

---

# Appendix: StateMod Input Type

2013-11-16

## Overview

The StateMod time series input type corresponds to the file format used by the State of Colorado's StateMod model, including:

- standard daily, monthly, average monthly (referred to as annual in the StateMod documentation) time series file formats
- water right input files that can be converted to cumulative decree time series
- output (\*.x\*) text files, such as the \*.xop file

See also the StateModB input type, which corresponds to StateMod binary output files and the StateCU input type, which corresponds to the State of Colorado's StateCU consumptive use model.

The following example illustrates the format of the three main standard time series file formats. See the **StateMod Documentation** for a complete description of StateMod input files. Important comments about the file format are:

- The file is divided into a header section (top) and data section (bottom). Comments can occur only at the top and are lines that begin with #.
- One or more time series can be stored in a file.
- Consistency in the order and number of the stations is required for each year of data, within the file.
- Other than comments, the file is fixed-format, compatible with FORTRAN applications. See the **StateMod Documentation** for field specifications.
- The format is optimized to allow a full year of data to be read for the entire data set. Reading a time series for a single location for the full period requires reading through the entire file.
- In addition to the required values, a total/average value is accepted as the far-right value on each data line. This value may be ignored by applications (it can be computed from the data values on the line if necessary).
- The precision of data values may be controlled by software, resulting in more or fewer fractional digits. This may lead to round-off differences when comparing raw data values with the total/average in the optional end column.

```
# StateMod time series files can have 3 main forms (monthly, average monthly, daily) as
# described below. The order of time series is important for
# some files (e.g., order of diversion time series should match order of
# diversion stations in .dds file); however, StateMod is being updated over
# time to remove this requirement). Different StateMod input files have
# slight variations on the general format (e.g., the reservoir target file
# has two time series for each reservoir for minimum and maximum targets).
# Missing data are typically indicated by -999.
# The generic extension for StateMod time series files is .stm, although specific
# extensions are used in a StateMod data set.
#
# 1) This is an example of a StateMod monthly time series for water year data:
#
# Comments are lines at the top of the file starting with the # character.
# The header may contain software-generated comments about the time series.
# The remainder of the file is fixed format, with the first non-comment
# line being a header with the following elements (i5,1x,i4,5x,i5,1x,i4,a5,a5):
#
```

## StateMod Input Type

```
# Beginning month (1=Jan)
# Beginning year (4-digit)
# Ending month
# Ending year
# Data units (AF/M, ACFT, CFS or ""), where rates are for diversions and
# flow, and volume is for reservoir contents. Units are not used for
# dimensionless data (like weight or percent).
# Year type (CYR=calendar, WYR=water, IYR=irrigation)
#
# Data lines then follow with:
# Year Station 12-monthly-values year-total/average (i4, 1x, a12, 12f8, f10)
# The year value is optional and is generally not read as input but is
# computed for output. The year in data lines corresponds to the calendar type.
# An example follows:
10/1926 - 9/1998 ACFT WYR
1927 08236000 1229.8 892.6 922.3 737.9 555.4 922.3 7049.4 32263.6 31000.1 14541.0
5662.9 8326.7 104104.0
1927 08235250 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0
-999.0 -999.0 0.0
1927 08235700 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0
-999.0 -999.0 0.0
1927 08236500 1047.3 595.1 614.9 614.9 555.4 1900.2 6769.7 31226.2 20338.8 14777.1
9465.3 4476.8 92381.5
...

#
# 2) This is an example of a StateMod average monthly time series for water year data:
#
# The average monthly time series is a pattern of twelve monthly values
# that are applied for each year in the period.
# The format is exactly the same as a monthly time series; however, the
# years in the header should be set to zero and year and month are ignored in data rows
# and can therefore be blank.
#
# An example follows:
10/ 0 - 9/ 0 ACFT WYR
08236000 1229.8 892.6 922.3 737.9 555.4 922.3 7049.4 32263.6 31000.1 14541.0
5662.9 8326.7 104104.0
08235250 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0
-999.0 -999.0 0.0
08235700 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0 -999.0
-999.0 -999.0 0.0
08236500 1047.3 595.1 614.9 614.9 555.4 1900.2 6769.7 31226.2 20338.8 14777.1
9465.3 4476.8 92381.5
...

#
# 3) This is an example of a StateMod daily time series for water year data:
#
# The daily time series is similar to the monthly time series except that
# a year and month are included on the data lines and 28, 30, or 31 daily
# data values can occur on each line (end values ignored, depending on month).
# The data format is (i4, i4, 1x, a12, 31f8, f8). The month total/average
# is optional and is generally read as input but is computed for output.
# Regardless of the calendar type in the header, the year and month in data records use
# calendar year (month 1 = January).
#
# An example follows:
10/1926 - 9/1998 ACFT WYR
1926 10 08236000 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -
999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -
999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 0.00 0.00
...
1927 4 08236000 38.00 42.00 42.00 67.00 90.00 90.00 100.00 118.00 93.00
80.00 93.00 80.00 80.00 80.00 80.00 80.00 68.00 80.00 68.00 68.00 80.00
80.00 106.00 136.00 170.00 229.00 250.00 296.00 322.00 348.00 0.00 114.65
1927 4 08235250 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -
999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -
999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 0.00 0.00
...
```

## StateMod Files and Standard Time Series Properties

The standard time series identifier for StateMod files is of the format:

`Location...Interval~StateMod~PathToFile`

StateMod files contain limited header information. Time series properties are set using the following guidelines:

- The location part of the time series identifier is taken from the identifier field in the data records (from the first year of data). A change in the year indicates that all time series have been identified.
- The data source part of the time series identifier is set to `StateMod` or blank. In the past this information was used to indicate the input type (file format) in the time series identifier; however, the new input type notation has a specific field for the input type and therefore data source can be used more appropriately. In the future, it may be possible to pass along the original input source but this information cannot currently be saved in the StateMod file format.
- The data type is often not assigned because it is not defined in the file. Currently no interpretation of the file name extension occurs. Some specific applications (e.g., the StateMod GUI) may set the data type, based on reading a StateMod data set response file (and therefore knowing the specific contents of the file).
- The data interval is assigned as `Day` or `Month` based on the file format (determined automatically).
- The scenario is typically not assigned. Older software may use the scenario to store the file name; however, the new time series identifier notation stores the file name as the input name field (see below).
- The input type part of the time series identifier is set to `StateMod`, indicating the file format. Software will use the interval and/or examine the file contents to verify whether the data are in daily or monthly format.
- The input name part of the time series identifier is set to the file name, either as the full path or a relative path to the working directory.
- The units are assigned to those indicated in the file header.
- The missing data value is assigned to `-999.0`.
- The description is set to the same value as the location. A verbose description can typically be determined by cross-referencing the identifier with another StateMod data file (e.g., diversion stations).
- The period is set based on the header information.

## Limitations

StateMod files have the following limitations:

- The format of the does not facilitate extracting one time series from the file. Software has been optimized to perform this within current constraints.
- Some time series properties are not explicitly included in StateMod files (e.g., data type). Therefore, general software like TSTool may not be able to provide default information. For example, a graph may show multiple time series with nearly the same legend text because more detailed information cannot be defaulted.
- If two time series for the same station are stored in the same file (e.g., reservoir maximum and minimum targets), there is no way to uniquely identify the two time series. The application or user

must understand the file type and data organization. Some specific software (e.g., StateMod GUI) may be able to recognize the specific format.

### Water Right Files

StateMod water right input files can be converted to time series of cumulative decrees. See the explanation in the in the `ReadStateMod()` command documentation.

### Text Output Files

StateMod text output files (\*.x\*) can be read by the `ReadStateMod()` command, with the following notes:

- Identifiers that include period have the period replaced by underscore.
- The file formats are not as structured as the standard files and include additional information. For example, information about each time series often is listed above the numerical tables of time series data.