Gunnison River Basin
Current Conditions and Forecasts

Aspinall Unit Operation Meeting
April 24, 2008

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Colorado Basin River Forecast Center
Outline

• Overview of Forecast Process
• Current conditions
• Current Forecast
• Peak Flow
• Improvements / New Tools
data analysis and quality control; check OFS initial states and current performance

run SWS and ESP models

SWS:
• Regression equations that relate observed data to future seasonal streamflow volume.

ESP:
• Uses Operational Forecast System (OFS), a continuous model, for initial states and historical precipitation and temperature data to develop probabilistic forecast.
Sample Equation for April 1:
Apr-Jul volume for Dillon Reservoir

> Apr 1 swe Fremont Pass Snotel
> Apr 1 swe Hoosier Pass Snotel
> Apr 1 swe Grizzly Peak Snotel

> Nov-Mar precip Dillon
> Nov-Mar precip Breckenridge
NWS River Forecast System

• Continuous, conceptual hydrologic model composed of three major interrelated functional systems.

Calibration System
- determine model parameters
- store historical data

Operational Forecast System
- generate short term deterministic river forecasts
- maintain model states

Ensemble Streamflow Prediction
- generate ensemble of hydrographs
- generate probabilistic forecasts
Current hydrologic states (from OFS):
River / Res. Levels
Soil Moisture
Snowpack

Historical time series of precipitation and temperature (from Calibration).

Start with current conditions - Apply each year of historical climate - Create several possible future streamflow patterns
1. Select a forecast window
2. Select a forecast variable
3. Model derives a distribution function
4. 50% exceedance value = most probable forecast
5. Correct for model bias

# Statistics based on all years.

<table>
<thead>
<tr>
<th>#</th>
<th>Exceedance</th>
<th>Conditional</th>
<th>Historical</th>
<th>Historical</th>
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<tbody>
<tr>
<td>0.900</td>
<td>439320.500</td>
<td>328520.656</td>
<td>252730.375</td>
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<td>0.750</td>
<td>559350.562</td>
<td>499977.531</td>
<td>435810.375</td>
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<td>0.500</td>
<td>711742.375</td>
<td>751782.938</td>
<td>691946.625</td>
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<tr>
<td>0.250</td>
<td>877104.612</td>
<td>973691.188</td>
<td>935549.938</td>
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<td>0.100</td>
<td>1080490.375</td>
<td>1170393.125</td>
<td>1157333.250</td>
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</table>

April – July Volume
Overview of Water Supply Forecast Process

- Data analysis and quality control; check OFS initial states and current performance
- Run SWS and ESP models
- Analyze model outputs
- CBRFC preliminary forecast
- NRCS preliminary forecast
- Final coordinated forecast
Current Conditions
Water Year 2008
Precipitation Water Year 2008

Legend
- SNOTEL
- COOP
- Lakes
- Rivers

Season
- % Avg Precipitation
  - < 50%
  - 50 - 69%
  - 70 - 89%
  - 90 - 99%
  - 100 - 109%
  - 110 - 130%
  - 130 - 150%
  - > 150%

Areas:
- 115%
- 132%
- 128%
- 152%
- 154%
- 158%
Snow Water Equivalent On April 22nd

Legend
SNOTELs
As of April 22nd
- < 50%
- 50 - 69%
- 70 - 89%
- 90 - 99%
- 100 - 109%
- 110 - 130%
- 130 - 150%
- > 150%
- Not Calculated
- Lakes
- Rivers
- USGS HUCs
Current Stream Flow

Colorado Basin River Forecast Center
GUNNISON - GUNNISON, NR - Hydrograph

Current: 2.0 (04/22/22), Flood Stage: 5.00, Bankfull: 6.00

NOAA/CBRFC, 2005

Colorado Basin River Forecast Center
TOMICHI CK - GUNNISON - Hydrograph

Current: 3.3 (04/22/22), No Flood Stage
Unofficial Estimated Bankfull: 13.16

NOAA/CBRFC, 2005

Colorado Basin River Forecast Center
LAKE FORK - GATEVIEW - Hydrograph

Current: 1.9 (04/22/22), No Flood Stage
Unofficial Estimated Bankfull: 4.75

NOAA/CBRFC, 2005

Observed - Forecast (04/22 20:00) - Outlook (increasing uncertainty)

Historical Exceedance Probability (USGS): 90-75% 75-50% 50-25% 25-10%
Overview of Monthly Conditions

Gunnison Basin Conditions
Percent of 1971-2000 Average

As of January 1, 2008
As of February 1, 2008
As of March 1, 2008
As of April 1, 2008

Monthly Precipitation
Water Year Precipitation
Snow Water Equivalent
Monthly Streamflow
Reservoir Contents*
Forecast
Grand Junction Forecast

GUNNISON - GRAND JUNCTION, NR (GJNC2)
Water Year 2008, Forecast Period Apr-Jul (highlighted)

Gunnison - Grand Junction, Nr

- 2008 Water Year
- 2007 Water Year
- Average
- Forecast

Forecast Period
HISTORY (1971-2000):
Period Minimum
Period Normal
Period Median
Period Maximum
NORMALS:
Monthly
Monthly (GJMPAZ)
Water Year Sum
OFFICIAL FORECAST:
Reasonable Maximum
Final
Reasonable Minimum
90%-50% (Final)
50%-10% (Final)

Volume (kaf)
Forecast Compared to Previous Years

<table>
<thead>
<tr>
<th>Rank</th>
<th>Year</th>
<th>Apr-Jul kaf</th>
<th>%Avg 720kaf</th>
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<tbody>
<tr>
<td>1st</td>
<td>1984</td>
<td>1433</td>
<td>199%</td>
</tr>
<tr>
<td>6th</td>
<td>1993</td>
<td>985</td>
<td>137%</td>
</tr>
<tr>
<td>2nd</td>
<td>1995</td>
<td>1242</td>
<td>173%</td>
</tr>
<tr>
<td>3rd</td>
<td>1997</td>
<td>1061</td>
<td>147%</td>
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<tr>
<td>4th</td>
<td>2008</td>
<td>1060</td>
<td>147%</td>
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</tbody>
</table>
Peak Flows into Blue Mesa
Peak Flow
Peak Regression Curves

NORTH FORK GUNNISON - SOMERSET
APRIL

\[ y = 0.0109x - 0.0558 \]

\[ R^2 = 0.6498 \]
1. Select a forecast window
2. Select a forecast variable
3. Model derives a distribution function
4. 50% exceedance value = most probable forecast
5. Correct for model bias
# North Fork Gunninson Peaks

www.cbrfc.noaa.gov/product/peak/peak.cgi

<table>
<thead>
<tr>
<th>Exceedance Prob.</th>
<th>90%</th>
<th>75%</th>
<th>50%</th>
<th>25%</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somerset: average peak 3,310 cfs between 5/11 &amp; 6/2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>CFSD</td>
<td>4000</td>
<td>4400</td>
<td>4900</td>
<td>5400</td>
<td>5900</td>
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<tr>
<td>Date of Peak</td>
<td>5/14</td>
<td>5/17</td>
<td>5/23</td>
<td>5/28</td>
<td>6/4</td>
</tr>
<tr>
<td>Cedaredge: average peak 210 cfs between 5/3 &amp; 6/8</td>
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<tr>
<td>CFSD</td>
<td>230</td>
<td>265</td>
<td>310</td>
<td>360</td>
<td>410</td>
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<tr>
<td>Date of Peak</td>
<td>5/14</td>
<td>5/18</td>
<td>5/23</td>
<td>5/29</td>
<td>6/5</td>
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<td>Delta (minus flow from Crystal):</td>
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<tr>
<td>CFSD</td>
<td>6000</td>
<td>6500</td>
<td>7200</td>
<td>8000</td>
<td>8750</td>
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<tr>
<td>Date of Peak</td>
<td>5/14</td>
<td>5/17</td>
<td>5/23</td>
<td>5/28</td>
<td>6/4</td>
</tr>
</tbody>
</table>
Climate Forecast
Climate Forecast

1 Month Temperature Forecast

1 Month Precipitation Forecast
Climate Forecast

3 Month Temperature Forecast

3 Month Precipitation Forecast

THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
0.5 MONTH LEAD
VALID MJJ 2008
MADE 17 APR 2008

THREE-MONTH OUTLOOK
PRECIPITATION PROBABILITY
0.5 MONTH LEAD
VALID MJJ 2008
MADE 17 APR 2008

EC MEANS EQUAL
CARTELS FOR A, B, C
A MEANS ABOVE
B MEANS NORMAL
C MEANS BELOW
Improvements / New Tools

Current:

• Added 2003 to 2005 data to ESP historical time series. Full ESP period now Water Years 1976 to 2005.

• New technique for looking at soil moisture

Future:

• CHPS (Community Hydrologic Prediction System)

• Verification Tools
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