

Prediction and Reanalysis of the Flood and High Precipitation Event

Canmore, Alberta
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A Cautionary Tale

- WATFLOOD and MESH
- Precipitation analysis
- WATFLOOD runs
- MESH run

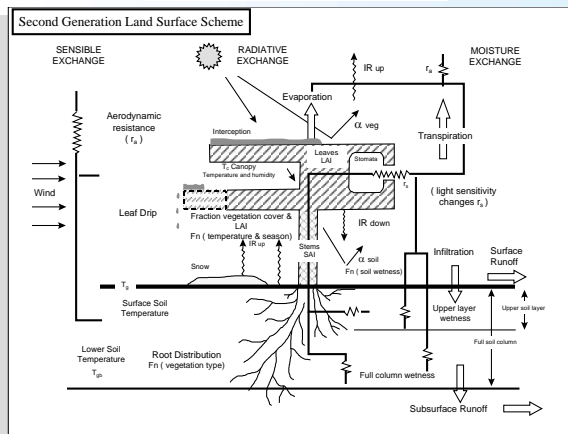
With a Silver Lining

WATFLOOD and MESH

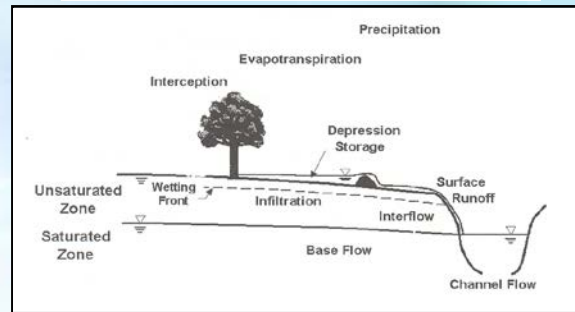
CLASS

WATFLOOD

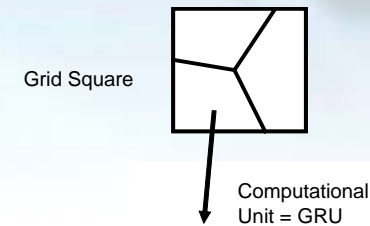
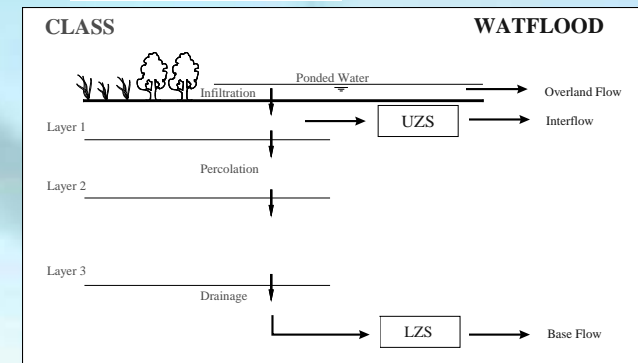
MESH



Sellers et al. 1997



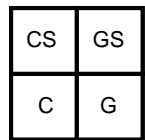
Sub-grid Variability



Computational Unit = Grid Square



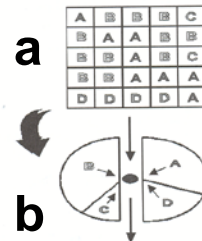
Mixture of 4 sub-areas



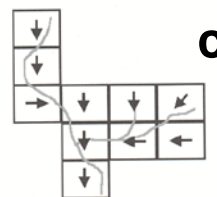
Blend of 5 vegetation groups



Group Response Unit to deal with basin heterogeneity



Physically Based Streamflow Routing

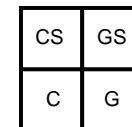


Kouwen et al. 1993

Individual Pixels



Mixture of 4 sub-areas



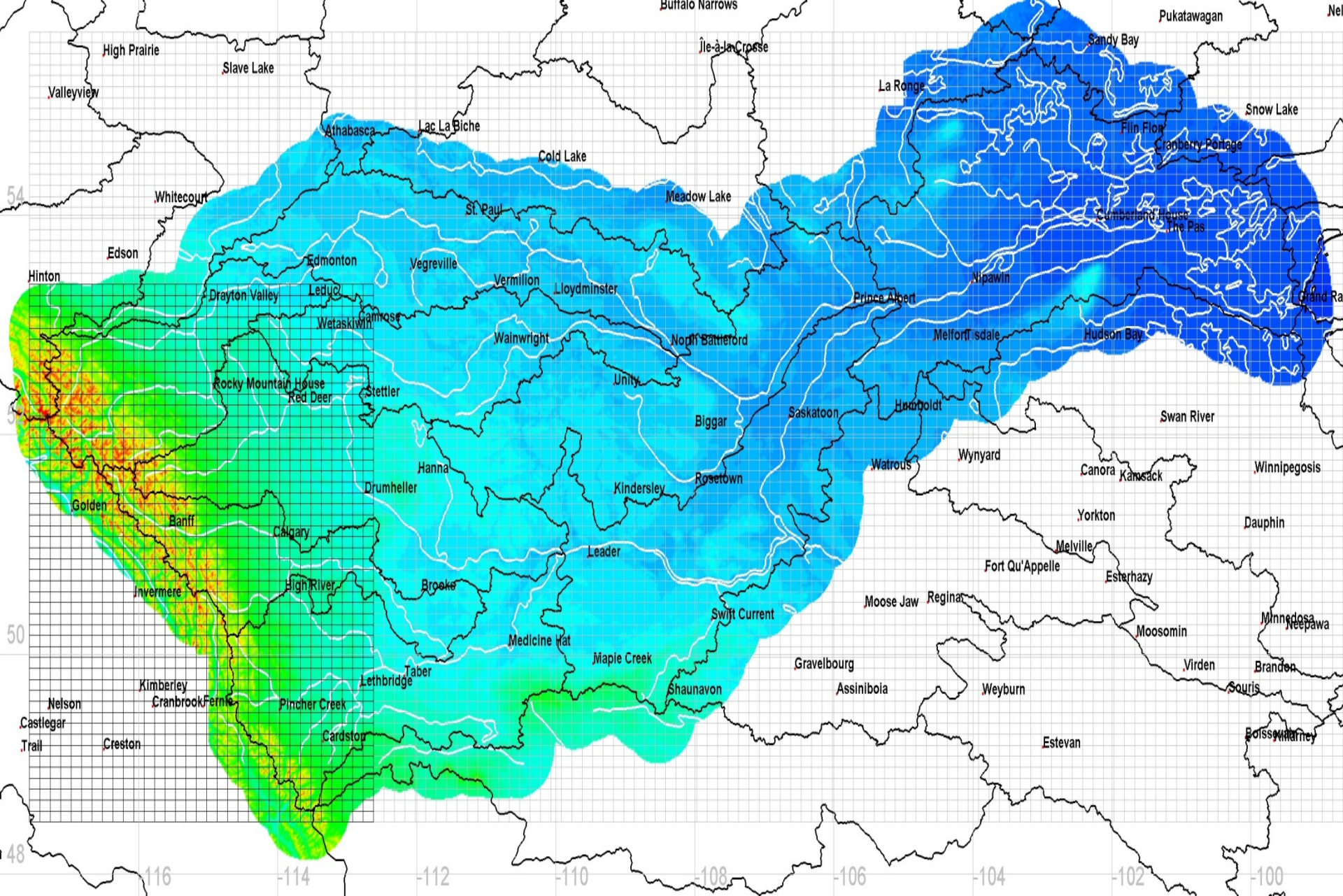
Blend of 5 vegetation groups

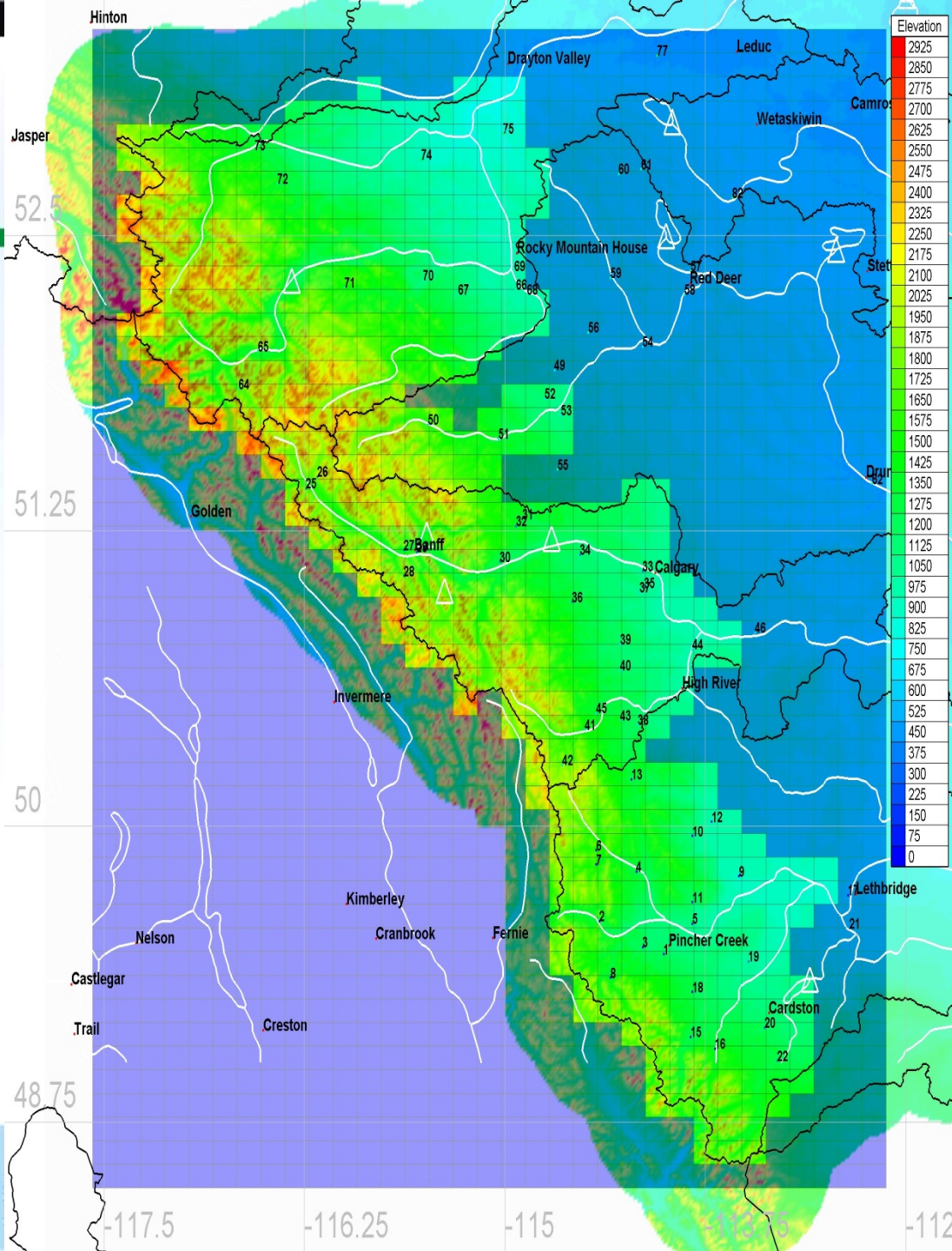


The approach - WATFLOOD

- Use existing watershed Manitoba Hydro WATFLOOD model for the headwaters of the North & South Saskatchewan rivers
- Convert CaPA precipitation and temperature data from its native format to Green Kenue (GK) r2c formats
- Re-calibrate the model parameters for the CaPA met data for 2002 – 2009
- Model the 2013 Calgary flood





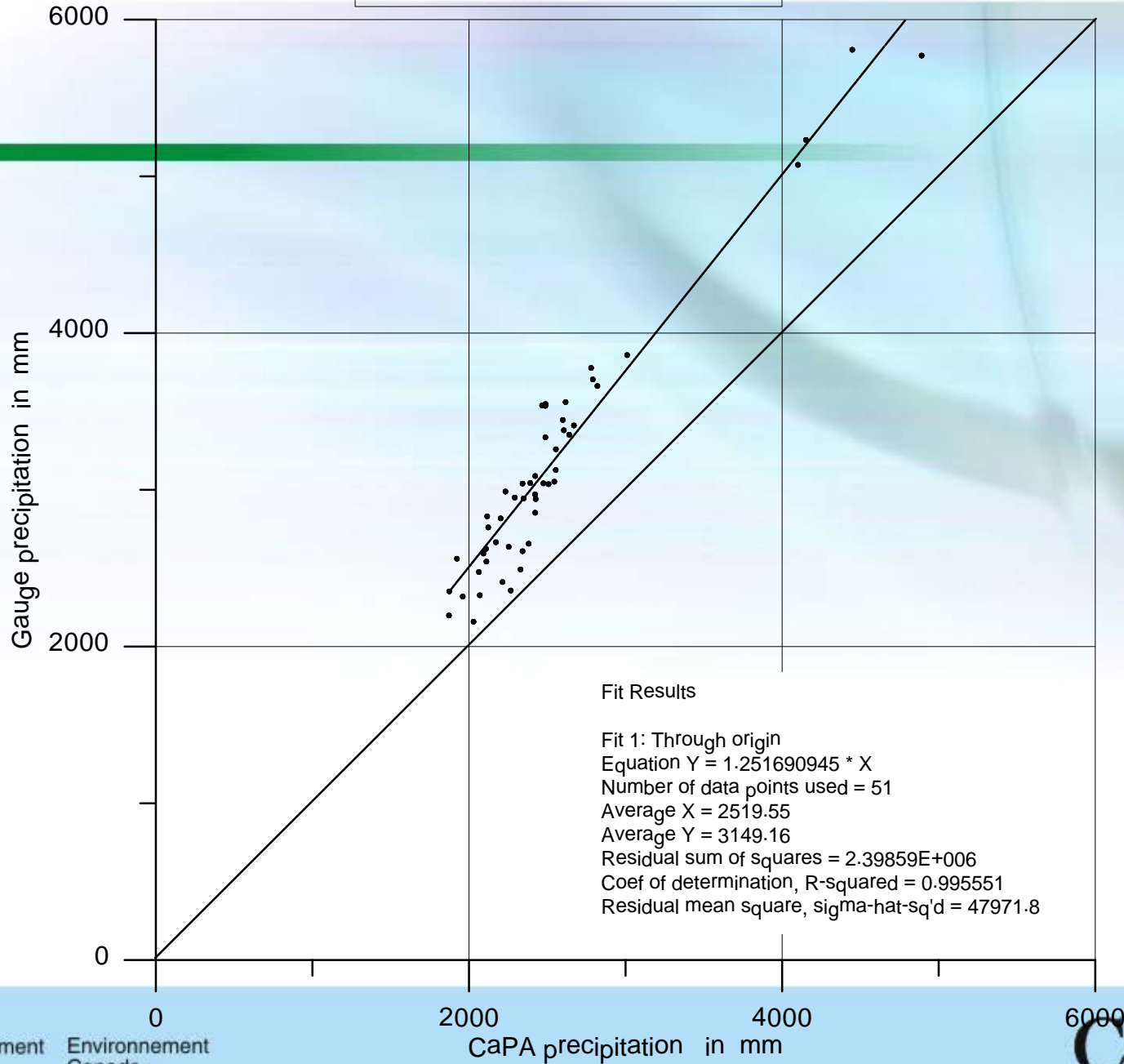


Distributed precip vs. CaPA

- First, the conventional gauge data was compared with the CaPA data
- Conventional data is distributed with the WATFLOOD pre-processors where the both the precipitation and temperature lapse rates and the radius of influence of each gauge are included in the DDS parameter fitting exercise
- The next slide compares CaPA with conventionally distributed gauge precipitation



Basin total precipitation 2002 - 2005



54

Whitecourt

Edson

Edmonton

Hinton

Drayton Valley

Leduc

52.8

Asper

Wetaskiwin

Camrose

51.6

Rocky Mountain House

Red Deer

Stettler

Revelstoke

Golden

Banff

Calgary

Drumheller

50.4

Invermere

High River

49.2

Castlegar

Kimberley

Cranbrook

Fernie

Pincher Creek

Lethbridge

Taber

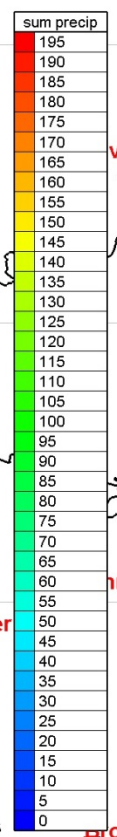
Grand Forks

Trail

Creston

Cardston

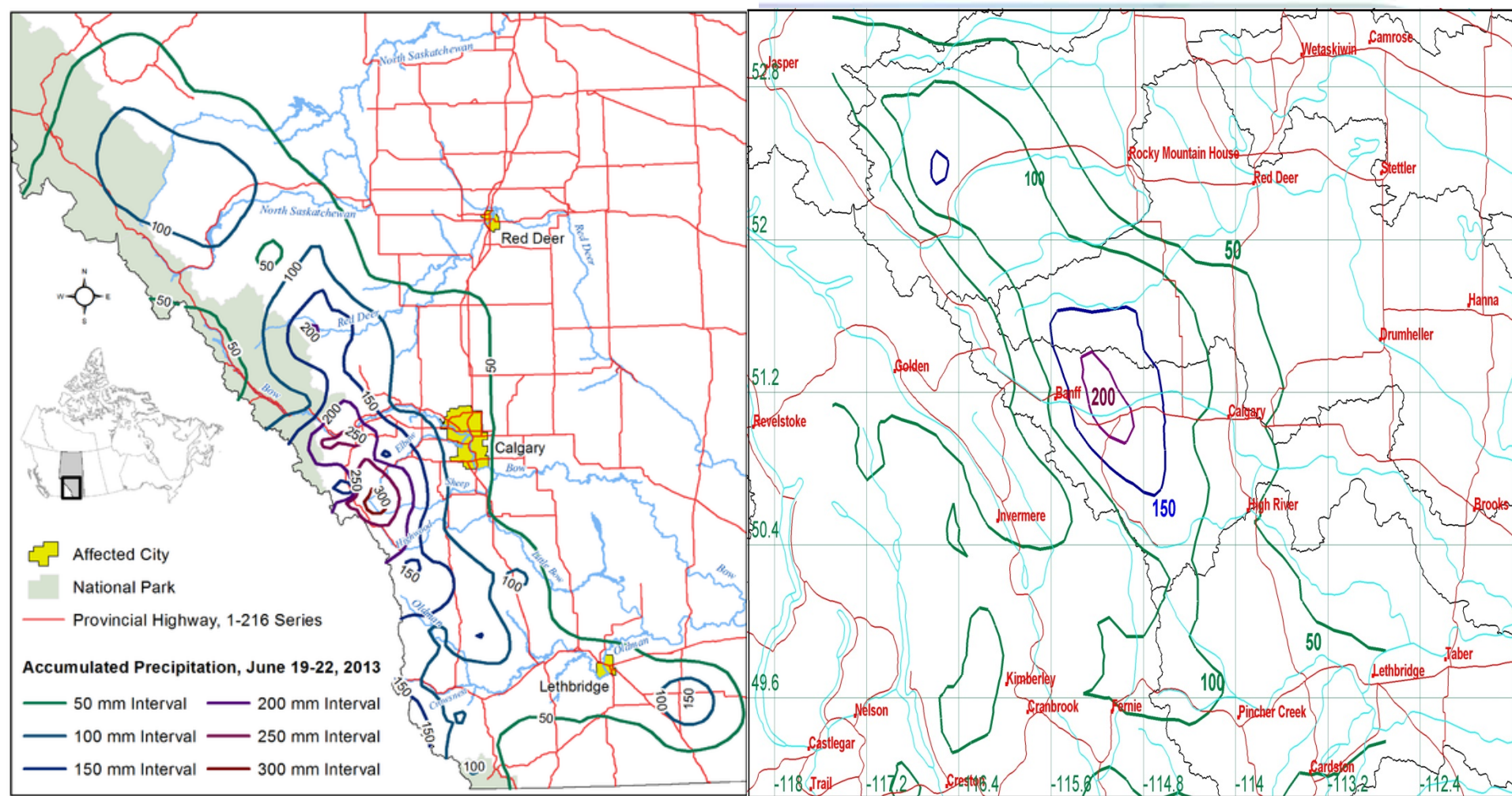
Brook



117.6 -116.4 -115.2 -114 -112.8

- As with the 2002 – 2005 comparison the 2013 storm precipitation appears underestimated when compared to published rainfall amounts





Published precipitation map

http://en.wikipedia.org/wiki/2013_Alberta_floods

Max. precip: over 300 mm

CaPA precipitation map

June 16 – June 30, 2013

Max. precip.: 221 mm

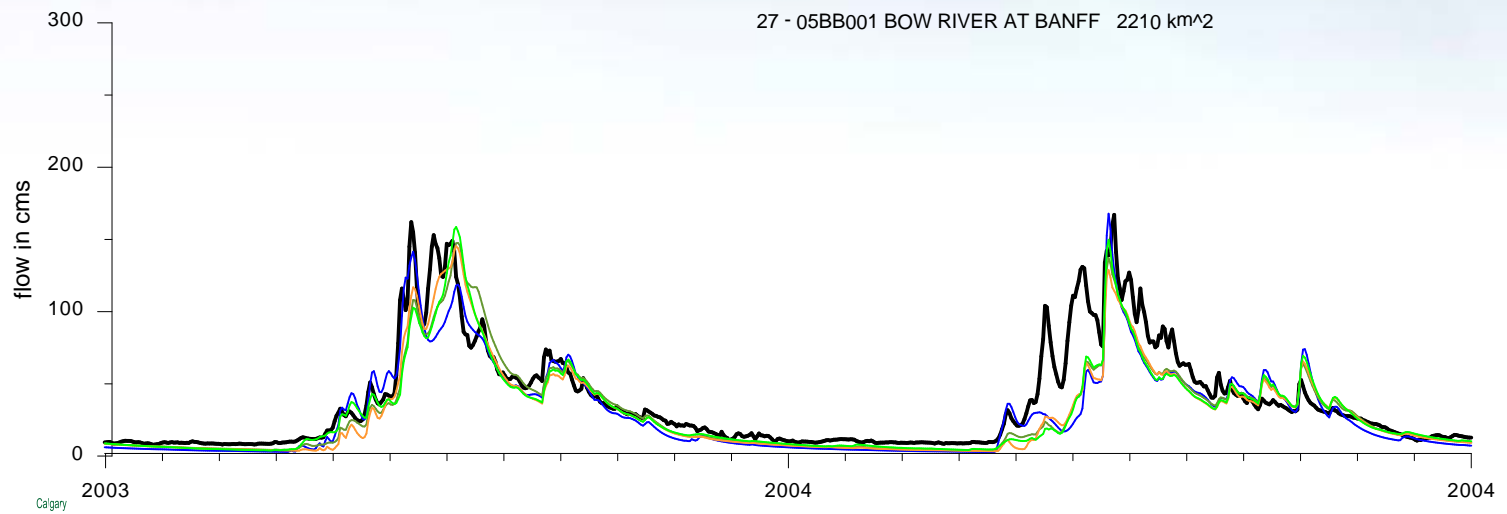
Model calibration approach

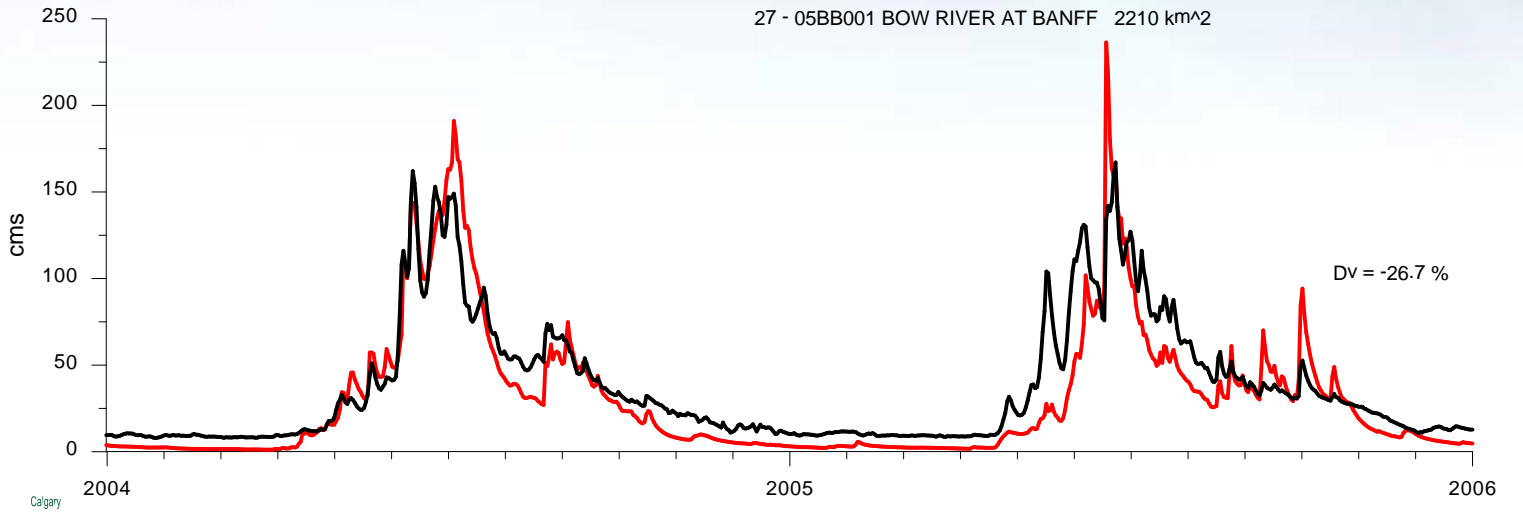
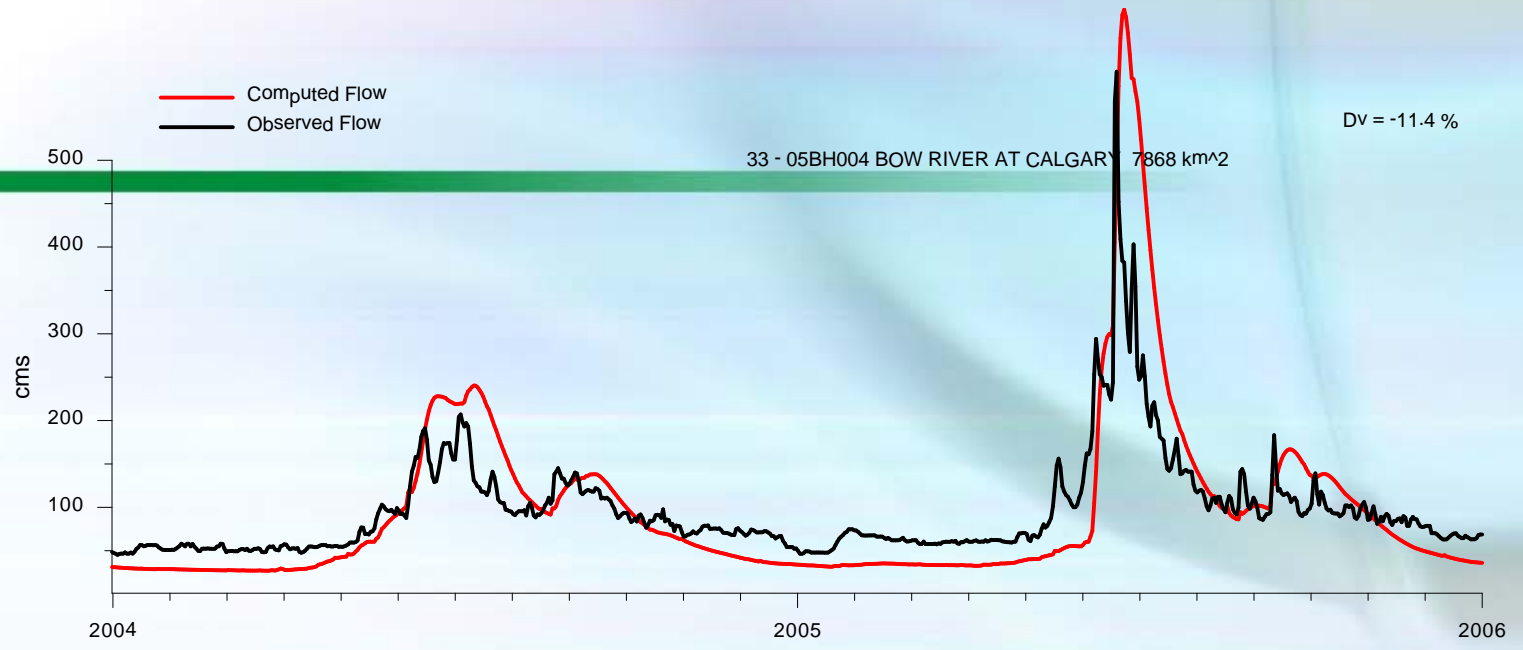
- The usual approach to calibrating WATFLOOD is to first obtain the proper overall volume using only those parameters that affect evapotranspiration, sublimation and lake evaporation
- The next step is to adjust the timing of the hydrographs
- The next ten slides show the result of 10 Dynamically Dimensioned Search (DDS) runs with WATFLOOD







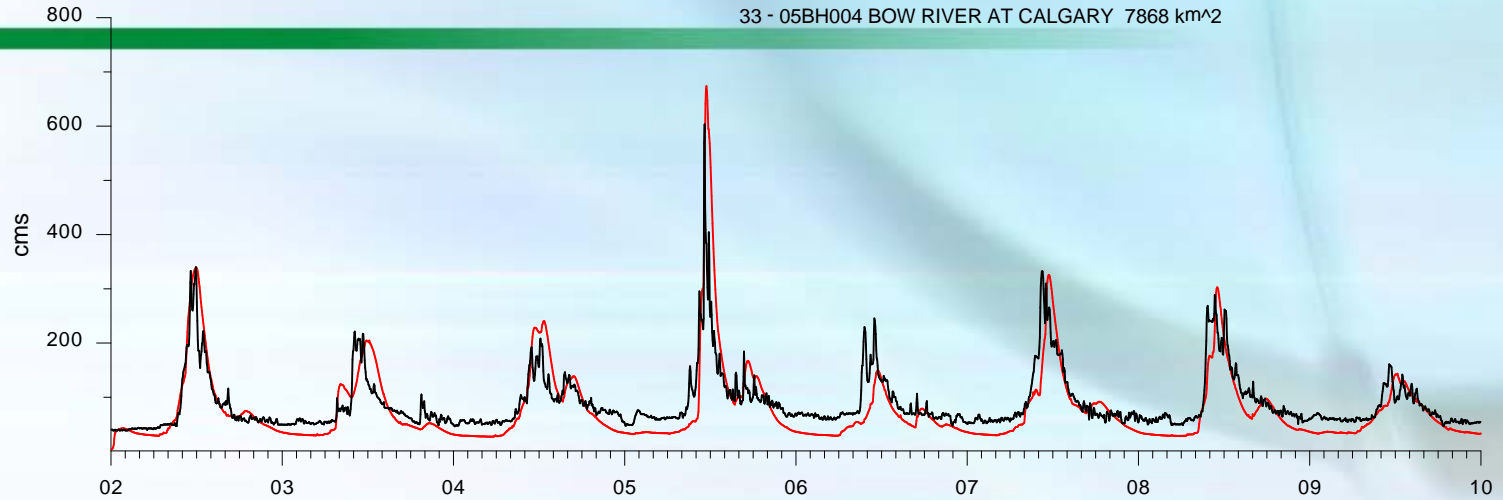




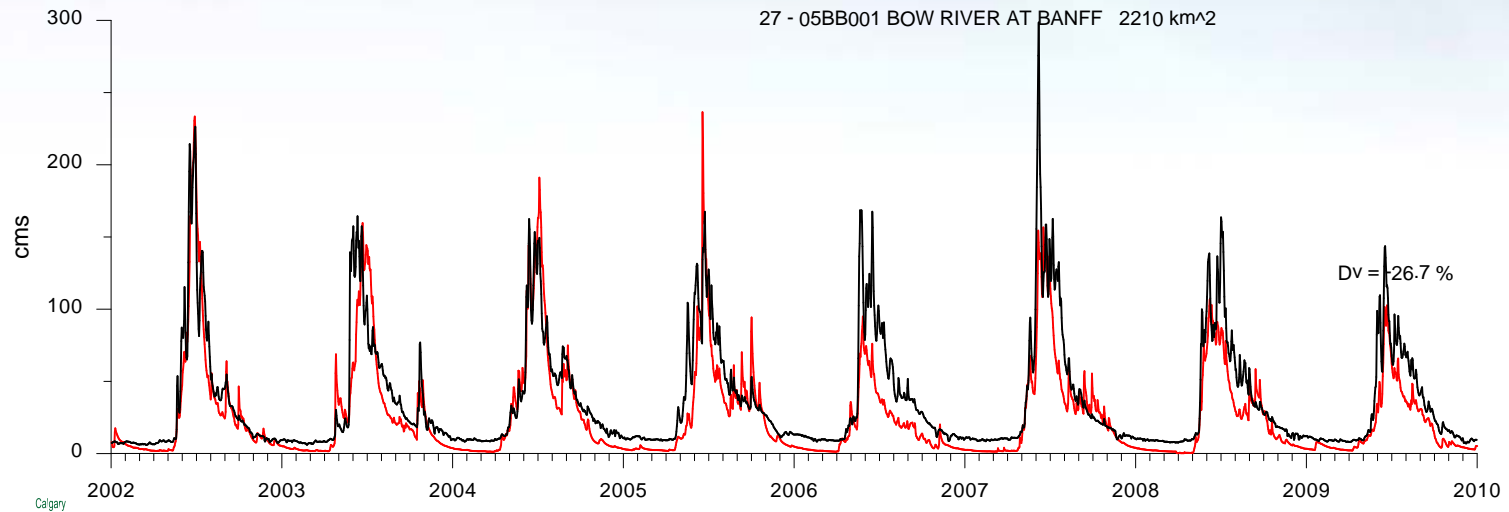
— Computed Flow
— Observed Flow

DV = -11.4 %

33 - 05BH004 BOW RIVER AT CALGARY 7868 km²

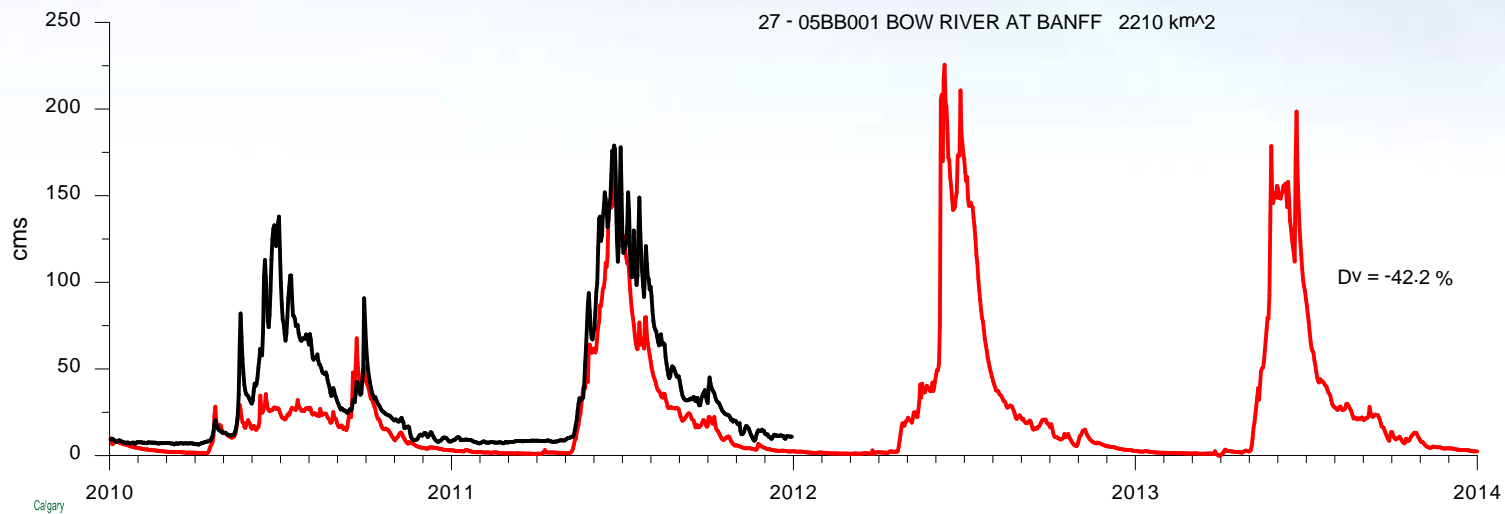
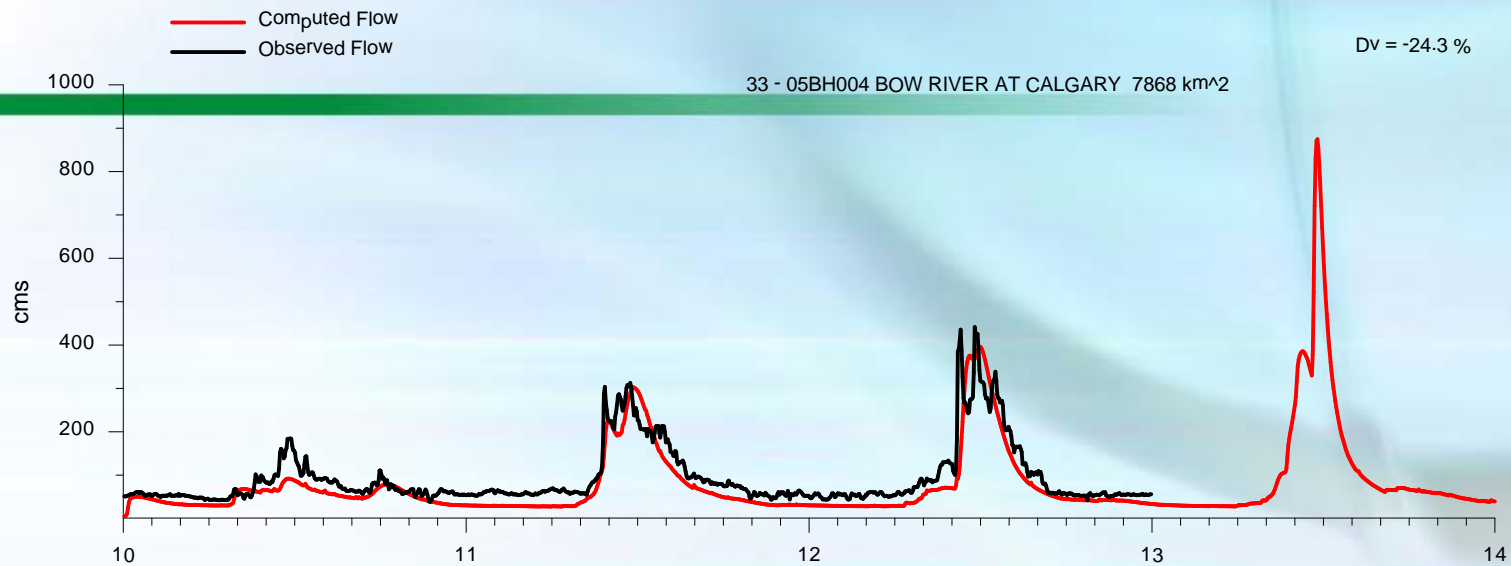


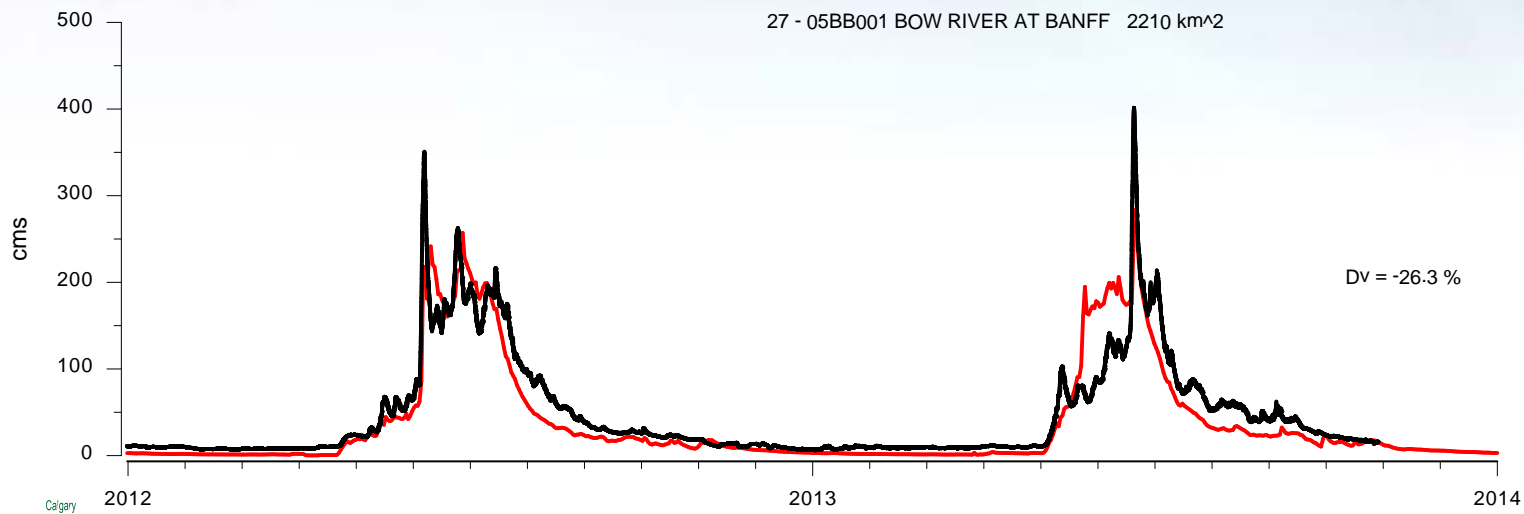
27 - 05BB001 BOW RIVER AT BANFF 2210 km²

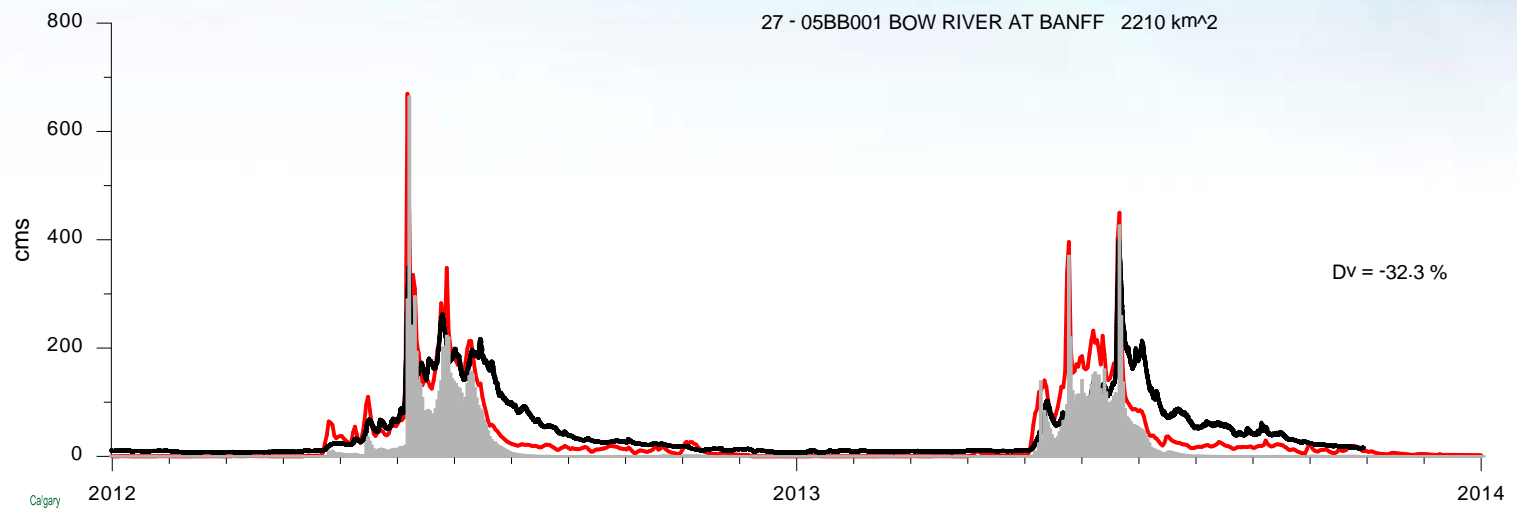
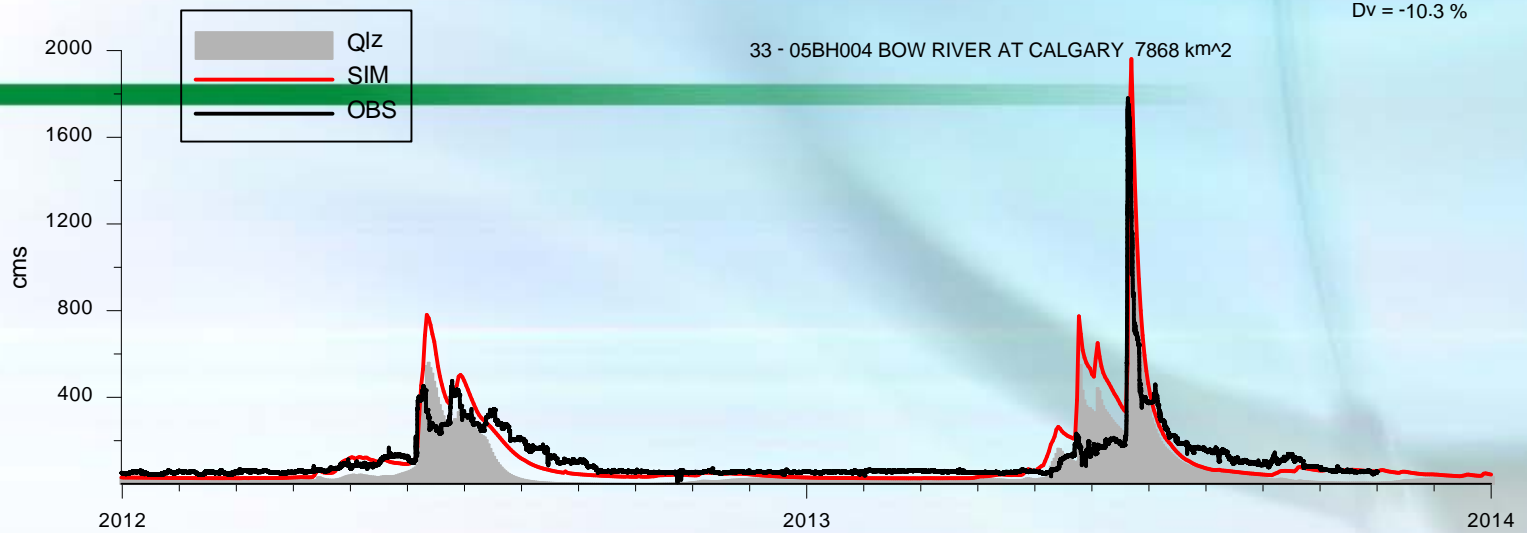


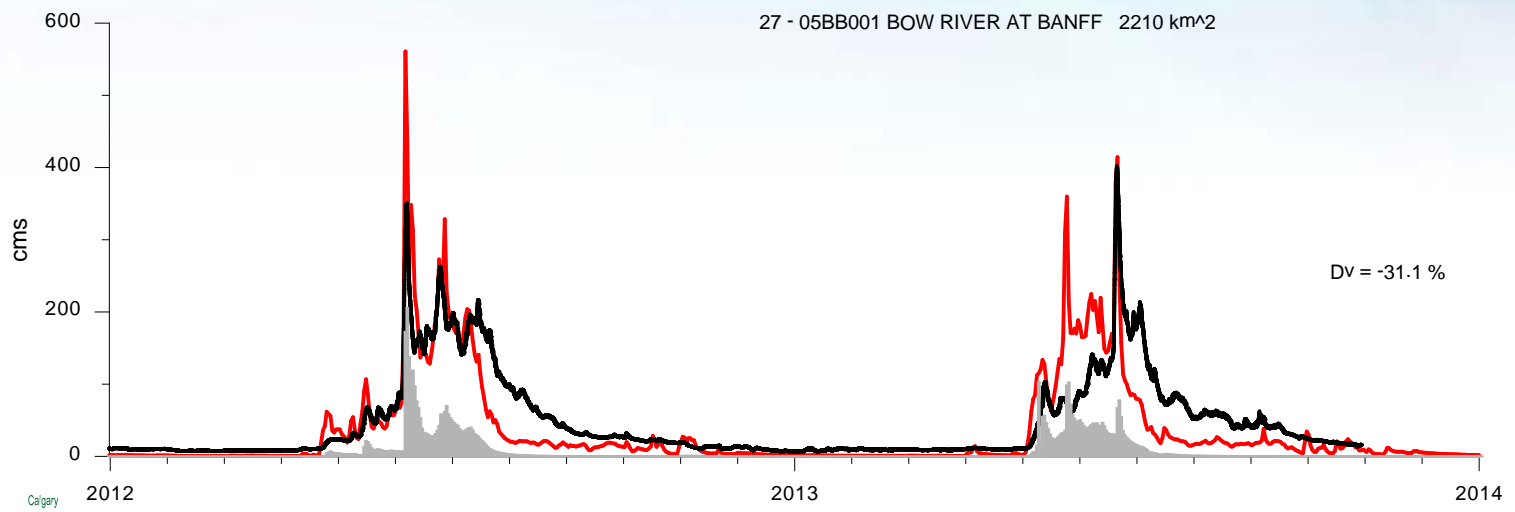
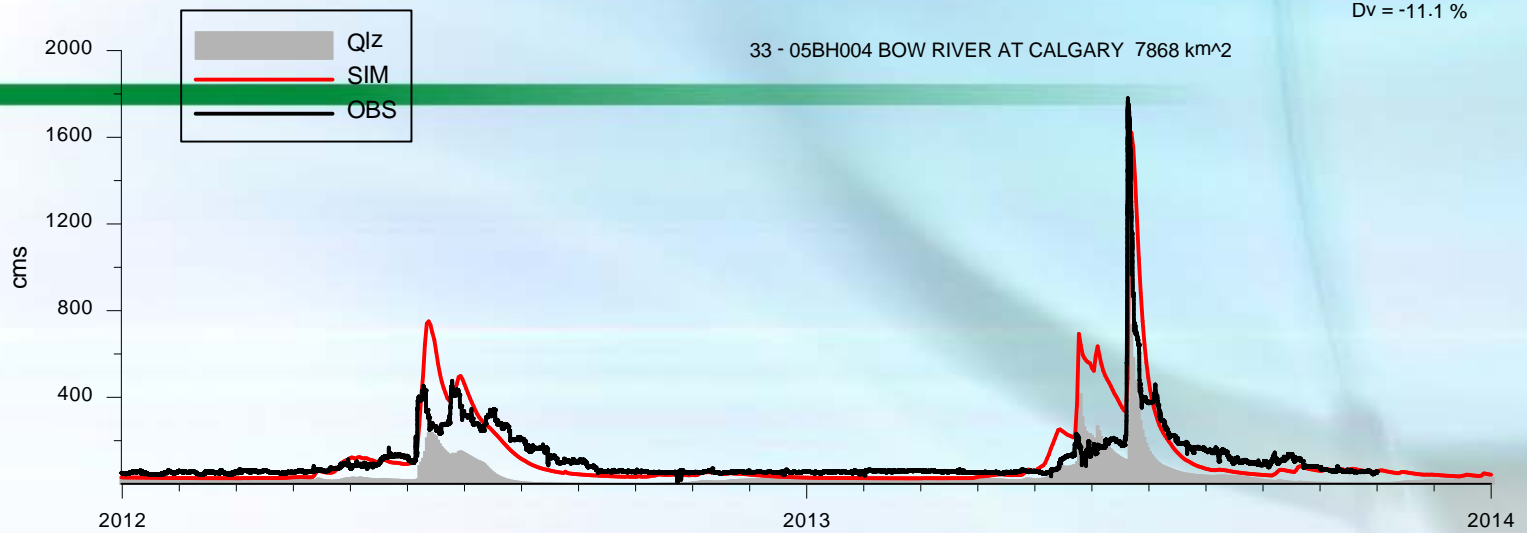
DV = 26.7 %











The approach - MESH

- Use existing watershed MESH model for the South Saskatchewan River
- Convert CaPA precipitation and temperature data from its native format to Green Kenue (GK) r2c formats
- Pre-calibrated the model parameters for the CaPA met data for Oct 2002 – Oct 2004
- Model the 2013 Calgary flood



Standalone MESH run

BOW RIVER AT CALGARY (7,868 km²)

