Exporting WaterML from the Earth System Modeling Framework

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August 4, 2009
Outline

• Project Overview
• WaterML
• Hydrologic Information System (HIS)
• ESMF
• Preliminary results
SIParCS Project Overview

• Motivation: Interdisciplinary science often requires scientists to access data archives from domains different from their own; in this case, hydrology, climate and atmospheric science

• Objective: The incorporation of a WaterML metadata package into ESMF, which will enable exporting atmospheric time series datasets in WaterML XML format
Water Markup Language (WaterML)

• A widely used data standard in the hydrologic research community seeking to establish a single common representation of key constructs

• A XML schema to provide generic and unambiguous water data services across multiple, heterogeneous data sources

• Incorporated into Hydrologic Information Service (HIS) web service
CUAHSI Hydrologic Information System

- CUAHSI is the Consortium of Universities for the Advancement of Hydrologic Science
- Seeks to provide better access to hydrologic data through a federated data archive with standard formats
  - All data are stored in relational databases
  - All data formats are converted to WaterML
Earth System Modeling Framework

- Metadata in ESMF appears in the form of Attributes, which are name-value pairs attached to ESMF objects such as Fields, Components, etc.

- Attribute packages are sets of attributes with the same convention and purpose

- ESMF contains a series of standard Attribute packages, i.e. Climate and Forecast (CF) convention for Field data
WaterML Attribute Package Architecture

Variable Name, Type, Code, etc.

Time Series Attribute Package

Method ID, Sample ID, etc.

Data Attribute Package

Data Element 1

Data Element 2

Data Element X
WaterML Example XML output from HIS

<timeSeries>
  <sourceInfo xsi:type="SiteInfoType">
    <siteName>Little Bear River at McMurdy Hollow near Paradise, Utah</siteName>
    <siteCode network="LittleBearRiver" siteID="2">USU-LBR-Paradise</siteCode>
    <geolocation>
      <geogLocation xsi:type="LatLonPointType" srs="EPSG:4269">
        <latitude>41.575552</latitude>
        <longitude>-111.855217</longitude>
      </geogLocation>
      <localSiteXY projectionInformation="NAD83 / UTM zone 12N">
        <X>428703.917</X>
        <Y>4603005.09</Y>
      </localSiteXY>
    </geolocation>
    <verticalDatum>NGVD29</verticalDatum>
    <note title="County">Cache</note>
    <note title="State">Utah</note>
    <note title="Site Comments">Located below bridge at 8700 South (McMurdy Hollow)</note>
  </sourceInfo>
  <variable vocab="LBR" default="true" variableID="39">USU39</variable>
  <variableName>Phosphorus, total as P</variableName>
  <valueType>Sample</valueType>
  <generalCategory>Water Quality</generalCategory>
  <sampleMedium>Surface Water</sampleMedium>
  <units unitsAbbreviation="mg/L" unitsCode="199">milligrams per liter</units>
  <NoDataValue>-9999</NoDataValue>
  <timeSupport isRegular="false"/>
</variable>
  <values unitsAbbreviation="mg/L" unitsCode="199" count="29">
    <value censorCode="nc" dateTime="2008-04-14T13:00:00"
      qualityControlLevel="Quality controlled data" methodID="27" sourceID="3" sampleID="590">0.1192</value>
    <value censorCode="nc" dateTime="2008-04-14T13:00:00"
      qualityControlLevel="Quality controlled data" methodID="27" sourceID="3" sampleID="591">0.114</value>
    <value censorCode="nc" dateTime="2008-04-14T14:00:00"
      qualityControlLevel="Quality controlled data" methodID="27" sourceID="3" sampleID="592">0.1424</value>
  </values>
</timeSeries>
WaterML Example XML output from ESMF

```xml
<timeSeries>
  <sourceInfo xsi:type="SiteInfoType">
    <siteName>Little Bear River at McMurdy Hollow Near Paradise, Utah</siteName>
    <siteCode network="LittleBearRiver" siteID="Z">USU-LBR-Paradise</siteCode>
    <geoLocation xsi:type="LatLonPointType" srs="EPSG:4269">
      <latitude>41.575552</latitude>
      <longitude>-111.855217</longitude>
    </geoLocation>
    <localSiteXY projectionInformation="NAD83 / UTM zone 12N">
      <X>428703.917</X>
      <Y>4603005.09</Y>
    </localSiteXY>
  </sourceInfo>
  <verticalDatum>NGVD29</verticalDatum>
  <note title="County">Cache</note>
  <note title="State">Utah</note>
  <note title="Site Comments">Located below bridge at 8700 South (McMurdy Hollow)</note>
</sourceInfo>

<variable>
  <variableCode vocabulary="LBR" default="true" variableID="39">USU39</variableCode>
  <variableName>Phosphorus, total as P</variableName>
  <variableType>Sample</variableType>
  <generalCategory>Water Quality</generalCategory>
  <sampleMedium>Surface Water</sampleMedium>
  <units unitsAbbreviation="mg/L" unitsCode="199">milligrams per liter</units>
  <NoDataValue>-9999</NoDataValue>
  <timeSupport isRegular="false"/>
</variable>

<values>
  <units unitsAbbreviation="mg/L" unitsCode="199" count="29">
    <value> censorCode="nc" dateTime="2008-04-14T13:00:00"
      qualityControlLevel="Quality controlled data" methodID="27" sourceID="3"
      sampleID="590">0.119</value>
    <value> censorCode="nc" dateTime="2008-04-14T13:00:00"
      qualityControlLevel="Quality controlled data" methodID="27" sourceID="3"
      sampleID="591">0.114</value>
  </values>
</timeSeries>
```
Accomplishments

- Created an ESMF use test case with a WaterML Attribute Package
- Output time series data annotated with WaterML attributes in XML
- Helping ESMF team modify ESMF XML output function to output time series data in WaterML compatible format
Thank you !!!!!

Questions?