Using Python, Partnerships, Standards and Web Services to provide Water Data for Texans

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To aid water resources planning and management efforts by providing scientific and engineering expertise to ensure continued availability of water supplies and maintenance of the ecological health of Texas inland aquatic and coastal systems.

Bays & Estuaries / Instream Flows / Hydrographic Survey / Water Availability Modeling / Data, Analysis & Modeling
Palmer Drought Severity Index (PDSI)

As of: 7/12/2011

Legend

-4.00 to -3.99 Severe Drought
-2.00 to -1.99 Moderate Drought
-1.00 to -1.99 Mild Drought
-0.50 to -0.99 Incipient Dry Spell
-0.49 to 0.49 Near Normal
0.50 to 0.99 Incipient Wet Spell
1.00 to 1.99 Slightly Wet
2.00 to 2.99 Moderately Wet
3.00 to 3.99 Very Wet
>= 4.00 Extremely Wet

Data courtesy of Climate Prediction Center, NCEP - NWS - NOAA. Graphic created by TWDB.
Q. How can I get all the salinity data for Galveston Bay?

A. Not easily or quickly.

Data Providers:
- TWDB
- USGS
- NOAA
- TPWD
- CBI/TCOON
- TCEQ
- Texas DSHS
- University Research Groups
- River Authorities
- Environmental Consulting Companies
WaterML and WaterOneFlow

Streamflow data in WaterML

```
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<value qualifierCode="A" network="USGS" vocabulary="dv_rmk_cd">Approved for publication -- Processing and review completed.</value>
</values>
```

Discharge of the San Marcos River at Luling, June 28 - July 18, 2002
Standards are like toothbrushes, everybody agrees you should have one, but no one wants to use yours.

— JOE CROSER

Every data provider’s data is already in the format they need it in.

Changing formats/delivery mechanisms is a pain

resources, resources, resources, resources …
**python as the glue**

**WOFPy** – a python wrapper for WaterOneFlow Services

```
install_requires=[
    'flask>=0.6.1',
    'sqlalchemy>=0.6.7',
    'pyodbc>=2.1.8',
    'lxml>=2.3',
    'soaplib>=2.0.0b',
    'suds',
    'nose'
],
```

```
install_requires=[
    'numpy>=1.4.0',
    'pandas>=0.3.0',
    'suds>=0.4',
    'quantities>=0.9.0',
    'sqlalchemy>=0.7.1',
    'attest>=0.5.0',
    'matplotlib'
],
```

Developed collaboratively by TWDB, University of Texas and Espey Consultants
marketing and adoption matters

- An adequate but widely used standard is better than a perfect one that no one has heard of.
- Packages need names to get organizations and IT departments to agree to use them.
- Branding matters.
- You need to be able to answer questions like `how do we deploy this on IIS?`
GIWW near East Matagorda Bay

**Salinity, psu**

- **tpwd**
- **tceq**

Data from 1999-05-12 to 2008-07-31

```
In [1]: import pyhis
   ...: cache_initialized_with_database: sqlite:///c:\windows\temp\pyhis_cache.db
In [2]: nwisdv = pyhis.Source('http://river.sdsc.edu/wateronaflow/nwfs/dailyvalues.asmx?wsdl')
In [3]: verts = [[-95.5, 26.5], [-95.5, 29.5], [-96.5, 29.5], [-96.5, 26.5]]
In [4]: nwisdv.get_sites_within_polygon(verts)
In [5]: nwisdv.sites
   ...: @Site: Brazos Rv nr Juliff, TX [081185000],
   ...: @Site: Big Ck nr Needville, TX [081150000],
   ...: @Site: Fairchild Ck nr Needville, TX [081155000],
   ...: @Site: Big Ck nr Guy, TX [081160000],
   ...: @Site: Brazos Rv nr Bosworth, TX [081166500],
   ...: @Site: W Bernard Ck at SH 60 nr Wharton, TX [08117400],
   ...: @Site: San Bernard Rv nr Boling, TX [081175000],
   ...: @Site: Big Bypass Ck nr Wharton, TX [081177000],
   ...: @Site: Colorado Rv at Wharton, TX [081620000],
   ...: @Site: Colorado Rv nr Bay City, TX [081625000],
   ...: @Site: Colorado Rv nr Matagorda, TX [081626000],
   ...: @Site: Colorado Rv nr Matagorda, TX [081626000],
   ...: @Site: Colorado Rv nr Midfield, TX [081626000],
   ...: @Site: W Mustang Ck nr Canad, TX [081845000],
   ...: @Site: E Mustang Ck nr Louise, TX [081845000].
In [6]: nwisdv.sites
   ...: @Site: Houston County Lk nr Crockett, TX [08065330]
In [7]: nwisdv.sites
   ...: @Site: Houston County Lk nr Crockett, TX [08065330].timeseries['00054'].DataType=Average
   ...: @timeseries: Reservoir storage, acre feet (1999-05-12 00:00:00 to 2008-07-31 00:00:00)
   ...: nwisdv.sites
   ...: @Site: Houston County Lk nr Crockett, TX [08065330].timeseries['00054'].DataType=Average
   ...: @timeseries: Reservoir storage, acre feet (1999-05-12 00:00:00 to 2008-07-31 00:00:00)
   ...: nwisdv.sites
   ...: @Site: Houston County Lk nr Crockett, TX [08065330].timeseries['00054'].DataType=Average
   ...: @timeseries: Reservoir storage, acre feet (1999-05-12 00:00:00 to 2008-07-31 00:00:00)
   ...: nwisdv.sites
   ...: @Site: Houston County Lk nr Crockett, TX [08065330].timeseries['00054'].DataType=Average
   ...: @timeseries: Reservoir storage, acre feet (1999-05-12 00:00:00 to 2008-07-31 00:00:00)
   ```
• WOFpy and pyhis are on github: https://github.com/swtools
• http://waterdatafortexas.org will be live this fall
• TPWD, TCEQ, USGS, UT-CRWR, CBI, HRI web services are live
• Live web services can be accessed with HydroExcel, HydroDesktop and pyhis.

dhraphas.pothina@twdb.state.tx.us
http://waterdatafortexas.org
WOFpy architecture (Backend)

- Implements a **reduced** ODM data model (‘**Model**’) for mapping to WaterML objects.
- **Model** is also mapped to the native database of the source by source-specific DAOs.

**DAOs** define object-relational mapping (ORM) from native schema to **Model**.
- Contains methods for translating user arguments into queries to native db.
- The python module, **SQLAlchemy**, supports ORMs and can accommodate different db environments (e.g. MSSQL, SQLite, etc).
Old Paradigm

- Data in original form
- ODM database as intermediate, data transformed to fit ODM Schema
- WOF For ODM
- WaterML Web Services

New Paradigm

- Data in original form
- Data Access Object (DAO)
- WOFpy (WaterOneFlow services in Python)
- WaterML Web Services

Data stays in original format, WOFpy DAO used to access data