Exploring the use of Risk Analysis to study the effects of climate change on California's Central Valley water and power operations

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This presentation highlights research on the use of risk analysis to study climate change effects on California's Central Valley water and power operations, which are sensitive to regional air temperatures, precipitation timing and type, runoff timing and quantities, and sea level conditions. Much has been discussed about how to assess potential impacts from regional climate change, and how such assessments might inform long-term water resources planning. Recent approaches have involved analyzing broad ensembles of climate projection scenarios to reveal impacts uncertainty. This work features similar ensemble impacts analysis, but also features methods to estimate relative scenario probabilities. Integrating impacts and probability components across scenarios allows the discussion to move beyond assessment of potential impacts to assessment of risk.

The research considers two ensembles of 21st Century IPCC AR4 projections at two climatological horizons: "2011-2040" and "2041-2070". The ensembles are labeled: **impacts** and **uncertainty**. The **impacts** ensemble consists of 22 projection scenarios that have been statistically downscaled over the Central Valley watershed and subjected to scenario-specific impacts analyses on headwater runoff, reservoir operations, and managed stream temperatures. The **uncertainty** ensemble consists of 75 projection scenarios, including the nested **impacts** ensemble, and provides the basis for estimating relative scenario probabilities. Nonparametric techniques are used to separately construct functions describing the range and consensus among projected temperature, precipitation and joint temperature-precipitation conditions in the **uncertainty** ensemble. Scenario-weighting derived from climate model-weighting is considered in this construction, building from the assumption that a climate model's credibility in 21st century projection is related to its capability in recreating of 20th century climate statistics.

Methods will be presented on estimating climate projection uncertainty, their application to produce projection distribution functions specific to projection parameter(s) (i.e. temperature, precipitation, and joint precipitation-temperature), and how relative probabilities were extracted from these functions for **impacts** ensemble scenarios. Given how scenario probabilities differ depending on the reference function, the presentation will show how the characterized risk for several impacts metrics is affected by choice of reference function.