9.3 WEB SERVICES ACCESS TO TAO MOORED BUOY DATA

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1. INTRODUCTION

The TAO (Tropical Atmosphere Ocean)/TRITON (Triangle Trans-Ocean Buoy Network) array of moored buoys located in the tropical Pacific is the cornerstone of NOAA's ENSO observing system, supporting NOAA's mission of improving seasonal to interannual monitoring and forecasts. The TAO Project of NOAA/PMEL originally maintained all the mooring sites. Since 2000, the TRITON program of JAMSTEC (Japan Marine Science and Technology Center) has maintained the western portion of the TAO/TRITON array (west of 160ºE). The TAO/TRITON array is presently composed of 71 surface moorings and each day returns approximately 1613 daily average data in near real time via ARGOS and NOAA's polar orbiting.

2. THE TAO DATA

All mooring sites in the TAO/TRITON array are instrumented to observe surface winds, air temperature and relative humidity, and eleven upper-ocean temperatures from the surface to 500 meters depth. TRITON sites also measure temperature at 750 meters depth. These data constitute the so called "standard data".

At many sites instrumentation is enhanced to allow observations of non-standard data including shortwave solar radiation, precipitation, and conductivity for salinity and density. At strategically located sites moorings may be further enhanced to include observations of outgoing longwave radiation, barometric pressure, and ocean currents at 10 and 40 meters depth, e.g., a recently concluded 3-year period of observations along 95ºW, for the Eastern Pacific Investigation of Climate Processes(EPIC).

TAO data processed and quality controlled at PMEL are archived in a MySQL data base at PMEL. These data are combined with TRITON data processed at JAMSTEC and made available as an integrated data set from the TAO web pages. At http://www.pmel.noaa.gov/tao/. Until TRITON data are integrated into the PMEL MySQL database, only TAO data are available through the web services system.

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3. RATIONALE FOR WEB SERVICES ACCESS

Presently there are two ways of retrieving TAO data. The first is through the TAO data delivery page, where a user a selects the sites, time range, and variable to extract and download.

The second is via anonymous FTP, where a user can download data from a collection of ASCII files which are updated daily.

With the advent of web services, we can provide a W3C standards-based interface for automated machine-to-machine, customized requests for designated subsets of the TAO distribution data sets

Although users will have to write their own client to connect to the service, they do gain the capability to retrieve their data customized to their requirements as XML objects. XML portability allows for easier parsing of the data either for use in a user application or for translation into another data format.

4. THE DATA SERVED

The data that are available through the TAO Web service are a subset of the TAO data referred to as ”standard data”.

Standard data comprise the following sensors: air temperature, winds (4m height), Humidity (3m), sea surface temperature and sub-surface temperatures to a depth of 500m.

More information on these data and the TAO buoy sampling and sensors can be found at http://www.pmel.noaa.gov/tao/. Data are now available through this web service for the period June 1985 to the present.

5. API EXPOSED

To simplify the TAO Web Service definition no method overloading was used. The web service exposes the following methods

5.1 *Parameters*

SiteID: An eight-character String designating a site, for example 2S155W. The site ID also indicates the location of this site in the TAO moored buoy array. An invalid site id will result in an error message.

StartDate and Endate: A date string in the format YYYY-MM-DD HH:MM:SS. HH is in 24 hour international time notation. The method will respond with an error message if the end date is earlier than the start date.

SensorName: A String representing each possible data set that can be requested from this service. Possible

values are AirT (air temperature), SST (sea surface temperature), Hum (humidity), Wind (wind direction and velocity) and SubT (sub surface water temperature).

5.2 *Data retrieval methods*

Air Temperature:
Temperature getAT(String siteID, Date startDate, Date EndDate);

Wind:
Wind getWind(String siteID, Date startDate, Date EndDate);

Humidity:
Humidity getHum(String siteID, Date startDate, Date EndDate);

Sea surface temperature
SST getSST(String siteID, Date startDate, Date EndDate);

Sub-surface water temperature
SubSurfaceTemp getSubTemp(String siteID, Date startDate, Date EndDate);

Example:
The method call getAT("2S170W", "1999-10-03 01:00:00", "1999-10-25 01:00:00",) will return air temperature data for the TAO site at 2°South, 170°West from October 3 1999 at 1:00 am to October 25 1999 at 1:00 am.

5.3 *Dataset information methods*

Sites getAllSites();
Returns a list of all TAO Database sites.

Sites getSitePeriod(Date startDate, Date endDate);
The method returns a list of sites that are archived in the database between start date and the end date.

Date getDataPeriod(String siteID, String sensorName);
Get the period of data availability for a particular site, for a particular sensor.

Example:
The method call getDataPeriod("2S170W", "SubT"); will return the period for which these data were measured at a particular the TAO mooring at 2°South and 170° West.

5.4 *Method return types*

For the sake of clarity the method return types in this paper have been defined as the type of dataset the method will return. In actual fact these method invocations will result in XML resultsets that are described below.

6. THE RESULT SET

Marine XML was used as the XML schema in which we return the TAO web service resultsets. The MarineXML resultset are embedded in the SOAP response message. All data are delivered as time series data.

Although MarineXML was used as the source implementation schema for the web service resultset data, it had some shortcomings, for example, indicating the measurement interval period for the data and matching the period and DataObject elements. We will work with other MarineXML users to resolve these issues.

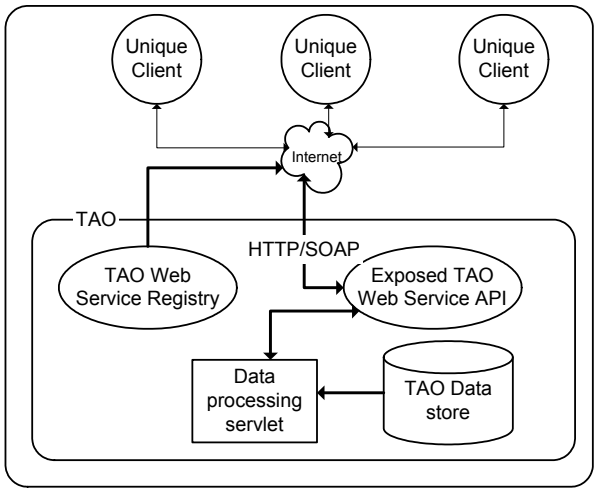

Fig. 1 The TAO web service components

7. UDDI REGISTRY

A UDDI registry will be set up where this web service will be registered, although it would be ideal to move this registration to a central NOAA Web Service registry.

8. CLIENT

The source code to a demonstration Java TAO Web Service client will be made available to users.

9. CONCLUSION

The TAO web service will allow users to retrieve the data they want, for the period they want, whenever they want to, with the added capability of automated access. The increased usage of TAO data via the web services system will enhance the utility and visibility of the TAO data.

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11. REFERENCES

Ronai, Belinda, P. Sliogeris, Mathhew de Plater, Krystyna Jankowska: "Development and use of Marine XML within the Australian Oceanographic Data Centre to encapsulate marine data" found at http://www.aodc.gov.au