RECLAMATION

Managing Water in the West

Hood River Basin Study

Surface Water Modeling (DHSVM)
Water Resource Modeling (MODSIM)

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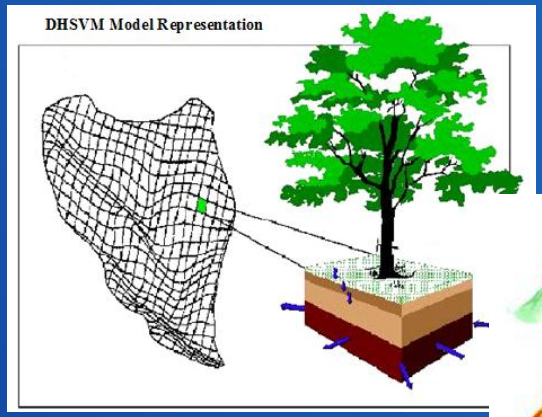
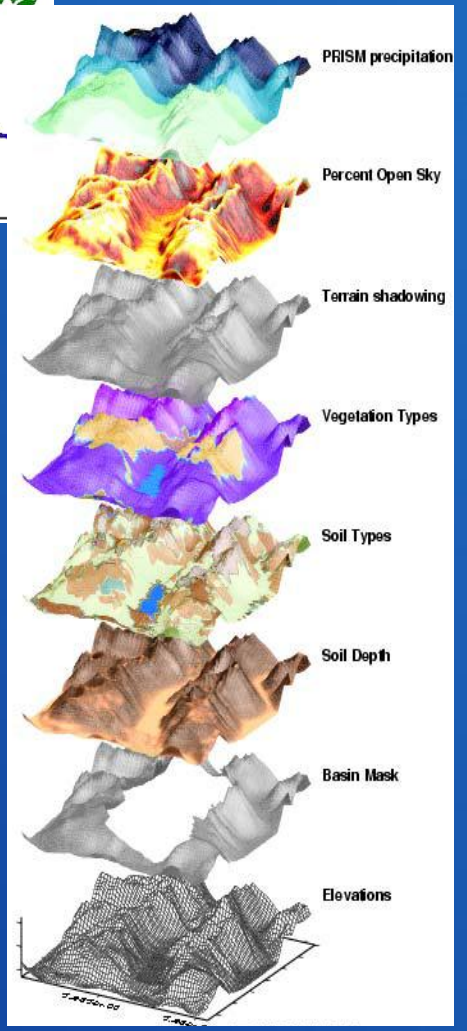
U.S. Department of the Interior
Bureau of Reclamation

Quick Definitions



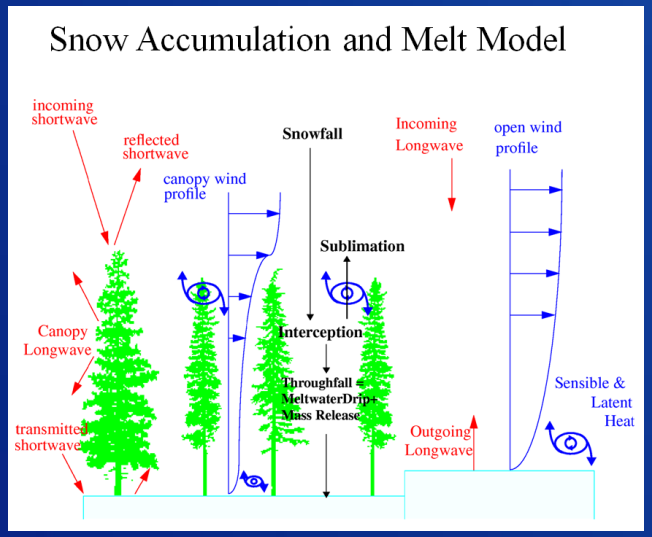
Figures courtesy of
UW and Wiley 2004



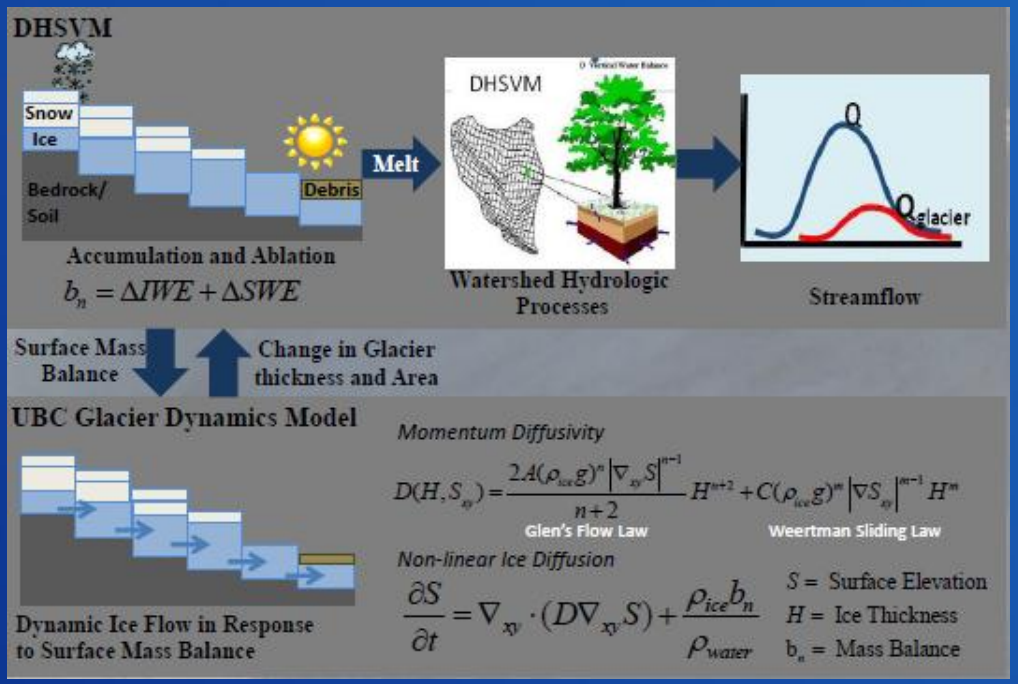
- **DHSVM: Distributed Hydrology, Soils, and Vegetation Model**
  - **Rainfall-runoff model**
    - ***Translates precipitation (and temperature) into natural stream flows***
  - **Distributed (vs. lumped) and physically-based (vs. conceptual)**
    - ***Divides basin into many sections, each with defined physical characteristics (i.e. soil properties, vegetation types, slope, elevation, etc.)***
  - **Developed by the University of Washington (UW) and the Pacific Northwest National Laboratory (PNNL)**

Quick Definitions

- **Enhancement: dynamic glacier extension**
  - **Developed by University of British Columbia (UBC)**
  - **Simulates glacier growth and melt (and contributions to stream flows)**



Figures courtesy of UW



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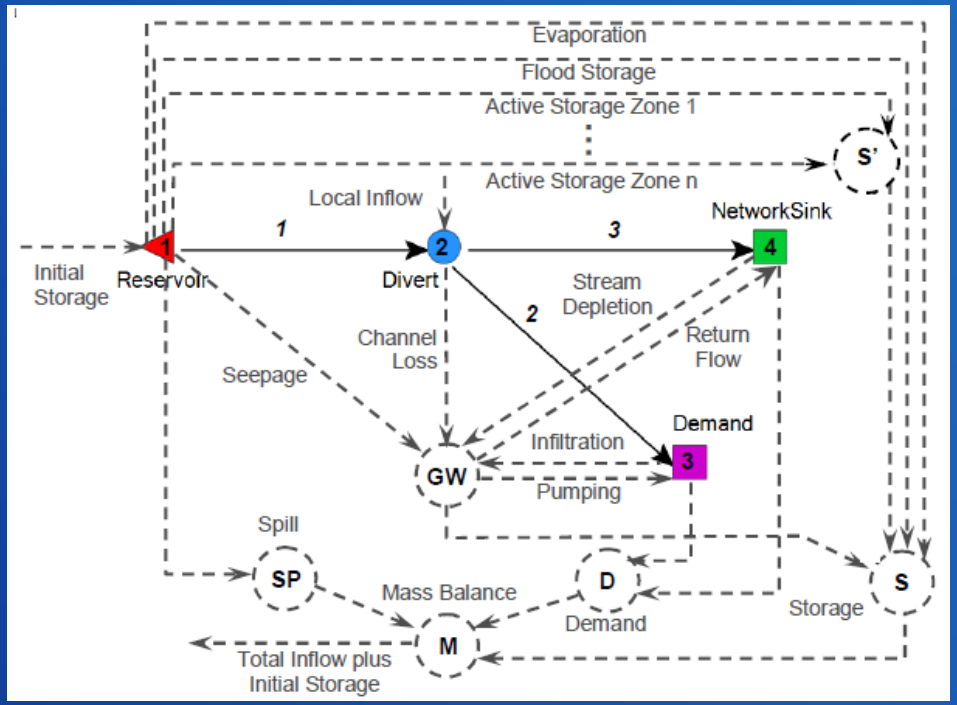
Quick Definitions

- **MODSIM:**
  - **Generalized river basin management decision support system**
    - *Translates natural stream flows into managed flows*
  - **Models how water is allocated for reservoirs, irrigation, municipalities, etc.**
  - **Accounts for water use priorities**
    - *Based on water rights and/or management objectives*
  - **Developed by Colorado State University**

Figure courtesy of CSU



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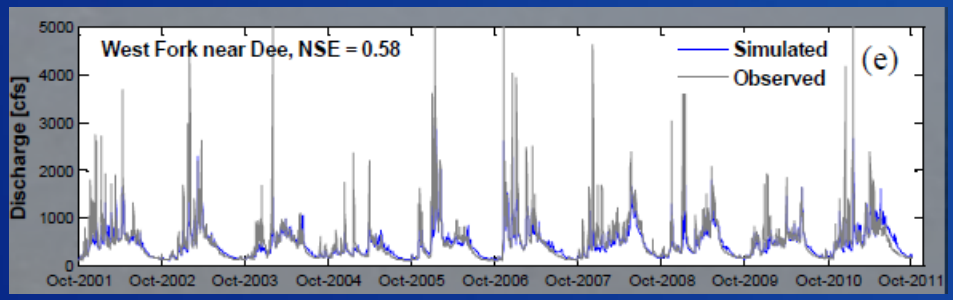
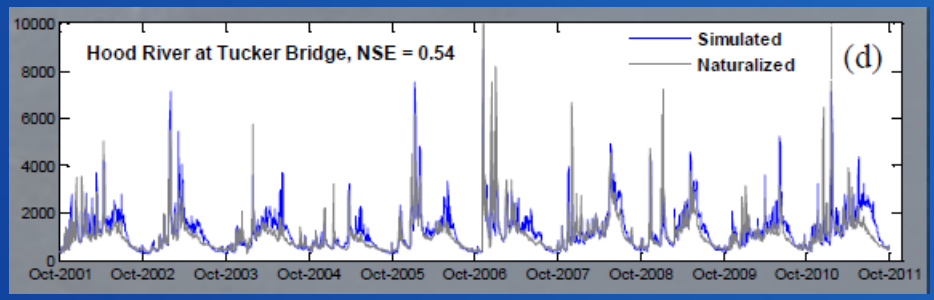
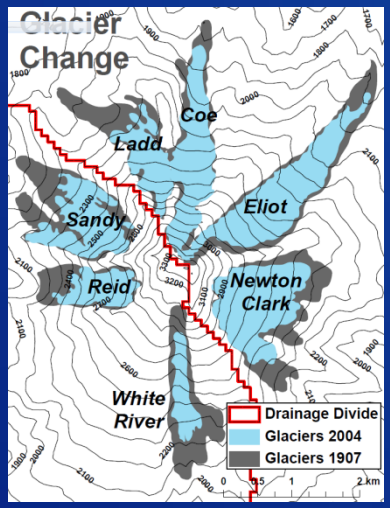
Hood River DHSVM

- **Collaborated with UW to obtain dynamic glacier DHSVM model for the Hood River Basin**
  - **Calibrated to long-term downstream gauges**
    - ***West Fork Hood River near Dee, Hood River at Tucker Bridge***





Figures courtesy of C. Frans, UW



  - **Calibrated to historical observations of Mt. Hood glacier volume and extent**
    - ***Ladd, Coe, Eliot, and Newton Clark glaciers***

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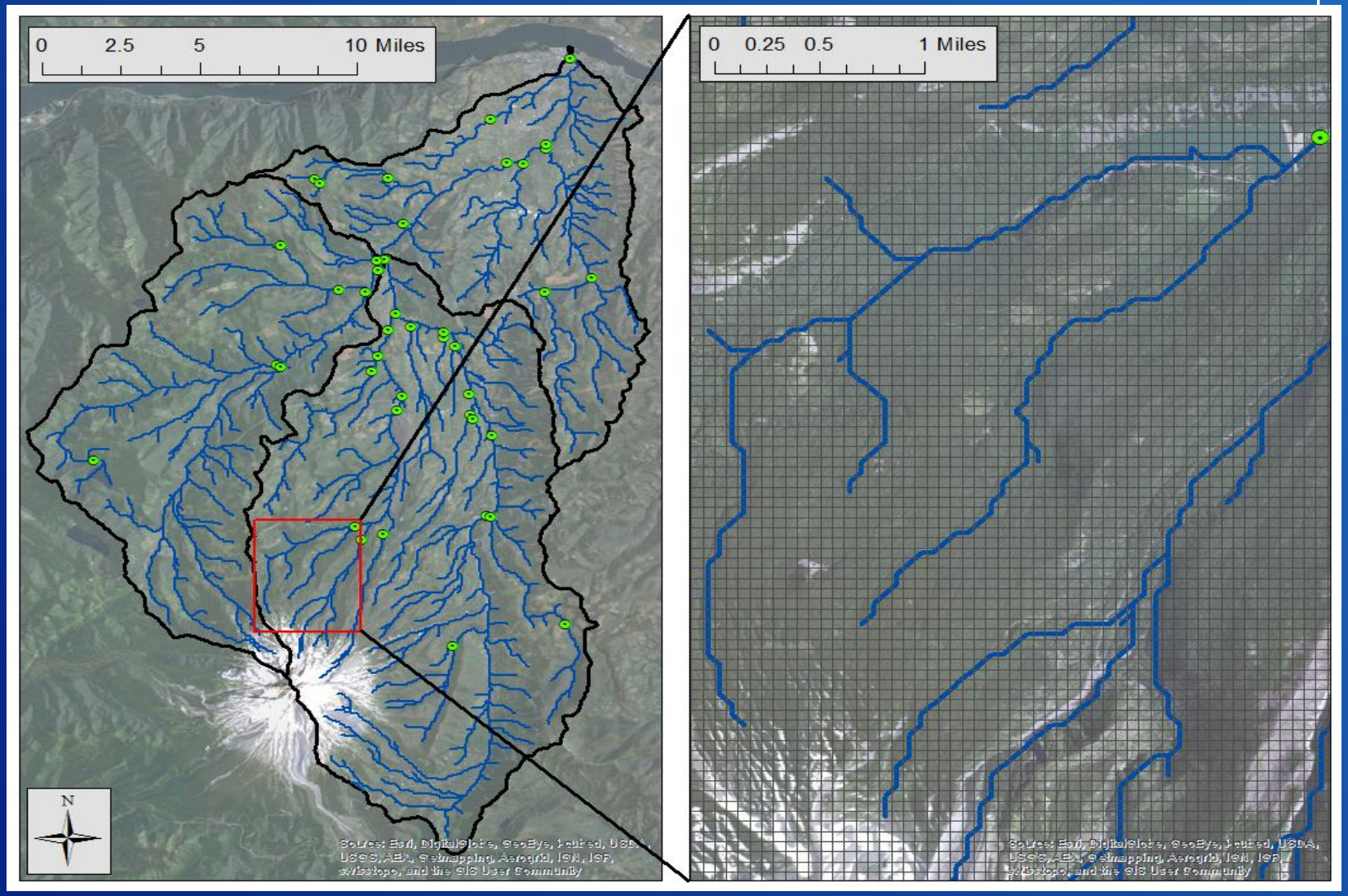
Hood River DHSVM

Laurance Lake inflows



Although complex, DHSVM model is still just a representation of reality

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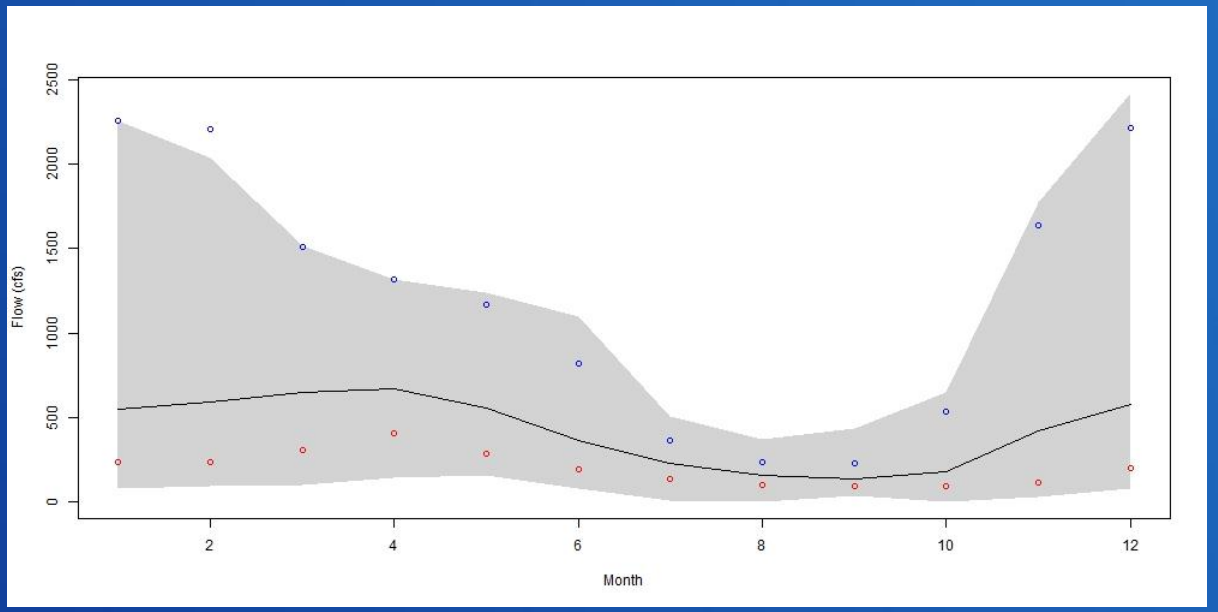
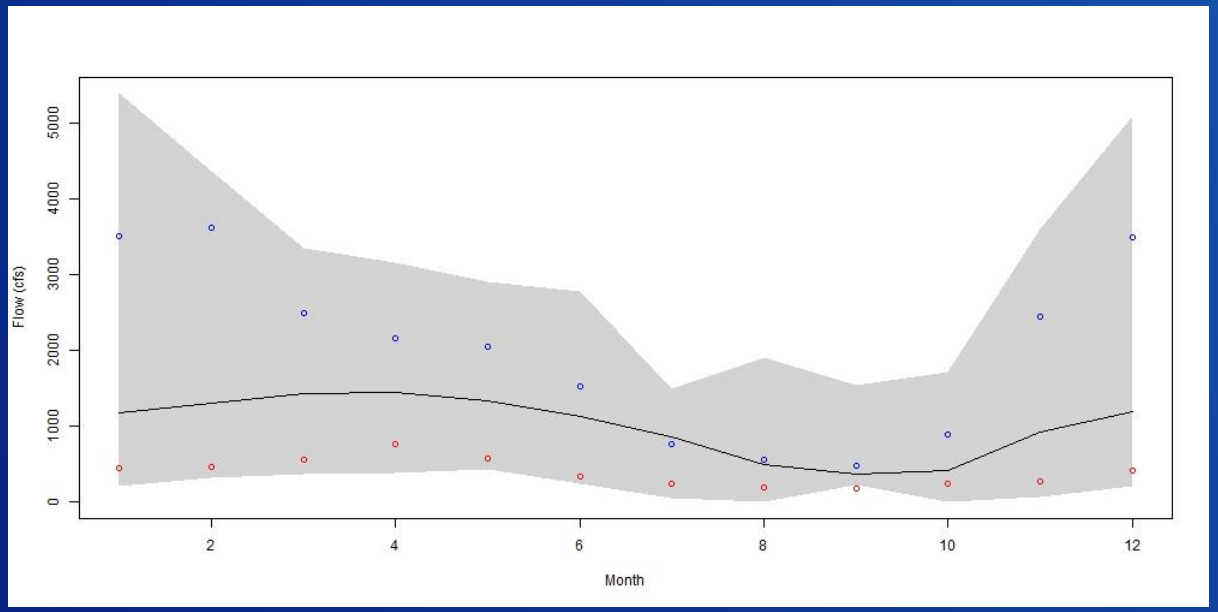
Hood River DHSVM

- **Reclamation investigated baseline DHSVM outputs with respect to:**
  - **Observed stream flows within the basin**
  - **Observed flows in nearby watersheds**
  - **Statistical estimates of flows in ungauged watersheds within and near the basin**
    - ***USGS developed methods specific for modeling eco-region encompassing the Hood River Basin***
- **Performed to ensure DHSVM flows were physically constrained**

Hood River DHSVM





black lines = median DHSVM flows;
points = high/low observed flows;
shading = USGS statistical estimates

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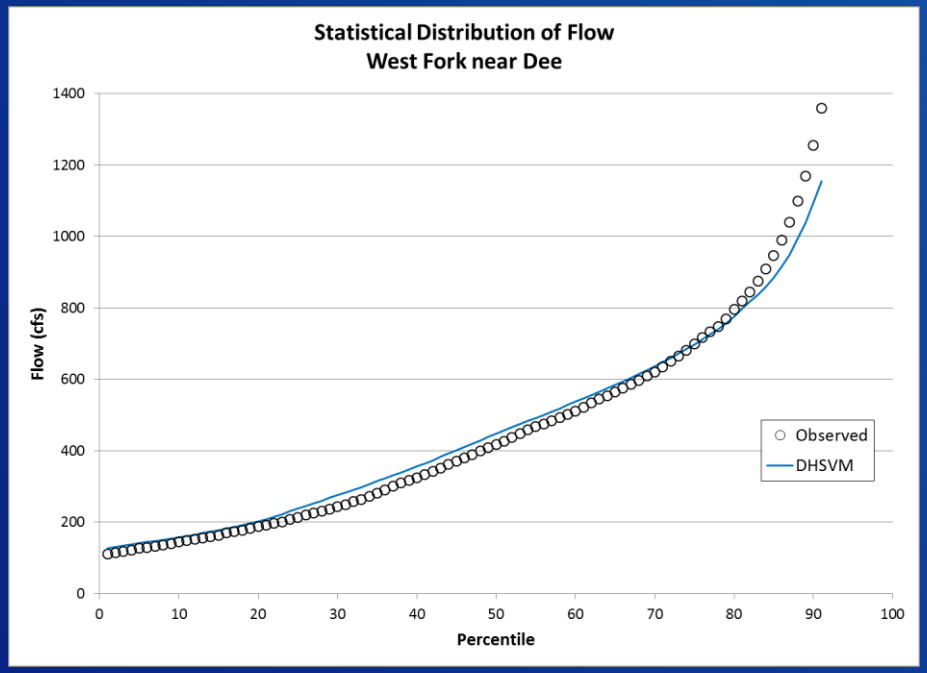
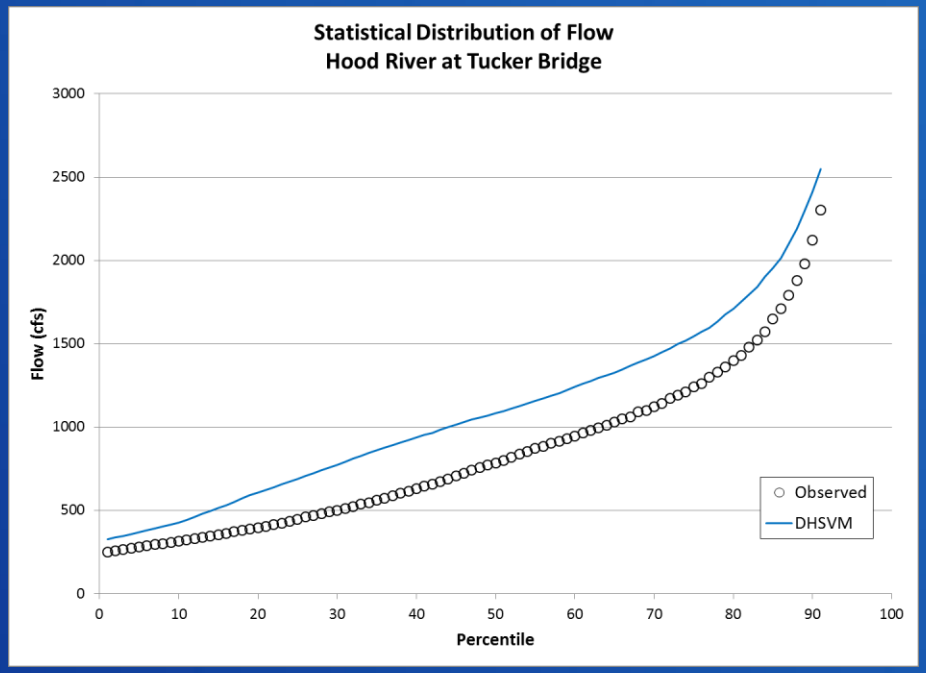
Hood River DHSVM

- Upstream water management accounts for majority of “bias” between modeled and observed flows



Average reported upstream irrigation use = 7 cfs



Average reported upstream irrigation use = 170 cfs

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Hood River DHSVM

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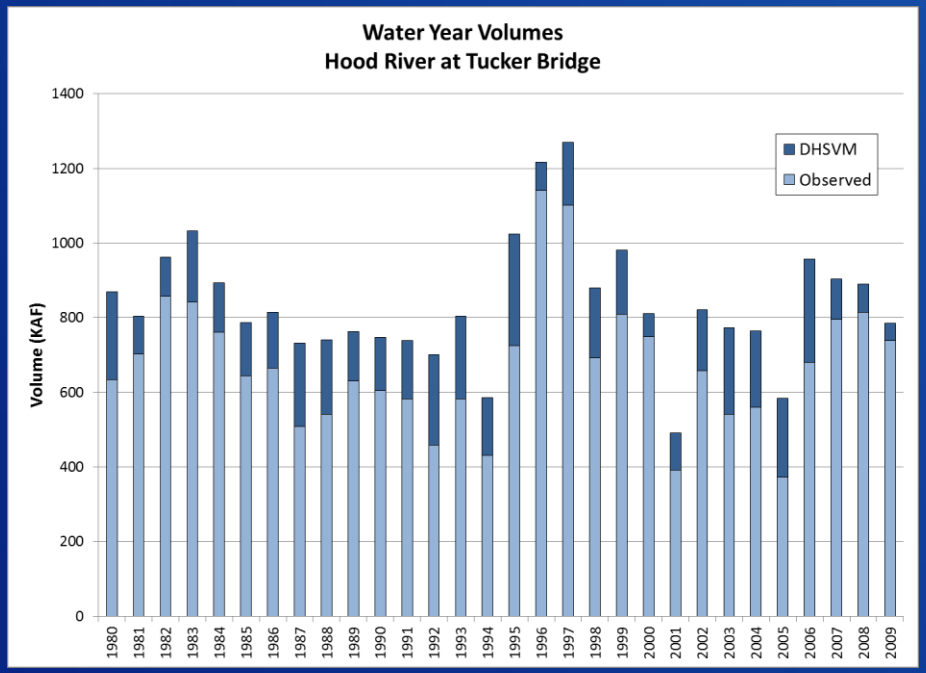
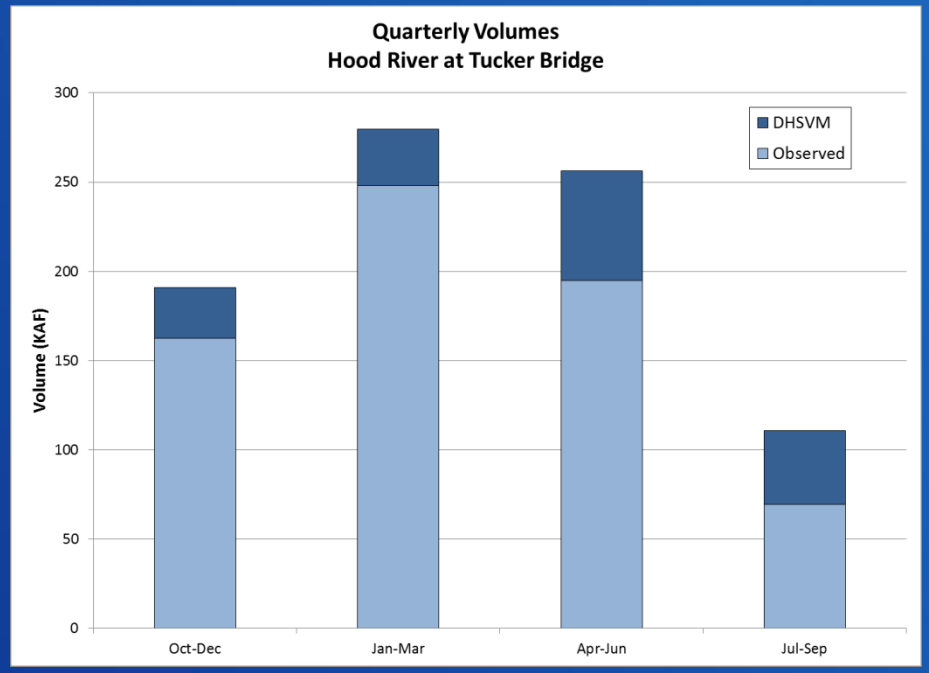


Average reported upstream irrigation use = 120 KAF



Average reported upstream irrigation use = 30 KAF

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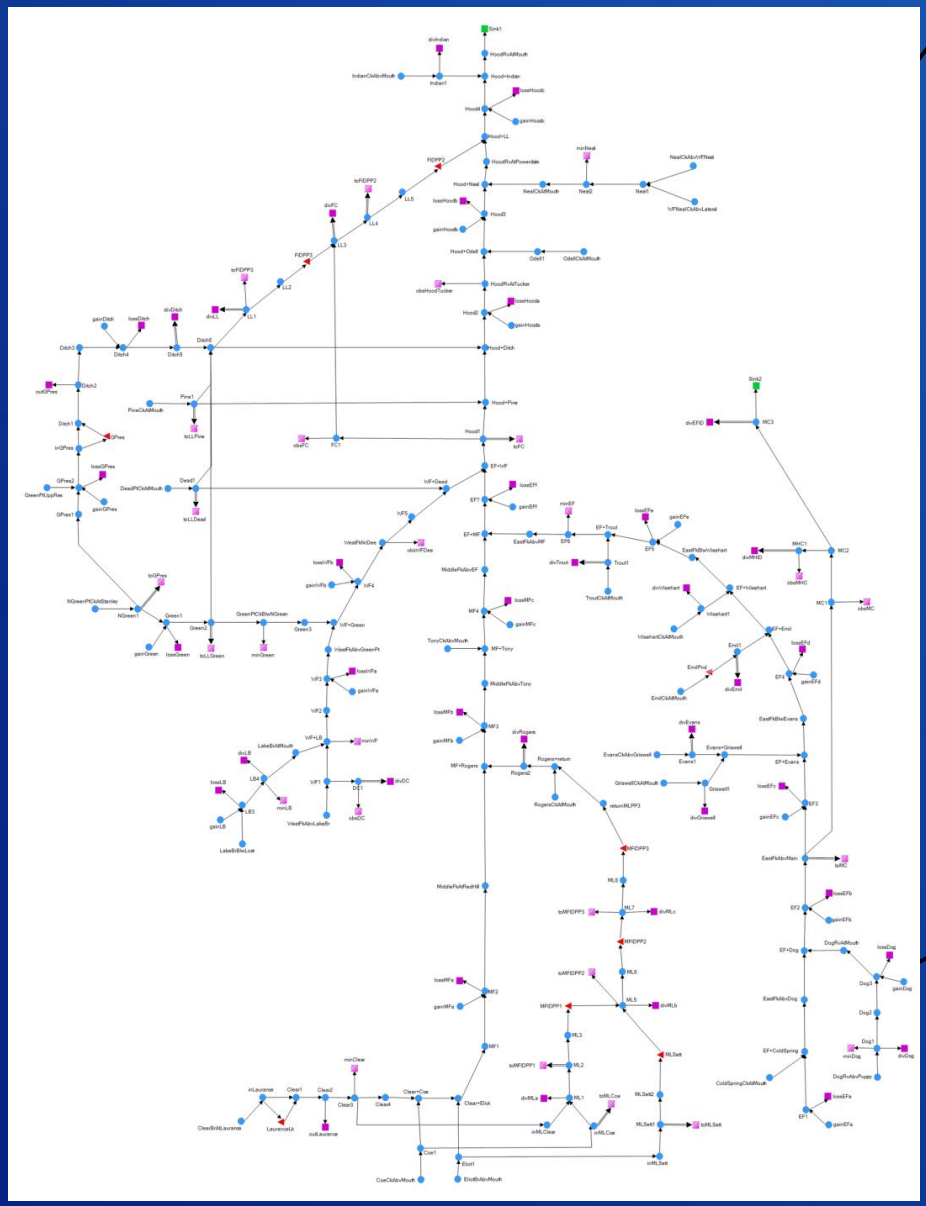
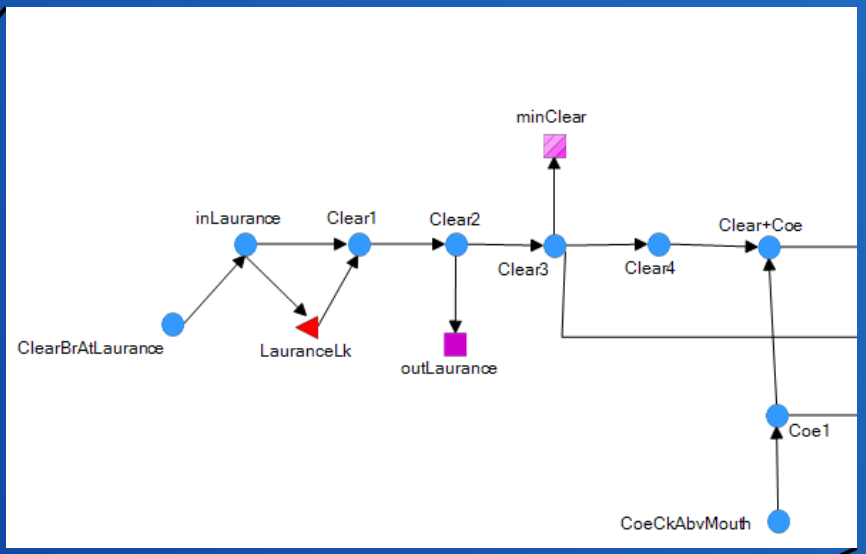
Hood River MODSIM

- **Constructed two MODSIM models of the HRB:**
  - **Unregulated (i.e. only natural flows)**
    - *Used to appropriately distribute DHSVM outputs across individual watersheds and local contributing areas within the HRB*
  - **Regulated (i.e. natural and managed flows)**
    - *Incorporates headwater inflows, local gains/losses, and water management structures, processes, and priorities*
- **Have run both unregulated and regulated models for baseline conditions**

Hood River MODSIM





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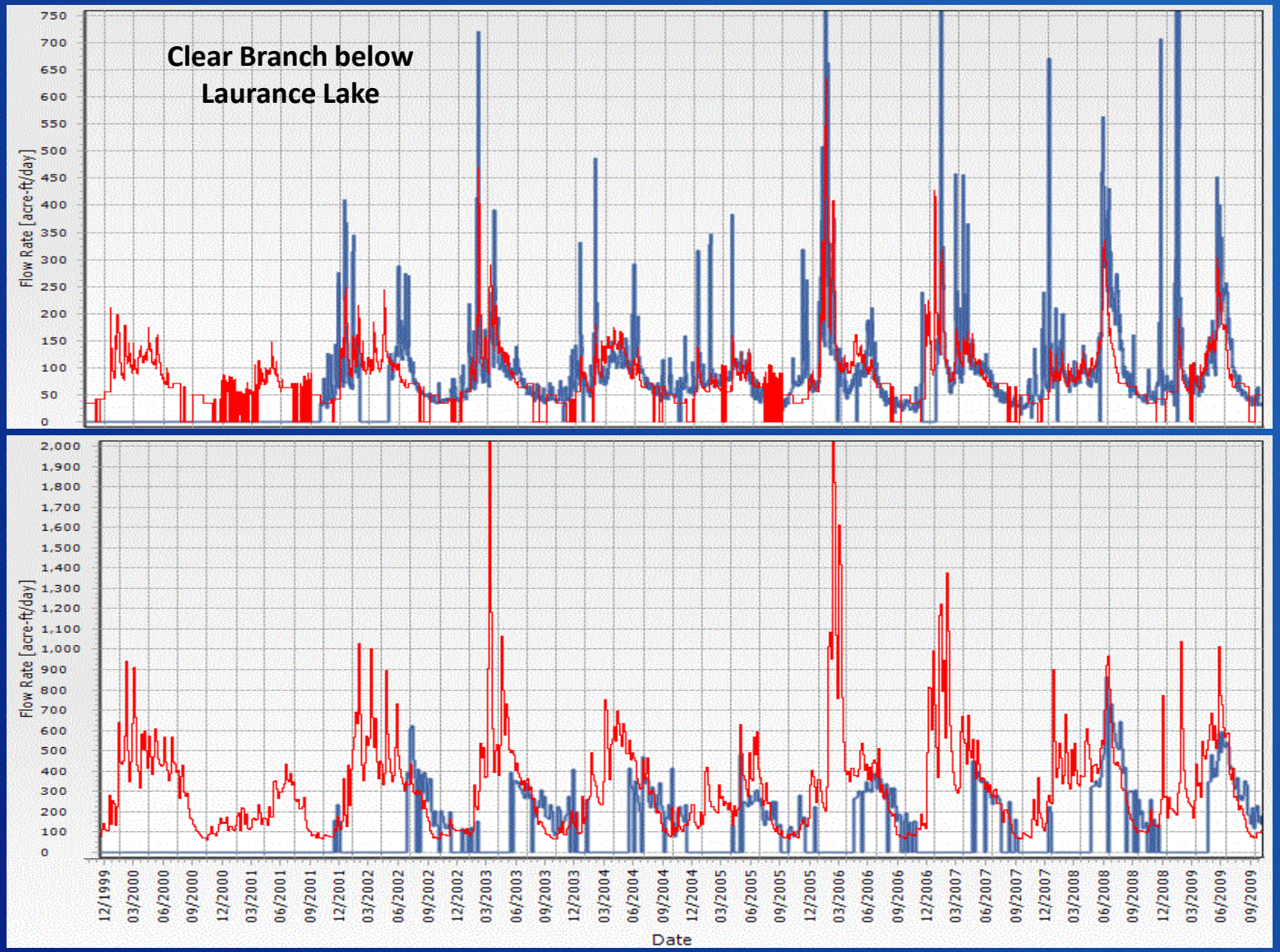

blue lines = observed flows;
red lines = modeled flows;

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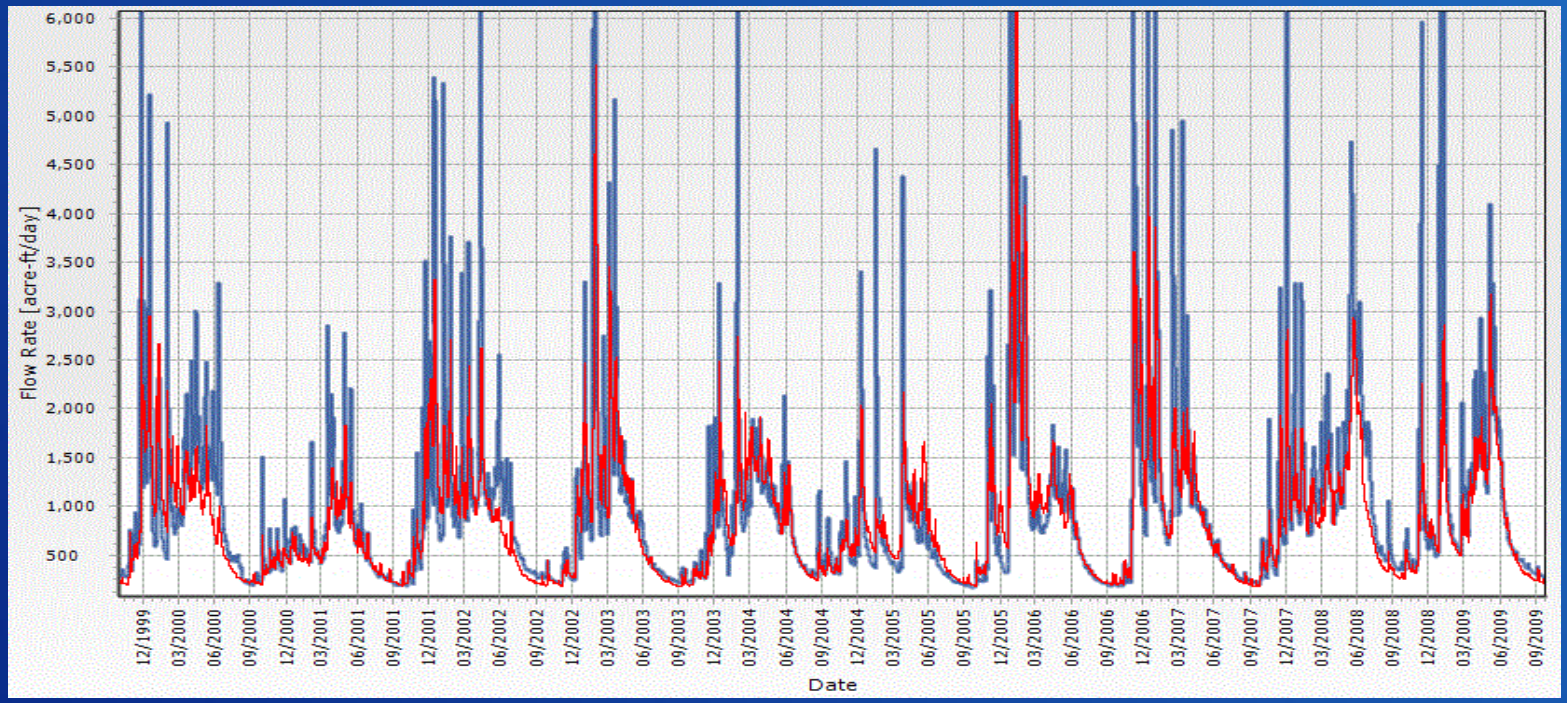
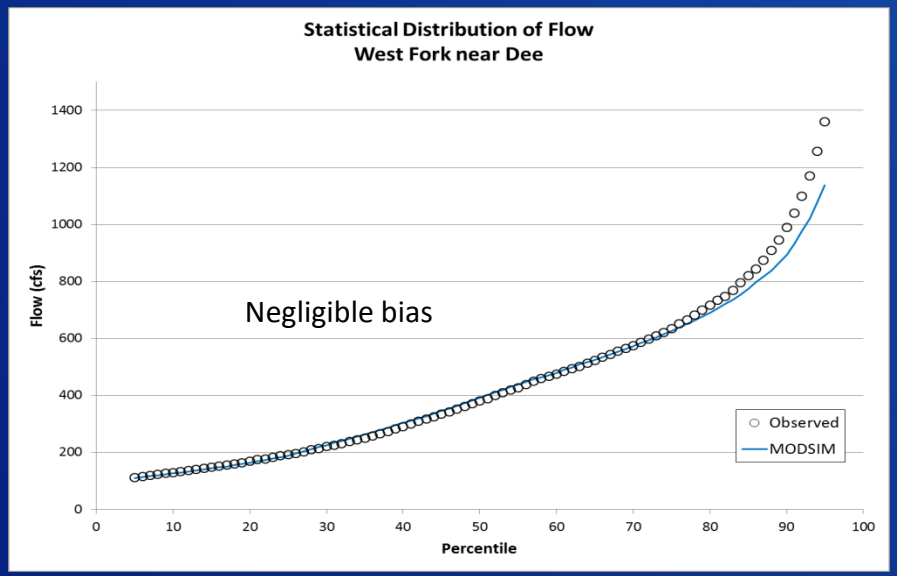
Hood River MODSIM





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West Fork near Dee

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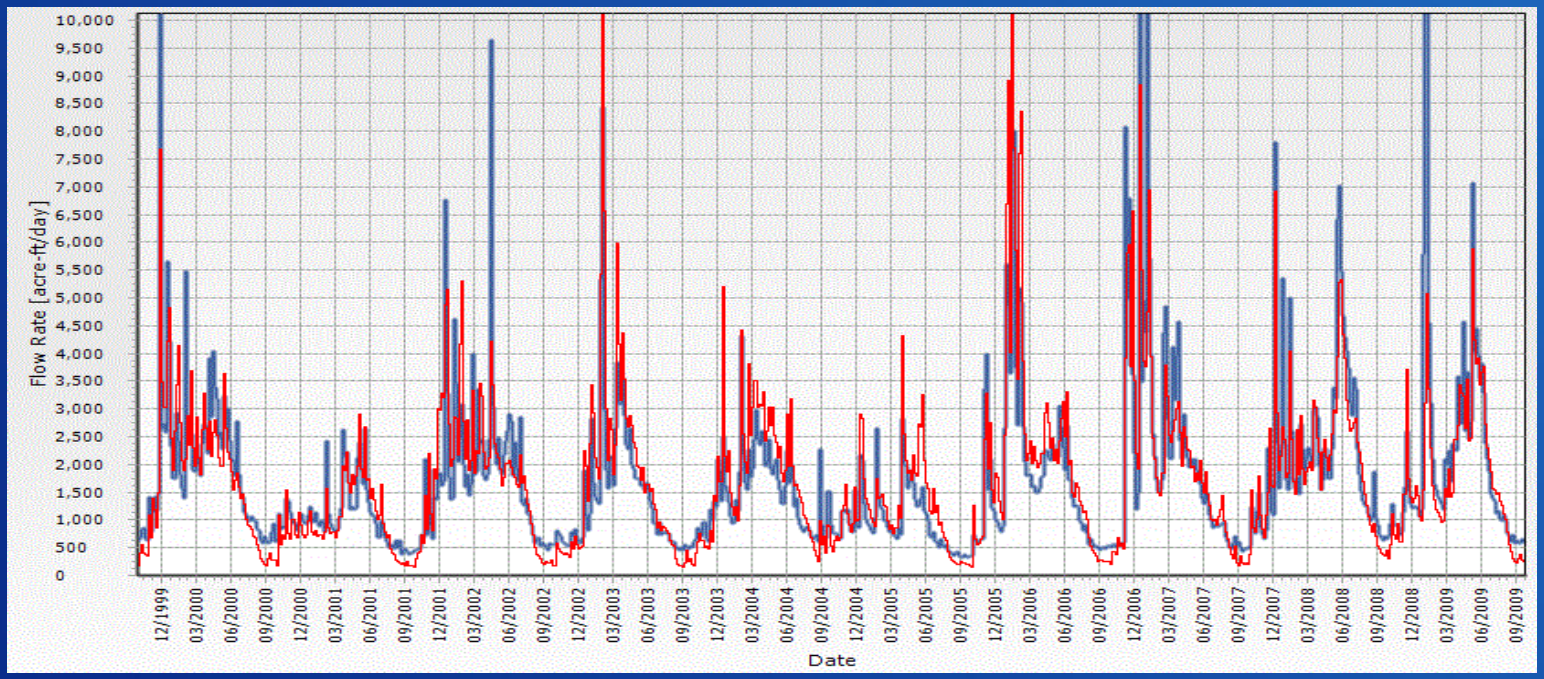
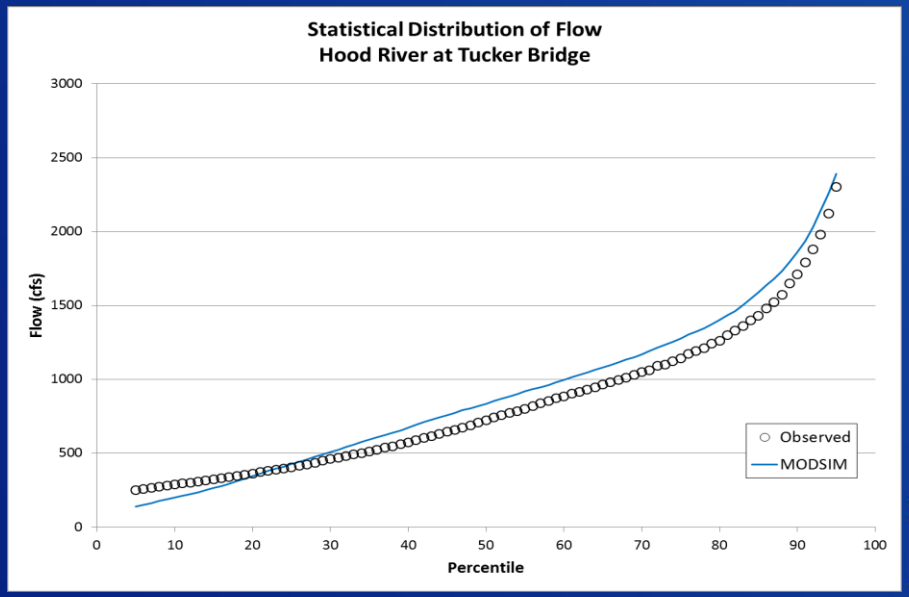
Hood River MODSIM





blue lines = observed flows;
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Hood River at Tucker Bridge

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Summary of Baseline Results

- **Overall DHSVM and MODSIM models performing well:**
  - ***In-channel and diverted flows along Middle Fork and West Fork are consistent with observations***
  - ***Diverted flows along East Fork consistent with observations***
    - ***No in-channel observations available for comparisons***
  - ***In-channel flows along mainstem generally exhibit reasonable bias***
    - ***However, bias during low flows is non-negligible***
- **Remember, models are just *representations* of reality**
- **However, if used appropriately, models can be very helpful**

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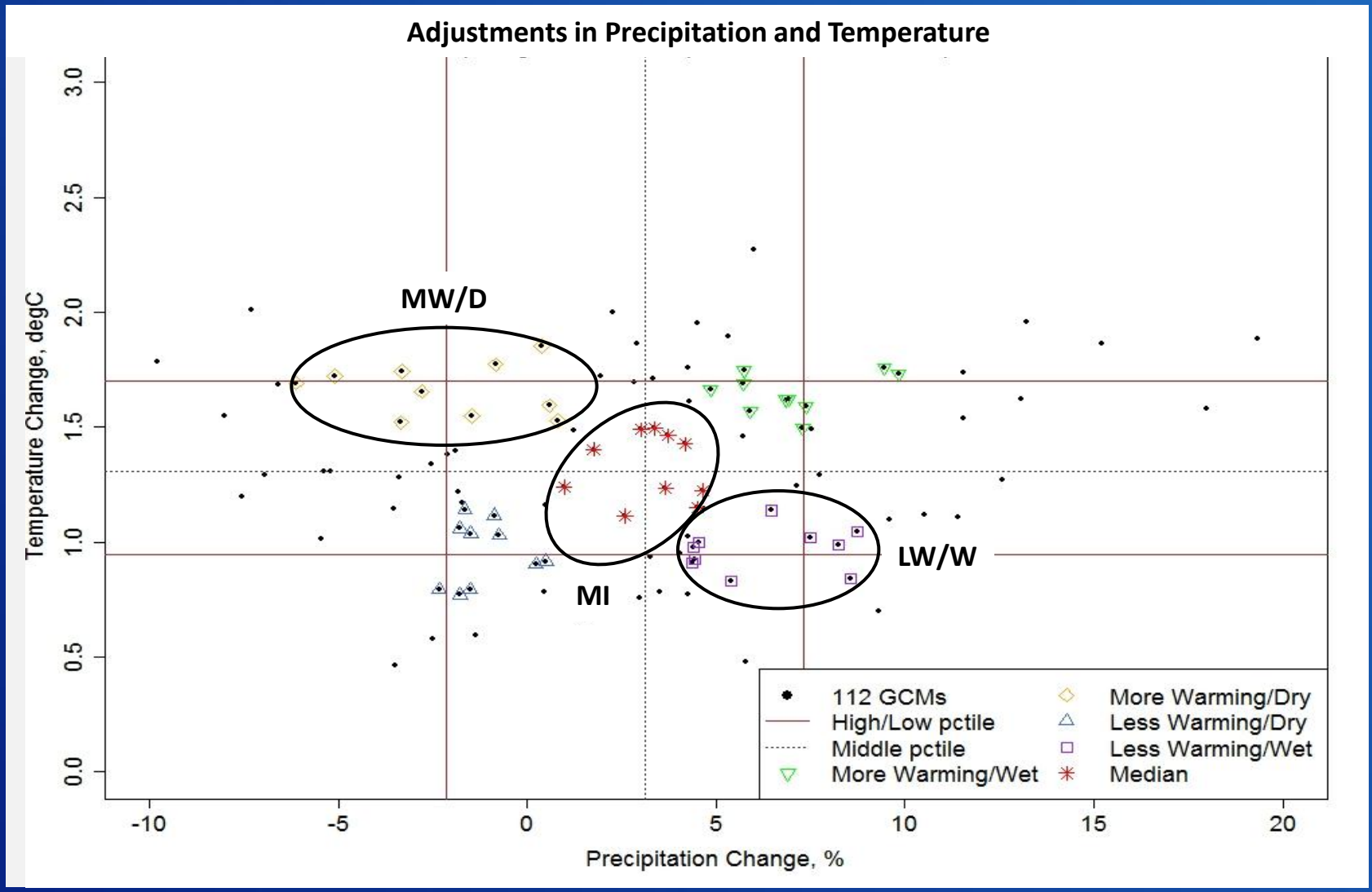
Preliminary Climate Scenario Results



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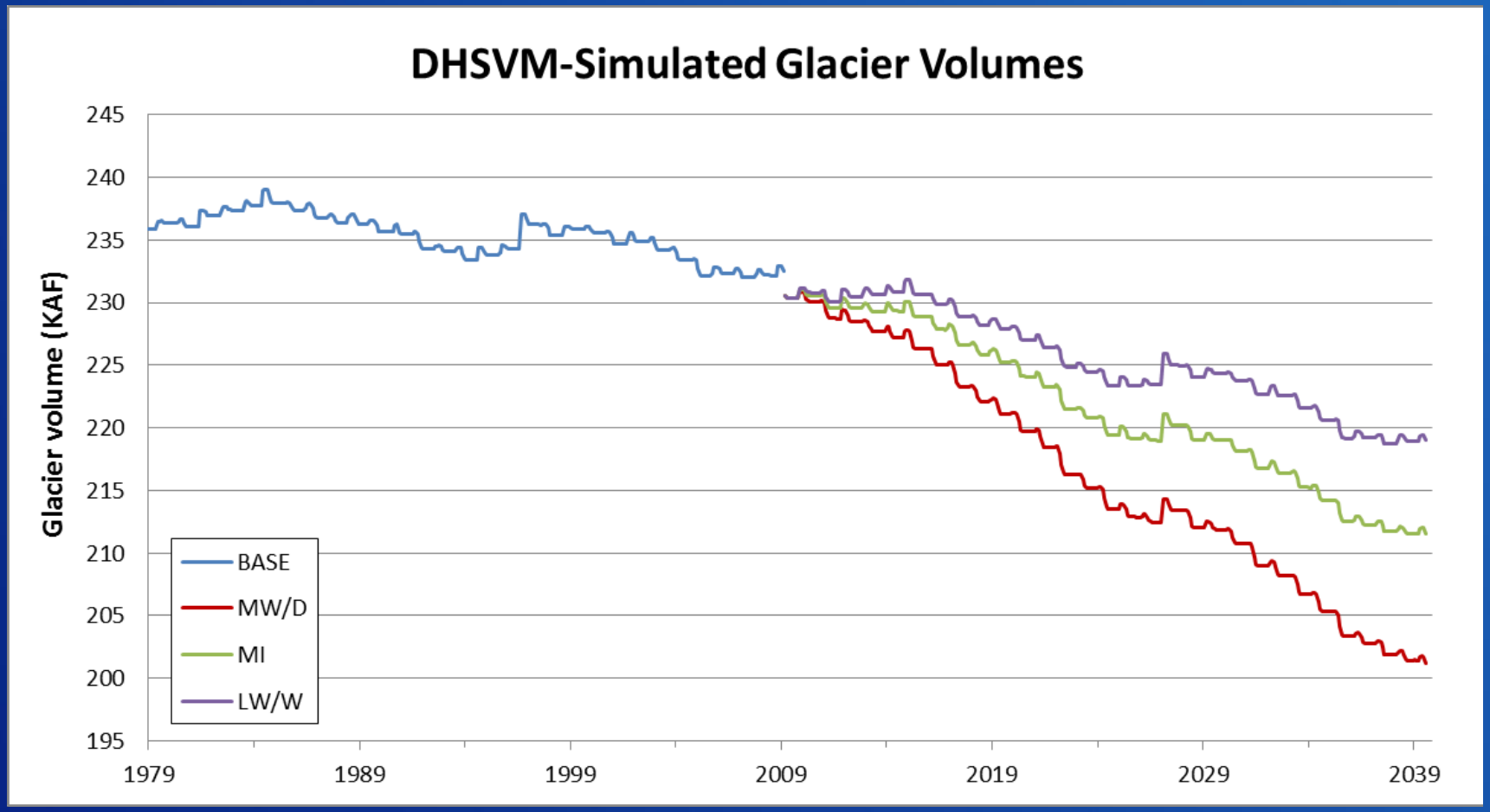

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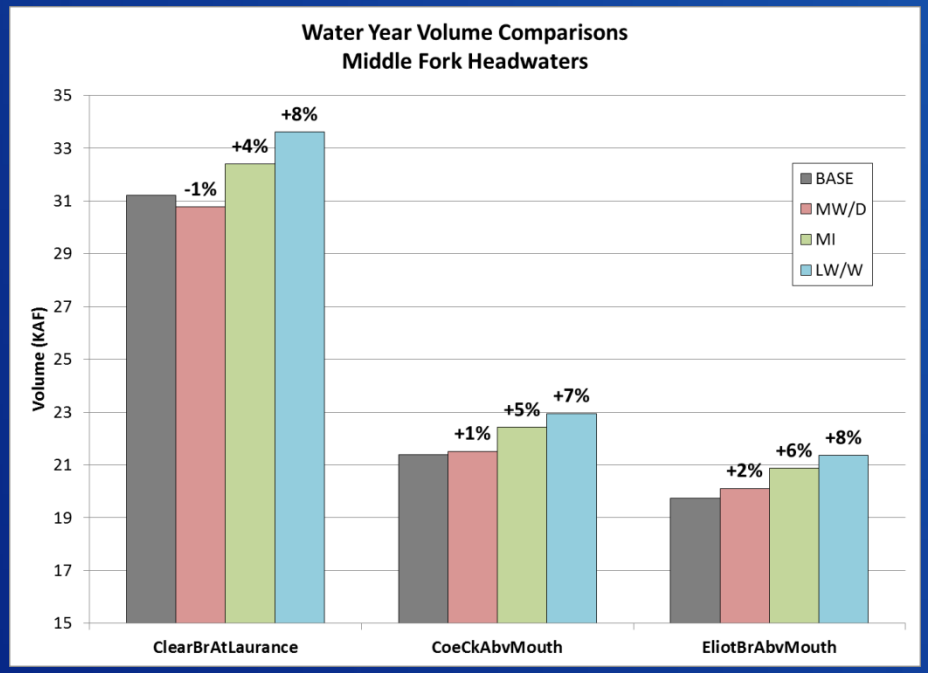

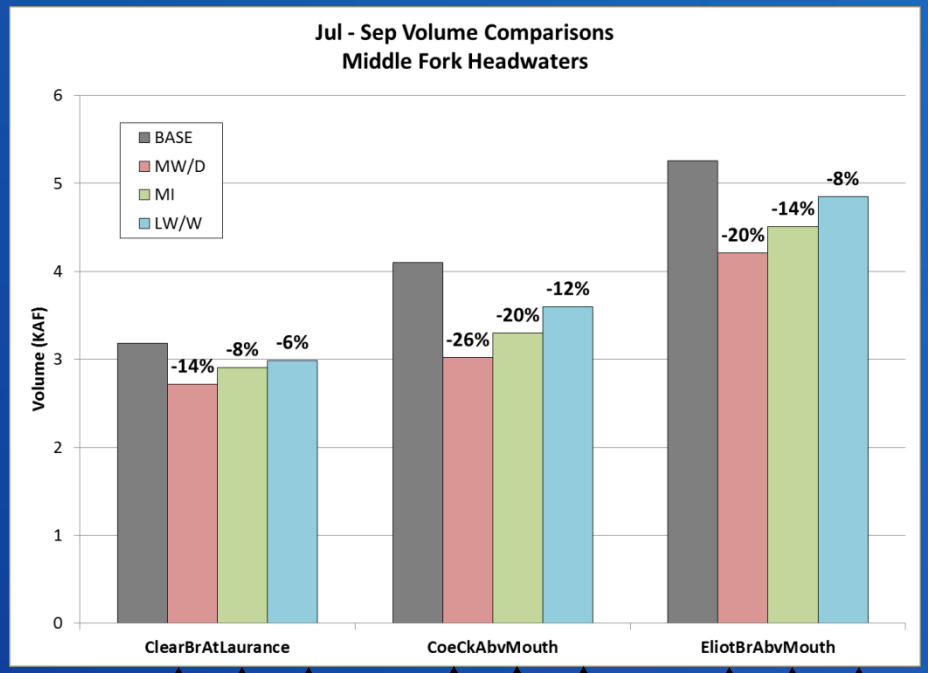

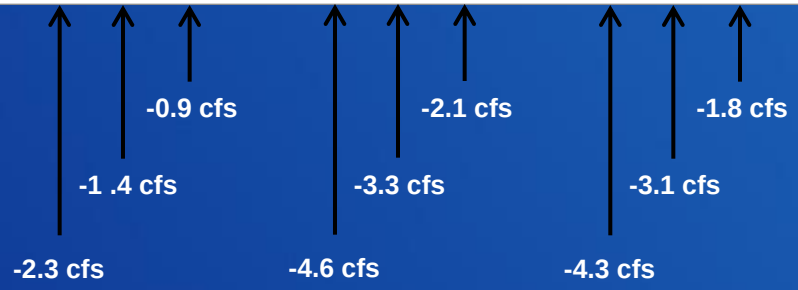

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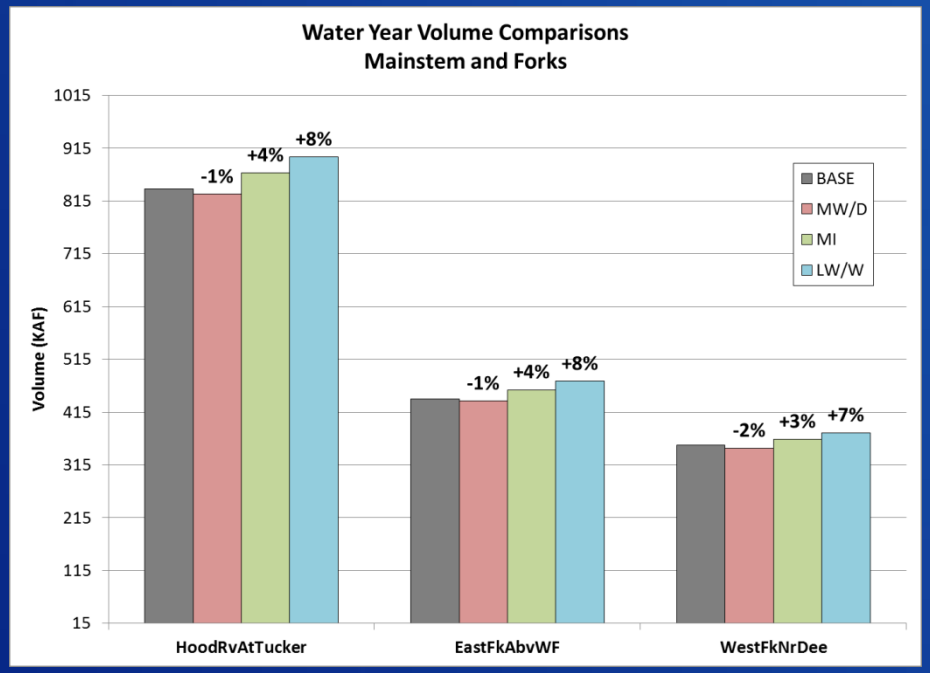

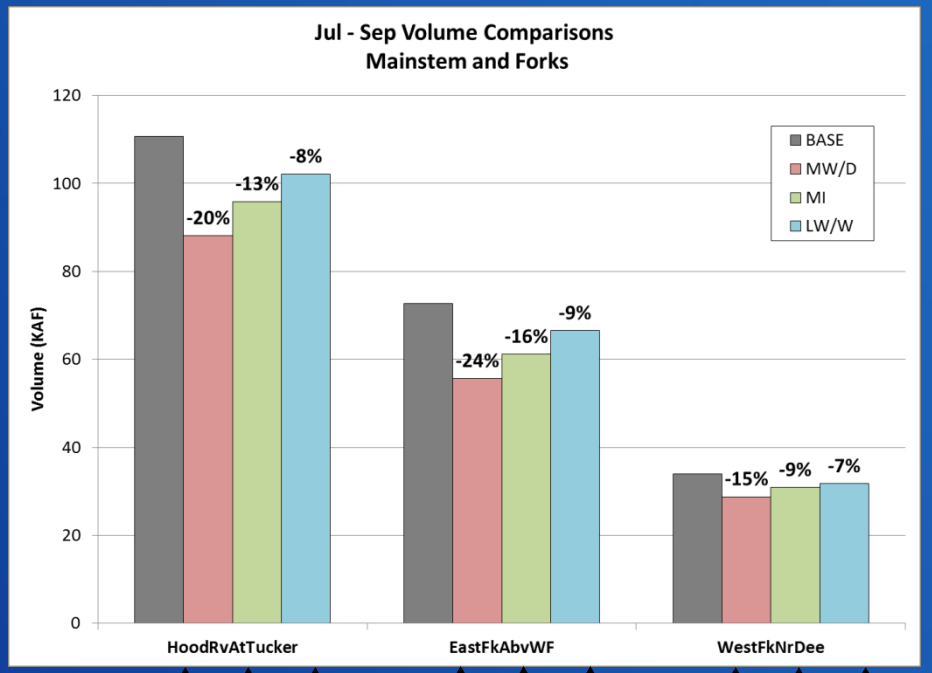

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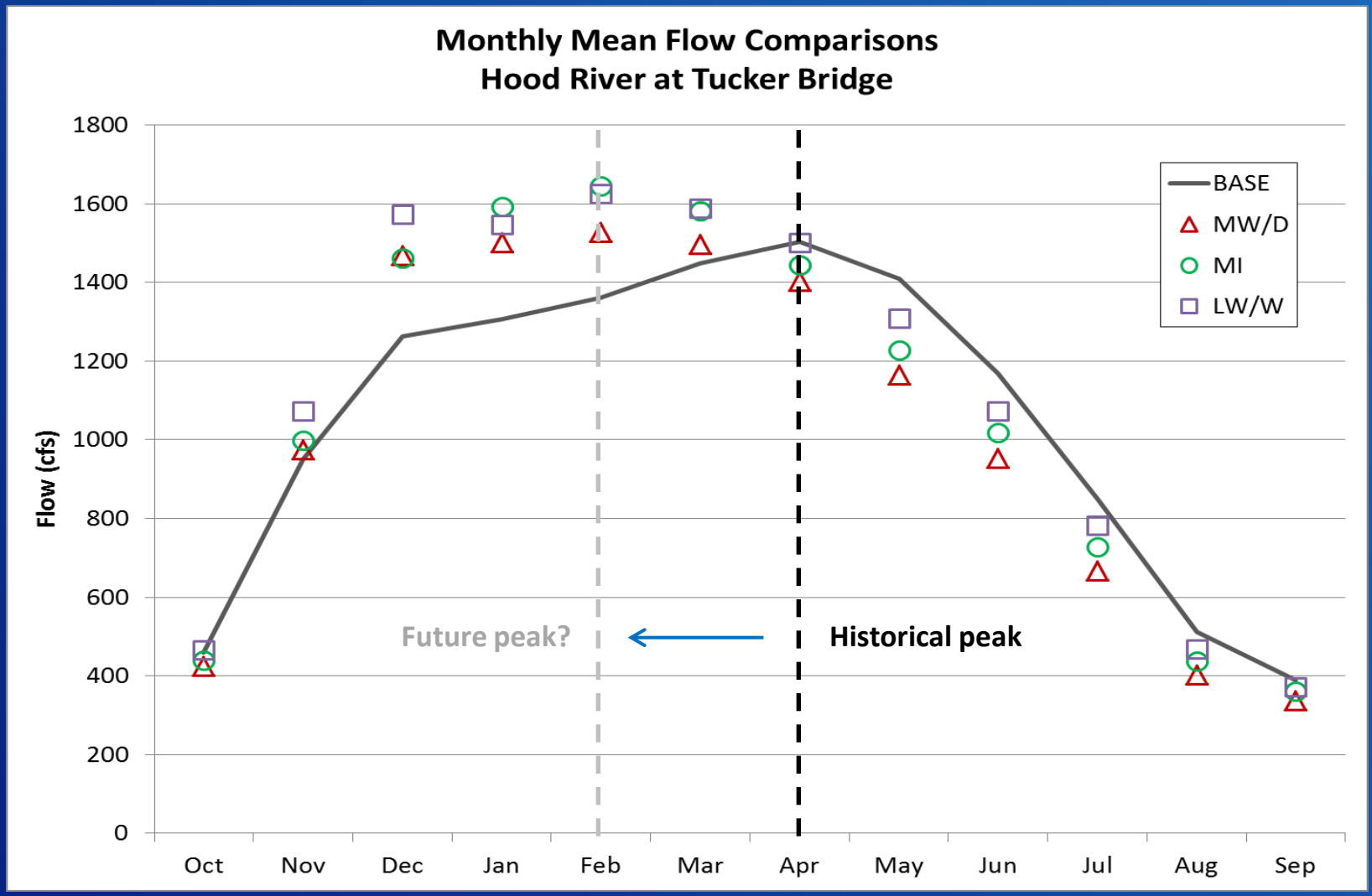

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Summary of Climate Change Results

- **Consistently suggests more water on an annual basis, but less water during the summer**
- **Can use to investigate relative changes to:**
  - *Volumes of shortages in each irrigation district*
  - *Timing of high and lows flows*
  - *Occurrences of storage falling below threshold*
  - *Occurrences of minimum flows not being met*

Questions?

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