FLOODS & DROUGHTS: A SIERRA NEVADA PERSPECTIVE

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The San Francisco Bay Estuary is at the receiving end of a cascade of climatic influences. Winter storms, droughts, El Niños and La Niñas, Pacific decadal regimes — all affect the Bay through changes in runoff from the Sierra Nevada. Therefore, climate variability is an important science topic with broad policy implications for long-term planning and adaptive management for the Bay.

Floods and droughts play particularly important roles in the Estuary and its watershed, not only because they inflict social and environmental damage, but because they can override water quality management strategies. Large-scale Pacific atmospheric systems always play a role, but there is no unique pattern that causes either flood or drought. For example, despite the varied large-scale climate conditions that prevailed during the 1987-1992 drought, which included both El Niños and La Niñas, that period yielded persistently low streamflow rates from the Sierra Nevada, and as a result, Bay salinities were persistently elevated.

Paleoclimatic records (from tree rings, lakes and coastal sediments) indicate that floods and droughts in California during the historical period (the last 100 years or so) are small and brief compared to climatic extremes experienced at other times during the last 1,000 years, during which time there have been much drier centuries, with 100-year droughts and extreme flood periods.

Climate change due to increasing greenhouse-gas concentration may soon augment such historical and prehistorical climate variations. With global warming would come less snowfall (less than 25% of current snowpack levels in certain areas by mid-century), more rainfall, earlier snowmelt and less spring and summer runoff. The dry summer regimes that typically result in the highest estuarine salinities would become more intense if Sierra Nevada streamflow declines earlier each year; winter floods could also become more severe. Indeed, Sierra Nevada streamflow has already begun to come earlier in the year, by about two weeks, leaving less runoff during the warm seasons (see graph).

Planning for the Estuary would benefit from improved understanding of the climatic and hydrodynamic variability of the Sierra Nevada (Dettinger, SOE 2001).

MORE INFO?

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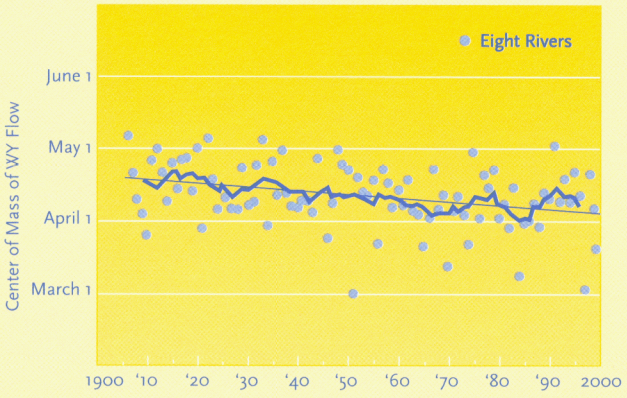
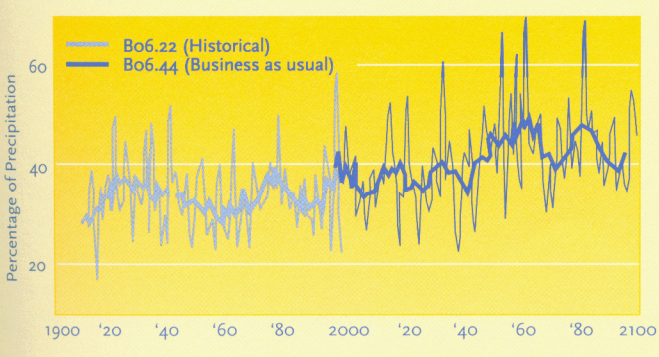
OBSERVED EARLIER STREAMFLOWS



Halfway dates for streamflow. During the past 50 years, streamflow from the Sierra Nevada has come progressively earlier in the year, as a result of warmer winter and spring temperatures over California which have fueled earlier snowmelts.

SIMULATED RAINFALL AS A FRACTION OF PRECIPITATION, MERCED RIVER BASIN



SCIENCE Questions

- To what extent did major, long-term droughts of the past 1,000 years in various parts of the Sierra Nevada affect the Bay and Delta?
- How likely are such droughts (and their wetter than normal complements) to recur within various planning horizons?
- What is the likely, plausible range of climate variations over the Bay, Delta, and their watersheds during the 21st century, given both past climate variations and projections of greenhouse warming?
- What are the most likely responses to such climate changes in terms of Delta inflows, Bay and Delta sediment budgets, and Bay and Delta ecosystems?