Obtaining Water Data for Oil Shale Research Using HydroSeek

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Major Topics

1. HydroSeek Search Engine

2. Piceance Creek Basin Data

3. Visual Patterns in Data
1. HydroSeek

- Ontology Aided Search Engine
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- Ontology Aided Search Engine
- Queries of Multiple Databases
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- Ontology Aided Search Engine
- Queries of Multiple Databases
- GIS and Index Driven Searches
1. HydroSeek

- Ontology Aided Search Engine
- Queries of Multiple Databases
- GIS and Index Driven Searches
- Developed by Bora Beran of Drexel University with NSF CUAHSI Support
Keyword: Discharge, Stream
GO!

For search by watershed:

End Date: 9/30/2007
Start Date: 10/1/1900

- Eastbound longitude: 106.11°
- Northbound latitude: 38.94°
- Westbound longitude: 109.64°
- Southbound latitude: 40.88°
2. Piceance Basin Data

- Colorado River at Cameo
- White River near Meeker
- Piceance Creek at White River
- Yellow Creek at White River
74 year mean = 3,810 cfs or 2.76 million acre-ft per year
White River Daily Discharge Near Meeker, CO 1901-2007

White River Annual Discharge Near Meeker, CO 1901-2007

103 yr mean = 620 cfs or 449,000 acre-ft per year
Piceance Creek Daily Discharge at White River, CO 1970-2007

Piceance Creek Annual Discharge at White River, CO 1970-2007

38 year mean = 36 cfs or 26,100 acre-ft per year
Yellow Creek Daily Discharge at White River, CO 1972-2007

Yellow Creek Annual Discharge at White River, CO 1972-2007

35 yr mean = 3 cfs or 2,175 acre-ft per year
## Summary of Water Data

<table>
<thead>
<tr>
<th>Station</th>
<th>Parameter</th>
<th>1973 ¹</th>
<th>2007 ²</th>
<th>Comments</th>
</tr>
</thead>
</table>
| Colorado River               | Discharge     | 4,138 cfs | 3,810 cfs | Fruita 30 ml west  
| Cameo, CO                    | Dis. Solids   | 387 ppm  | 496 ppm | > 7,600 cfs  
|                              |               |         |        | > 850 ppm                                                                |
| White River                  | Discharge     | 638 cfs  | 620 cfs | 2007 flow based on longer period                                          |
| Meeker, CO                   | Dis. Solids   | 344 ppm  | 370 ppm |                                                                          |
| Piceance Creek               | Discharge     | 17 cfs   | 36 cfs  | 2007 flow based on longer and wetter period                              |
| White River, CO              | Dis. Solids   | 2,500 ppm| 1,750 ppm|                                                                          |
| Yellow Creek                 | Discharge     | 1.4 cfs  | 3 cfs   | Extreme peak flows especially in the Fall                                |
| White River, CO              | Dis. Solids   | 2,140 ppm| 2,447 ppm|                                                                          |

*Source*

¹ 1973: US DOI Final Environmental Statement on the Prototype Oil Shale Leasing Program
² 2007: Data Collected with HydroSeek in this Paper
3. Analysis of Data Patterns

- Visual Patterns in Data
- Wet and Dry Phases
- Long-Term Oscillations
- Pacific Decadal Oscillation (PDO)
Colorado River Annual Discharge Near Cameo, CO 1934-2007

Median 3600 cfs
Colorado River Annual Discharge Near Cameo, CO 1934-2007

Characterization of phases as wet or dry

- 19 yrs: 15 wet, 4 dry
- 24 yrs: 14 dry, 10 wet
- 22 yrs: 15 wet, 7 dry
- 8 yrs: 7 dry, 1 wet

CFS

Colorado River Annual Discharge Near Cameo, CO 1934-2007

19 yrs
Wet
4220 cfs

24 yrs
Dry
3531 cfs

22 yrs
Wet
4158 cfs

8 yrs
Dry
2869 cfs
Colorado River Annual Discharge Near Cameo, CO 1934-2007

- 43 yrs trendline period
- 43 yrs wet/dry period
- 19 years
- 24 years
- 22 years
- 8 years

polynomial trendline
What Causes the Long-term Oscillation?
• What Causes the Long-term Oscillation?

• Can a Future Recurrence be Predicted?
Pacific Decadal Oscillation (PDO)

- Oscillation in Sea Surface Temperatures (SST) and Sea Level Pressures (SLP) in North Pacific Ocean > 20° N. Latitude
Pacific Decadal Oscillation (PDO)

- Oscillation in SST and SLP in N. Pacific
- Warm and Cool Phases 20-30 yrs
Pacific Decadal Oscillation (PDO)

- Oscillation in SST and SLP in N. Pacific
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- Periods Average about 50 Years
Pacific Decadal Oscillation (PDO)

- Oscillation in SST and SLP in N. Pacific
- Warm and Cool Phases 20-30 yrs
- Periods Average about 50 Years
- Strongly Associated with Climate Changes
Warm Phase
Positive Index Measured
Along the Eastern Wedge

1977 – 1999
Wet Period

Cool Phase
Negative Index Measured
Along the Eastern Wedge

1999 - ?
Dry Period

Ref: Nate Mantua
(mantua@atmos.washington.edu)
JISAO
monthly values for the PDO index: 1900 – February 2007

Water year values for PDO averaged from Nate Mantua’s index table on internet
PDO Index and Colorado River Discharge at Cameo, CO
PDO Index and Colorado River Discharge at Cameo, CO
Correlation Results
PDO and Colorado River Flow

- PDO and Annual Discharge \( .14 \)
- 5-yr Avg of PDO and Discharge \( .30 \)
- 5-yr Avg and 1-yr Lag Discharge \( .34 \)