Appendix: WaterOneFlow – WaterOneFlow Web Service Data Store

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Support for WaterOneFlow is under development.

Overview

The WaterOneFlow data store corresponds to the web service specification developed by the Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI) as part of the Hydrologic Information System (HIS). Access to web service documentation, registry, and other information are available at the following link:

http://his.cuahsi.org/wofws.html

The WaterOneFlow web services are implemented using SOAP technologies. A Java API has been generated using the Web Services Description Language (WSDL) file:

http://river.sdsc.edu/waterOneFlow/NWIS/DailyValues.asmx?WSDL

This Java API is used for all interactions with version 1.0 WaterOneFlow web services. WaterOneFlow/HIS 1.0 uses WaterML 1.0 to return time series data in the SOAP response. The Java API reads the data elements from the WaterML content in order to allow transfer of the data to internal time series properties and data values. Other web services supported by TSTool, such as the UsgsNwisDaily data store (see the **WaterML Data Store Appendix)**, also use WaterML as the transport format. See the **WaterML Input Type Appendix** for more information about the WaterML format and the `ReadWaterML()` command for information about reading WaterML files.

The version of WaterOneFlow and the corresponding WaterML are important because the internal API used to read the web services must be compatible. At this time, TSTool only supports WaterOneFlow 1.0 (and corresponding WaterML 1.0) because the Java API was generated using a version 1.0 WSDL file. However, TSTool's `ReadWaterML()` command provides additional support for WaterML versions because the files are read independent of the WaterOneFlow WSDL API code.

A WaterOneFlow data store is configured by specifying the location of a web service root URL (see section on configuration below). A registry of WaterOneFlow WaterML services can be found at the following location:

http://hiscentral.cuahsi.org/pub_services.aspx

To select a version 1.0 WSDL, review the URL for the WSDL (e.g., http://river.sdsc.edu/wateroneflow/EPA/cuahsi_1_0.asmx?WSDL) and look for "cuahsi_1_0" in the URL. Alternatively, view the WSDL file and look for "his/1.0" in the targetNamespace, as in the following (this information ultimately is checked by the software to determine the version):

```
<wsdl:definitions targetNamespace="http://www.cuahsi.org/his/1.0/ws/">
```

WaterOneFlow/WaterML 1.1 appears to have been a development version and introduces changes that are not supported in TSTool. WaterML 2.0 is being reviewed as an Open Geospatial Consortium (OGC) standard, but is not yet supported in TSTool:

http://www.opengeospatial.org/projects/groups/waterml2.0swg

It is expected that organizations that currently publish data in WaterML will update their services to version 2.0 and support for version 2.0 will be added in TSTool when sites become available for testing and production use.

WaterOneFlow Standard Time Series Properties

This section will be updated to apply to WaterOneFlow. Currently it focuses on UsgsNwisDaily.

The standard time series identifier for WaterOneFlow time series in TSTool is of the form, and are consistent with the WaterML conventions (other than the data store being configured appropriately for a WaterOneFlow data store):

```
Location.DataSource.DataType.Interval~DataStoreName
```

More specifically, the identifier adheres to the following convention:

```
SiteNum.AgencyCode.ParameterCode-StatisticCode.Day~DataStoreName
```

where identifier parts are described as follows:

- The `SiteNum` corresponds to a USGS site. The NWIS Mapper (http://wdr.water.usgs.gov/nwisgmap/), USGS Site Inventory (http://waterdata.usgs.gov/nwis/inventory) and other published information from the USGS can be used to determine site numbers.
- `AgencyCode` can be blank for USGS sites or is specified from the following list (for example, use `USGS` for the code):
  http://nwis.waterdata.usgs.gov/nwis/help/?read_file=nwis_agency_codes&format=table
- `ParameterCode` is taken from the parameter list available from the following list:
  http://nwis.waterdata.usgs.gov/usa/nwis/pmcodes
  Ideally a parameter name could be used; however, the list of parameters is extensive, descriptions may change, and special characters like the period are used in descriptions and would interfere with the TSID convention. Consequently, a concise unique parameter name is not readily apparent, and the initial implementation uses the numerical parameter code. In the future, the text name may be allowed and a prefix may be used to indicate whether a code or name is used.
- `StatisticCode` and `StatisticName` are taken from the list of supported statistics:
  http://waterservices.usgs.gov/rest/USGS-DV-Service.html
  Currently TSTool uses `StatisticCode` rather than `StatisticName`. In the future, the text name may be allowed and a prefix may be used to indicate whether a code or name is used
- Interval defaults to `Day`.
- `DataStoreName` is the user-defined data store name from the configuration information.
- Data units are taken from the following:
  - WaterML `unitCode` in `variable` element
- Missing numerical values are internally represented as `NaN` and are assigned to any date/times in the period that do not have values.

    - WaterML `noDataValue` in `variable` element is checked and matching data values are handled as missing
- Data value flags, if encountered, are retained in the time series. However, because the USGS uses "A" for approved, it may be necessary to ignore this flag so that other flags stand out more when visualized.
- Data value qualifiers definitions are saved with time series and are available to use in time series visualization as flag definitions

Limitations

This section will be updated to apply to WaterOneFlow. Currently it focuses on UsgsNwisDaily.

USGS NWIS data store limitations relative to TSTool standard features are as follows:

- Interpretation of USGS data is limited by WaterML limitations, as follows:
    - WaterML files from NWIS do not indicate the interval of the data. Day can be assumed for the daily values web service; however, trying to read the WaterML file later will require that the interval is specified.
    - Some of the descriptions contain units, which may lead to confusion if time series are processed into different units.
- The USGS web services does not allow for all historical data to be returned. Specifying no period returns only the most recent value. Start and end dates must be specified to retrieve a longer period; however, there is no way to request the entire available period. Consequently, users must request a period of interest for their analysis and the browsing features of TSTool cannot list the available period (because doing so would require querying all data, which would be very slow).

Data Store Configuration File

A data store is configured by enabling WaterOneFlow data stores in the main *TSTool.cfg* configuration file and creating a data store configuration file for each data store. Configurations are processed at software startup. An example of the TSTool configuration file is shown below. Multiple data stores can be defined using the `[DataStore:DataStoreName]` syntax. This allows, for example, accessing web services for different organizations that publish WaterOneFlow web services.

```
# Configuration file for TSTool

[TSTool]

WaterOneFlowEnabled = true

# Startup data stores (note that data store name in config file takes precedence)

[DataStore:WaterOneFlow-NWISDV]

ConfigFile = "WaterOneFlow-NWISDV.cfg"
```

TSTool Configuration File with WaterOneFlow Data Store Properties

Properties for each data store are specified in an accompanying data store configuration file (see below), which in the following example is located in the same folder as the TSTool configuration file and configures a data store named “WaterOneFlow-NWISDV”.

```
# Configuration information for "WaterOneFlow-NWISDV" data store,
# which corresponds to the NWISDV registered network in WaterOneFlow.
# Properties are:
#
# The user will see the following when interacting with the data store:
#
# Type - WaterOneFlowDataStore (required as indicated)
# Name - data store identifier used in applications, for example as the
#     input type information for time series identifiers (usually a short string)
# Description - data store description for reports and user interfaces (short phrase)
# Enabled - whether the data store is enabled (default=True)
#
# The following are specific to the USGS NWIS daily data store:
#
# ServiceRootURI - web service root URI for WSDL
# Version - WaterOneFlow/WaterML version (may be removed in the future)

Type = "WaterOneFlowDataStore"
Name = "WaterOneFlow-NWISDV"
Description = "WaterOneFlow USGS NWIS Daily Value Web Service (1.0)"
ServiceRootURI = "http://river.sdsc.edu/waterOneFlow/NWIS/DailyValues.asmx?WSDL"
Version = "1.0"
```

WaterOneFlow Data Store Configuration File