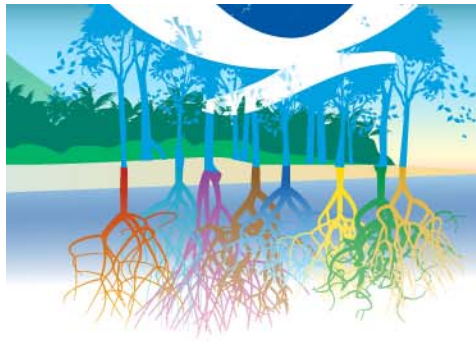


2009 Water Supply Forecasting



2009 Water Seminar

“Dust in the Wind and
Other Winds of Change”



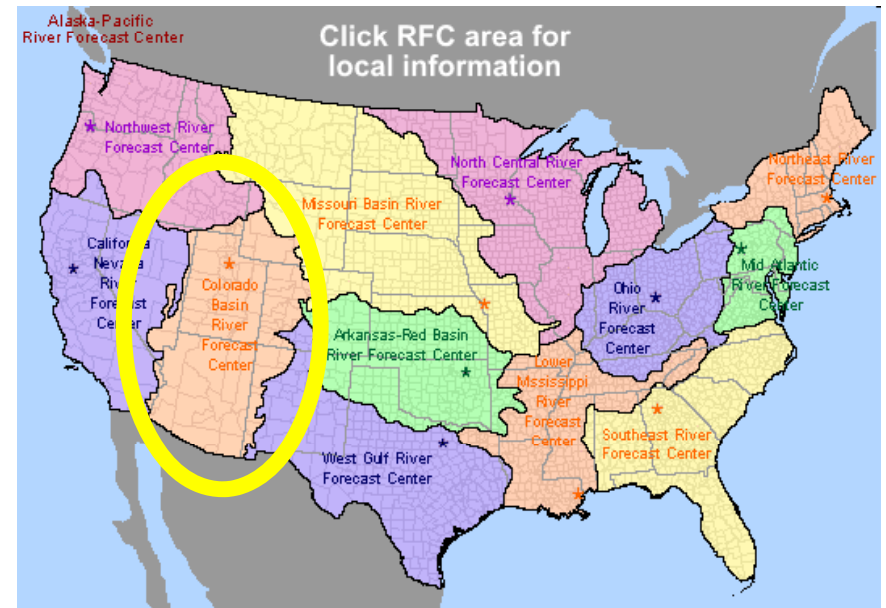
Colorado Basin River Forecast Center

One of 13 River Forecast Centers

Established in the 1940s for water supply forecasting

Three primary missions:

1. Seasonal **Water supply forecasts** for water management
2. **Daily forecasts** for flood, recreation, water management
3. **Flash flood warning support**



www.cbrfc.noaa.gov



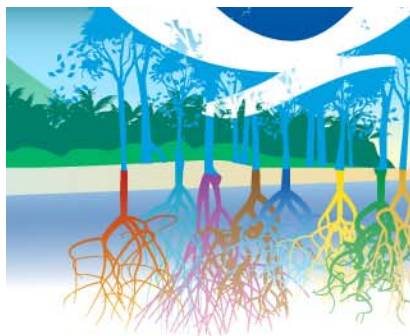
Forecast: April – July Runoff Volumes

Location: Colorado at Lake Powell, Glen Cyn Dam, At, Arizona (GLDA3 - CBRFC)

[change location](#)

[clear location](#)

Water Supply Forecasts Map (including Green, Upper Colorado, San Juan, and Lake Powell)



99 Water Supply Forecast Points Above Lake Powell

Green - Bill Reed

Upper Colorado & Lake Powell - Brenda Alcorn

San Juan - Tracy Cox

April 1st 2009 Forecasts (basin average):

UG 80%

Y/W 110%

Duchesne 75%

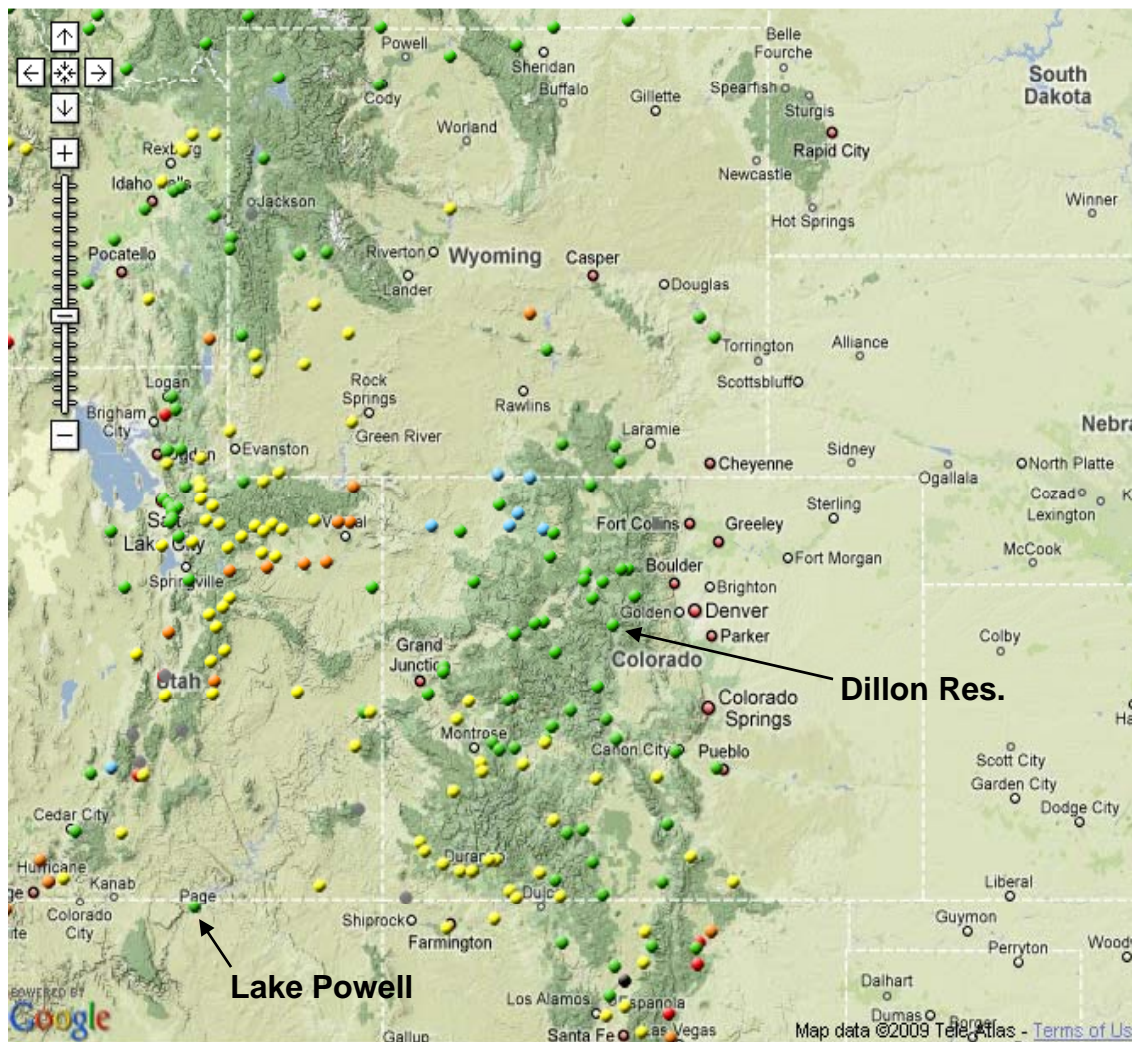
LG 75%

UC (MS) 105%

Gunnison 95%

Dolores 85%

SJ 85%



Options

Map Display

Water Supply Forecast

Mean

Median

April 2009

Water Resources Outlook

Monthly 'Observed' Streamflow

Climate Change Scenarios

Map Options

Legend

- > 150% of Average
- 130% - 150% of Average
- 110% - 130% of Average
- 90% - 110% of Average
- 70% - 90% of Average
- 50% - 70% of Average
- < 50% of Average
- No Average
- No Forecast Available

- Lake Powell
- Dillon Res. (headwater)



What drives the forecasts ???



**Forecasts
Begin
Jan 1**

Forecast Target



Snowpack as the primary driver

~ 35% of seasonal snowpack has accumulated by January 1st.

~ 90% of seasonal snowpack has accumulated by April 1st.

Month:

J F M A M J J

Observed snow water equivalent
Observed Precipitation
Observed Streamflow
Modeled Soil Moisture Conditions

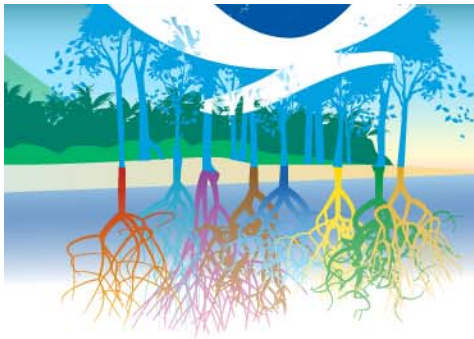
} Primary
Forecast
Drivers



Colorado - Lake Powell

2009 Water Supply Inflow Forecasts



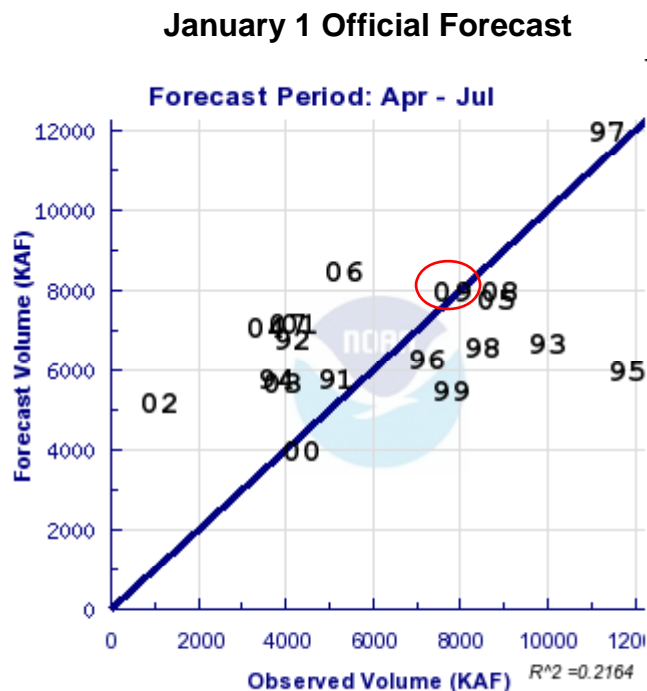


Colorado - Lake Powell, Glen Canyon Dam

Years: 1991-2009

- Because little is known about the future weather (precipitation & temperatures) for the next 7 months.
- Only ~ 35% of seasonal snowpack has accumulated

Scatterplots

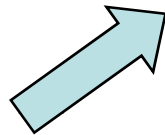
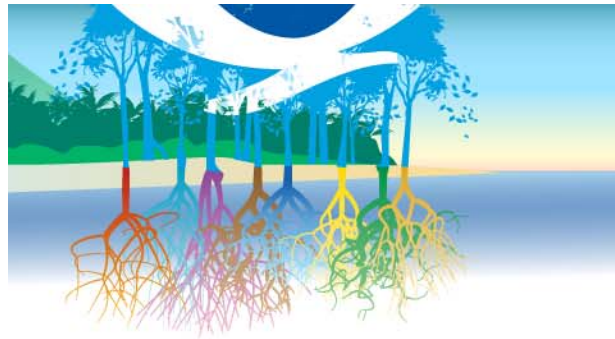


First Forecast of Year;
scatter plot shows wide
spread,

R squared = 0.22;

R squared is the square of
the correlation coefficient,
in this case 78% of the
variation in forecast
volume vs. observed
volume is not explained
yet.

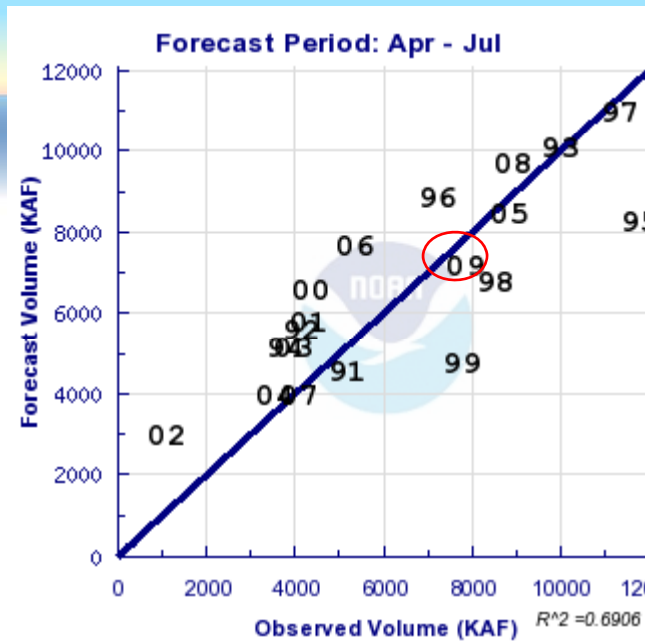




January 1 Official Forecast

April 1 Official Forecast

Colorado - Lake Powell, Glen Canyon Dam
Years: 1991-2009

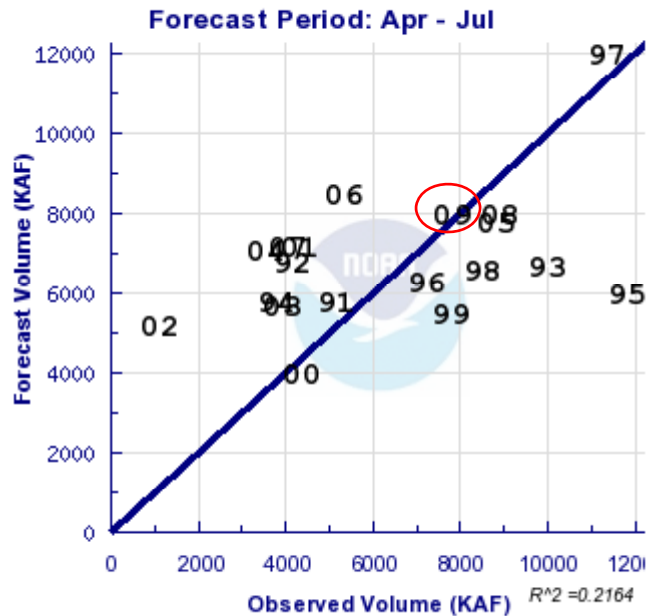


Known: **Scatterplots**

- snow on ground (~ 90% of seasonal snowpack has accumulated)

Not Known:

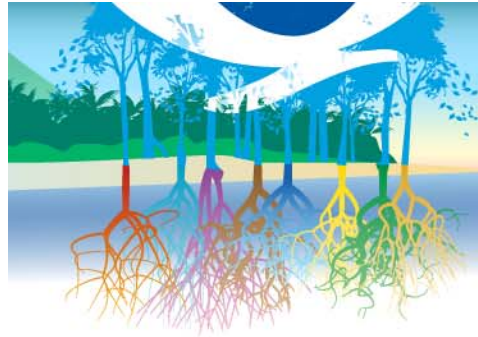
- future weather for next four months



Forecast at Beginning of Runoff Season; scatter plot shows less spread,

R squared = 0.69

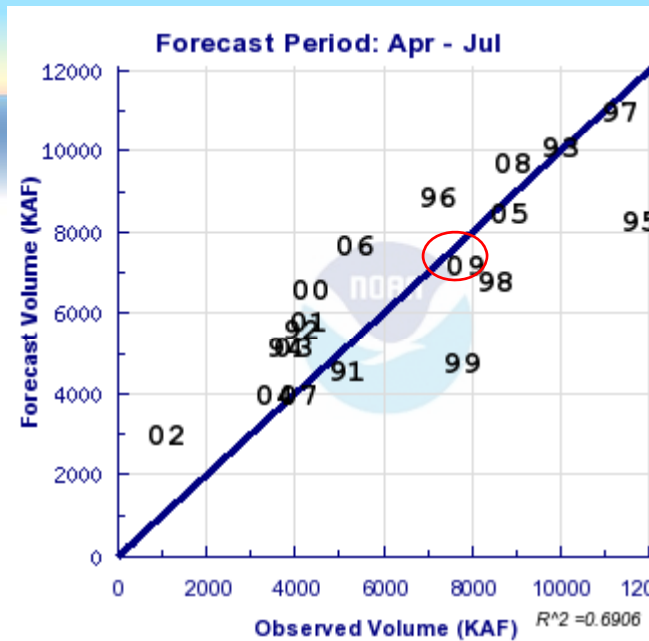




Scatterplots

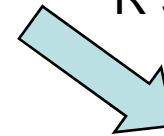
April 1 Official Forecast

Colorado - Lake Powell, Glen Canyon Dam
Years: 1991-2009



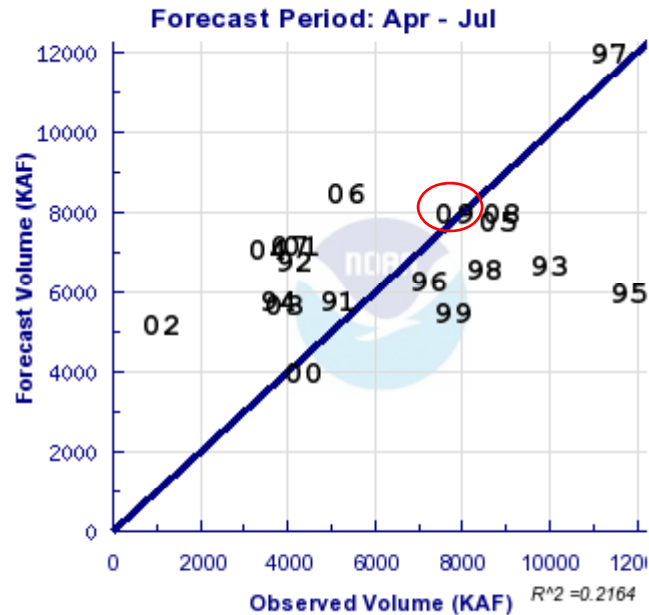
Forecast at Middle of
Runoff Season;
scatter plot shows
little spread,

R squared = 0.95



June 1 Official Forecast

January 1 Official Forecast



Forecasts:

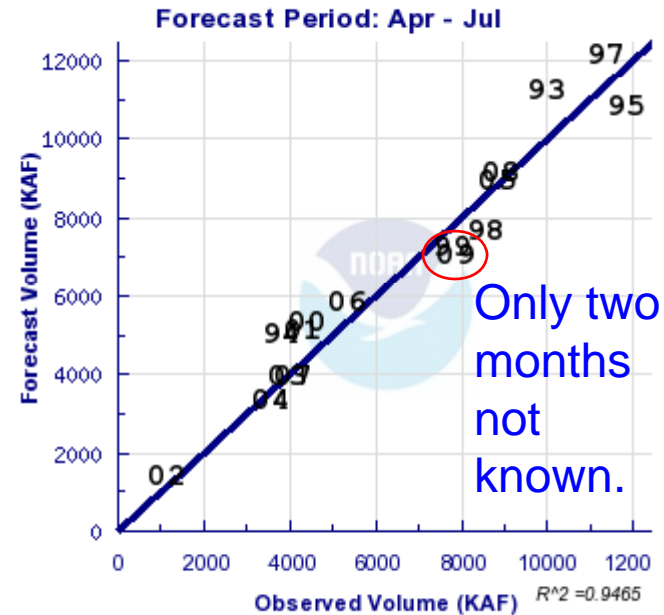
January 1 - 8000 KAF

April 1 - 7200 KAF

June 1 - 7100 KAF

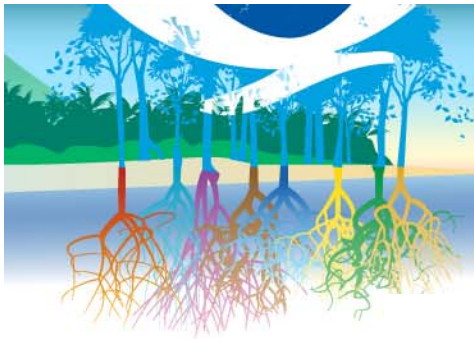
Observed: 7814 KAF

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Only two
months
not
known.

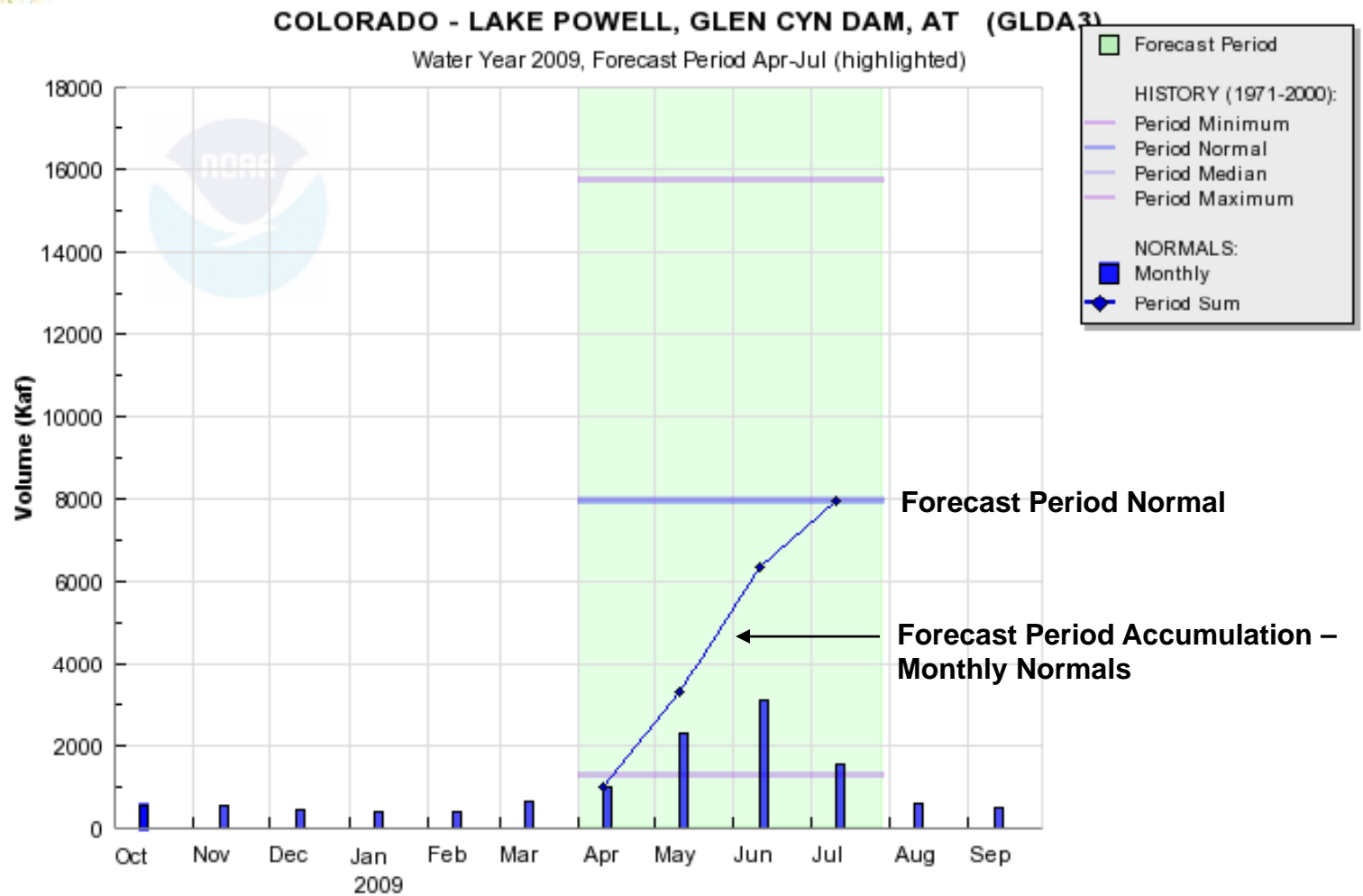


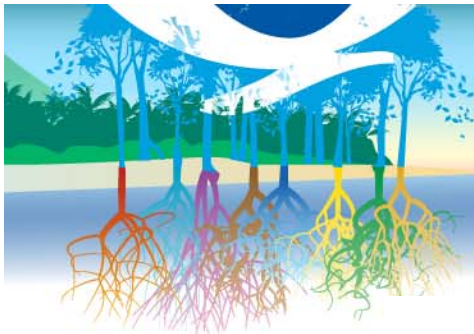


Forecast Evolution Plot

Will explain this plot in three steps.

1971-2000 History and Normals

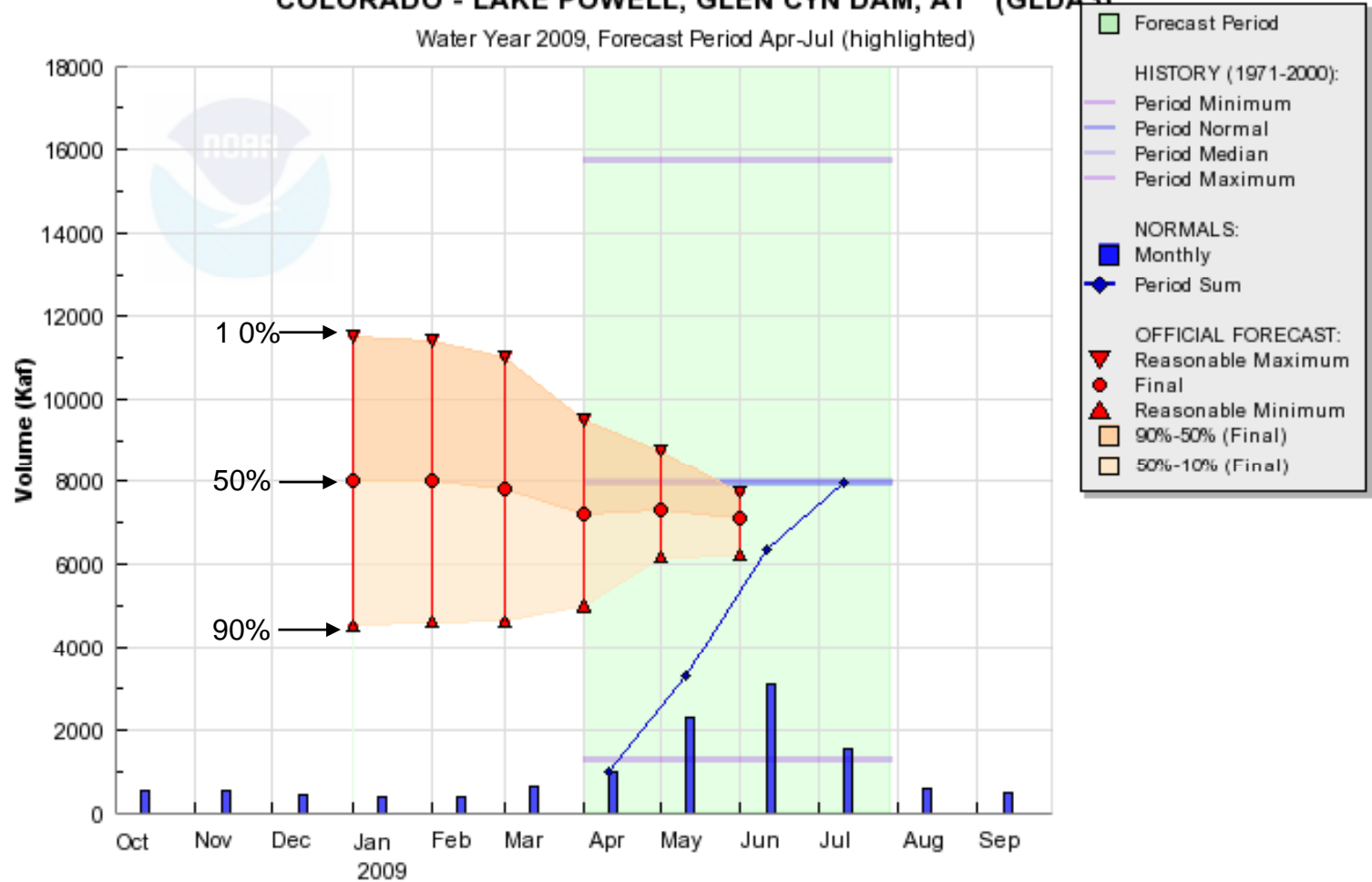


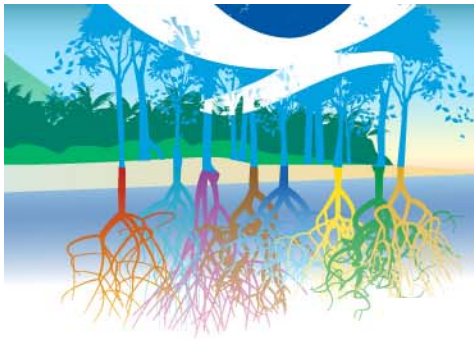


Forecast Evolution Plot

**2009 Beginning
Of Month
Exceedence
Forecasts
For April-July
Runoff Volume**

COLORADO - LAKE POWELL, GLEN CYN DAM, AT (GLDA3)
Water Year 2009, Forecast Period Apr-Jul (highlighted)

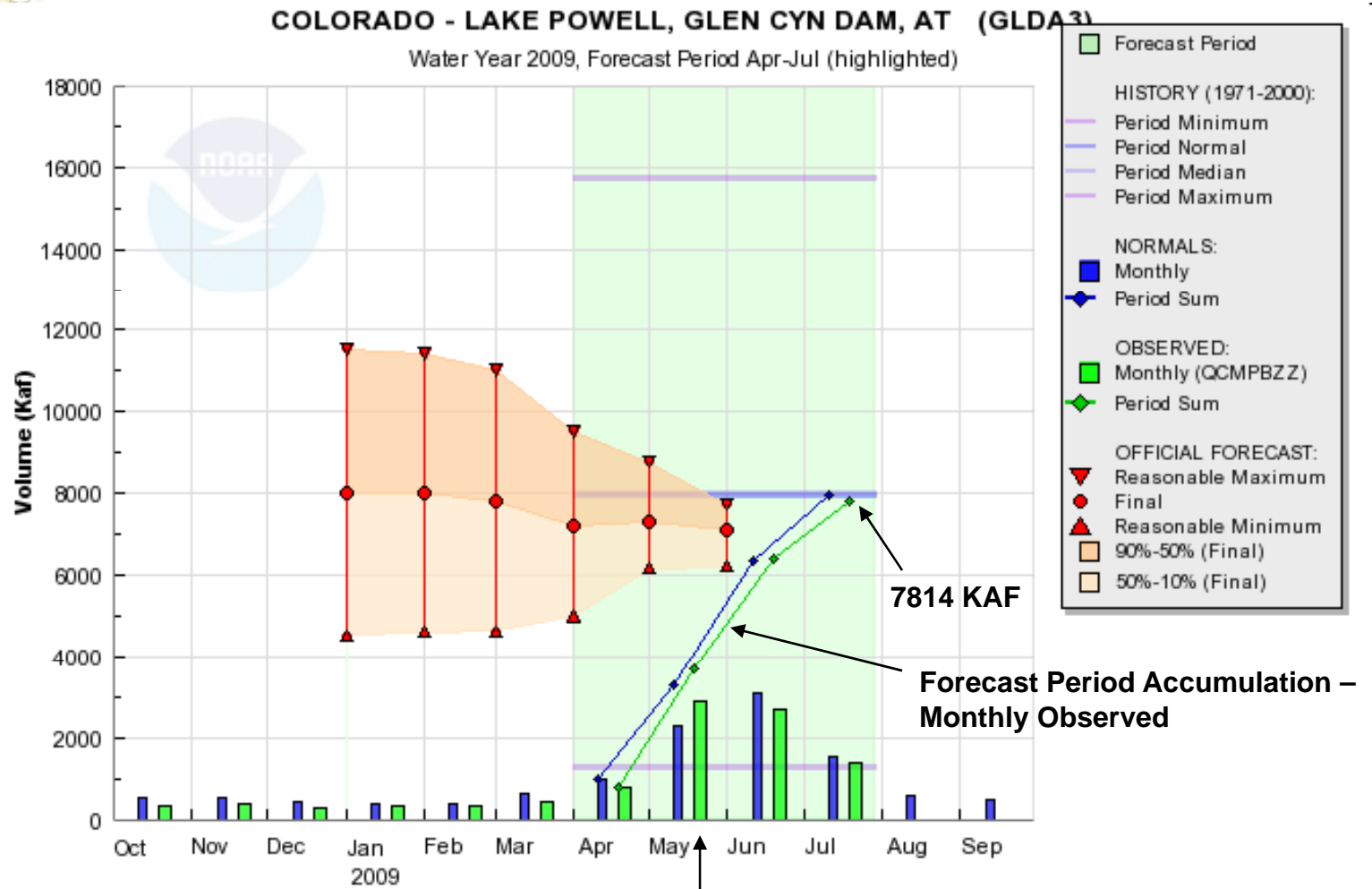




Forecast Evolution Plot

2009 Observed Values:

2009
Observed
(7814 KAF)
Slightly
Above June
1st 10%
Exceedence
Forecast
(7720 KAF)



www.nwrfc.noaa.gov/westernwater

CBRFC/NWS/NOAA 09/09/09 21:09:45 UTC



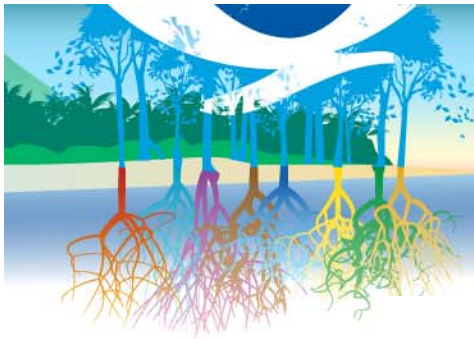


Upper Colorado

2009 Water Supply Inflow Forecasts

Blue – Dillon Reservoir

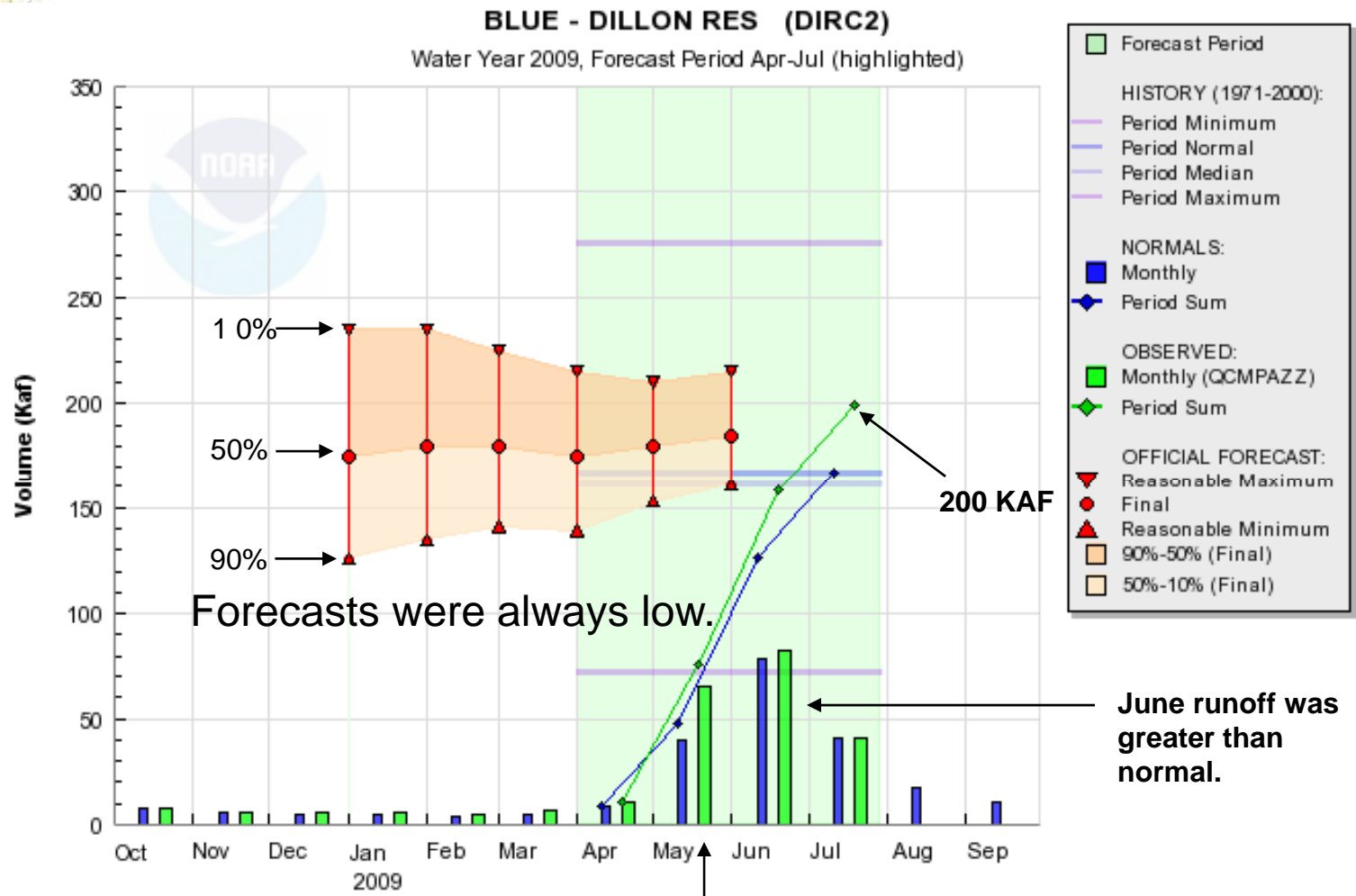




Forecast Evolution Plot

2009:

2009
 Observed
 (200 KAF) Is
 Half Way
 Between
 June 1st 50%
 Exceedence
 Forecast
 (185 KAF)
 and June 1st
 10%
 Exceedence
 Forecast
 (215 KAF)

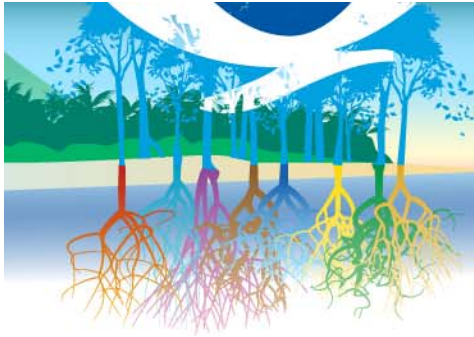


May runoff was greater than normal.

www.nwrfc.noaa.gov/westernwater

CBRFC/NWS/NOAA 09/09/09 21:21:19 UTC



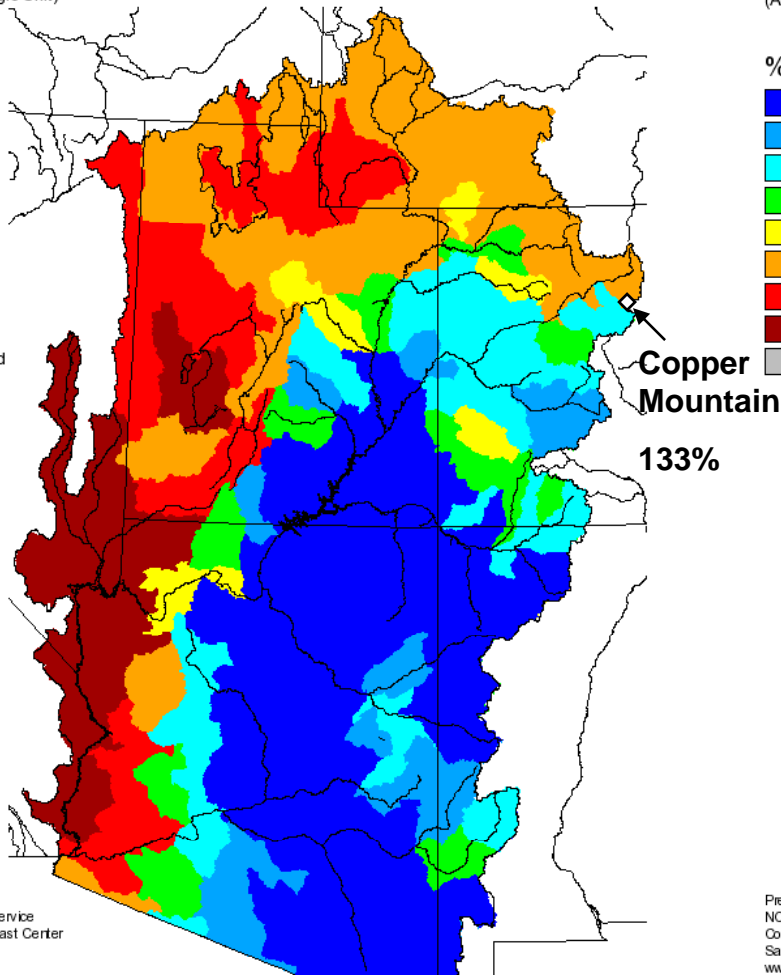
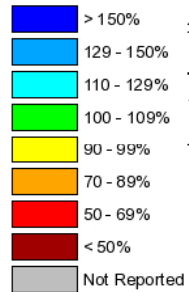


2009 Precipitation

Monthly Precipitation for May 2009

(Averaged by Hydrologic Unit)

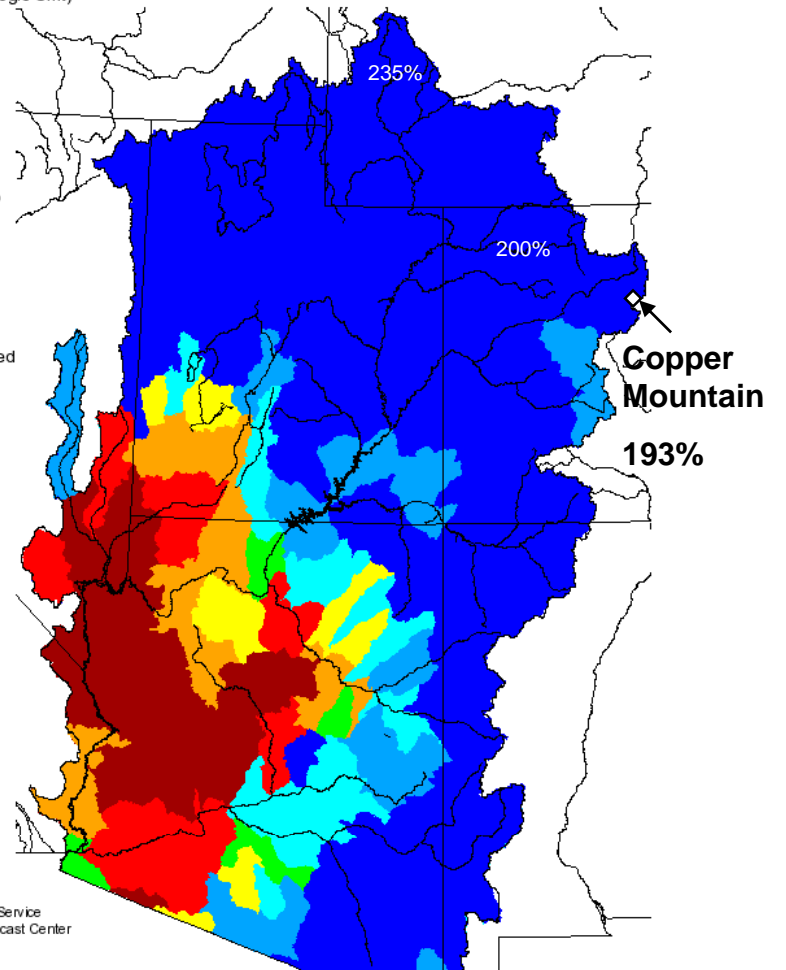
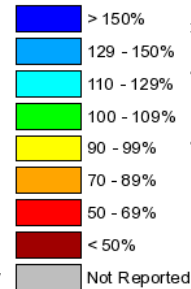
% Average



Monthly Precipitation for June 2009

(Averaged by Hydrologic Unit)

% Average



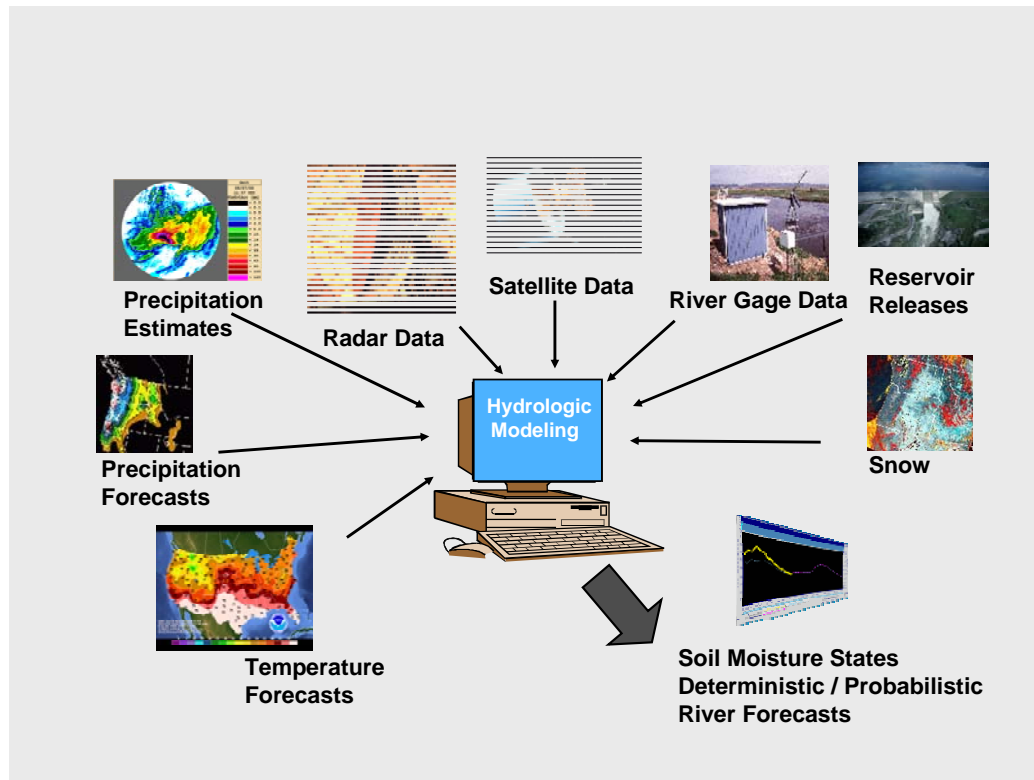
Prepared by
NOAA, National Weather Service
Colorado Basin River Forecast Center
Salt Lake City, Utah
www.cbffc.noaa.gov

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Forecast Process

Inputs to our forecasting process:



Things we do not directly account for:

- Direct measurement of soil moisture
- Evapotranspiration measurements
- Vegetative changes (e.g. beetle kill)
- Energy balance (e.g. dust on snow, cloudiness, atmospheric moisture)

Further research required to determine relative importance



Summary

Interesting Forecast Year

- Variation among Basins
- Big warming during May
- Wet June with rain at high elevations
- In general, the April 1 50% exceedance forecasts were slightly below the final observed runoff volumes



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