
Appendix: RCC ACIS Data Store

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Overview

The RCC ACIS data store corresponds to the Regional Climate Center (RCC) Applied Climate Information System (ACIS), which stores real-time and historical climate data (see overview: <http://data.rcc-acis.org/doc/VariableTable.html>). ACIS data values are the “best available” and may include values merged from multiple sources. Data are accessed via a REST web service (see http://en.wikipedia.org/wiki/Representational_State_Transfer) application programmer interface (API). On July 1, 2012 ACIS web services were updated to the version 2 design, described here:

<http://data.rcc-acis.org/>

The earlier version 1 API is described here:

<http://data.rcc-acis.org>
<http://data.rcc-acis.org/doc/VariableTable.html>

Support of ACIS in TSTool is being enhanced over time. The basic functionality is in place; however, additional effort is needed due to the large number of data types and data reductions that are offered. The initial effort has focused on basic data access for daily data and integration with TSTool; however, technical issues remain, as described below.

RCC ACIS and Standard Time Series Properties

The standard time series identifier for RCC ACIS time series is of the form:

`Location.DataSource.DataType.Interval~DataStoreName`

More specifically, the identifier follows the following convention for version 2:

`IDType:StaID.ACIS.Elem.Interval~DataStoreName`

and version 1:

`IDType:StaID.ACIS.VarMajor.Interval~DataStoreName`

where identifier parts are described as follows:

- The location is indicated by station ID type and the station identifier. Because ACIS cross-references identifiers used in multiple data systems, the identifier cannot be guaranteed to be unique without knowing the identifier type. For the above identifier, the identifier type is selected in the following order (these abbreviations are taken from the ACIS REST API documentation): COOP, ICAO, NWSLI, FAA, WMO, WBAN, ThreadEx, AWDN, GHCN, CoCoRaHS, ACIS. This order may in the future be added as an RCC ACIS data store configuration property, or command parameter.
- The data source is set to ACIS.

- The data type for the version 2 API is set to the element name (`elem` in ACIS documentation). For version 1 the data type is set to `VarMajor`, which is a unique number guaranteed not to change.
- Interval is determined from the ACIS variable list (e.g., “daily” is translated to “Day”) for consistency with TSTool conventions. Intervals that are not explicitly specified (e.g., “sub-hrly”) or are not directly supported by TSTool (e.g., “weekly”) are converted to “Irregular”. TSTool currently only supports daily interval.
- `DataStoreName` is the user-defined data store name from the configuration information.
- Data units are taken from the ACIS variable list (version 1) and are assigned otherwise.
- Data flags (see: http://www.ncdc.noaa.gov/oa/climate/research/gdcn/GDCN_V1_0.doc) are handled as follows:
 - Missing numerical values from ACIS are indicated by a data value of `M` and are converted to `NaN` internally, with an `M` flag on the data value.
 - Trace numerical values for precipitation and snow from ACIS are indicated by a data value of `T` and are converted to `0.0` internally, with a `T` flag on the data value.
 - No value with a flag is set to missing and the flag is set.
 - Value with flag is set to the value and the flag is set.
- Time series retrieved by the `MultiStn` and `StnMeta` request sometimes come back with no dates – these time series are omitted from the time series list when displaying in TSTool.
- Time series with “valid daterange” having dates with year 9999 have the year replaced with the current year.
- Data values with unexpected values and/or flags (e.g., `12.2A, S`) are handled as follows: if a numerical value is at the start of data, it is used to set the data value. Remaining text is used to set the data flag for the value.

Limitations

RCC ACIS data store limitations relative to TSTool standard features are as follows. Some of these issues may have been resolved with ACIS version 2 but have not yet been confirmed.

- Limited testing of combinations of query parameters has been implemented. Some technical issues have been identified, as documented below, and if resolved, may clarify other issues. Some of the variable types are only supported in limited fashion and may be eliminated or changed.
- The ACIS general API does not provide the variable list but may do so in the future – currently the variable list is determined from the HTML list mentioned above (version 1) or is hard-coded to core data types (version 2). Requesting some variables in version 1 may not return any data.
- The ACIS variable list is unique according to the “variable major”. Using a unique string for variable is more human readable than the numeric “major”. Abbreviations are mentioned in the ACIS documentation and are supported by ACIS version 2; however, a universal list has not yet been published and consequently not all variables are available in TSTool.
- The ACIS general web services provide area information that can be presented as choices. However, choices have been implemented only for criteria where lists have been published and are reasonably short.
- Although a variety of query parameters can be specified (e.g., for location), not all of the information is returned as metadata in results. Consequently, when displaying lists of station-time series in TSTool, some attributes are omitted or would need to be determined from the query criteria (but this is not as robust). A requested design change is therefore to allow returned metadata for all query parameters (such as `clim_div`, `cwa`).

- The bbox MultiStn query parameter is documented in version 1 with an example as being surrounded by [] when in fact these characters should not be included.
- Area parameters can include multiple values (e.g, postal=CO,WY), but this is not documented in version 1 text (only in an example). Some clarification may be appropriate, in particular if this behavior only applies to postal.
- It appears that multiple location parameters can be specified to limit the query (e.g., county that intersects a climate division)? However, this feature is not documented. TSTool will allow multiple location criteria to be specified.
- How are start and end dates with year 9999 to be interpreted?
- Requesting a data type may return a full list of stations, even if that data type is not collected at the stations. The start and end dates for the data can be consulted to determine whether data actually are available. A cleaner way to omit missing time series needs to be implemented.
- No attempt has been made to use reduced data available using JSON input. For example, reduced data include monthly values computed from daily values. Some anticipated issues are:
 - Would it be possible to implement the reductions via a URI rather than having to provide data behind the scenes? This would make the API more transparent for troubleshooting.
 - Need to understand how to map the reduced data time series identifiers to TSTool time series identifiers?
 - Does the reduction result in a time series or a statistic (table of 1+ numbers)? TSTool has some conventions for dealing with time series and statistics and additional evaluation is needed.
 - Should the API for reduced data fundamentally be the same as getting other time series (e.g., specify an interval of monthly instead of daily) or should the user need to specify additional input parameters to control the reduction. This depends on how “acceptable” the defaults are. It would seem that some standard reductions could simply result in more time series choices... but how does the major/variable name change?

Data Store Configuration File

A data store is configured by enabling RCC ACIS data stores in the main *TSTool.cfg* configuration file, and creating a data store configuration file for each data store connection. 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. For ACIS, this would allow, for example, accessing systems at different RCC or different versions of the web services.

```
# Configuration file for TSTool

[TSTool]

RCCACISEnabled = true

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

[DataStore:RCC-ACIS]

ConfigFile = "RCC-ACIS.cfg"
```

TSTool Configuration File with RCC ACIS Data Store Properties

Properties for each data store are specified in an accompanying configuration file described below.

The following illustrates the RCC ACIS data store configuration file format, which in this example is located in the same folder as the TSTool configuration file and configures a data store named “RCC-ACIS”.

```
# Configuration information for "RCC-ACIS" data store.
# Properties are:
#
# The user will see the following when interacting with the data store:
#
# Type - RccAcisDataStore (required as indicated)
# Name - data store name 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 RCC ACIS data store:
#
# ServiceRootURI - web service root URI, including the server name and root path
#                 additional information will be appended to make specific requests
# ServiceVersion - indicate the ACIS API version as 1 or 2 (default)

Type = "RccAcisDataStore"
Name = "RCC-ACIS"
Description = "RCC ACIS Web Services"
ServiceRootURI = http://data.rcc-acis.org
ServiceVersion = "1"
```

RCC ACIS Data Store Configuration File