TSTool Training: Getting Started

Duration: ~30 minutes

Level: introduction

TSTool version used: 14.0.4

Updated: 2021-12-19



Presentation Goals

- Explain how to download, install, and configure TSTool.
- Provide an introduction to TSTool for new users.
- Run working examples, each of which reside in a folder distributed with this presentation:
 - See the doc/training folder under the software installation folder.
 - Full use of TSTool requires access to the internet and may require installing databases and other software.



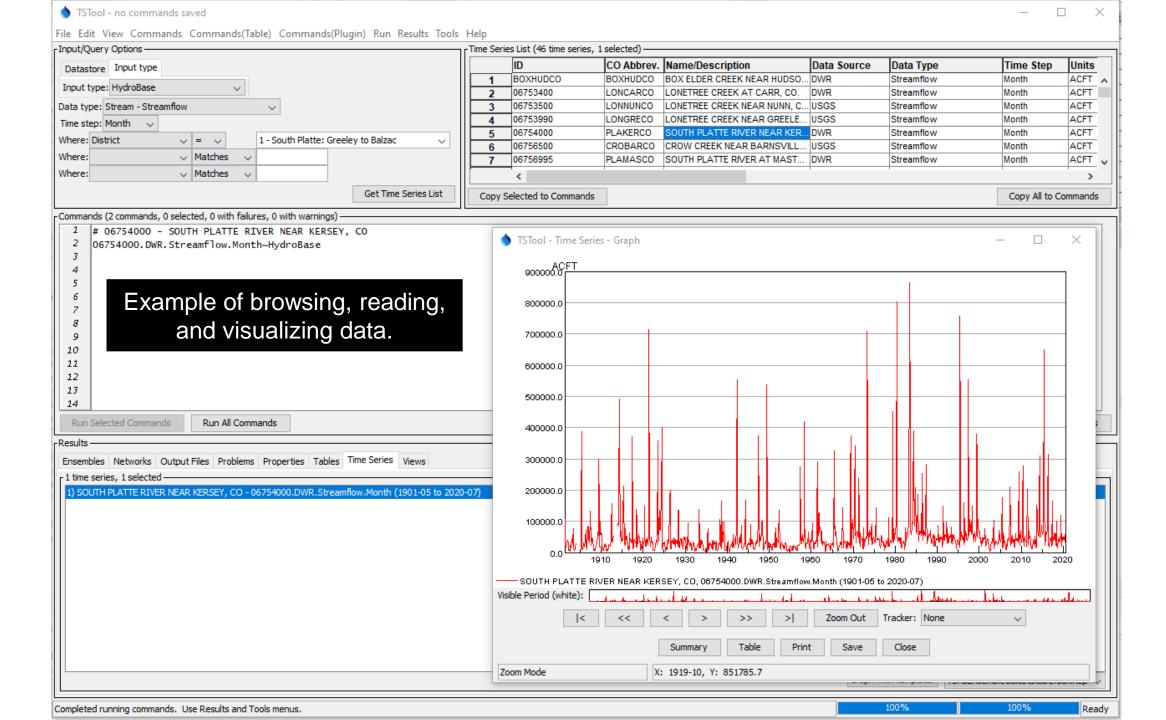


TSTool Feature Summary

- Read and write time series, tables, and other data using various data sources and formats.
- Automate processing using a workflow command language.
- Fill and manipulate data.
- Analyze and visualize data.
- Implement workflows for business processes, modeling, and decisionmaking.







TSTool Role in CDSS

- Read time series from State of Colorado's HydroBase database and other sources.
- Fill missing data and manipulate data.
- Create input files for CDSS models including StateCU and StateMod.
- Process model results into information products.
- Perform software testing and quality control.
- Automate workflows, which increases efficiency and reproducibility.
- TSTool complements StateDMI software, which processes specific model data files.



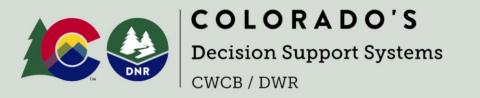


Installation and Configuration

The following slides describe how to install and configure TSTool.

If the default configuration is OK, skip forward to examples of using TSTool.

See the Troubleshooting chapter of the documentation for additional guidance, available from the TSTool *Help* menu.





Download the TSTool Installer

- CDSS website (used for CDSS work):
 https://cdss.colorado.gov/software/tstool
- OpenCDSS website with newer versions and history of releases: https://opencdss.state.co.us/tstool/

Download the installer to the C:\Users\user\Downloads folder (where "user" is a specific user).

Multiple versions of TSTool can be installed on a computer, which allows software to be updated without overwriting old versions.

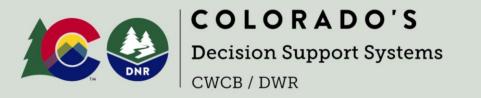




Install TSTool

- Run the installer as Administrator (future updates may remove this requirement).
- Typically accept all the defaults.
- See the documentation installation appendix for more information:

```
https://opencdss.state.co.us/tstool/latest/doc-
user/appendix-install/install/
```





Run TSTool

- Use the Start / CDSS / TSTool-14.0.4 menu (or similar) to start TSTool.
- If installing for the first time, the user's files will be automatically created during the first session.
- If a previous version has been installed with the same major number (e.g., 14), the user's configuration files will be shared between installations.
- If a previous version has been installed with a different major number (e.g., updating from 13 to 14), the user's configuration files will be copied to the new version.
- Additional configuration may be needed as explained in the following slides.
- The configuration will depend on the type of work being done, such as modeling, data analysis, research, etc.





TSTool Log File

- The TSTool log file may need to be checked during troubleshooting.
- The log file may need to be provided to support.
- Use the *Tools / Diagnostics View Log File (Startup)...* menu to view startup messages, including information about configuration.
- The StartLog command can be used to start a new log file for the command file, which can be viewed with the *Tools / Diagnostics* View Log File... menu (commands in the Commands menu are discussed in other training lessons).





TSTool Installation and User Files

- TSTool files exist in the software installation folder and user files.
- TSTool software installation configuration files are used by default, for example in: C:\CDSS\TSTool-14.0.4\...
- Additional user configuration files are shared between TSTool installations with the same major version, for example:
 C:\Users\user\.tstool\14\...
- User configuration files add to and override the software installation configuration settings.





HydroBase Database Configuration

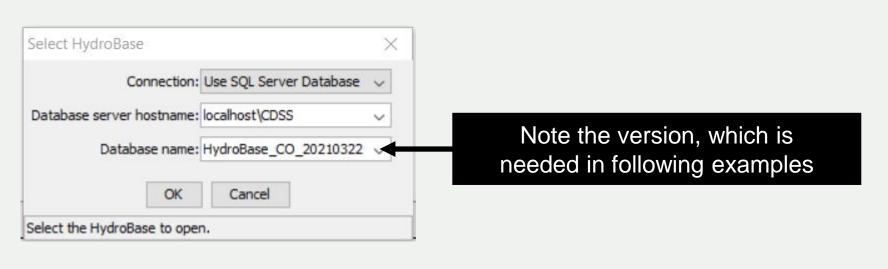
- HydroBase is the State of Colorado's database for water resources data.
- TSTool is distributed with a default HydroBase configuration to facilitate use of a local HydroBase database; however, a HydroBase database must be installed separately.
- One or more HydroBase databases and the HydroBase Database Manager software can be downloaded and installed: https://opencdss.state.co.us/opencdss/hydrobase/
- Or, HydroBase database features can be disabled and HydroBase web services can be used (described in following slides).





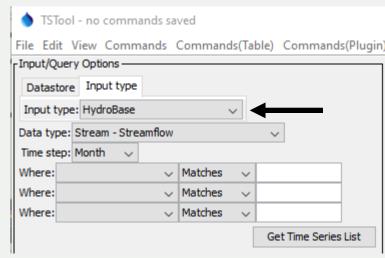
HydroBase Database Selection (as Input Type)

- If HydroBase is installed on the computer, the default configuration will cause TSTool to prompt for the HydroBase to use in the current session (left image below).
- After selection, HydroBase will be listed in the *Input Type* tab in the upper left TSTool main window (right image below).



COLORADO'S

Decision Support Systems











Colorado Water Conservation Board

Department of Natural Resources

Enable HydroBase Database Datastore

- A HydroBase datastore can be enabled if HydroBase database is available.
- Datastores are a general feature, are newer than input types, and allow databases and web services to be configured, which enable useful software features such as ability to run SQL statements.
- Take note of the HydroBase version that is listed in the previous slide to use in the configuration file below.
- Copy file
 C:\CDSS\TSTool-14.0.4\datastores\HydroBase.cfg (using the correct software version) to
 C:\Users\user\.tstool\14\DataStores\HydroBase.cfg
 - With a text editor, update the HydroBase version in the file (e.g. HydroBase_CO_20210322) and confirm that:

 Enabled = True
- Restart TSTool to see the datastore listed in the *Datastore* tab in the upper left of the main TSTool window.
- Selecting a HydroBase database at startup will use a database input type named HydroBase. If a datastore named HydroBase is also defined, the datastore will take precedence in time series identifiers used in commands. Time series identifiers are discussed later in this presentation.
- Use the View / Datastores menu and TSTool log file to troubleshoot database connections.
- Update the datastore configuration file if a new HydroBase version is installed.





Disabling HydroBase Database Features

- A HydroBase database is **not installed** with TSTool by default.
- TSTool by default **does** attempt to list HydroBase databases when it starts.
- This will cause the HydroBase selector to display each time that TSTool starts and will be slow as TSTool searches for HydroBase on the network.
- To disable HydroBase because no local database has been installed, use a text editor to create the file

C:\Users\user\.tstool\14\system\TSTool.cfg
and include the content shown below:

[TSTool]
HydroBaseEnabled = False

Restart TSTool to confirm that no HydroBase selector is shown.





HydroBase Web Service Datastore

- The HydroBaseWeb web service datastore is enabled by default and allows HydroBase to be accessed over the internet.
- This is slower than a local database but avoids having to install a HydroBase database on the local computer.
- Historical data are updated whereas data in a local database version are a snapshot in time.
- Not all HydroBase data are available in TSTool via web services and new features are added over time.
- Examples in this training presentation use HydroBase web services to avoid the need for a local database.
- Examples that use a datastore named HydroBaseWeb can be run with a HydroBase database by replacing HydroBaseWeb with HydroBase.





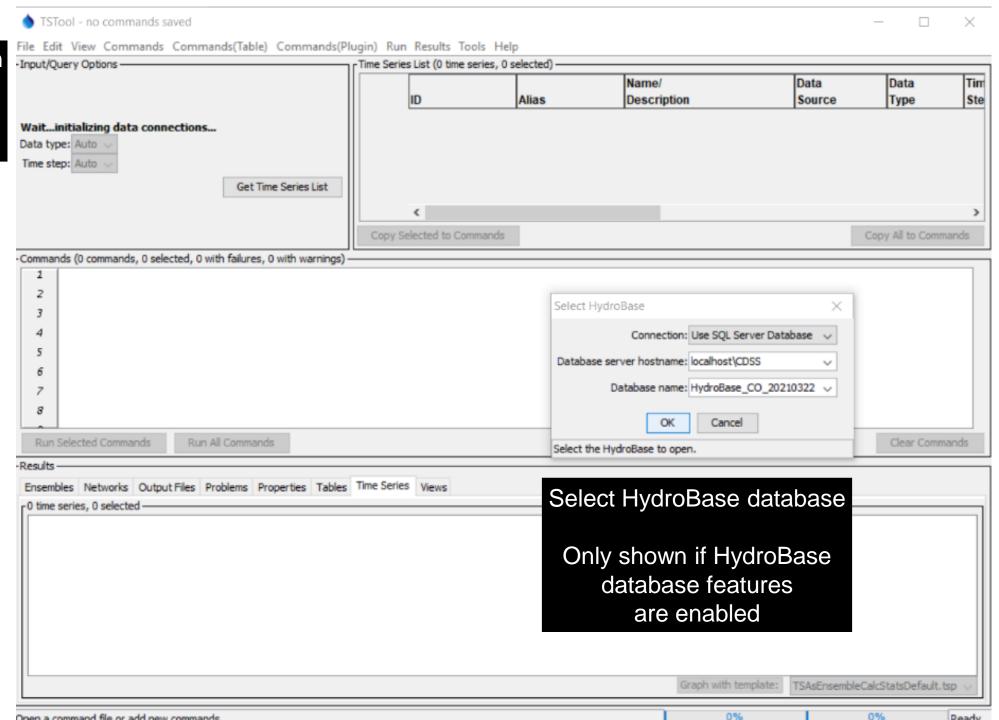
Examples

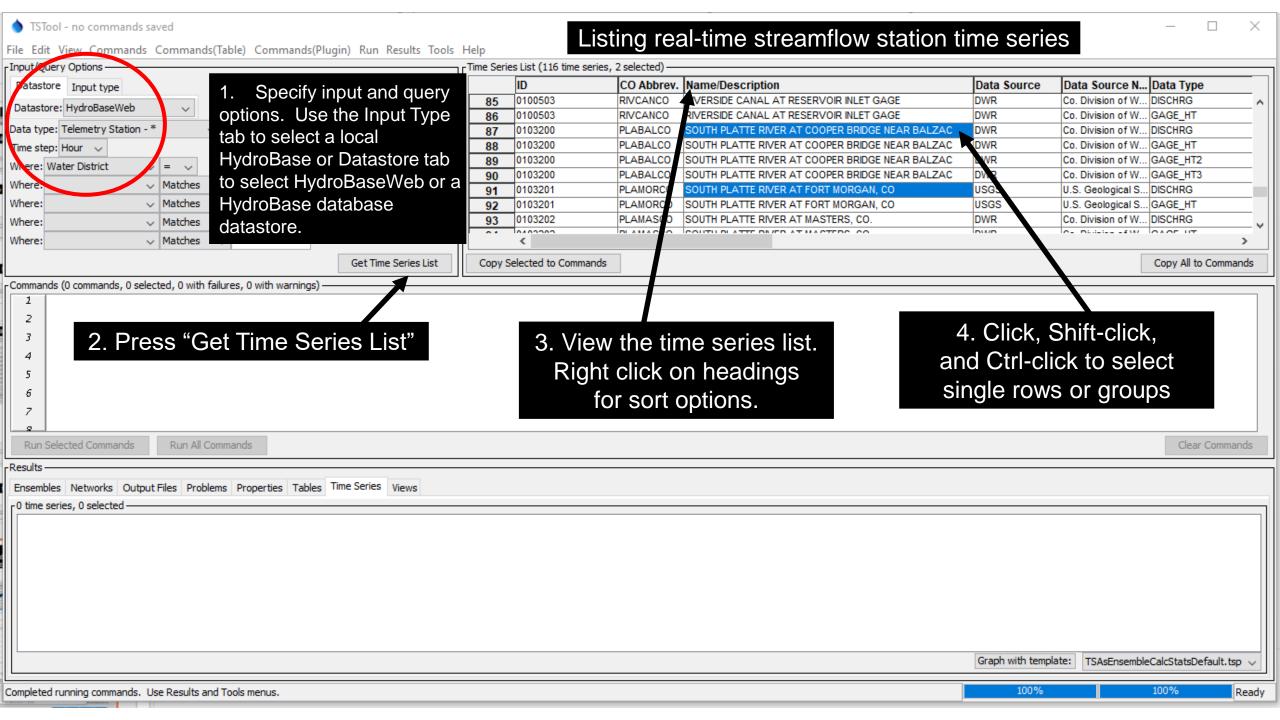
The following example TSTool session illustrates basic software functionality.

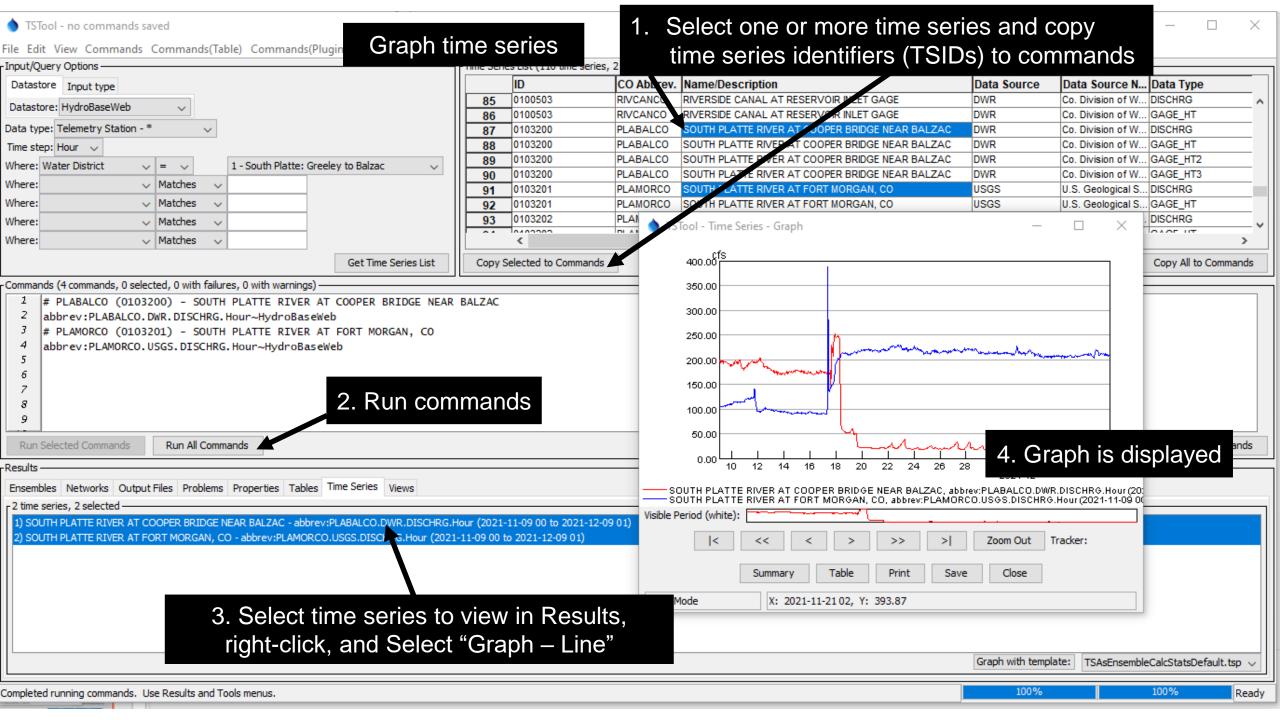


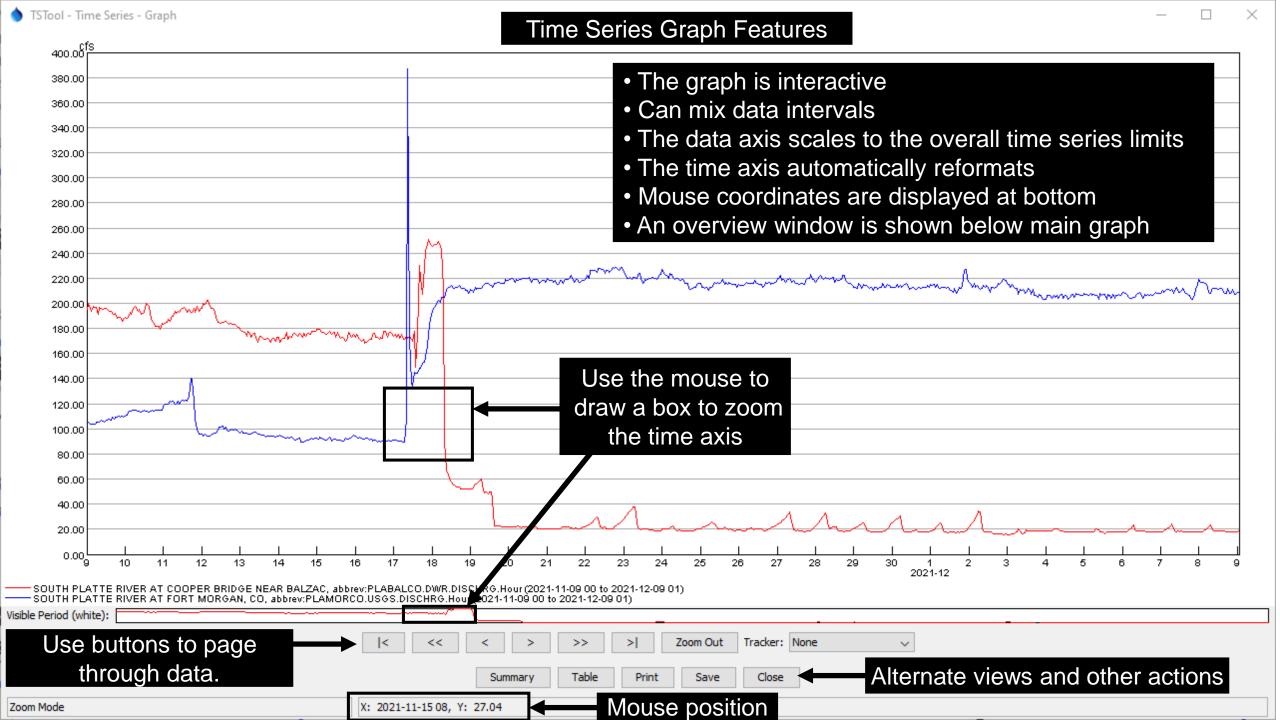


After starting TSTool when the HydroBase database is enabled and has been installed

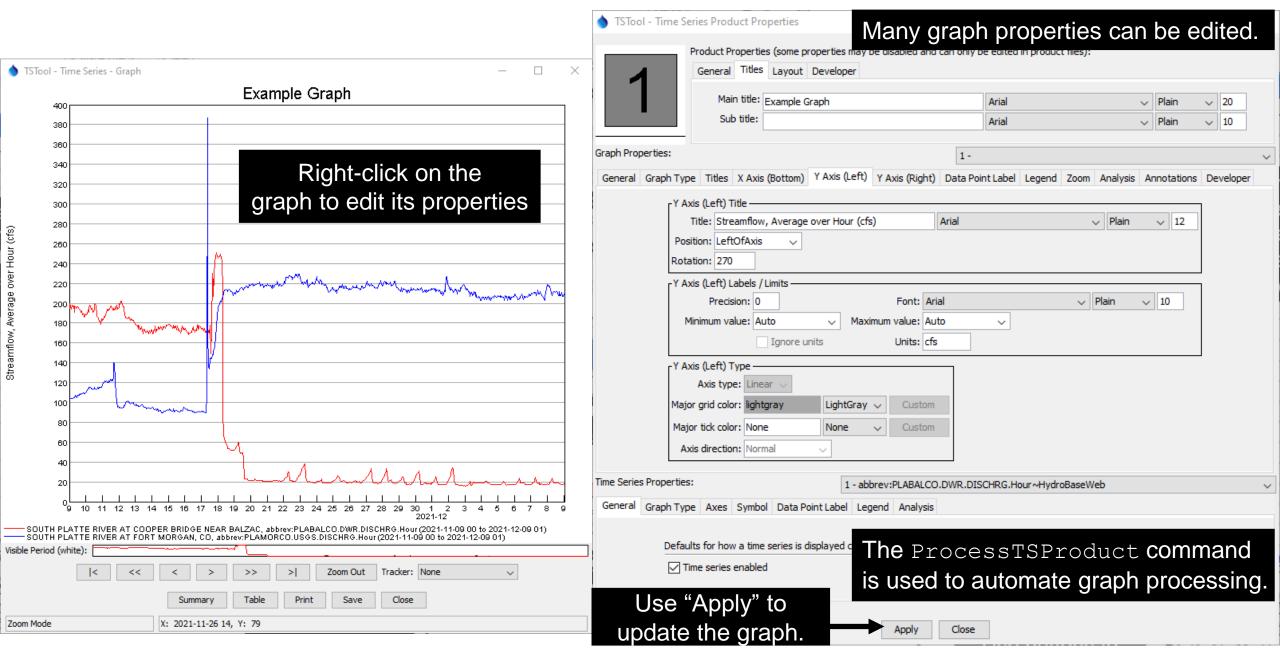


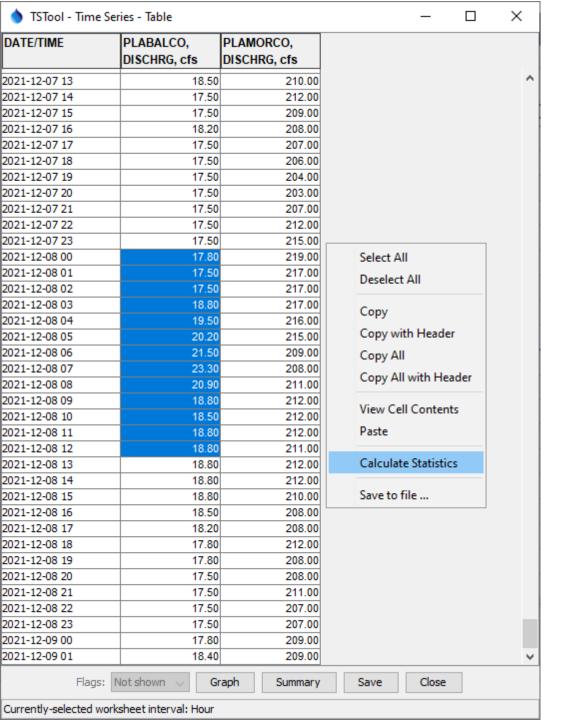






Time Series Graph Properties





Time Series Table

- The table shows a column for each time series that was selected.
- Right-click on a column header to sort.
- Click, Shift-click, and Ctrl-click to select single cells and groups of cells (similar to Microsoft Excel).
- Multiple tables will be shown if the time intervals are different.
- If time series have irregular time interval, date/times are added for all data with blanks shown when data do not align.
- Missing values are shown as empty cells.
- If data flags are used in time series, they can be shown next to the data value by using the *Flags* choice in the lower left.
- Table contents can be saved to a file.

Time series alias

Description

Data source

Data interval Data units

Orig./Avail. period

Data type

Period

General time series metadata

Comments:

Telemetry and time series information from HydroBaseRest...

Time series identifier = abbrev:PLABALCO.DWR.DISCHRG.Hour

= DISCHRG = Hour

= cfs

= abbrev:PLABALCO.DWR.DISCHRG.Hour Time Series Identifier

= SOUTH PLATTE RIVER AT COOPER BRIDGE NEAR BALZAC Description

= 2021-11-09 00 to 2021-12-09 01

= 1988-01-31 00 to 2021-12-09 00

= SOUTH PLATTE RIVER AT COOPER BRIDGE NEAR BALZAC

Data Source = Co. Division of Water Resources

Data Type = DISCHRG Data Interval = Hour Data Units

HydroBase query period = null to null

HydroBase availabe period

Located in water div = 1

Located in county = MORGAN

Latitude, Longitude = 40.357682, -103.528595

Additional information if available (e.g., from HydroBase) = 1988-01-31 00 to 2021-12-09 00

Time series creation history:

Created new time series with interval determined from TSID "abbrev:PLABALCO.DWR.DISCHRG.Hour~HydroBaseWeb"

read data from web services https://dwr.state.co.us/rest/get/api/v2/telemetrystations/telemetrystation?format=json&includeThirdParty=true&abbrev=PLABALCO&apiKey=NCKUCgSHXvJj2gtFZ

Date	0/12	1/13	2/14	3/15	4/16	5/17	6/18	7/19	8/20	9/21	10/22	11/23	Average
2021-11-09	195.00	200.00	196.00	194.00	198.00	197.00	197.00	191.00	197.00	196.00	195.00	196.00	
	196.00	195.00	194.00	194.00	192.00	191.00	192.00	188.00	189.00	189.00	186.00	187.00	193.54
2021-11-10	189.00	188.00	190.00	193.00	191.00	196.00	198.00	196.00	194.00	195.00	191.00	192.00	
	193.00	200.00	199.00	198.00	187.00	186.00	184.00	182.00	182.00	182.00	179.00	184.00	190.38
2021-11-11	183.00	184.00	185.00	187.00	186.00	189.00	190.00	194.00	192.00	194.00	193.00	195.00	
	196.00	197.00	195.00	193.00	195.00	193.00	193.00	196.00	193.00	198.00	194.00	195.00	192.08
2021-11-12	196.00	200.00	199.00	202.00	202.00	198.00	196.00	196.00	193.00	189.00	185.00	185.00	
	184.00	185.00	185.00	186.00	185.00	183.00	184.00	183.00	183.00	183.00	182.00	181.00	189.38

Default report format for the data interval

Graph

Search

Close

Time Series Identifier (TSID)

Example time series identifiers:

```
LocID.DataSource.DataType.Interval LocID.DataSource.DataType.Interval~InputType
LocID.DataSource.DataType.Interval~InputType~Filename
LocID.DataSource.DataType.Interval~DataStore
LocID.DataSource.DataType.Interval.Scenario~DataStore
LocID.DataSource.DataType.Interval.Scenario[Trace]~DataStore
```

- TSID commands are used when selecting specific time series.
- The above illustrates typical TSID syntax.
- The TSID uniquely identifies the time series and allows TSTool to find the time series in databases, files, and web services.
- The . (period), [], (square brackets), and ~ (tilde) characters have special meaning and cannot be used in TSID parts.
- A Datastore has properties such as database name (see View / Datastores).
- TSIDs vary by data source, as documented in datastore appendices.





TSIDs and Time Series Alias

- TSIDs can be long and complex, but are necessary to uniquely identify time series, especially when reading and writing time series.
- Each TSID must provide unique identification across all data sources handled by TSTool.
- A time series "alias" can optionally be defined for each time series to facilitate identifying the time series during workflow processing.
- The alias can be short, for example using the location identifier and data type (e.g. 123456-Streamflow).
- TSIDs and alias are used in commands.



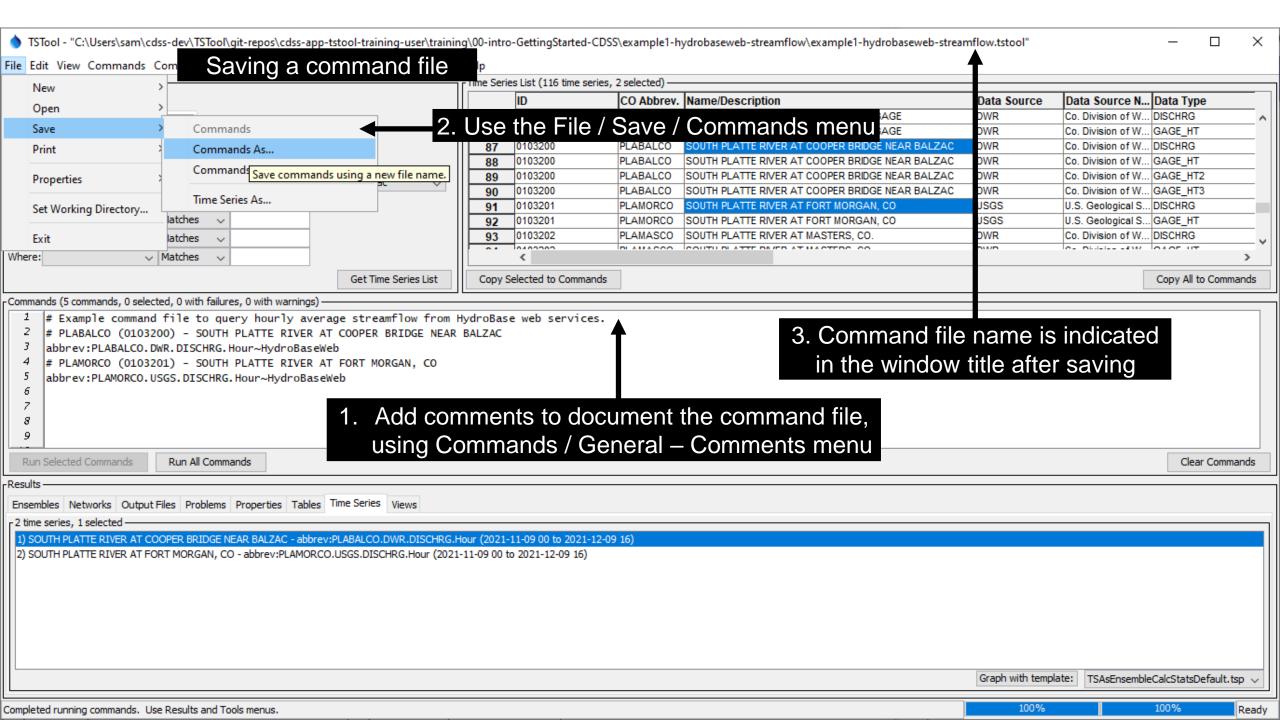


Command Files

- The commands in the Commands area can be saved to a file, opened later, and rerun.
- Command files automate data processing and can be run in batch mode without using the user interface.
- See the File / Save / Commands menu and File / Open / Command File... menu.
- Command files can be maintained with datasets to automate data processing.
- Command files can be managed in a version control system such as GitHub to track changes over time, support collaboration, and provide examples of workflows.
- Use the Commands / General Comments ... menu to insert comments in command files to document workflows.

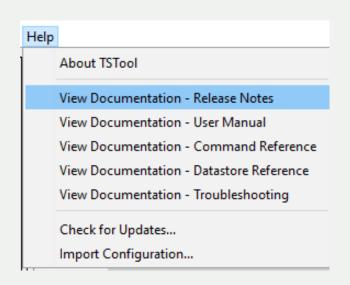


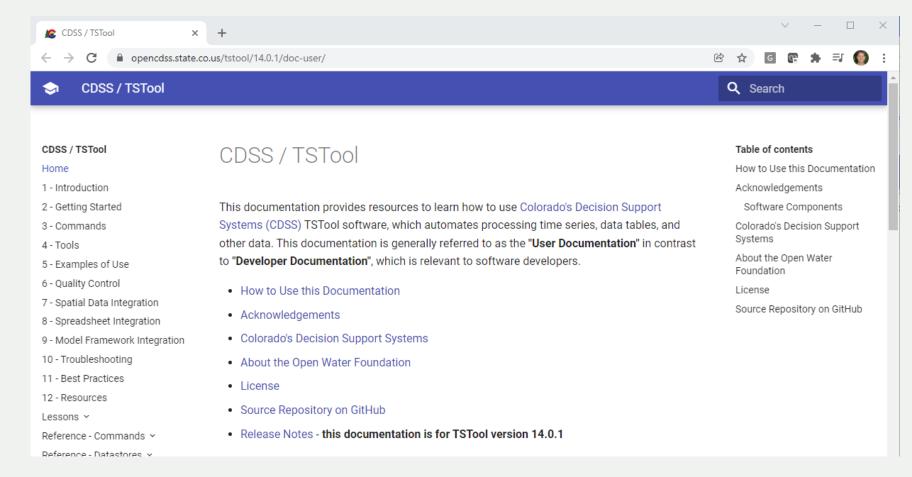




More Information

See the TSTool *Help* menu for links to online documentation.









Decision Support Systems

CWCB / DWR



Next Steps

- Other training presentations are available.
- For example, see the "Introduction to Commands".

