

# Okanagan Basin Climate Studies

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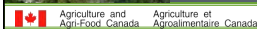
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<sup>2</sup>Environment Canada, PYR, Vancouver, BC

<sup>3</sup>RHF Systems, Kelowna, BC



Osoyoos Lake Water Science Forum, Sept 18-20<sup>th</sup>, 2011  
Osoyoos, BC.

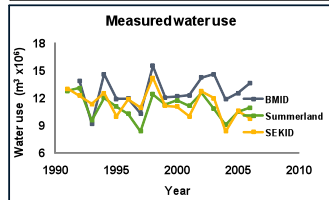
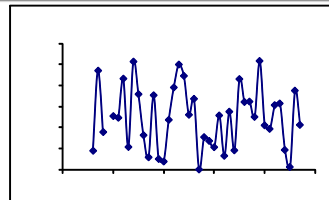
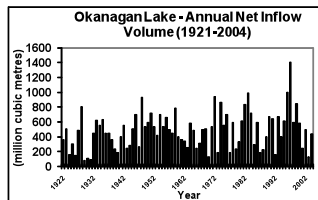


# Outline

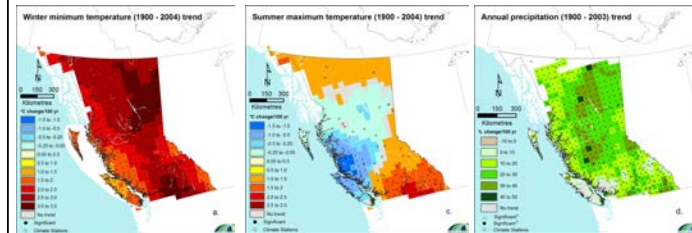
- Historic variability and trends
  - Data Sources
    - Weather stations
    - Modeled climate
- Future climates
  - Limiting factors for natural and managed ecosystems
- Data Use
  - Water supply demand modeling
  - Other uses

# Okanagan weather

- Highly variable
- Best illustrated by weather 'integrators'
  - Snow accumulation
  - Basin hydrology
  - Water use



# Climate trends in BC 1900-2004



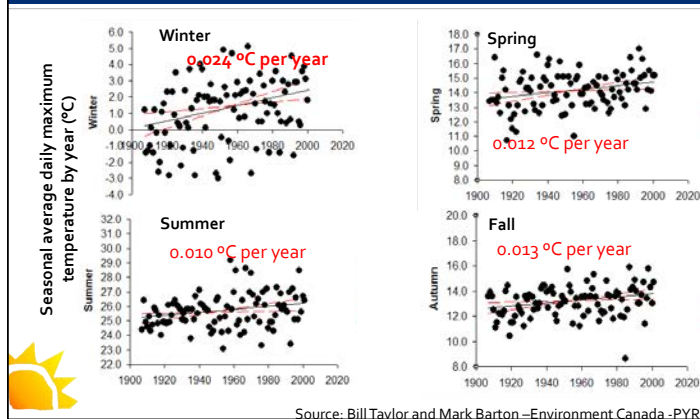
Winters are getting less cold

Summers warming in the south 1.0-2.5°C

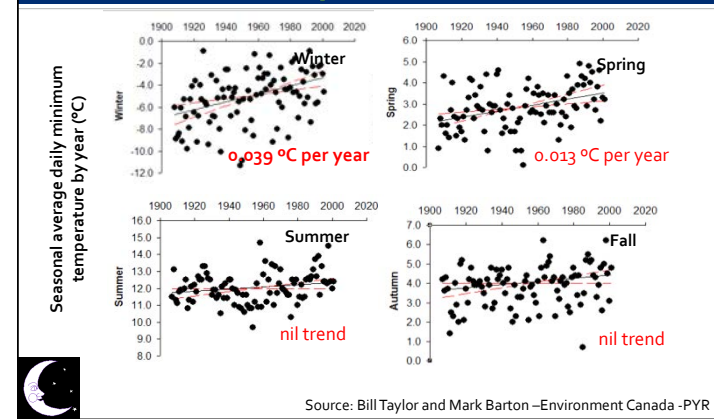
Getting Wetter ~20%

Courtesy Pacific Climate Impacts Consortium, Victoria, BC

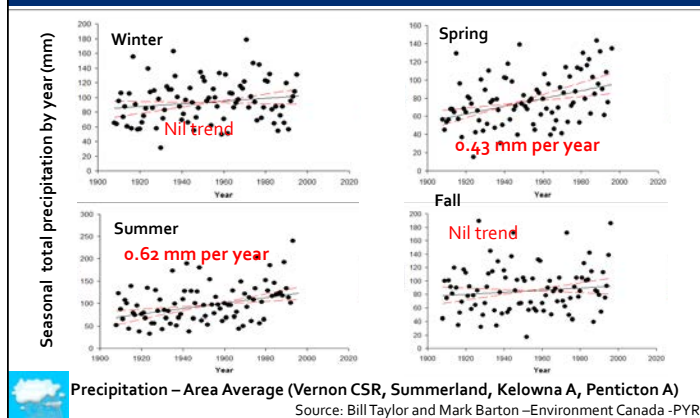
## Okanagan -Trends in Daily Maximum Temperature (1916-2000)



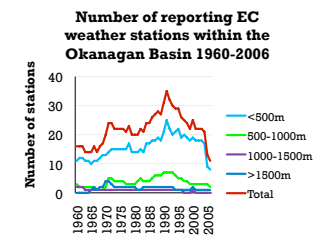
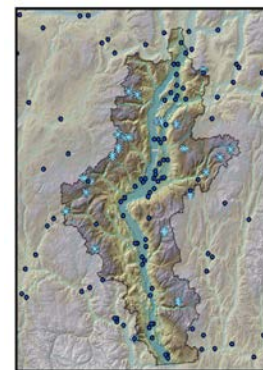
## Okanagan -Trends in Daily Minimum Temperature (1916-2000)



## Okanagan- Precipitation Trends (1916-2000)

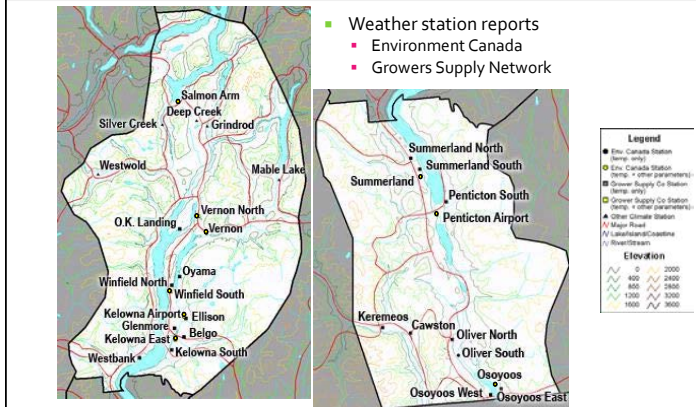


## Climate data

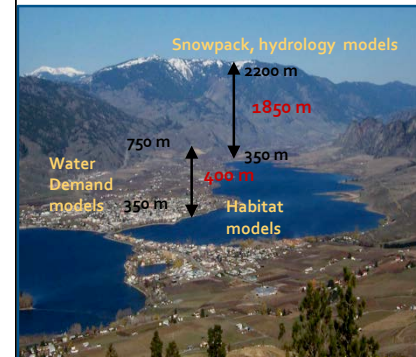


- Environment Canada, BC Ministries responsible for Environment, Forestry and Transportation
- Increasingly sparse weather data to characterize climatic variation

## Weather data available for Farmwest.com



## Need for Gridded Climate Data



- Complex terrain
- Limited station data particularly at high elevation
- Basis for historic and future climate downscaling

## Gridded Climate Data Model

- Interpolates daily minimum and maximum temperature and precipitation from weather station data
- Takes into account
  - Latitude
  - Elevation
  - Distance to major Lakes
- Produces daily temperatures and precipitation at a 500x500m spacing (grid) ~32000 grid cells



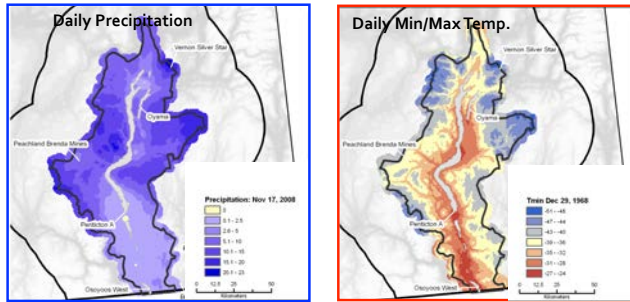
## Gridded Climate Data Model

- Daily precipitation and min/max temperature 1961-2006
- Climate change analysis based on 6 Global Climate Model outputs 1961-2100 with two greenhouse gas emissions scenarios
- Statistically downscaled using synoptic map typing and a weather generator

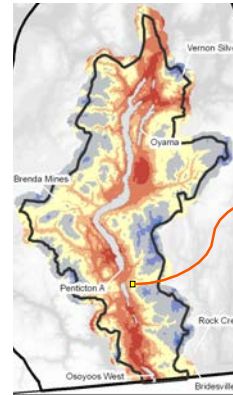
Neilsen et al. 2010. Can. Water Res. J. 35  
 Cannon et al. 2002. Monthly Weather Review, 130  
 Cannon et al. 2008. Journal of Hydrometeorology.  
<http://dx.doi.org/10.1175/JHM960.a>



## Daily climate data

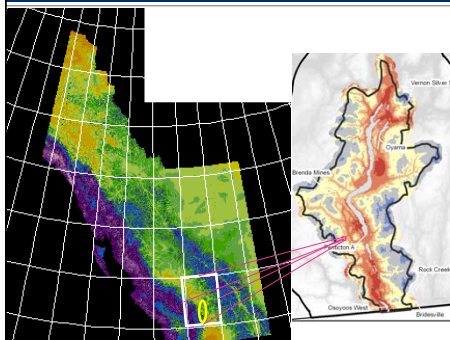


## Gridded climate indices



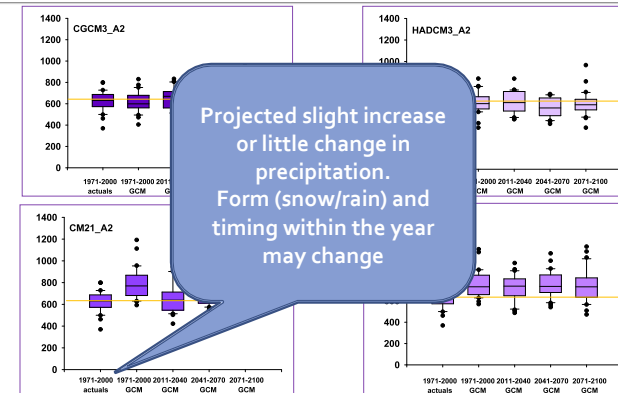
- Grid Cell calculations**
- Potential Evapo-transpiration  $ET_0$  (P. M. FAO 56)
  - Form of precipitation (Rain/snow)
  - Snow water equivalent
- Agricultural climate indices**
- Growing Degree Days Base 5°C, 10°C (GDD)
  - TSUM (range of values)
  - Crop growing season
  - Frost free days (FFD)

## Creating future climate scenarios

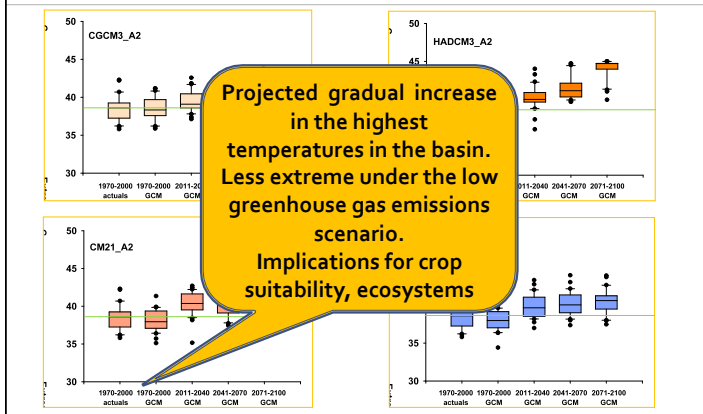


- Resolution of GCMs ~400km x 250km
- Downscaled statistically to meet regional needs
- To give fine resolution climate data 500m x 500m

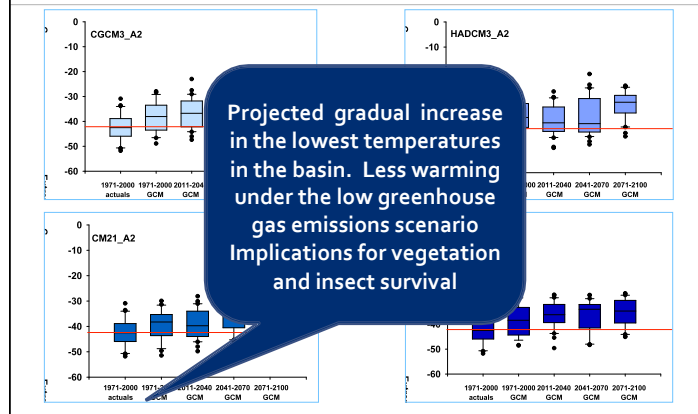
## Projected precipitation (Basin average)



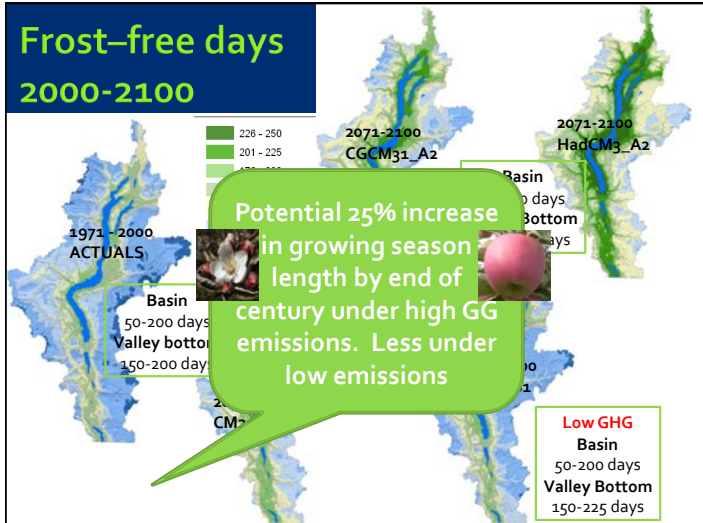
## Projected maximum temperature (Basin extreme)



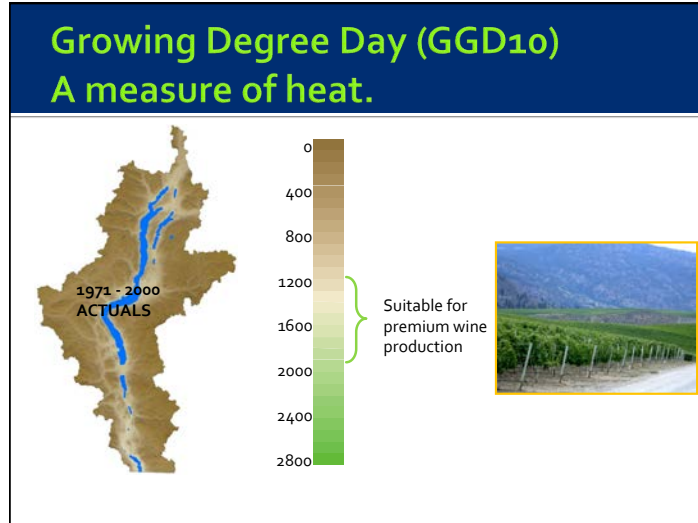
## Projected minimum temperature (Basin extreme)

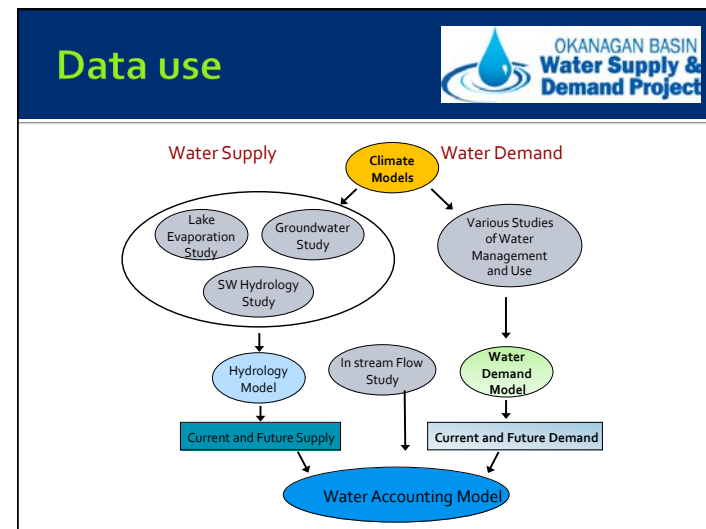
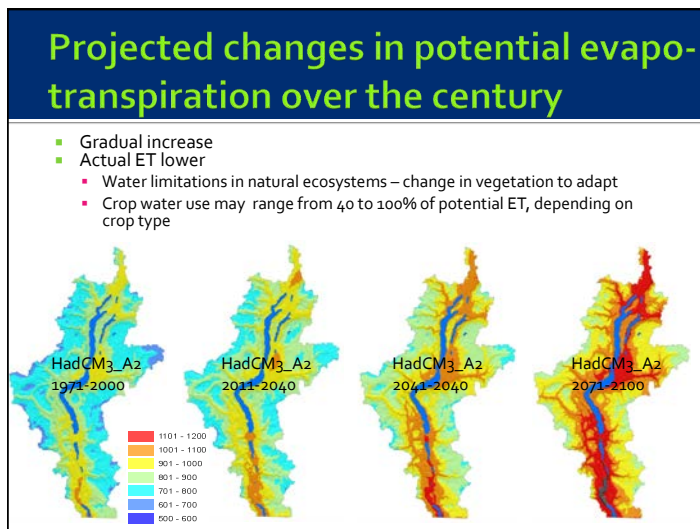
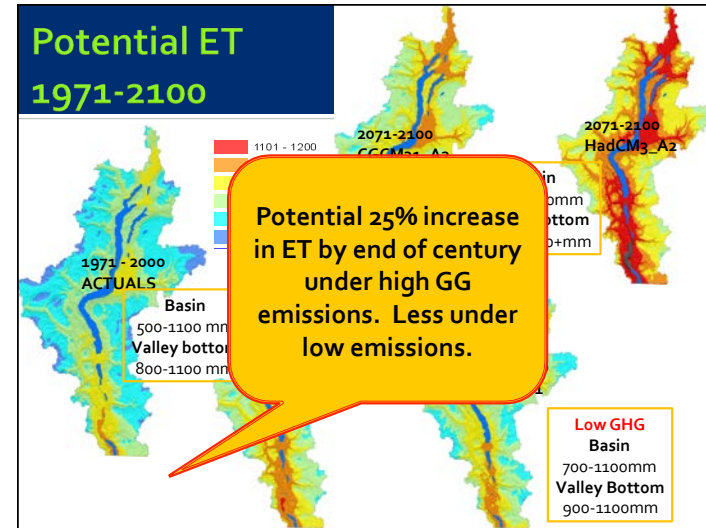
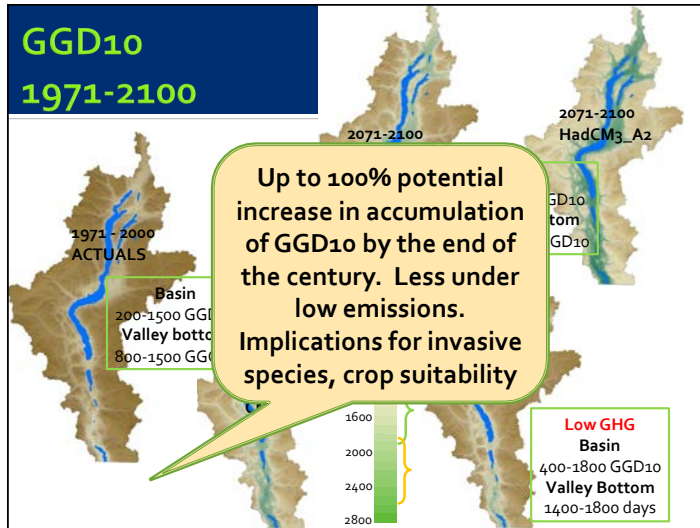


## Frost-free days 2000-2100

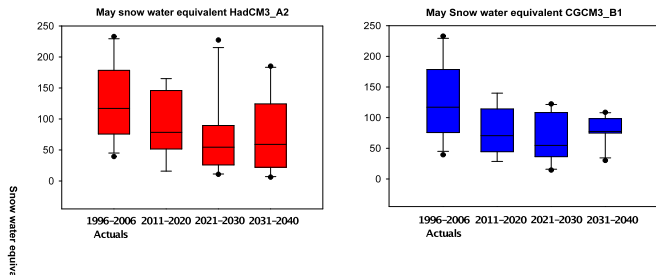


## Growing Degree Day (GGD10) A measure of heat.

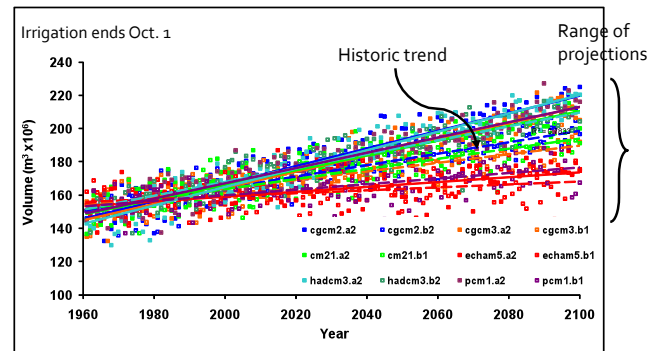




## Projected changes in snow pack 2011-2040

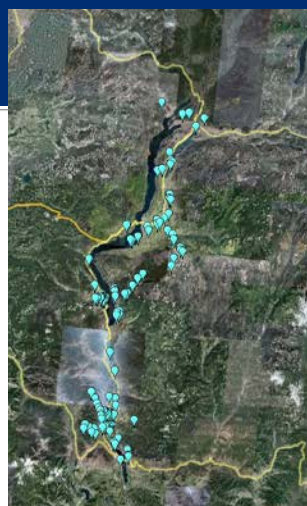


## Projected Annual Irrigation Demand Okanagan Basin (Restricted growing season)

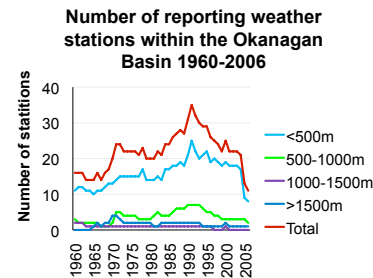


## Next steps - data

- AAFC HOBO Network
  - Hourly temperature data
  - Relative Humidity at some sites
  - 150 sensors
  - High and low elevation data
- Model Improvement
  - Temperature lapse rates
  - Cold air drainage models
- New Model Uses
  - Crop and Insect development models



## Next steps - climate modeling



- Too few weather stations to continue with the current process
- New methods under development for S. British Columbia (Cannon et al.)

Thank you

