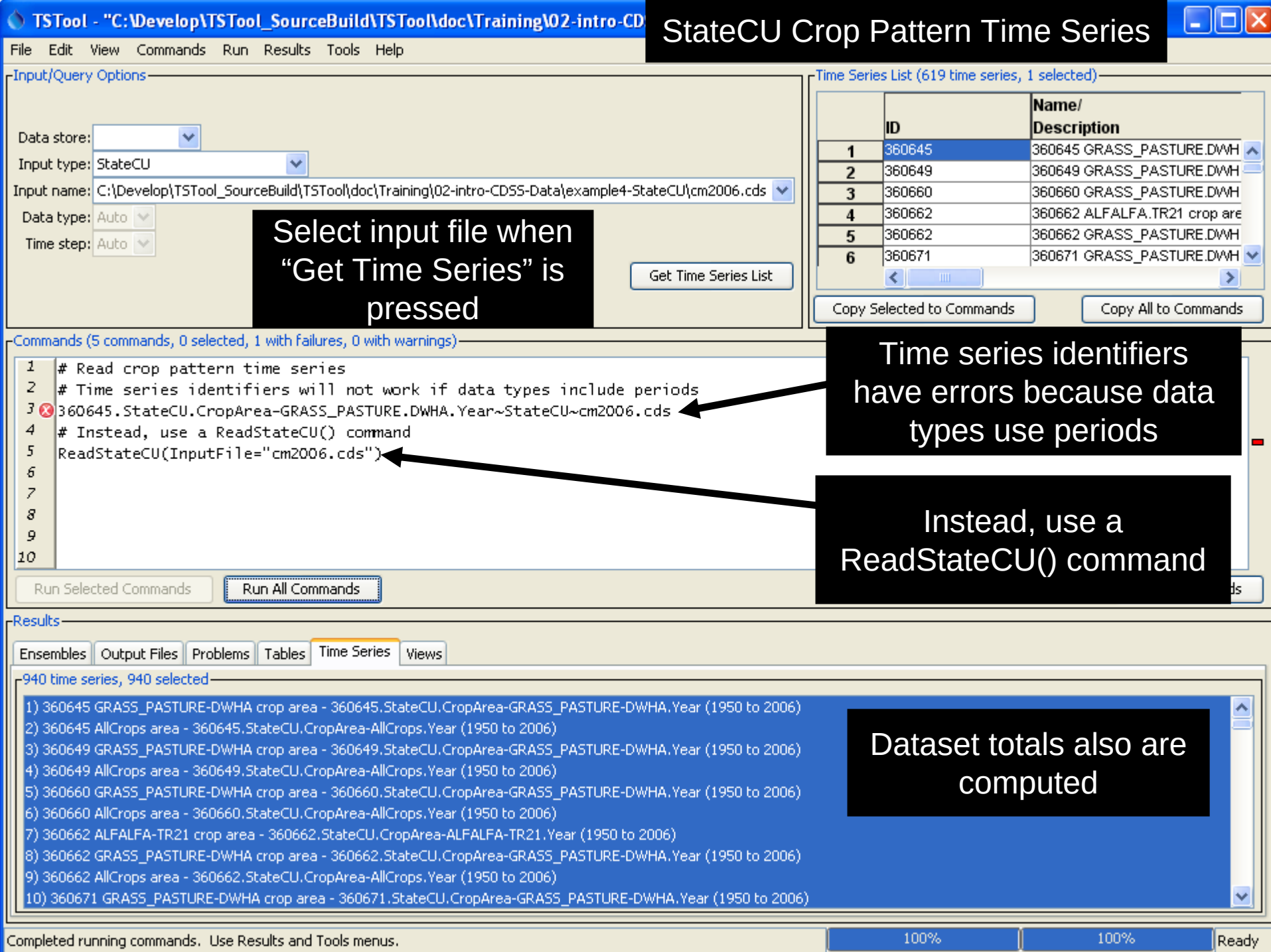
Notes at bottom of report summarize how many values are flagged.

# StateCU Input Files

- StateCU is the CDSS consumptive use model
- StateCU input files are created by TSTool and StateDMI software, which also can read the files
- StateCU processes data by calendar year and the timestep for input depends on analysis method (e.g., Blaney-Criddle, Penman-Monteith)
- Simple time series (e.g., precipitation, temperature) use StateMod time series file format
- Complex time series (e.g., crop patterns) use a StateCU format

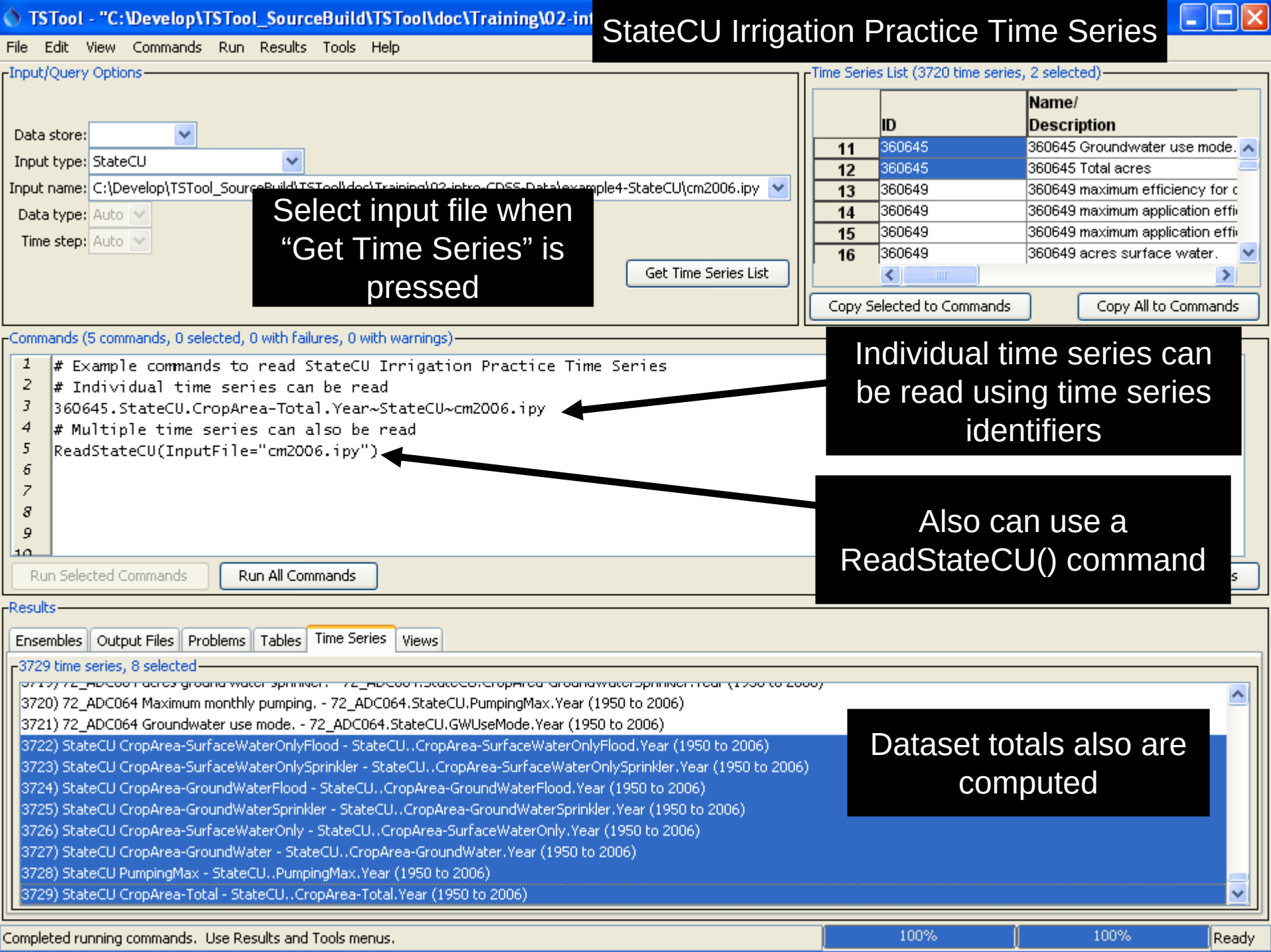
Crop pattern time series:

See example4-StateCU\
CropPatterns.TSTool


TSTool - "C:\Develop\TSTool_SourceBuild\TSTool\doc\Training\02-intro-CD
StateCU Crop Pattern Time Series
File Edit View Commands Run Results Tools Help
Input/Query Options
Data store:
Input type: StateCU
Input name: C:\Develop\TSTool_SourceBuild\TSTool\doc\Training\02-intro-CDSS-Data\example4-StateCU\cm2006.cds
Data type: Auto
Time step: Auto
Select input file when "Get Time Series" is pressed
Get Time Series List
Time Series List (619 time series, 1 selected)
ID
Name/ Description
1 360645 360645 GRASS_PASTURE.DWH
2 360649 360649 GRASS_PASTURE.DWH
3 360660 360660 GRASS_PASTURE.DWH
4 360662 360662 ALFALFA.TR21 crop are
5 360662 360662 GRASS_PASTURE.DWH
6 360671 360671 GRASS_PASTURE.DWH
Copy Selected to Commands
Copy All to Commands
Commands (5 commands, 0 selected, 1 with failures, 0 with warnings)
1 # Read crop pattern time series
2 # Time series identifiers will not work if data types include periods
3 360645.StateCU.CropArea-GRASS_PASTURE.DWHA.Year~StateCU~cm2006.cds
4 # Instead, use a ReadStateCU() command
5 ReadStateCU(InputFile="cm2006.cds")
6
7
8
9
10
Time series identifiers have errors because data types use periods
Instead, use a ReadStateCU() command
Run Selected Commands
Run All Commands
Results
Ensembles Output Files Problems Tables Time Series Views
940 time series, 940 selected
1) 360645 GRASS_PASTURE-DWHA crop area - 360645.StateCU.CropArea-GRASS_PASTURE-DWHA.Year (1950 to 2006)
2) 360645 AllCrops area - 360645.StateCU.CropArea-AllCrops.Year (1950 to 2006)
3) 360649 GRASS_PASTURE-DWHA crop area - 360649.StateCU.CropArea-GRASS_PASTURE-DWHA.Year (1950 to 2006)
4) 360649 AllCrops area - 360649.StateCU.CropArea-AllCrops.Year (1950 to 2006)
5) 360660 GRASS_PASTURE-DWHA crop area - 360660.StateCU.CropArea-GRASS_PASTURE-DWHA.Year (1950 to 2006)
6) 360660 AllCrops area - 360660.StateCU.CropArea-AllCrops.Year (1950 to 2006)
7) 360662 ALFALFA-TR21 crop area - 360662.StateCU.CropArea-ALFALFA-TR21.Year (1950 to 2006)
8) 360662 GRASS_PASTURE-DWHA crop area - 360662.StateCU.CropArea-GRASS_PASTURE-DWHA.Year (1950 to 2006)
9) 360662 AllCrops area - 360662.StateCU.CropArea-AllCrops.Year (1950 to 2006)
10) 360671 GRASS_PASTURE-DWHA crop area - 360671.StateCU.CropArea-GRASS_PASTURE-DWHA.Year (1950 to 2006)
Dataset totals also are computed
Completed running commands. Use Results and Tools menus.
100%
100%
Ready

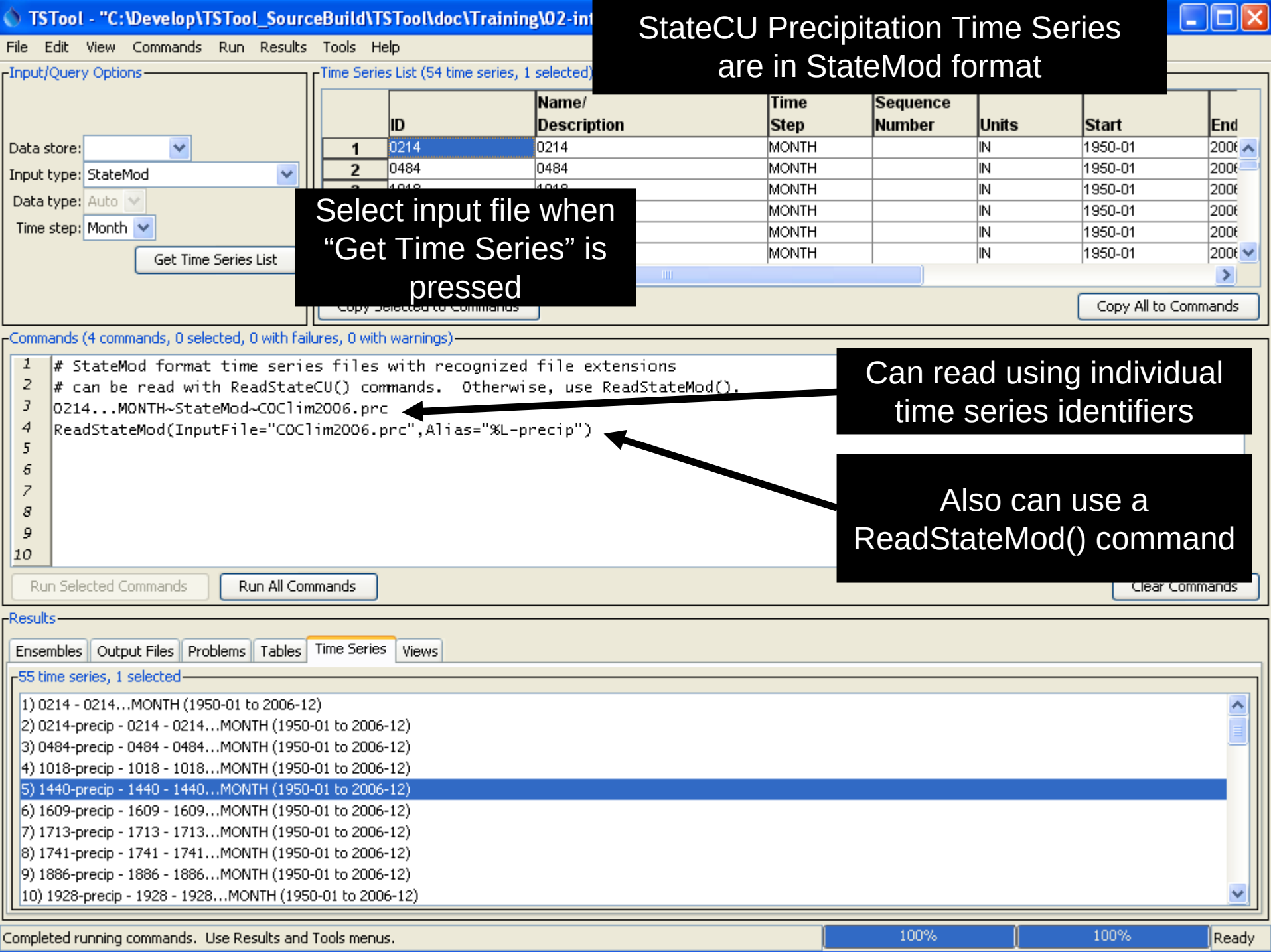
# StateCU Irrigation Practice Time Series

See example4-StateCU\IrrigationPractice.TSTool


TSTool - "C:\Develop\TSTool_SourceBuild\TSTool\doc\Training\02-int
StateCU Irrigation Practice Time Series
File Edit View Commands Run Results Tools Help
Input/Query Options
Data store:
Input type: StateCU
Input name: C:\Develop\TSTool_SourceBuild\TSTool\doc\Training\02-intro-CDSS-Data\example4-StateCU\cm2006.ipy
Data type: Auto
Time step: Auto
Select input file when "Get Time Series" is pressed
Get Time Series List
Time Series List (3720 time series, 2 selected)
ID
Name/ Description
11 360645 360645 Groundwater use mode.
12 360645 360645 Total acres
13 360649 360649 maximum efficiency for c
14 360649 360649 maximum application effi
15 360649 360649 maximum application effi
16 360649 360649 acres surface water.
Copy Selected to Commands
Copy All to Commands
Commands (5 commands, 0 selected, 0 with failures, 0 with warnings)
1 # Example commands to read StateCU Irrigation Practice Time Series
2 # Individual time series can be read
3 360645.StateCU.CropArea-Total.Year~StateCU~cm2006.ipy
4 # Multiple time series can also be read
5 ReadStateCU(InputFile="cm2006.ipy")
Individual time series can be read using time series identifiers
Also can use a ReadStateCU() command
Run Selected Commands
Run All Commands
Results
Ensembles Output Files Problems Tables Time Series Views
3729 time series, 8 selected
3720) 72_ADC064 Maximum monthly pumping. - 72_ADC064.StateCU.PumpingMax.Year (1950 to 2006)
3721) 72_ADC064 Groundwater use mode. - 72_ADC064.StateCU.GWUseMode.Year (1950 to 2006)
3722) StateCU CropArea-SurfaceWaterOnlyFlood - StateCU..CropArea-SurfaceWaterOnlyFlood.Year (1950 to 2006)
3723) StateCU CropArea-SurfaceWaterOnlySprinkler - StateCU..CropArea-SurfaceWaterOnlySprinkler.Year (1950 to 2006)
3724) StateCU CropArea-GroundWaterFlood - StateCU..CropArea-GroundWaterFlood.Year (1950 to 2006)
3725) StateCU CropArea-GroundWaterSprinkler - StateCU..CropArea-GroundWaterSprinkler.Year (1950 to 2006)
3726) StateCU CropArea-SurfaceWaterOnly - StateCU..CropArea-SurfaceWaterOnly.Year (1950 to 2006)
3727) StateCU CropArea-GroundWater - StateCU..CropArea-GroundWater.Year (1950 to 2006)
3728) StateCU PumpingMax - StateCU..PumpingMax.Year (1950 to 2006)
3729) StateCU CropArea-Total - StateCU..CropArea-Total.Year (1950 to 2006)
Dataset totals also are computed
Completed running commands. Use Results and Tools menus.
100%
100%
Ready

# StateCU Precipitation Time Series

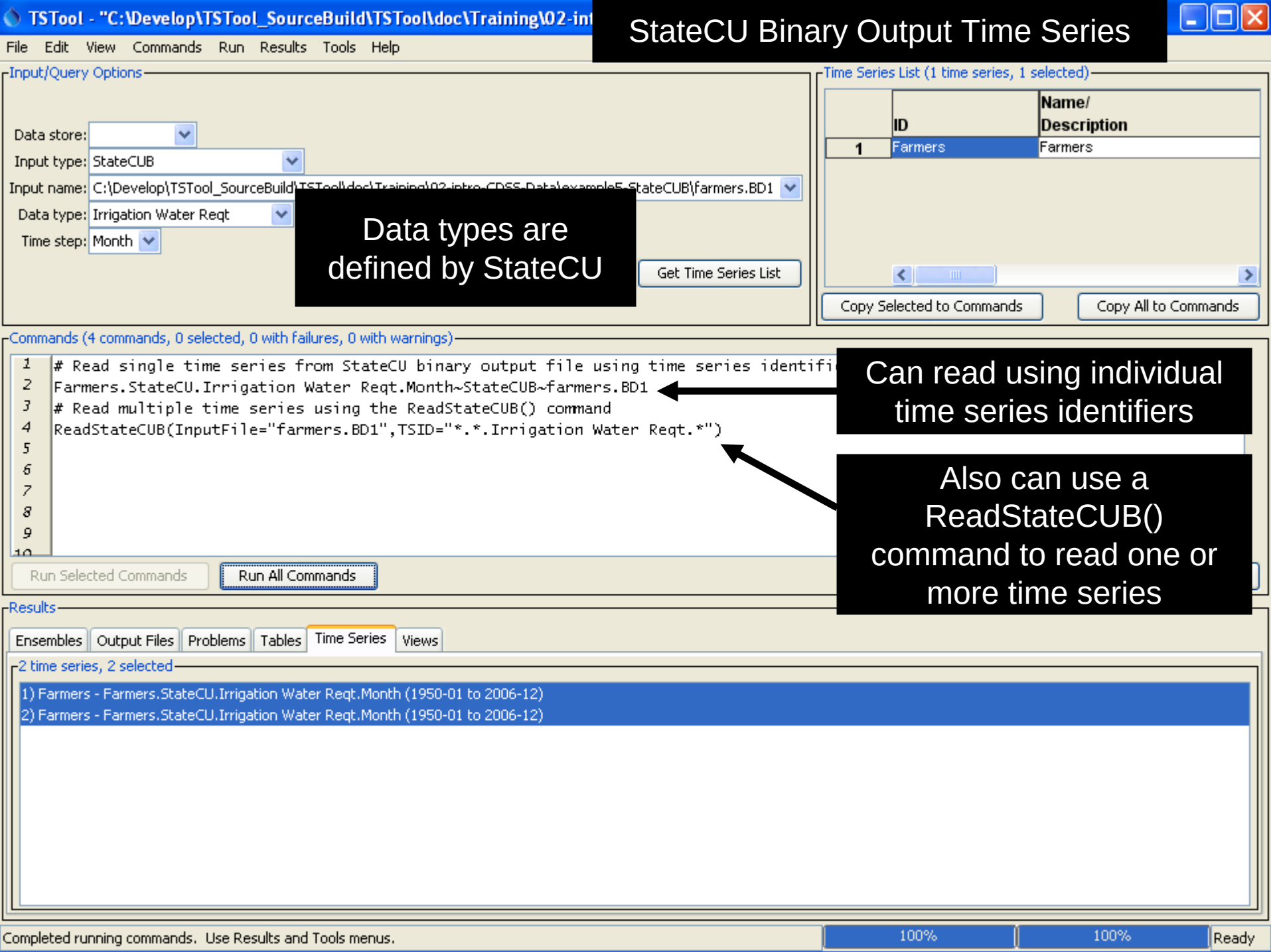
See example4-StateCU\ Precipitation.TSTool


TSTool - "C:\Develop\TSTool_SourceBuild\TSTool\doc\Training\02-int
File Edit View Commands Run Results Tools Help
StateCU Precipitation Time Series are in StateMod format
Input/Query Options
Data store:
Input type: StateMod
Data type: Auto
Time step: Month
Get Time Series List
Select input file when "Get Time Series" is pressed
Time Series List (54 time series, 1 selected)
ID
Name/ Description
Time Step
Sequence Number
Units
Start
End
1 0214 0214 MONTH IN 1950-01
2 0484 0484 MONTH IN 1950-01
MONTH IN 1950-01
MONTH IN 1950-01
MONTH IN 1950-01
MONTH IN 1950-01
Copy All to Commands
Commands (4 commands, 0 selected, 0 with failures, 0 with warnings)
1 # StateMod format time series files with recognized file extensions
2 # can be read with ReadStateCU() commands. Otherwise, use ReadStateMod().
3 0214...MONTH~StateMod~COClim2006.prc
4 ReadStateMod(InputFile="COClim2006.prc",Alias="%L-precip")
5
6
7
8
9
10
Can read using individual time series identifiers
Also can use a ReadStateMod() command
Run Selected Commands
Run All Commands
Clear Commands
Results
Ensembles Output Files Problems Tables Time Series Views
55 time series, 1 selected
1) 0214 - 0214...MONTH (1950-01 to 2006-12)
2) 0214-precip - 0214 - 0214...MONTH (1950-01 to 2006-12)
3) 0484-precip - 0484 - 0484...MONTH (1950-01 to 2006-12)
4) 1018-precip - 1018 - 1018...MONTH (1950-01 to 2006-12)
5) 1440-precip - 1440 - 1440...MONTH (1950-01 to 2006-12)
6) 1609-precip - 1609 - 1609...MONTH (1950-01 to 2006-12)
7) 1713-precip - 1713 - 1713...MONTH (1950-01 to 2006-12)
8) 1741-precip - 1741 - 1741...MONTH (1950-01 to 2006-12)
9) 1886-precip - 1886 - 1886...MONTH (1950-01 to 2006-12)
10) 1928-precip - 1928 - 1928...MONTH (1950-01 to 2006-12)
Completed running commands. Use Results and Tools menus.
100%
100%
Ready

# StateCUB (StateCU Binary Output) Consumptive Use Estimates

- Binary file is consistent with reports and facilitates optimized data extraction
- Use TSTool to read from binary file and export to different formats

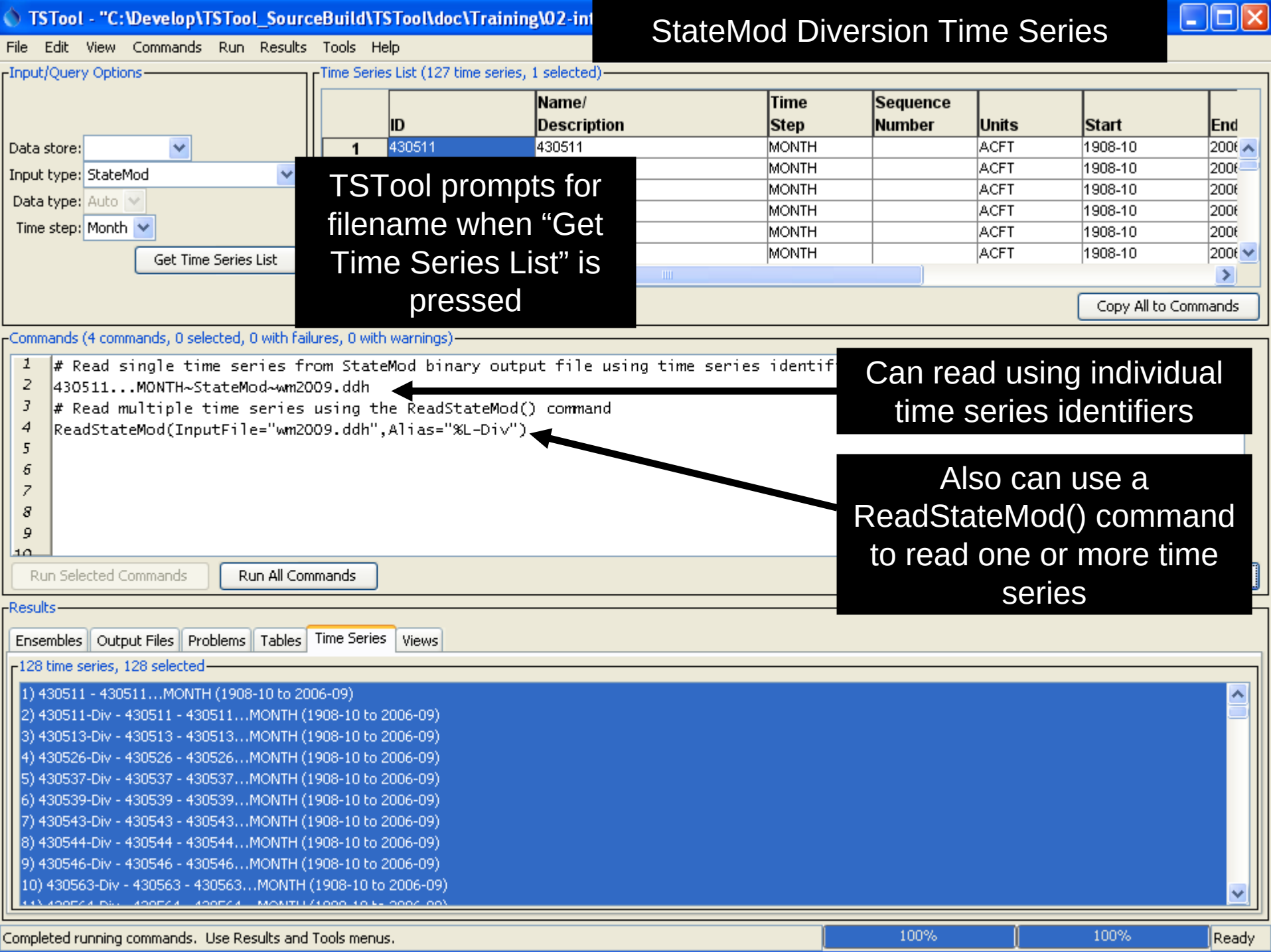
See example5-StateCUB\ Farmers.TSTool


TSTool - "C:\Develop\TSTool_SourceBuild\TSTool\doc\Training\02-int
StateCU Binary Output Time Series
File Edit View Commands Run Results Tools Help
Input/Query Options
Data store:
Input type: StateCUB
Input name: C:\Develop\TSTool_SourceBuild\TSTool\doc\Training\02-intro-CDSS-Data\example5-StateCUB\farmers.BD1
Data type: Irrigation Water Reqt
Time step: Month
Data types are defined by StateCU
Get Time Series List
Time Series List (1 time series, 1 selected)
ID
Name/ Description
1
Farmers
Farmers
Copy Selected to Commands
Copy All to Commands
Commands (4 commands, 0 selected, 0 with failures, 0 with warnings)
1 # Read single time series from StateCU binary output file using time series identifi
2 Farmers.StateCU.Irrigation Water Reqt.Month~StateCUB~farmers.BD1
3 # Read multiple time series using the ReadStateCUB() command
4 ReadStateCUB(InputFile="farmers.BD1",TSID="*.*.Irrigation Water Reqt.*")
Can read using individual time series identifiers
Also can use a ReadStateCUB() command to read one or more time series
Run Selected Commands
Run All Commands
Results
Ensembles Output Files Problems Tables Time Series Views
2 time series, 2 selected
1) Farmers - Farmers.StateCU.Irrigation Water Reqt.Month (1950-01 to 2006-12)
2) Farmers - Farmers.StateCU.Irrigation Water Reqt.Month (1950-01 to 2006-12)
Completed running commands. Use Results and Tools menus.
100%
100%
Ready

# StateMod Input Files

- StateMod is the CDSS water allocation model
- Most time series use the same format
- A few (e.g., reservoir targets, which have maximum and minimum) are different
- Daily and monthly formats

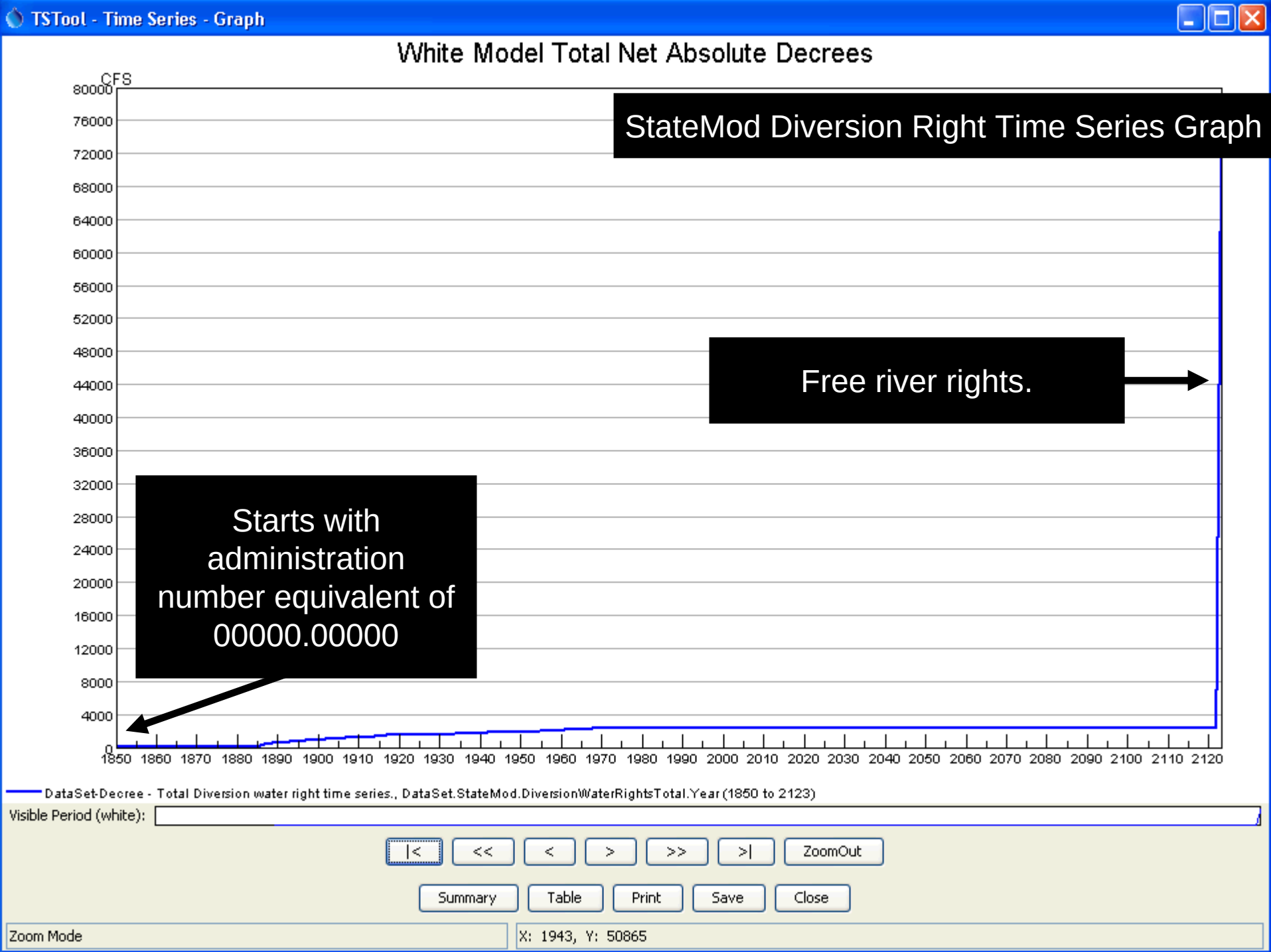
See example6-StateMod\HistoricalDiversions.TSTool

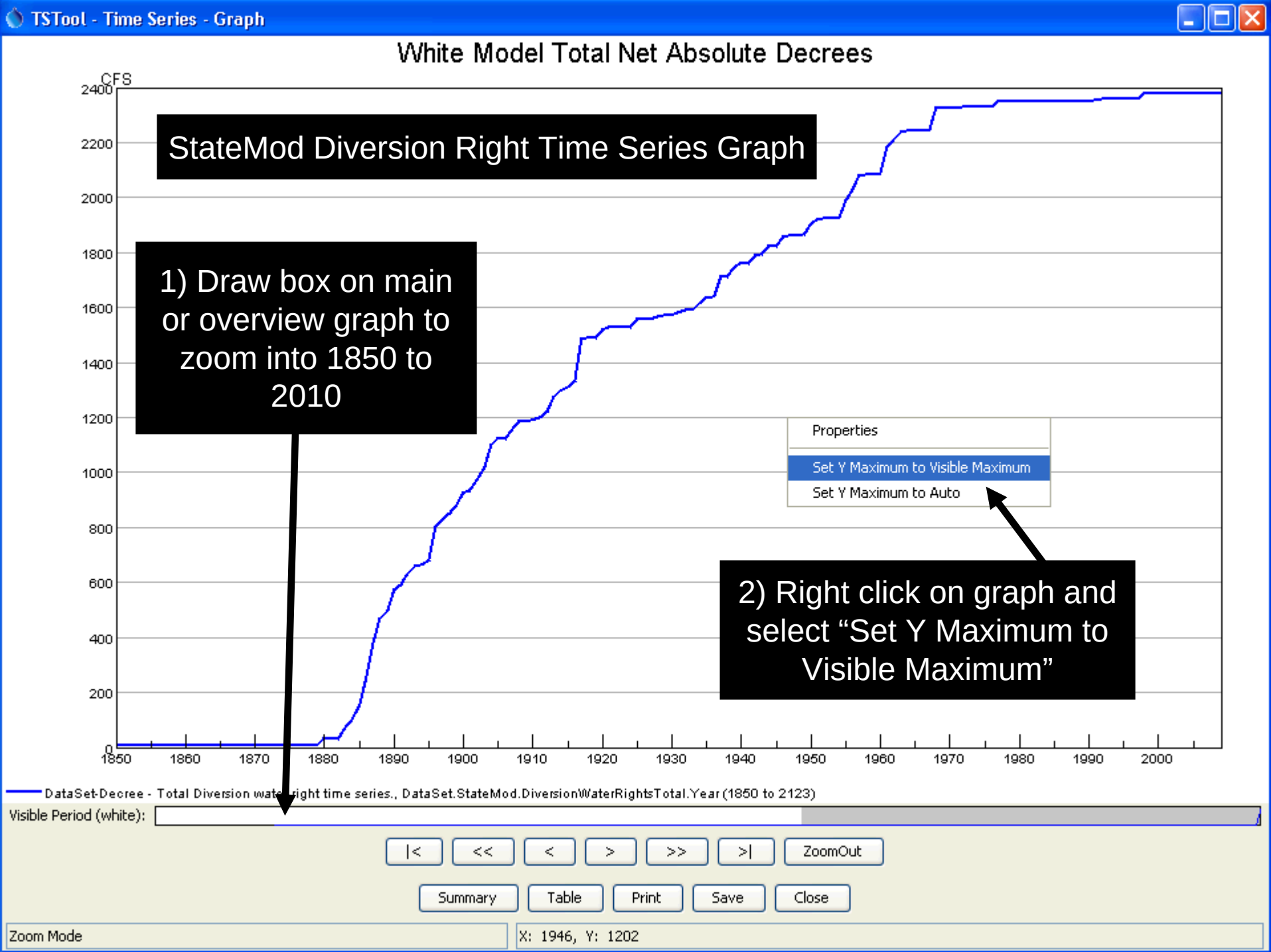

TSTool - "C:\Develop\TSTool_SourceBuild\TSTool\doc\Training\02-int
StateMod Diversion Time Series
File Edit View Commands Run Results Tools Help
Input/Query Options
Data store:
Input type: StateMod
Data type: Auto
Time step: Month
Get Time Series List
TSTool prompts for filename when "Get Time Series List" is pressed
Time Series List (127 time series, 1 selected)
ID
Name/ Description
Time Step
Sequence Number
Units
Start
End
1 430511 430511 MONTH ACFT 1908-10
Copy All to Commands
Commands (4 commands, 0 selected, 0 with failures, 0 with warnings)
# Read single time series from StateMod binary output file using time series identif
430511...MONTH~StateMod~wm2009.ddh
# Read multiple time series using the ReadStateMod() command
ReadStateMod(InputFile="wm2009.ddh",Alias="%L-Div")
Can read using individual time series identifiers
Also can use a ReadStateMod() command to read one or more time series
Run Selected Commands
Run All Commands
Results
Ensembles Output Files Problems Tables Time Series Views
128 time series, 128 selected
1) 430511 - 430511...MONTH (1908-10 to 2006-09)
2) 430511-Div - 430511 - 430511...MONTH (1908-10 to 2006-09)
3) 430513-Div - 430513 - 430513...MONTH (1908-10 to 2006-09)
4) 430526-Div - 430526 - 430526...MONTH (1908-10 to 2006-09)
5) 430537-Div - 430537 - 430537...MONTH (1908-10 to 2006-09)
6) 430539-Div - 430539 - 430539...MONTH (1908-10 to 2006-09)
7) 430543-Div - 430543 - 430543...MONTH (1908-10 to 2006-09)
8) 430544-Div - 430544 - 430544...MONTH (1908-10 to 2006-09)
9) 430546-Div - 430546 - 430546...MONTH (1908-10 to 2006-09)
10) 430563-Div - 430563 - 430563...MONTH (1908-10 to 2006-09)
Completed running commands. Use Results and Tools menus.
100%
100%
Ready

# StateMod Input Files
# Water Rights as Time Series

- Water rights are defined by a priority date (administration number) and decree
- HydroBase net amounts (sum of transactions) are used in StateMod modeling
- Time series of rights are used in some data processing tasks, such as limiting groundwater pumping to times when rights existed

See example6-StateMod\
DiversionRights.TSTool

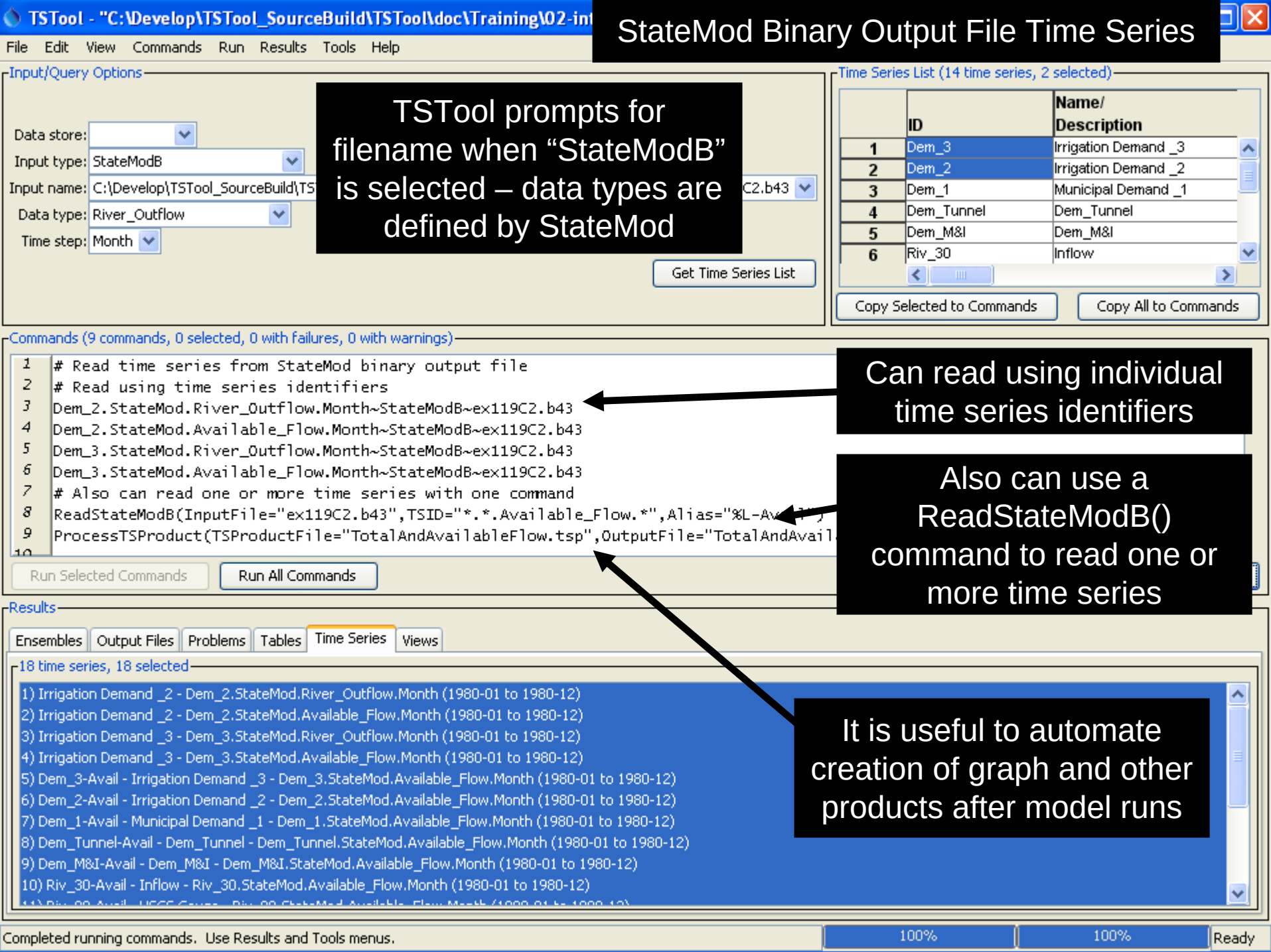

TSTool - Time Series - Graph
White Model Total Net Absolute Decrees
CFS
80000
76000
72000
68000
64000
60000
56000
52000
48000
44000
40000
36000
32000
28000
24000
20000
16000
12000
8000
4000
0
1850 1860 1870 1880 1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010 2020 2030 2040 2050 2060 2070 2080 2090 2100 2110 2120
StateMod Diversion Right Time Series Graph
Free river rights.
Starts with administration number equivalent of 00000.00000
DataSet-Decree - Total Diversion water right time series., DataSet.StateMod.DiversionWaterRightsTotal.Year (1850 to 2123)
Visible Period (white):
|<
<<
<
>
>>
>|
ZoomOut
Summary
Table
Print
Save
Close
Zoom Mode
X: 1943, Y: 50865

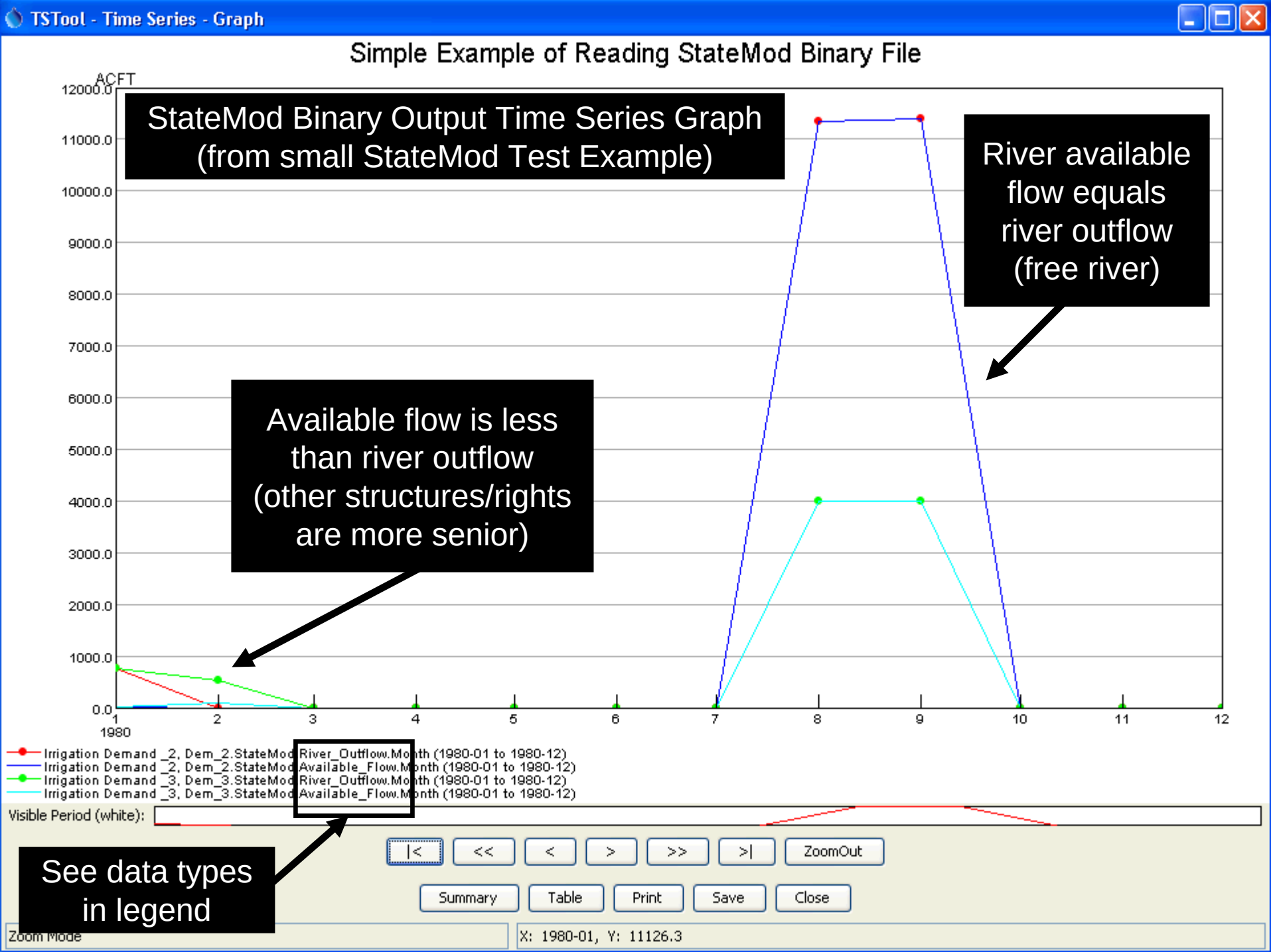

TSTool - Time Series - Graph
White Model Total Net Absolute Decrees
CFS
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1850
1860
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
StateMod Diversion Right Time Series Graph
1) Draw box on main or overview graph to zoom into 1850 to 2010
Properties
Set Y Maximum to Visible Maximum
Set Y Maximum to Auto
2) Right click on graph and select “Set Y Maximum to Visible Maximum”
DataSet-Decree - Total Diversion water right time series., DataSet.StateMod.DiversionWaterRightsTotal.Year (1850 to 2123)
Visible Period (white):
|<
<<
<
>
>>
>|
ZoomOut
Summary
Table
Print
Save
Close
Zoom Mode
X: 1946, Y: 1202

# StateModB (StateMod Binary Output) Water Allocation Results

- Binary file is consistent with reports and facilitates optimized data extraction
- Use TSTool to read and export to different formats
- Different binary files store time series for different model node types.

See example7-StateModB\
TotalAndAvailableFlow.TSTool


TSTool - "C:\Develop\TSTool_SourceBuild\TSTool\doc\Training\02-int
StateMod Binary Output File Time Series
File Edit View Commands Run Results Tools Help
Input/Query Options
Data store:
Input type: StateModB
Input name: C:\Develop\TSTool_SourceBuild\TS
C2.b43
Data type: River_Outflow
Time step: Month
TSTool prompts for filename when "StateModB" is selected – data types are defined by StateMod
Get Time Series List
Time Series List (14 time series, 2 selected)
ID
Name/ Description
1 Dem_3 Irrigation Demand _3
2 Dem_2 Irrigation Demand _2
3 Dem_1 Municipal Demand _1
4 Dem_Tunnel Dem_Tunnel
5 Dem_M&I Dem_M&I
6 Riv_30 Inflow
Copy Selected to Commands
Copy All to Commands
Commands (9 commands, 0 selected, 0 with failures, 0 with warnings)
1 # Read time series from StateMod binary output file
2 # Read using time series identifiers
3 Dem_2.StateMod.River_Outflow.Month~StateModB~ex119C2.b43
4 Dem_2.StateMod.Available_Flow.Month~StateModB~ex119C2.b43
5 Dem_3.StateMod.River_Outflow.Month~StateModB~ex119C2.b43
6 Dem_3.StateMod.Available_Flow.Month~StateModB~ex119C2.b43
7 # Also can read one or more time series with one command
8 ReadStateModB(InputFile="ex119C2.b43",TSID="*.*.Available_Flow.*",Alias="%L-Av
9 ProcessTSProduct(TSProductFile="TotalAndAvailableFlow.tsp",OutputFile="TotalAndAvail
Can read using individual time series identifiers
Also can use a ReadStateModB() command to read one or more time series
Run Selected Commands
Run All Commands
Results
Ensembles Output Files Problems Tables Time Series Views
18 time series, 18 selected
1) Irrigation Demand _2 - Dem_2.StateMod.River_Outflow.Month (1980-01 to 1980-12)
2) Irrigation Demand _2 - Dem_2.StateMod.Available_Flow.Month (1980-01 to 1980-12)
3) Irrigation Demand _3 - Dem_3.StateMod.River_Outflow.Month (1980-01 to 1980-12)
4) Irrigation Demand _3 - Dem_3.StateMod.Available_Flow.Month (1980-01 to 1980-12)
5) Dem_3-Avail - Irrigation Demand _3 - Dem_3.StateMod.Available_Flow.Month (1980-01 to 1980-12)
6) Dem_2-Avail - Irrigation Demand _2 - Dem_2.StateMod.Available_Flow.Month (1980-01 to 1980-12)
7) Dem_1-Avail - Municipal Demand _1 - Dem_1.StateMod.Available_Flow.Month (1980-01 to 1980-12)
8) Dem_Tunnel-Avail - Dem_Tunnel - Dem_Tunnel.StateMod.Available_Flow.Month (1980-01 to 1980-12)
9) Dem_M&I-Avail - Dem_M&I - Dem_M&I.StateMod.Available_Flow.Month (1980-01 to 1980-12)
10) Riv_30-Avail - Inflow - Riv_30.StateMod.Available_Flow.Month (1980-01 to 1980-12)
It is useful to automate creation of graph and other products after model runs
Completed running commands. Use Results and Tools menus.
100%
100%
Ready


TSTool - Time Series - Graph
Simple Example of Reading StateMod Binary File
ACFT
12000.0
11000.0
10000.0
9000.0
8000.0
7000.0
6000.0
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
1
1980
2
3
4
5
6
7
8
9
10
11
12
StateMod Binary Output Time Series Graph
(from small StateMod Test Example)
River available flow equals river outflow (free river)
Available flow is less than river outflow (other structures/rights are more senior)
Irrigation Demand _2, Dem_2.StateMod River_Outflow.Month (1980-01 to 1980-12)
Irrigation Demand _2, Dem_2.StateMod Available_Flow.Month (1980-01 to 1980-12)
Irrigation Demand _3, Dem_3.StateMod River_Outflow.Month (1980-01 to 1980-12)
Irrigation Demand _3, Dem_3.StateMod Available_Flow.Month (1980-01 to 1980-12)
Visible Period (white):
|<
<<
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ZoomOut
Summary
Table
Print
Save
Close
See data types in legend
Zoom Mode
X: 1980-01, Y: 11126.3

TSTool - Time Series - Table

| DATE | Dem_2, River_Outflow, ACFT | Dem_2, Available_Flow, ACFT | Dem_3, River_Outflow, ACFT | Dem_3, Available_Flow, ACFT |
|---|---|---|---|---|
| 1980-01 | 767.6 | 10.9 | 769.6 | 10.9 |
| 1980-02 | 0.0 | 0.0 | 525.4 | 78.5 |
| 1980-03 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1980-04 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1980-05 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1980-06 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1980-07 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1980-08 | 11354.4 | 11354.4 | 4000.0 | 4000.0 |
| 1980-09 | 11385.6 | 11385.6 | 4000.0 | 4000.0 |
| 1980-10 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1980-11 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1980-12 | 0.0 | 0.0 | 0.0 | 0.0 |

StateMod Binary Output Time Series Table

Available flow is less than river outflow (other structures/rights are more senior)

River available flow equals river outflow (free river)

Graph | Summary | Save | Close

Currently-selected worksheet interval: Month

# More Information

Help…View Documentation to view the TSTool documentation