SUSITNA-WATANA
HYDROELECTRIC PROJECT

Operations and Climate Change

Prepared by MWH

Agency Meeting on Initial Issue Identification and Study Concepts

October 24, 2011

ALASKA ENERGY AUTHORITY

Preliminary information, subject to change in future studies

Project Operations with Climate Change

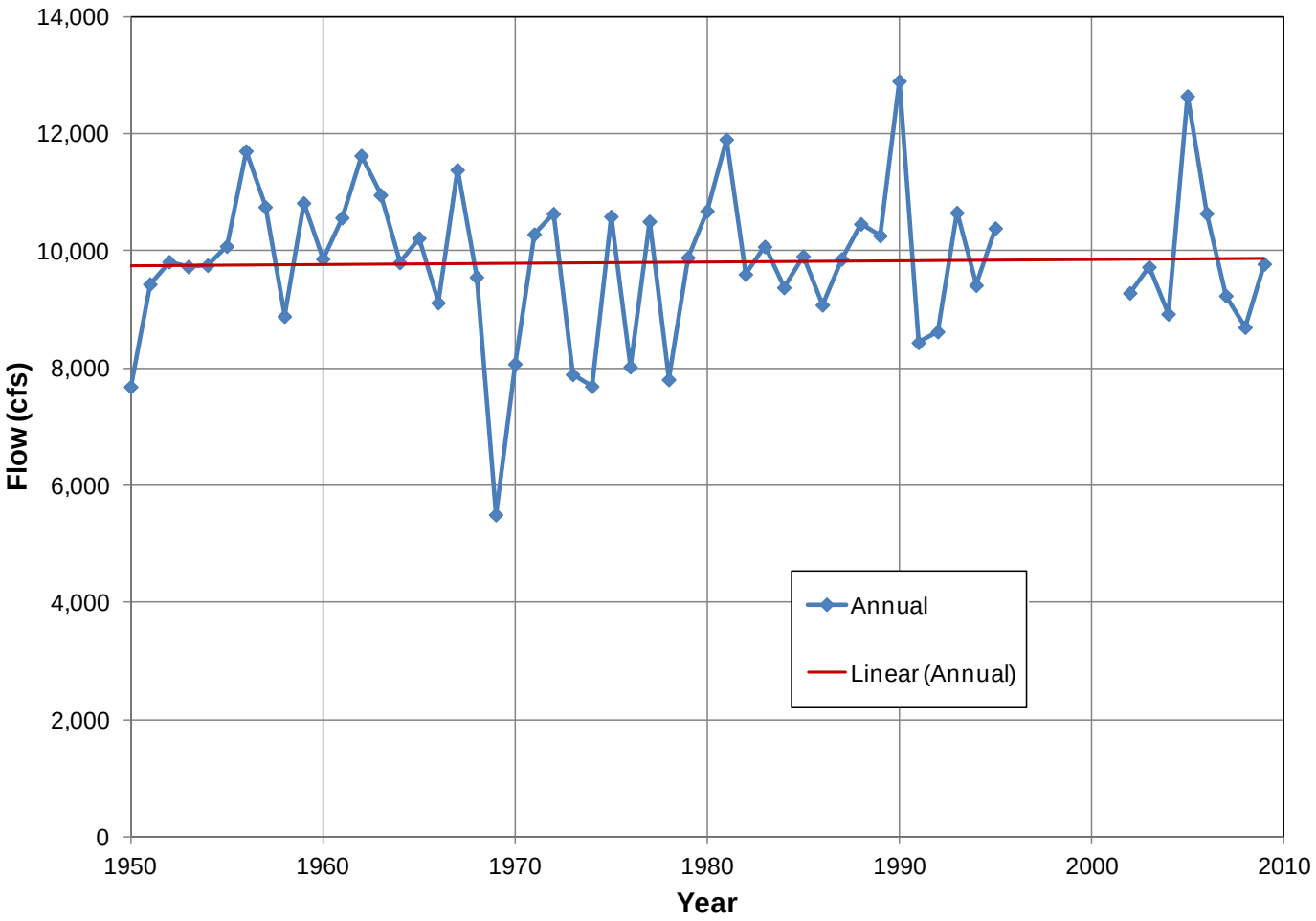
- Need for a preliminary, quantitative assessment of potential climate change impacts on Susitna-Watana operations
- Work-in-progress; all results and conclusions are preliminary
- Reconnaissance level – does not use an ensemble of 23 AOGCMs (Atmosphere-Ocean General Circulation Models) and multiple emission scenarios as in IPCC
- Temperature projections are considered to be more reliable than for precipitation and runoff
- Based on historic recorded flow data for the Susitna River

Preliminary Findings

Preliminary Hydrology Studies to date indicate:

1. Trend toward earlier snow and glacier melt runoff probably due to climate warming.
2. Slightly increasing Susitna River basin runoff expected in the coming decades.
3. Net positive effect on Susitna-Watana Project annual and firm power generation over time (increase).

USGS Gage at Gold Creek – Calendar Year Flows



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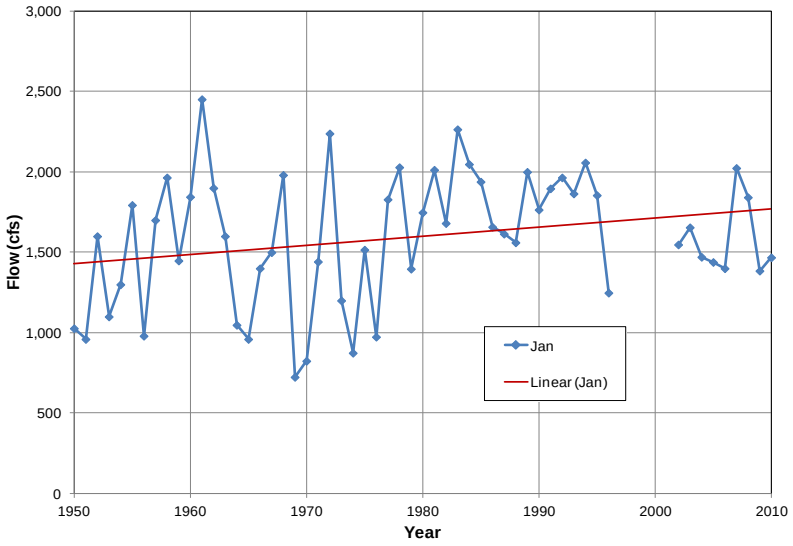
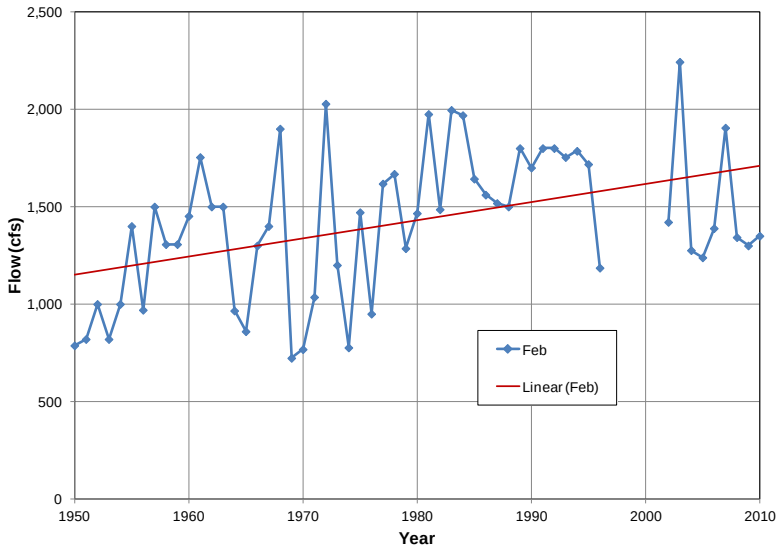
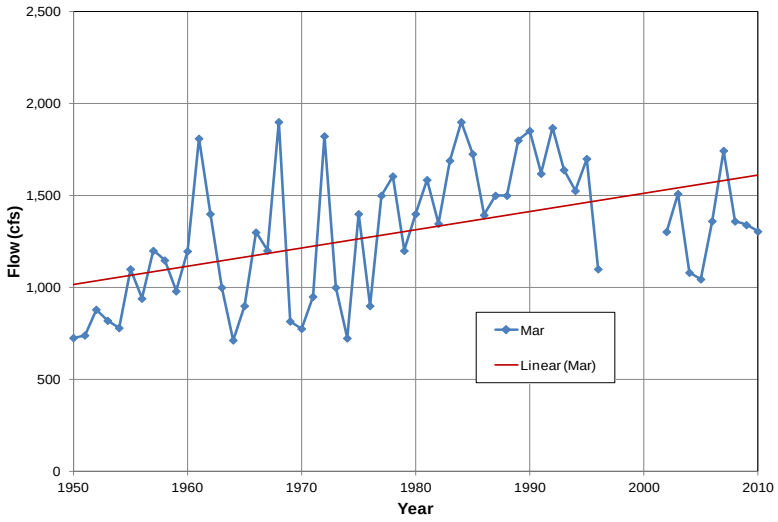
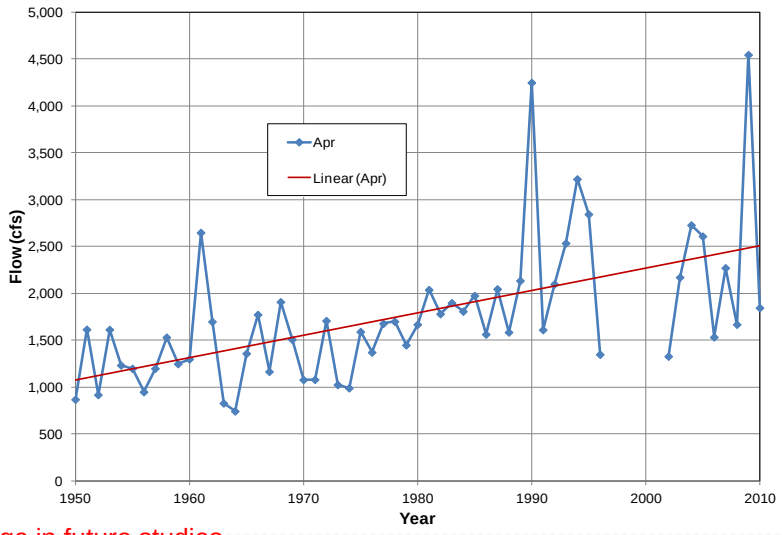
Gold Creek USGS Gage – Jan-Apr Linear Regression









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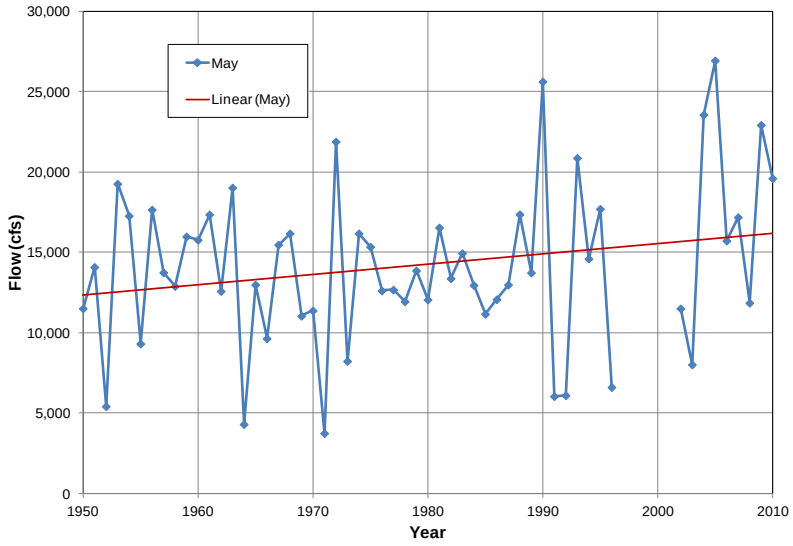
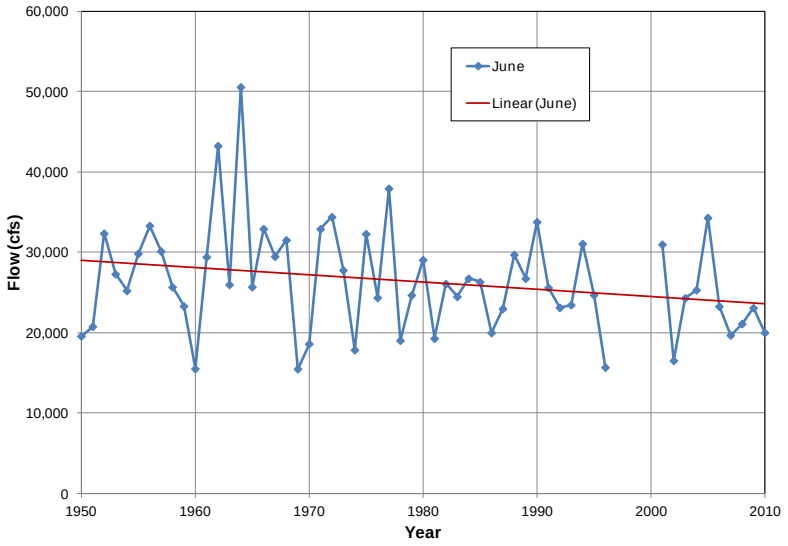
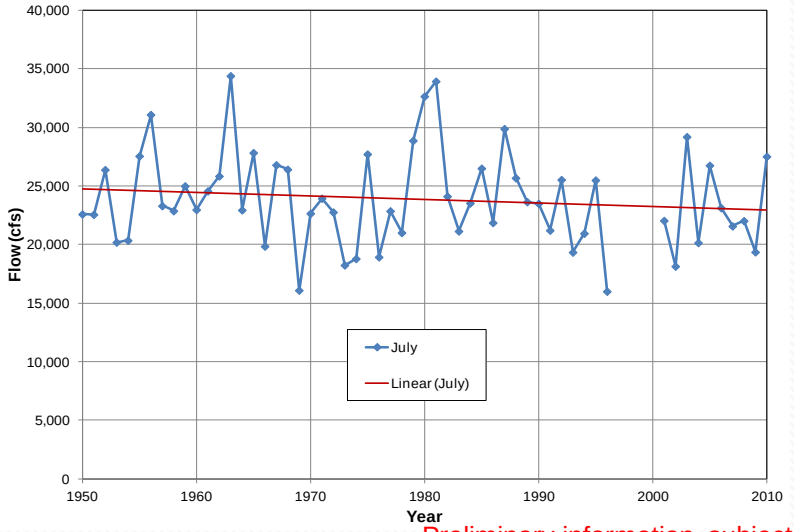
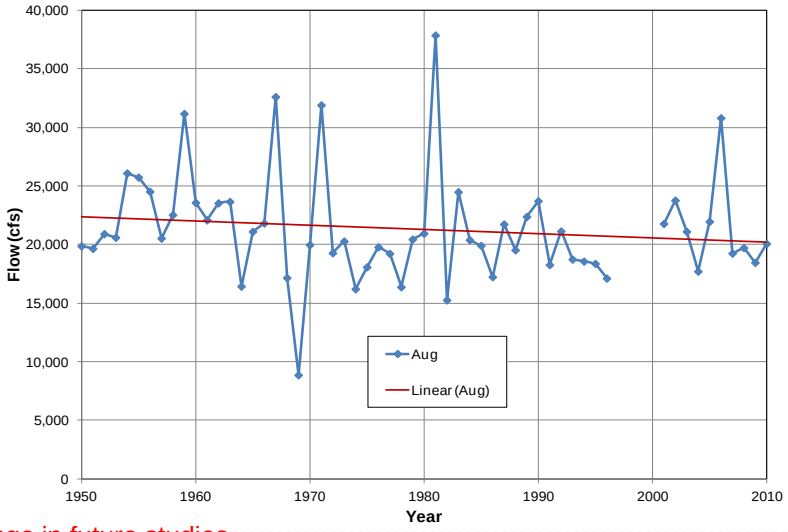
Gold Creek USGS Gage – May-Aug Linear Regression









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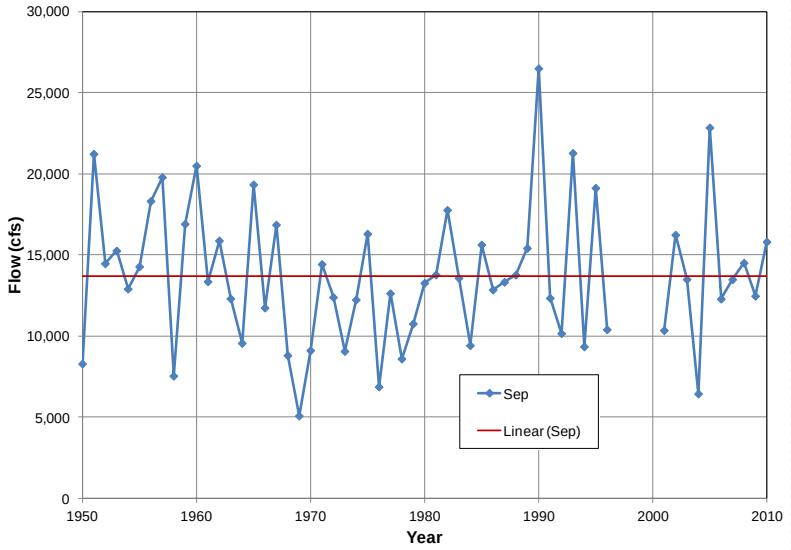
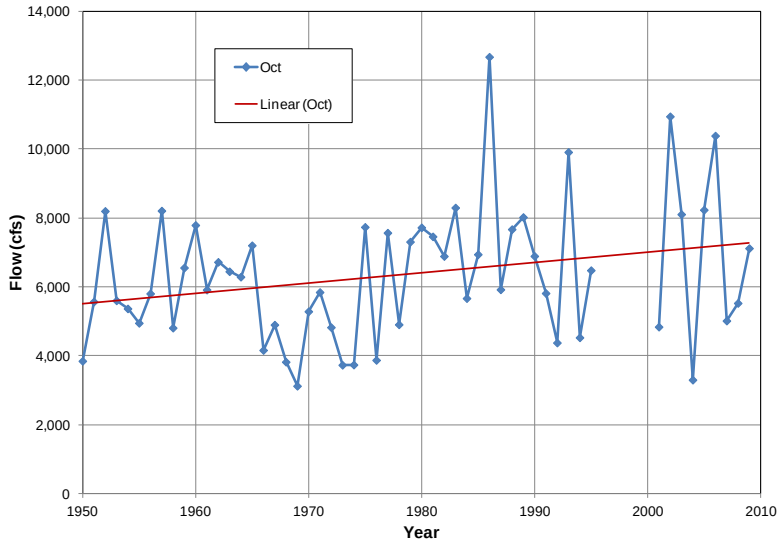
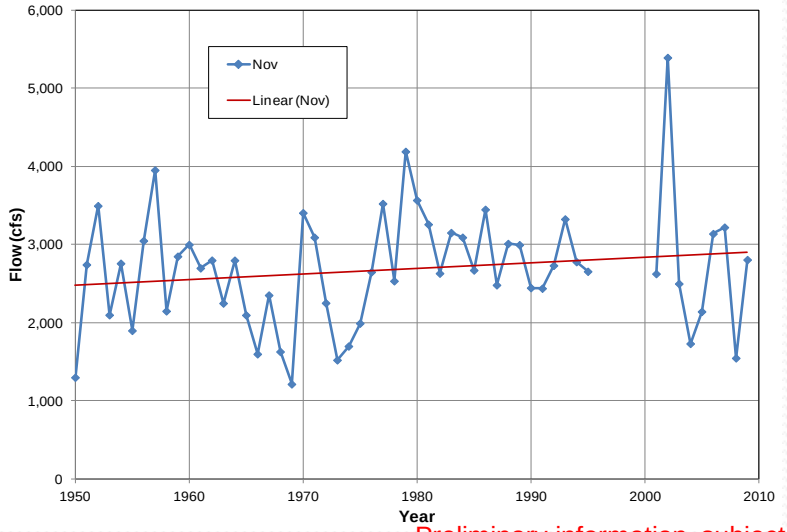
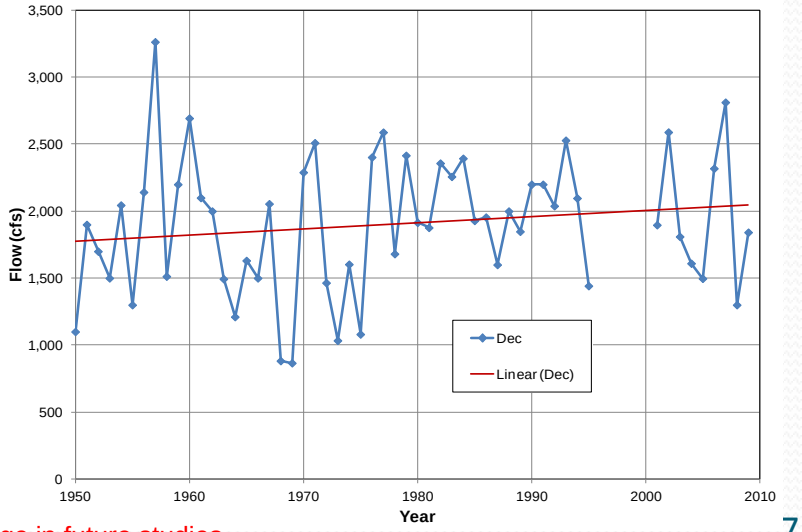
Gold Creek USGS Gage – Sep-Dec Linear Regression









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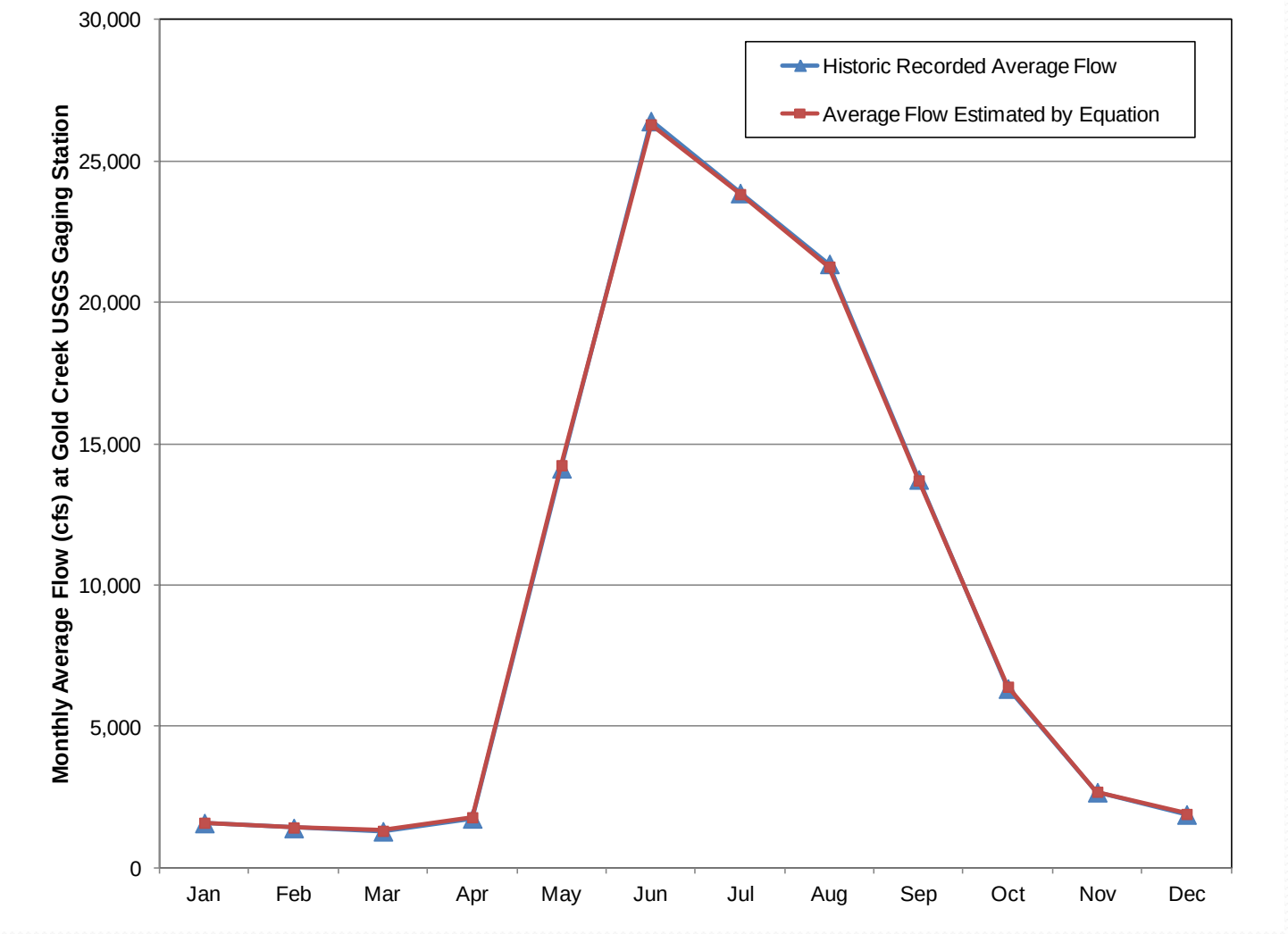
Check – Historic Averages from Equation



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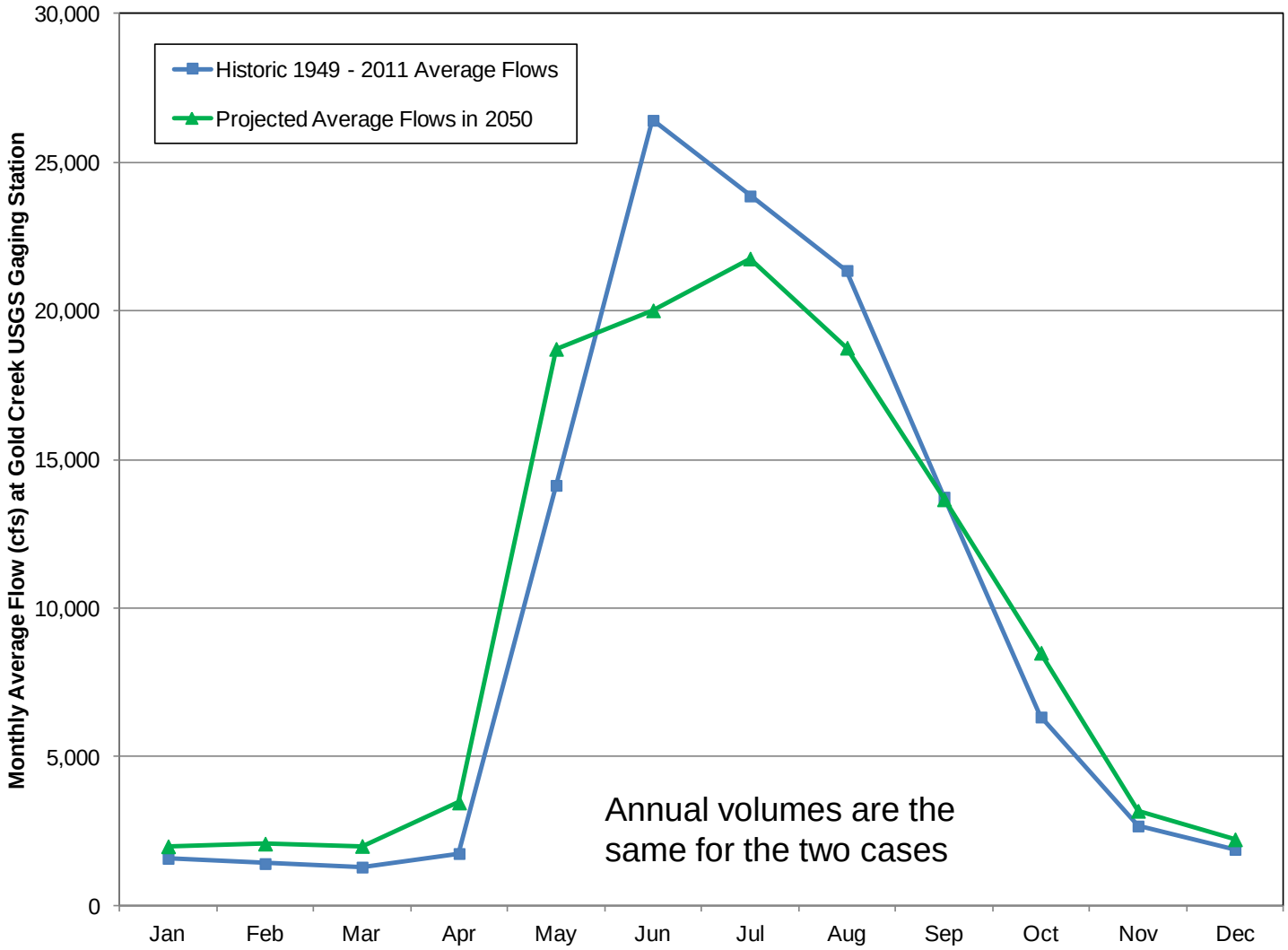
Gold Creek Historic and Projected Monthly Average Flows



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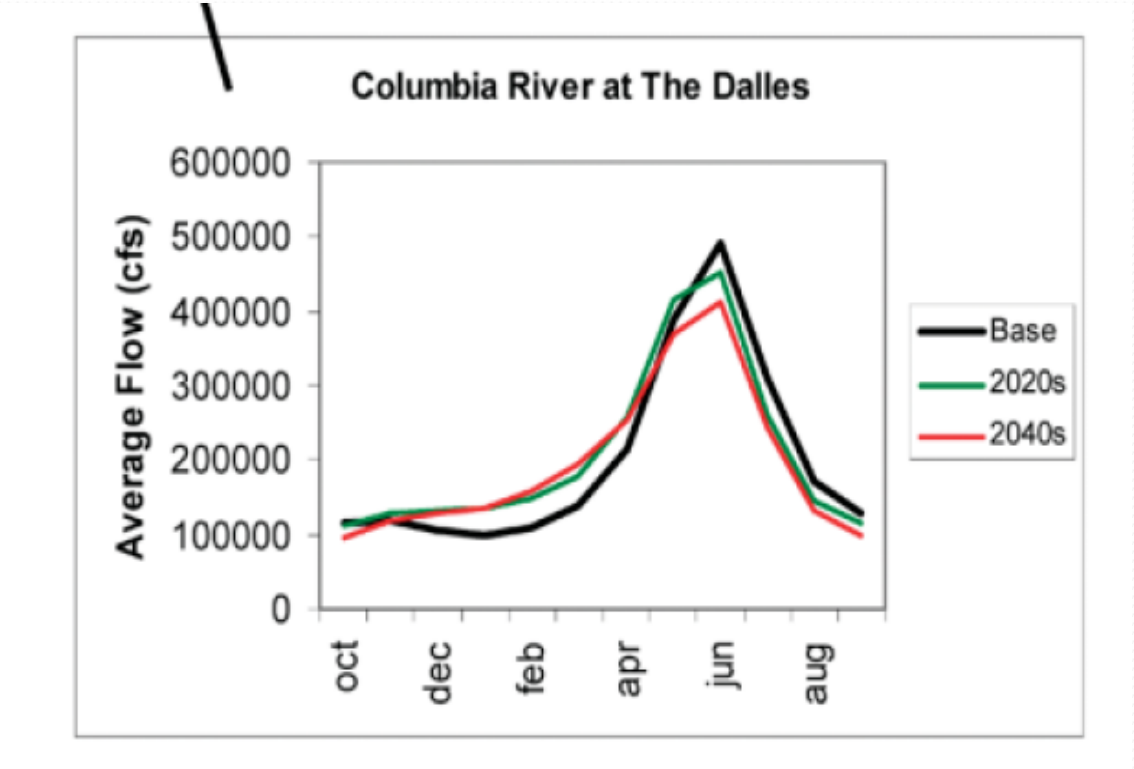
Results Comparison to Another Study



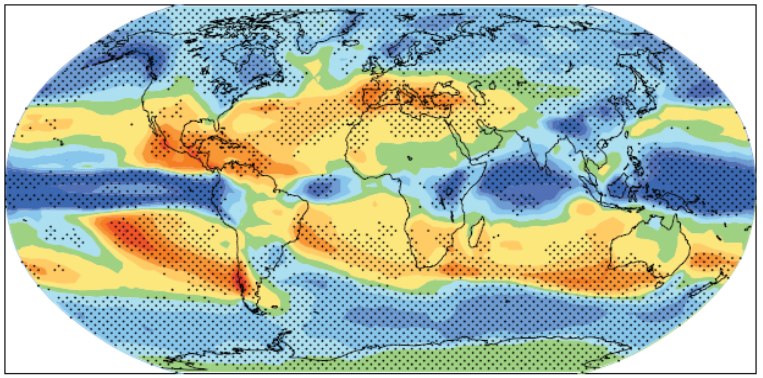
Source: “The Washington Climate Change Impacts Assessment”, by the Climate Impacts Group, University of Washington, June 2009.

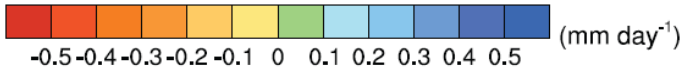
IPCC Model Projections

Source: “Climate Change 2007: The Physical Science Basis”, Intergovernmental Panel on Climate Change (IPCC), pg. 769.

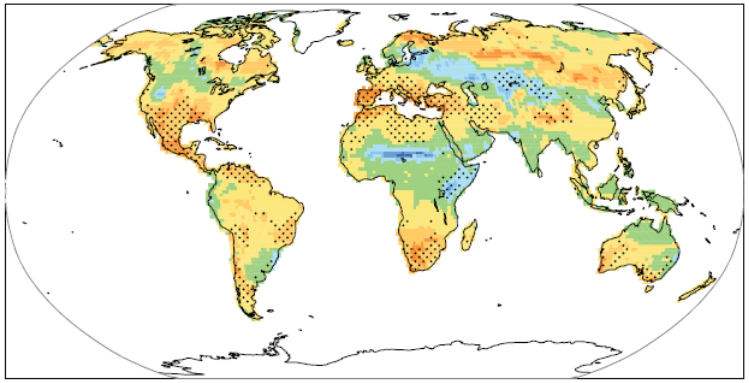
Figures represent changes in the annual mean for the period 2080 to 2099 relative to the period 1980 to 1999 for the SRES A1B scenario. (SRES refers to IPCC Special Report on Emissions Scenarios , 2000)

a) Precipitation

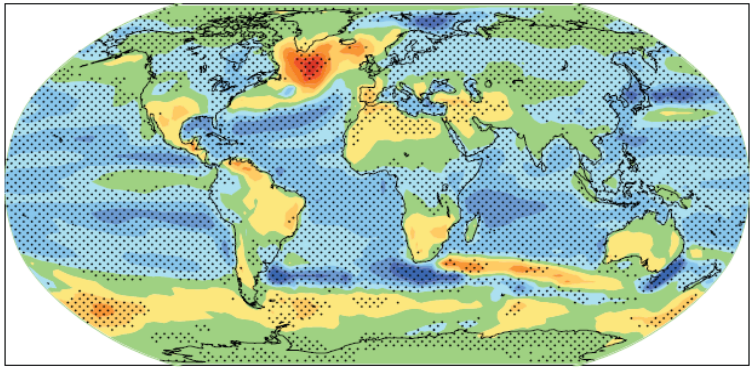


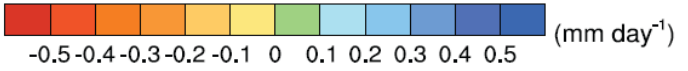


b) Soil moisture



d) Evaporation





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IPCC Temperature Projection

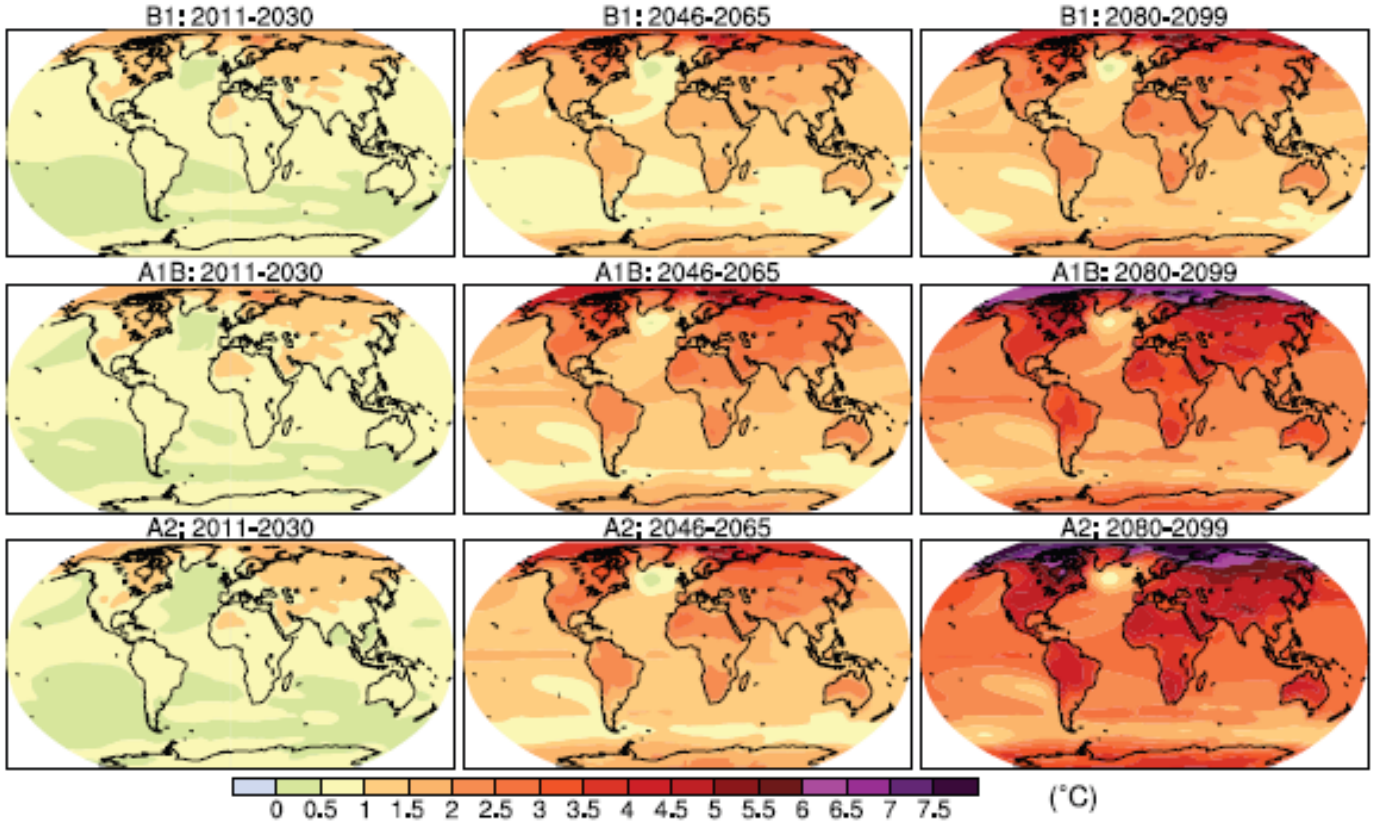
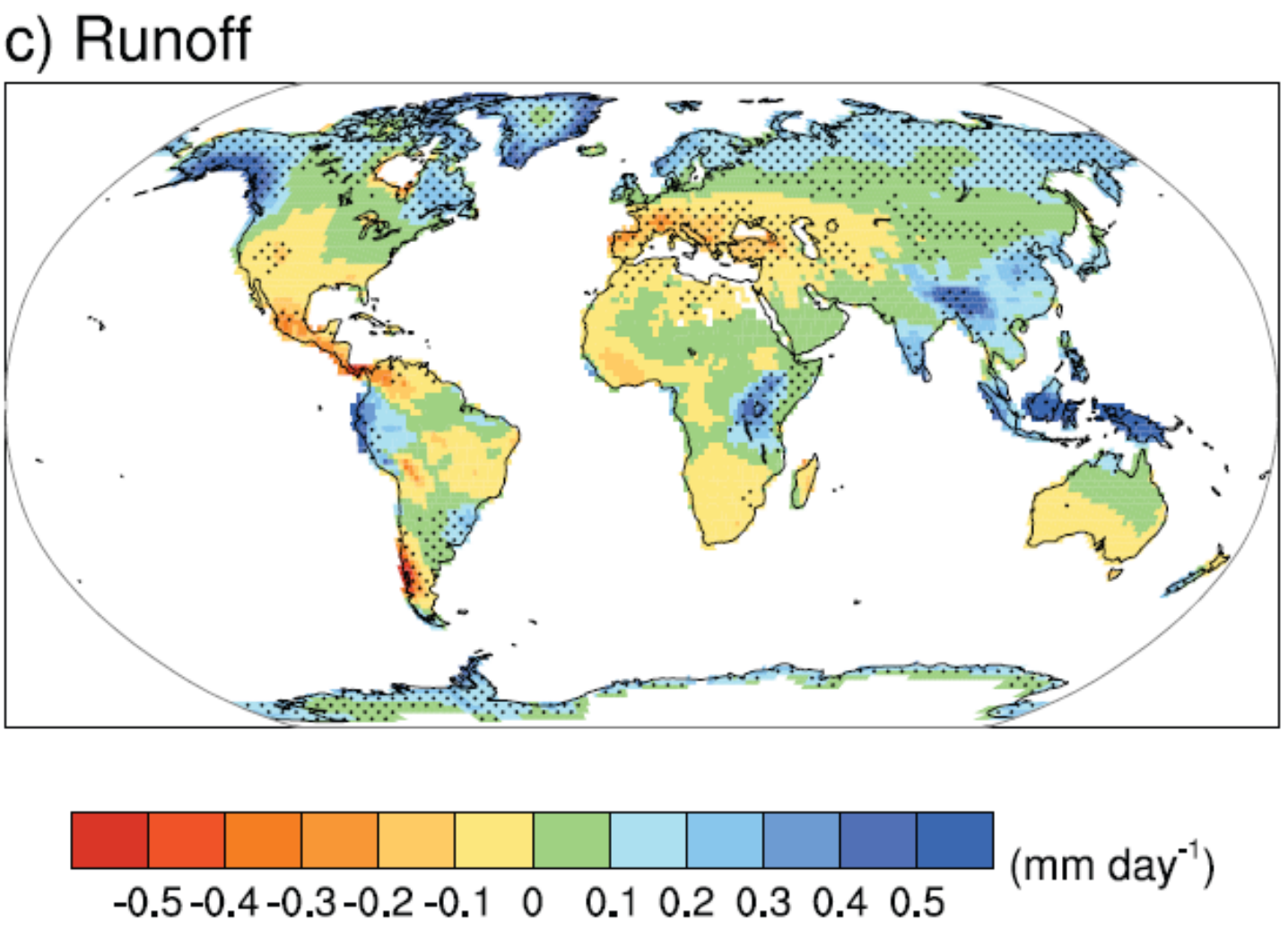


Figure 10.8. *Multi-model mean of annual mean surface warming (surface air temperature change, °C) for the scenarios B1 (top), A1B (middle) and A2 (bottom), and three time periods, 2011 to 2030 (left), 2046 to 2065 (middle) and 2080 to 2099 (right). Stippling is omitted for clarity (see text). Anomalies are relative to the average of the period 1980 to 1999. Results for individual models can be seen in the Supplementary Material for this chapter.*

Source: "Climate Change 2007: The Physical Science Basis", Intergovernmental Panel on Climate Change (IPCC), pg. 766.

IPCC Runoff Projection



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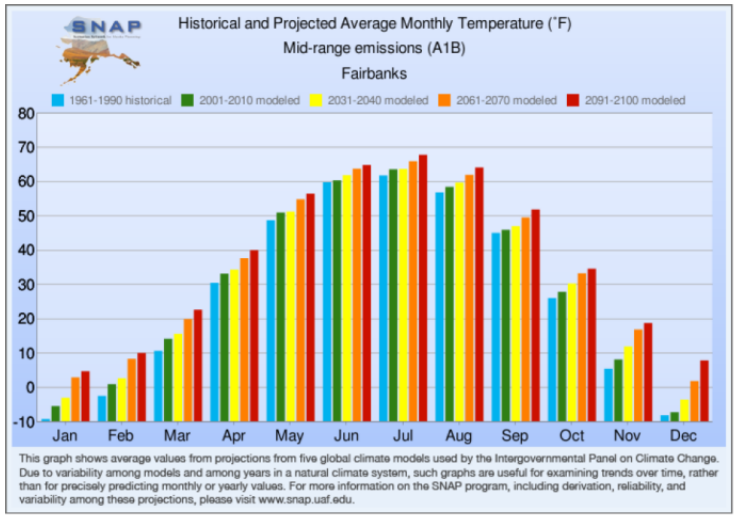
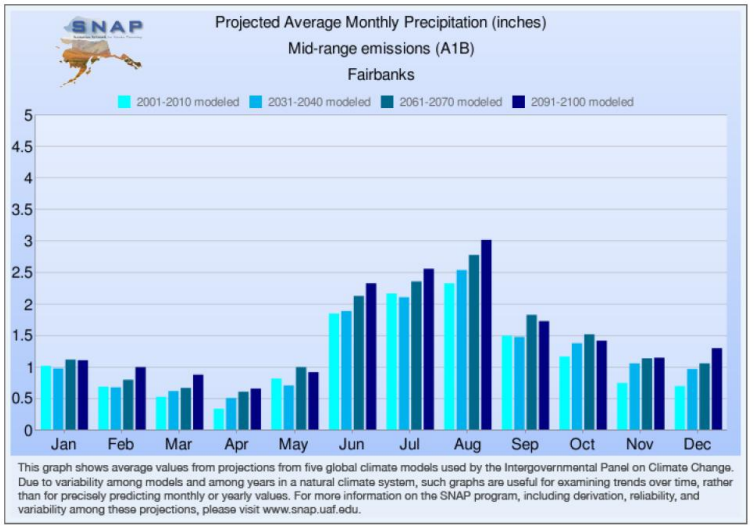
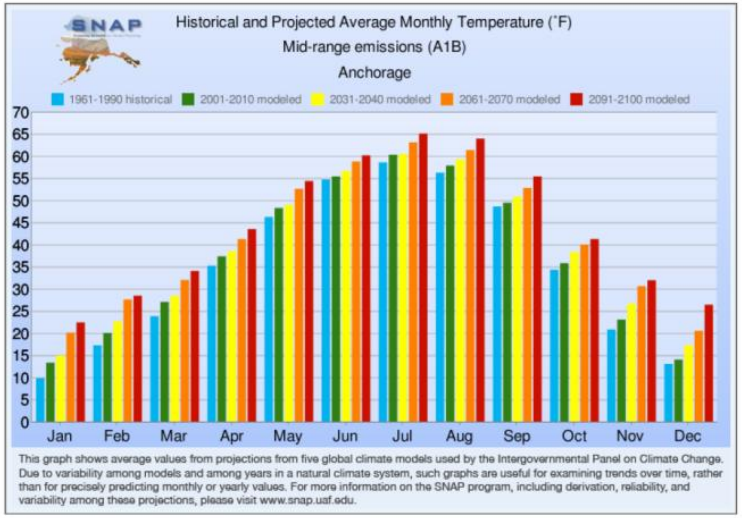
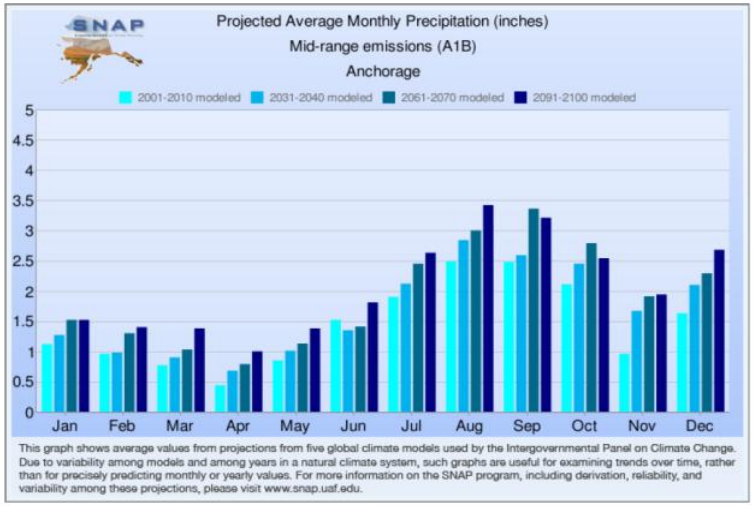
Scenario Network for Alaska Planning (SNAP)









Preliminary information, subject to change in future studies

Climate Change – Summary of Results

- Susitna River streamflow projection by equation appears to give reasonable results
- With projected seasonal changes in flow, but no change in annual average flow – in 2050 model, results show a 6% increase in firm energy and a 3% increase in average annual energy.
- IPCC model results show about a 10% increase in flow in the Susitna River vicinity by 2050.
- With projected seasonal changes in flow, and a 10% increase in average annual flow – in 2050 model, results show an 8% increase in firm energy and an 11% increase in average annual energy.
- All results are preliminary.

Climate Change – Next Steps

- Analysis of supporting data – long-term recorded temperature and precipitation
- SNAP results focused on Susitna River watershed
- Glacier effects – based on existing literature review
- Trend versus shift
- Pacific Decadal Oscillation (PDO)
- Other considerations?
- Quantitative projections on Project operations – adjustments or other scenarios
- Technical memorandum on climate change