Drought, Climate Variability and Water Supply Workshop

Water Supply Challenges and New Tools for Water Managers

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Lakewood, Colorado

Andy Pineda

Northern Colorado Water Conservancy District

C-BT Project

A supplemental water supply for: 600,000 acres of irrigated farmland; 30 cities, towns, and domestic water purveyors; 120 ditch and reservoir companies

- 12 reservoirs
- 35 miles of tunnels and siphons
- 95 miles of canals
- 6 hydro-power plants
- Green Mountain Reservoir

NCWCD Water Supply Information

- Snow pack conditions
- Stream flow forecasts
- Storage
  - South Platte tributary storage
  - C-BT Project
- Supply utilization
  - Diversions – direct use
  - Diversions – to storage
  - Diversions – from storage
  - C-BT Project allocation

Stream Flow Forecasts

- Western Slope
  - Upper Colorado
  - Willow Creek
  - Fraser River
  - Blue River
- Eastern Slope
  - Cache la Poudre
  - Big Thompson
  - St. Vrain
  - Boulder Creek

Sources of Information

- NRCS/Local Cooperators
  - Snow, Total Precipitation
- Forecasts By
  - Dr. Art Douglas – Creighton University
  - Klaus Wolter – NOAA CIRES CDC
  - John Henz – HDR Engineering / CWCB
- Outside the Box
  - Wooly Worm indicators
  - Peak Bloom Period of Flowering Crab Trees
  - Arrival of Merganser Ducks

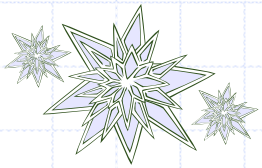
Distribution

- NCWCD Board of Directors
  - Annual C-BT Quota Allocation
- Spring Water Users Meeting
- NCWCD & USBR Annual Planning
  - Planning & Allocation model – MODSIM
  - River Basin Model – Big Thompson DSS
- NCWCD Website

Stream Flow Forecast Models

- NCWCD Forecast Models
  - **Principal Components Analysis (PCA)**

Streamflow Forecasting



1st of Month
SNOWPACK

?

Apr-Jul
STREAMFLOW

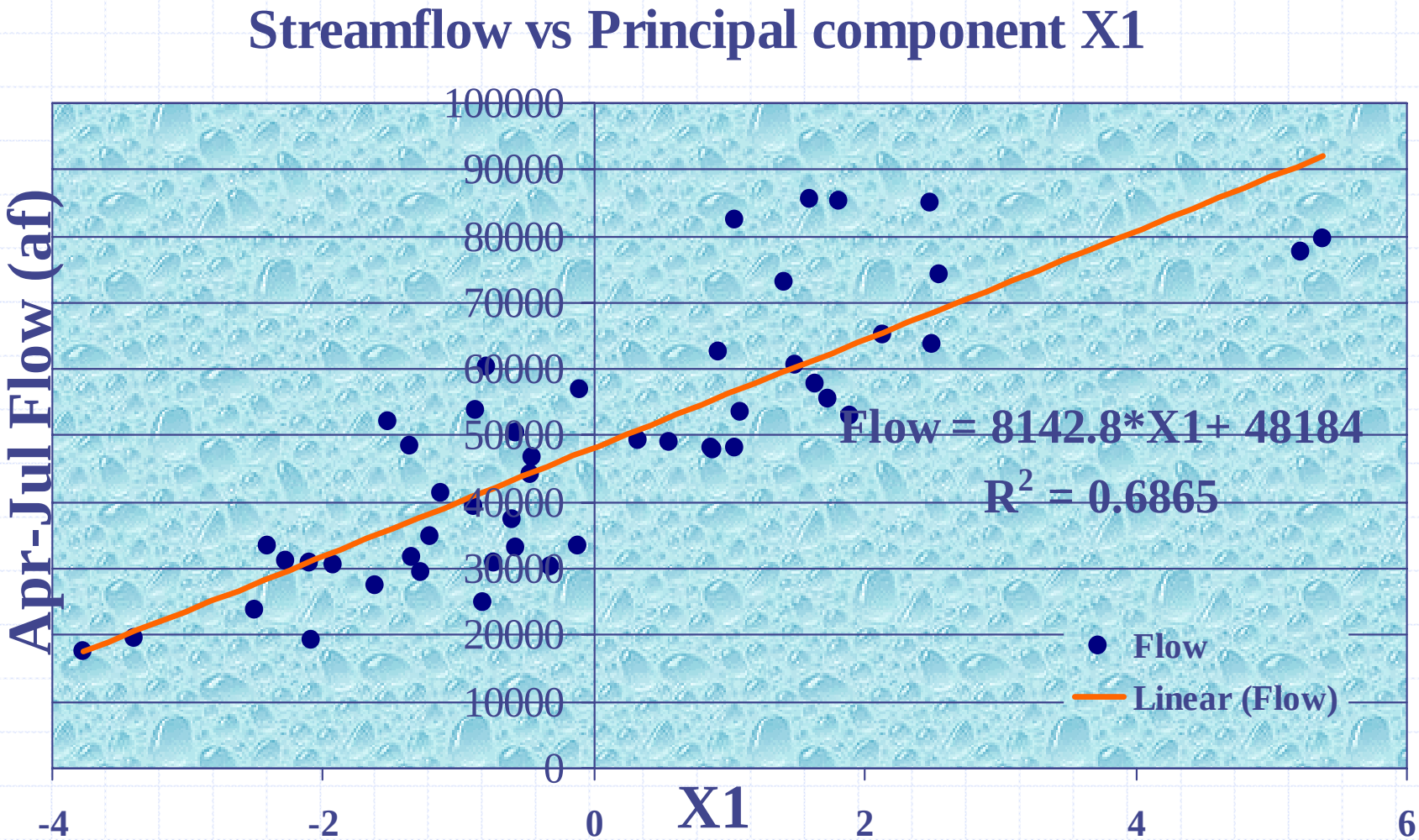
Inside of the Black Box

- Apr-Jul Flow = F(Snowpack)
- PCA transforms snowpack data : extracts relevant info from snowpack data, gets rid of "noise" in the data
- Regression establishes relationship between Apr-Jul flows and transformed snowpack:

$$\mathbf{Flow = a * X_1 + b * X_2 + \ldots + c}$$

where X_1, X_2….: transformed snowpack

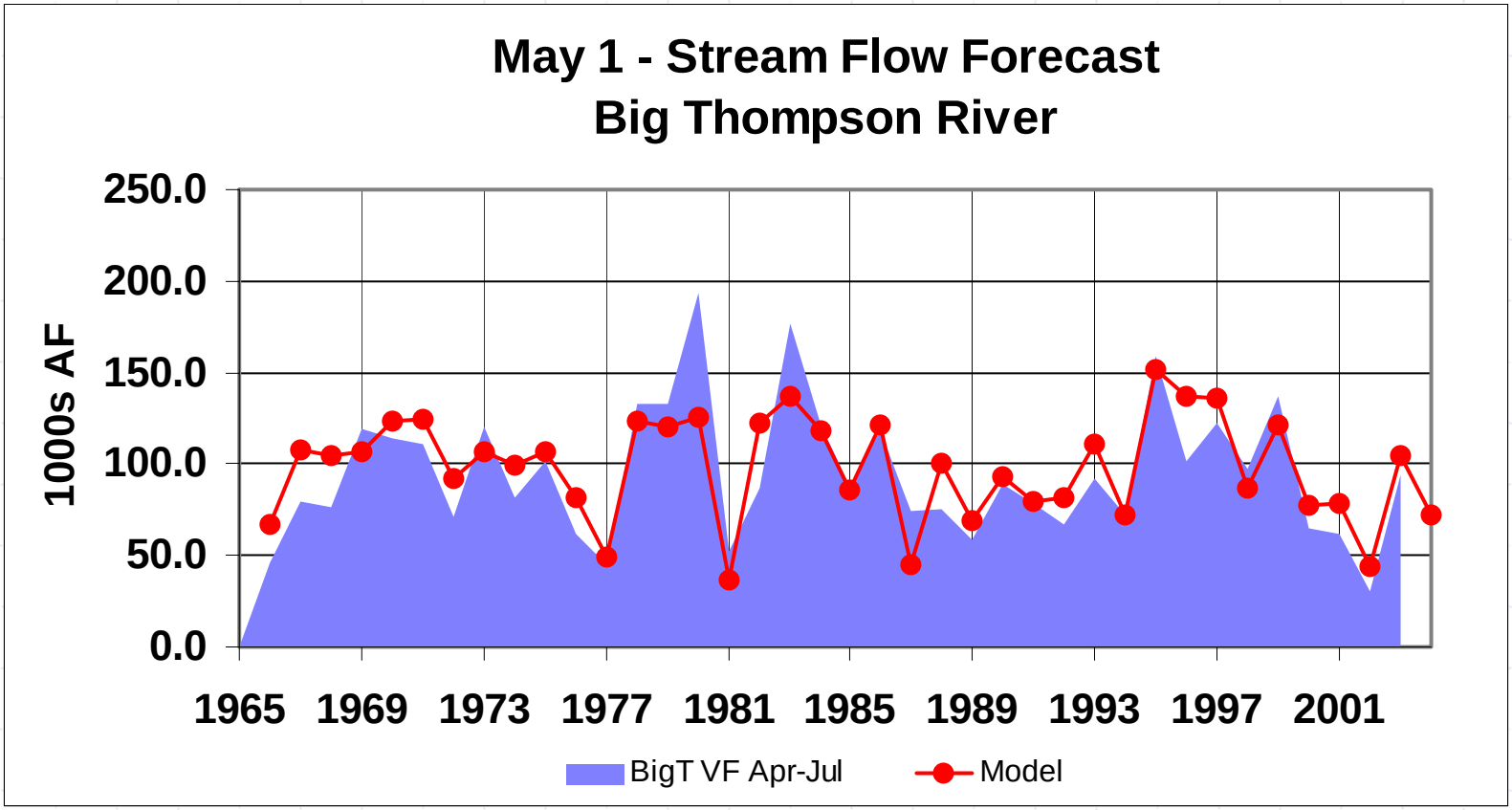
Streamflow=f(Snowpack)



Stream Flow Forecast Models

- NCWCD Forecast models
  - Principal Components Analysis (PCA)
  - **Multiple Regression (SWE, Total Precipitation, Elevation-Area Delineation)**

Multiple Regression Model



Stream Flow Forecast Models

- NCWCD Forecast models
  - Principal Components Analysis (PCA)
  - Multiple Regression (SWE, Total Precipitation, Elevation-Area Delineation)
- **USBR Stream Flow Forecasts**
- **NRCS Stream Flow Forecasts**
- **Denver Water Forecasts**

Decision Making

- Assess the model output
- Compare present conditions with past events
- Any trends in long-term forecast?
- Experience

Limitations with Forecasts

- Typically are “Region Wide”
- Many of...
- Conflicting forecasts

Potential Improvements

- Is there additional information that can improve forecasts at a “local level”?
- Was the forecast accurate when all was said and done?
- Can the role of wind be quantified?

Thank You