Developing a Consensus on Climate Change: A Puget Sound Regional Perspective

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UNIVERSITY OF WASHINGTON

CLIMATE IMPACTS GROUP

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Presentation Outline

- Goal
- Evaluating Regional Water Supply
- Regional Water Supply Planning in the Puget Sound
- Previous Studies
- The Need for Consensus
- The Building Blocks
- Summary

Goals

- To provide accurate estimates of regional water supply and demand for planning
- Establish the need to include climate change in regional water supply planning
- To shift a planning paradigm through consensus

Evaluating Regional Water Supply

- Water Supply - Evaluate the worst hydrologic sequence from the past as a surrogate for what will happen in the future
  - Assume stationarity
  - Cannot anticipate conditions more severe than those that have occurred
  - Does NOT include climate change
- Water Demand – Forecast the future

WMO

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

UNEP

IPCC web sites

- About IPCC
- Activities
- Calendar of Events
- Publications
- Presentations & Graphics
- Press releases & Speeches
- Official documents
- Other links

Search

New Language Portals in all UN languages

Bienvenido

Добро пожаловать 欢迎光临

مرحبا Bienvenue

User Guide to the IPCC Website

How do I find information about climate change on the IPCC

"Climate Change 2007"

The IPCC 4th Assessment Report is coming out

A comprehensive and rigorous picture of the global present state of knowledge of climate change

Play

Paris, 2 February 07

The first volume will be released.

- What progress has been made in understanding and attributing climate change?
- What do observations of the atmosphere, oceans, sea level, snow and ice tell us?
- How has climate been behaving in the last hundreds of thousands years?
- Which are the projections of future changes?

Find the latest information on "The Physical Science Basis of Climate Change" in Working Group I report

The Intergovernmental Panel on Climate Change (IPCC) has been established by WMO and UNEP to assess scientific, technical and socio- economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation. It is currently finalizing its Fourth Assessment Report "Climate Change 2007". The reports by the three Working Groups provide a comprehensive and up-to-date assessment of the current state of knowledge on climate change. The Synthesis Report integrates the information around six topic areas. More

Working Group I "The Physical Science Basis"

- See chapters outline
- **Acceptance and approval at the 10th Session of Working Group I, 29 Jan - 1 Feb 2007, Paris, France**
  Information for participants
- Release: 2 February 2007

Working Group II "Impacts, Adaptation and Vulnerability"

- See chapters outline
- Distribution of final draft report 22 December 2006
  Letter to governments - comments on SPM invited by 16 February 2007
  Correction
- **Acceptance and approval at the 8th Session of Working Group II, 2-5 April 2007, Brussels, Belgium**
  Information for participants

Working Group III "Mitigation of Climate Change"

Information for Press

WG1 Release

- 22 Jan 07 - Media Advisory
- 2 Feb 07 Press Information Note
- Download Summary For Policymakers
- Access the WEBCAST of the Press Conference

Information for Authors

- Finalizing graphics and maps for a scientific report
  Graphics manual and information about support for graphics work
- Guidance Notes for Lead Authors of the IPCC Fourth Assessment Report on Addressing Uncertainties

The Synthesis Report (SYR)

Pacific Northwest Studies

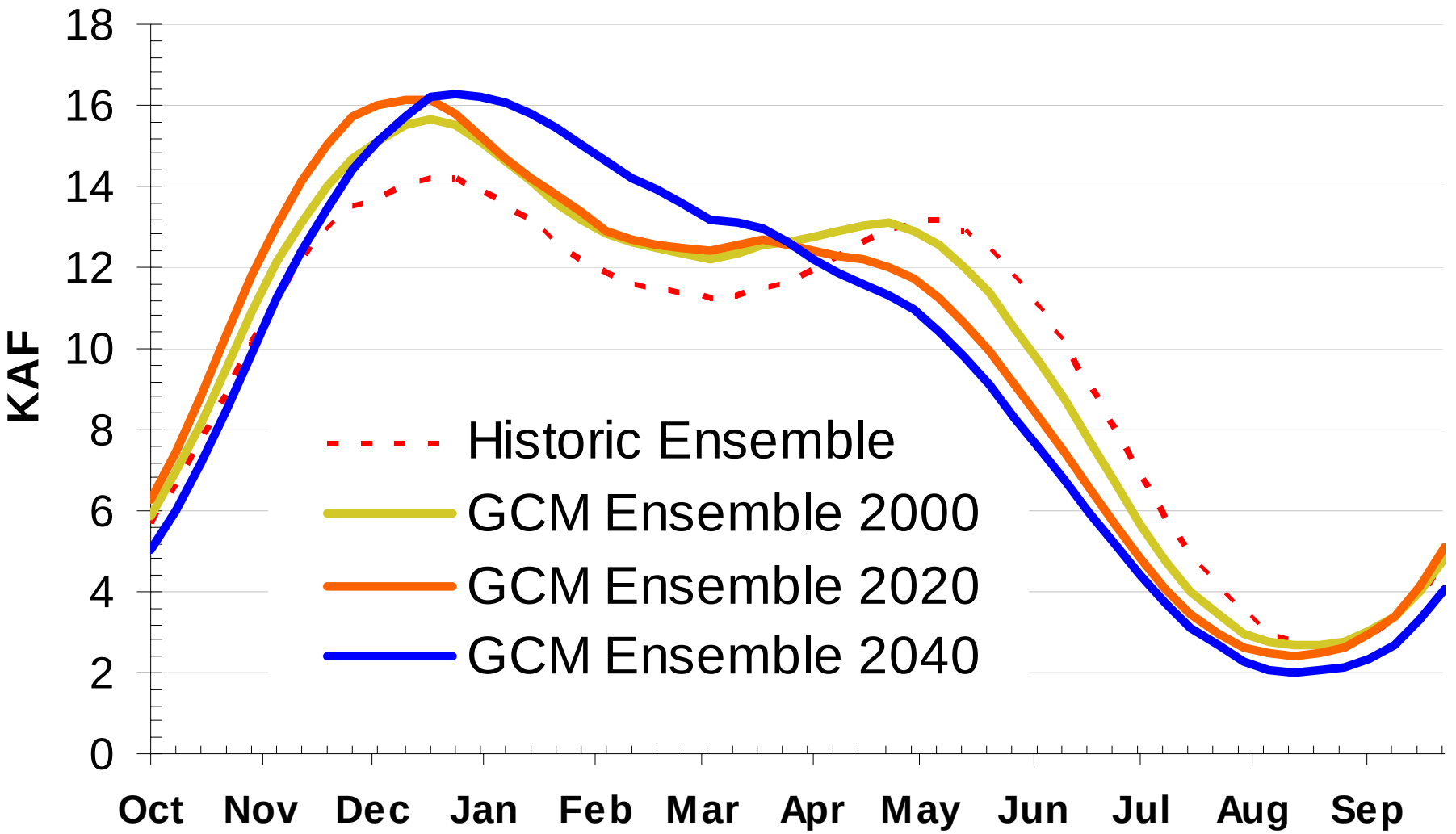
- Columbia River Basin
- Seattle Water Supply
- Portland Water Supply
- Salmon Recovery in the Snohomish

In these studies, climate change was evaluated by a series of loosely-linked models consisting of GCMs, hydrologic models, and system operations models.

In the studies, yields of water supply systems decreased in the future due to climate change

Why do Yields Decrease?

- Warmer temperatures result in:
  - Precipitation occurring as rain rather than snow
  - Earlier spring melt
  - Increased evapotranspiration
- Thus, less late spring and early summer flows, and longer draw-down periods for reservoirs
- Precipitation is also shifted into winter months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Historic Ensemble
GCM Ensemble 2000
GCM Ensemble 2020
GCM Ensemble 2040

Regional Planning Process

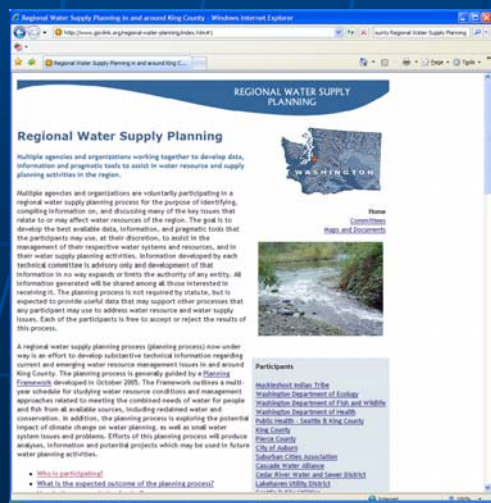
- Multiple agencies and organizations are voluntarily participating to identify, compile, and discuss many of the key issues that may affect water resources of the region.
- The goal is to collect the best available data, generate information, and develop pragmatic tools.
- All information generated will be shared among all those interested in receiving it.
- Each of the participants is free to accept or reject the results of this process.

Participants

- Muckleshoot Indian Tribe
- Washington Department of Ecology
- Washington Department of Fish and Wildlife
- Washington Department of Health
- Public Health - Seattle & King County
- King County
- Pierce County
- City of Auburn
- Suburban Cities Association
- Cascade Water Alliance
- Cedar River Water and Sewer District
- Lakehaven Utility District
- Seattle Public Utilities
- Tacoma Public Utilities
- Woodinville Water District
- Shared Strategy for Puget Sound
- Center for Environmental Law & Policy
- Washington Environmental Council
- King County Business Community

Consensus

- General agreement or concord; harmony
- Required in voluntary process
- To change how supply is evaluated, the need must be obvious
- First step was establishing a Climate Change Committee within larger Planning Process



Building Blocks Document

- Make participants aware of climate change research
- Use peer-reviewed literature to ensure that information was of high quality
- Recognize that uncertainties exist, but much is known

(Source: http://agexted.cas.psu.edu/FCS/mk/images/BuildingBlocks.jpg)

Building Blocks

- Climate Change Building Blocks are simply written, direct statements of facts concerning well-accepted information related to climate change. These originate from peer-reviewed literature

Areas of interest

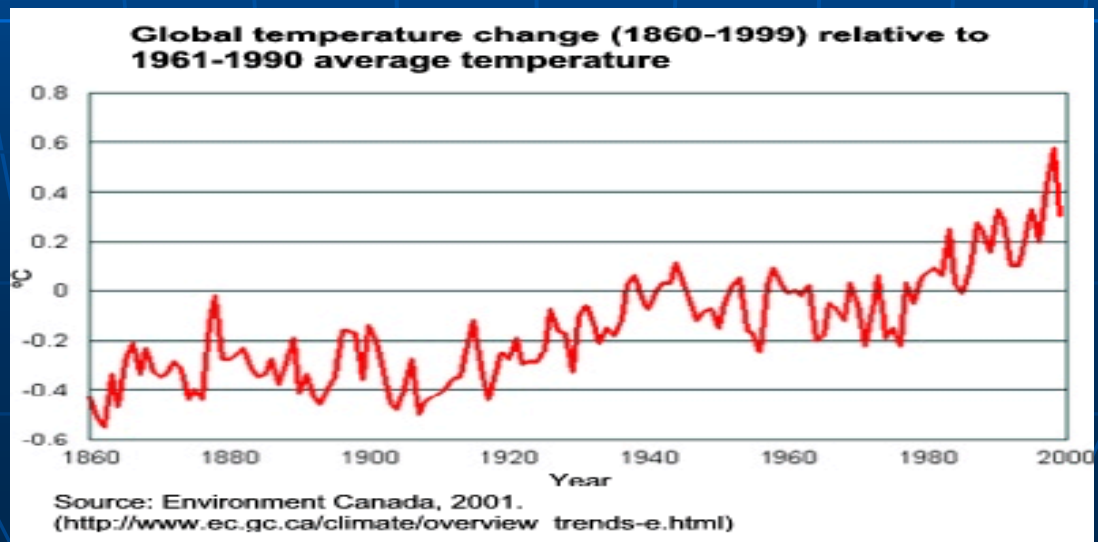
- Global trends
- National trends
- Pacific Northwest trends
- Puget Sound Region

(Source: http://www.afsc.org/locations/us/images/pacificNW.gif)

Building Block 1

- The global average temperature has increased during the 20th century and is forecasted to increase in the 21st century.

"[T]he globally averaged surface temperatures have increased by 0.6 ± 0.2°C over the 20th century" (IPCC, 2001)



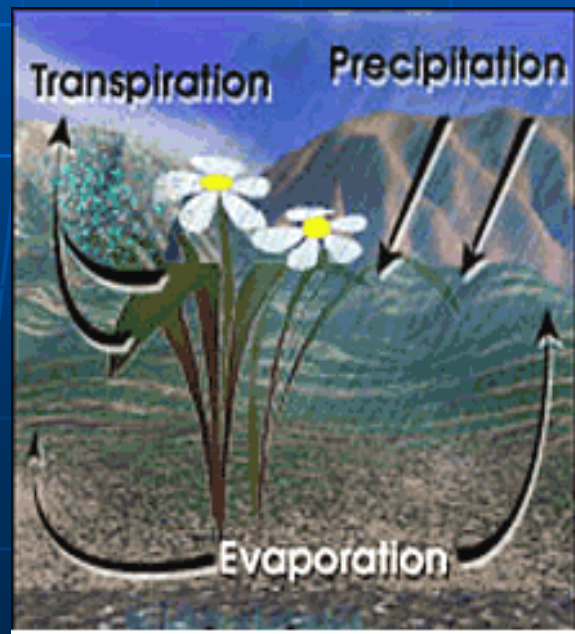
Building Block 2

- Warming in the Puget Sound has increased at a faster rate during the 20th century than the global average and increases in temperatures are forecasted to continue.

Building Block 3

- Increased surface temperatures in the Pacific Northwest will increase the rates of evaporation and transpiration (evapotranspiration).

  - "Streamflow during seasonal low flow periods would decrease in many areas due to greater evaporation; changes in precipitation may exacerbate or offset the effects of increased evaporation." (IPCC, 2001)



Hailey King, NASA, GFSC

Building Block 4

Global precipitation is projected to increase in the future, although there is less certainty in predicting changes in precipitation than in temperature.

(Source: http://www.nestucca.k12.or.us/tec/rain-drop.jpg)

- **“Based on global model simulations and for a wide range of scenarios, global average water vapour concentration and precipitation are projected to increase during the 21st century.” (IPCC, 2001)**

Building Block 5

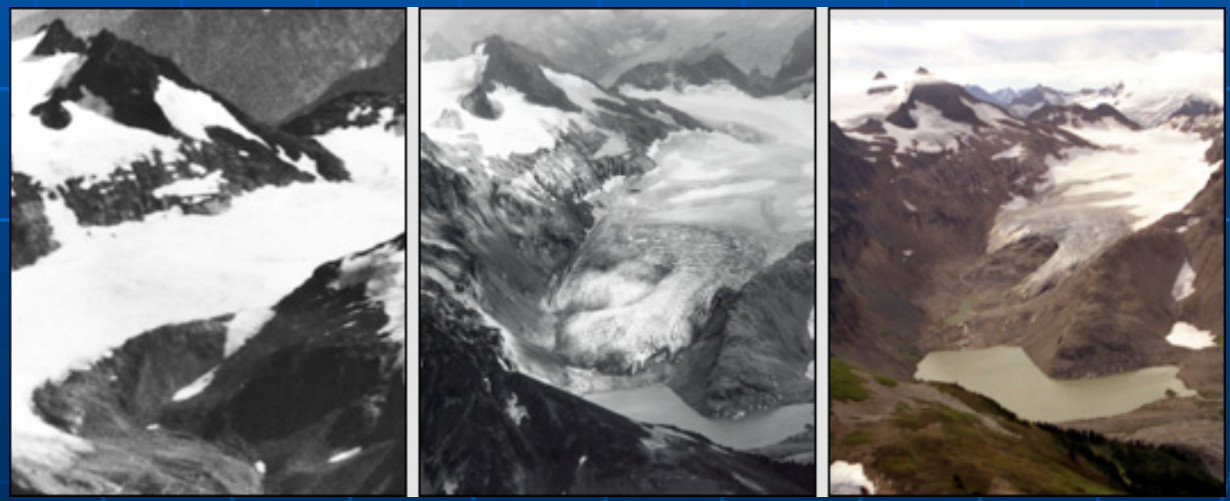
The occurrence of heavy precipitation events has increased over the U.S. during the 20th century. This trend is projected to continue during the 21st century.

Think, November of 2006!!

(Source: http://wwwpeople.arch.usyd.edu.au/~nigu6276/newpicture/rain-drop.jpg)

Building Block 6

The loss of snowpack and glaciers in the Pacific Northwest mountains has been due to increased temperatures in the 20th century.



1928
South Cascade Glacier, Washington

1979
South Cascade Glacier, Washington

2003
South Cascade Glacier, Washington

Building Block 7

Forecasted increases in temperatures associated with climate change will further reduce snowpack and glaciers in the Pacific Northwest mountains.

"Glaciers and ice caps are projected to continue their widespread retreat during the 21st century." (IPCC, 2001)

A North Cascades Glacier

(Source: http://www.nps.gov/archive/noca/journey/images/glaciers/glacier_classicsm.jpg)

Building Block 8

Climate change is projected to increase winter flows and decrease summer flows in snowmelt influenced river systems of the Pacific Northwest, particularly transient watersheds.

> “Available evidence suggests that global warming may lead to substantial changes in mean annual streamflows, seasonal distributions of flows, and the probabilities of extreme high or low-flow conditions.” (IPCC, 2001)

Building Block 9

- Climate change is projected to increase the frequency of flood events in most western Washington river basins.

(Source: http://kgsweb.uky.edu/download/misc/landuse/BUTLER/Image295.jpg)

Building Block 10

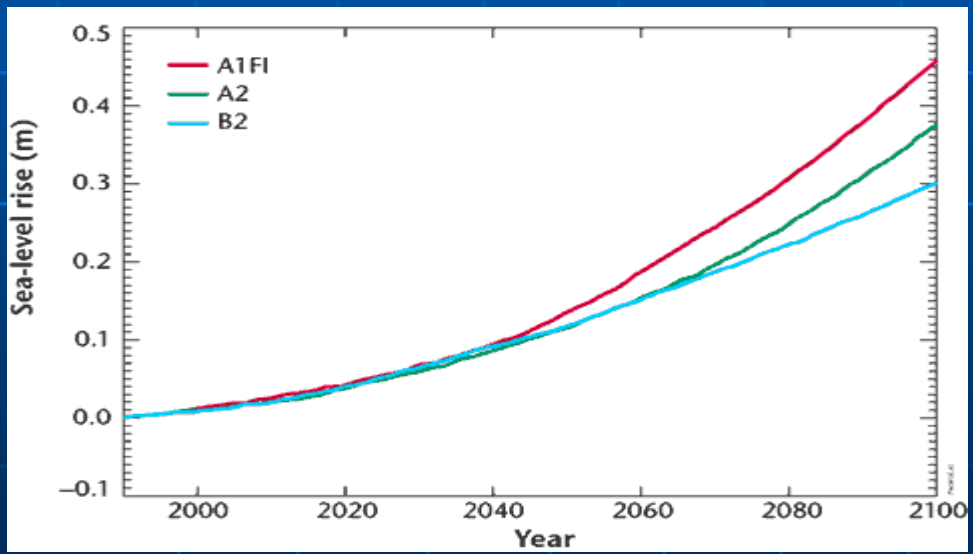
- Climate change is projected to increase the frequency of drought events in the Pacific Northwest.

(Source: www.ecy.wa.gov/programs/wr/drought/2005/images/photo/pic_lkroosevelt1.jpg&imgrefurl)

- "A change in mean flow or in variability could cause the physical infrastructure to be inadequate for the intended purposes or increase the risk of failure of the water resource system under extremes of drought or flood. In large water systems, such risks are buffered by robustness and resilience in the design of the system; smaller systems may be more vulnerable under climate scenarios beyond those considered in their design." (IPCC, 2001)

Building Block 11

- Climate change is forecasted to raise global mean sea level in the 21st century.



(Source: http://www.metoffice.gov.uk/research/hadleycentre/pubs/brochures/B2000/images/p7MEANSL.gif)

- "A number of these are particularly relevant for water utilities located in coastal areas, including:
  - 1) lowland inundation and wetland displacement;
  - 2) altered tidal range in rivers and bays;
  - 3) changes in sedimentation patterns;
  - 4) severe storm-surge flooding;
  - 5) saltwater intrusion into estuaries and freshwater aquifers[.]"

(Miller, K., D. Yates, C. Roesch and D. J. Stewart, 2005.)

Building Block 12

- Climate change is forecasted to increase temperatures of rivers, streams, lakes, and river mouth estuaries in the Puget Sound region.

(Source: http://www.veriscope.com/images/salmon-river-chinook-and-st.jpg)

"Looking toward the future, global warming is almost certain to lead to additional [warming] of the surface waters of Puget Sound and its tributary rivers as a result of the projected increases in regional temperatures and decreases in summer stream flow." (Snover, A. K., P. W. Mote, L. Whitely Binder, A.F. Hamlet, and N. J. Mantua. 2005.)

Building Block 13

- Climate change, as described in Building Blocks 1-12, is forecasted to contribute toward stream flow and temperature conditions that have been shown to negatively impact freshwater and estuarine habitat of most species of salmonids in the Puget Sound watersheds.

(Source: http://www.canadianrainforests.org/images/estuary.JPG)

Next Steps

- Develop appropriately evaluated climate impacted hydrology for the region
  - This will represent an optimistic, pessimistic, and middle of the road forecast.
- Provide this information to utilities for their evaluation of water supplies
- Aggregate this information into a regional evaluation of water supply

Summary

- Tri-County Planning Process provides opportunity to incorporate climate change into water supply planning
- Process is voluntary, so consensus is essential
- Climate Change Building Blocks provide common ground, and are based on observed recent past and peer reviewed literature
- Imagine the challenge of embracing the uncertainty of the future, when using the past is so comfortable!!
- Engaged professionals can shift a well established paradigm when need is clear

Summary

- www.tag.washington.edu
- http://www.govlink.org/regional-water-planning/index.htm#1
- Google:
  - Climate Change Building Blocks Regional Planning Process King County