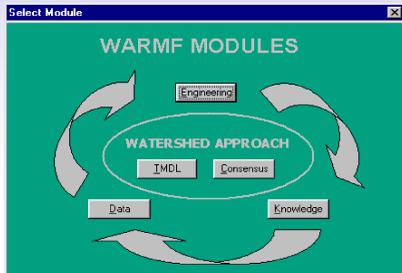


Decision Support System

for the effect of climate change on water supply in San Juan Basin

Carl W. Chen*, L. Weintraub, L. Chen, J. Herr, P. Rich (LANL), and R. Goldstein (EPRI)
 Systech Engineering, Inc.
 3180 Crow Canyon Place, Suite 260
 San Ramon, CA 94583
 Phone: 925-355-1780
 www.systechengineering.com

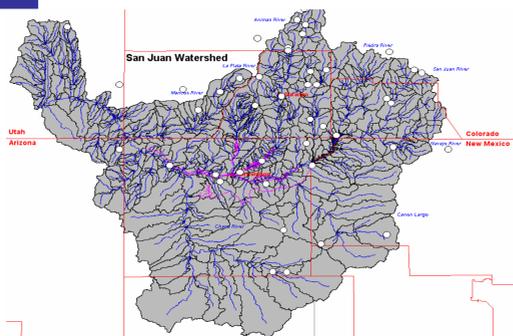
The Decision Support System (DSS)



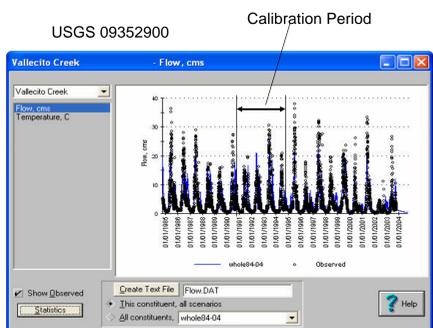
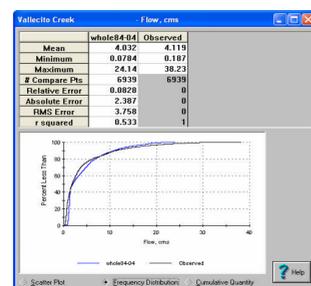
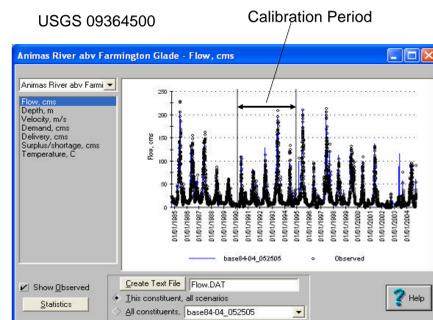
- Engineering module simulates hydrology and water quality of San Juan River Basin
- Data module supplies meteorological data to drive the model
- Consensus module presents the results (scientific facts) step-by-step for stakeholders to learn, evaluate, select and negotiate a management alternative that is scientifically correct and politically economically and socially acceptable

1 Set up the model

- 42,000 Km² of San Juan Basin were delineated into catchments, river segments and lakes
- 46 meteorology stations provided 19 years' data (1985-2004) to drive the model
- Stream flows of USGS gage stations provided data to compare against model predictions
- Calibration of flow simulation was made with data of 1990 to 1994.
- Verification was made with data of the entire 19 years



2 Prove the model correct



- Calibrate the model with 4 years' flow data at Vallecito Creek (USGS 09352900) where there is no diversion (fewer uncertainty in input data)
- Apply the calibrated coefficients to Animas River (USGS 09364500) with minor adjustment of initial soil moisture
- Verify the model with 19 years meteorological and flow records.

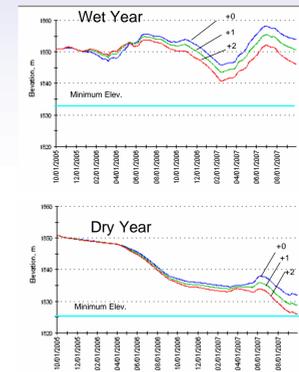
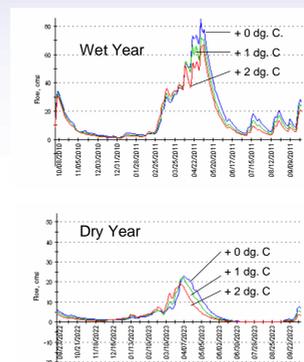
Acknowledgement

The project was funded by the National Energy Technology Laboratory (NETL) of DOE through the ZeroNet Water-Energy Initiative of Sandia National Laboratory, Los Alamos National Laboratory (LANL), Electric Power Research Institute (EPRI), and Public Service Company of New Mexico (PNM).

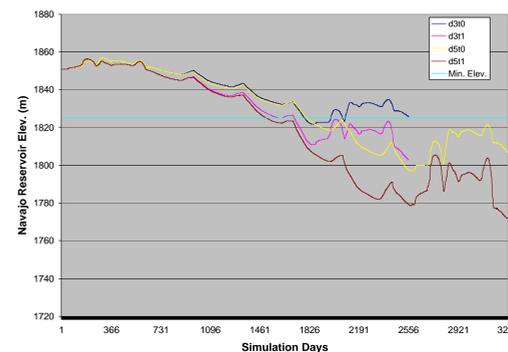
San Juan Water Commission, New Mexico Interstate Stream Commission, Colorado Department of Water Resources, US Bureau of Reclamation, PNM, Navajo Nation Department of Water Resources, Water Shortage Sharing Group provide inputs to the study.

3 Quantify global warming effect

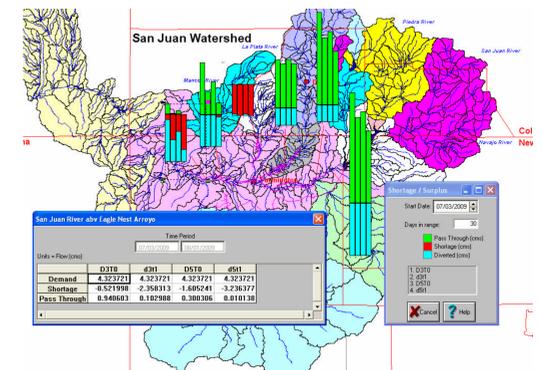
Effect on hydrograph of San Juan River Effect on Navajo Reservoir Elevation



4 Effect of global warming + drought

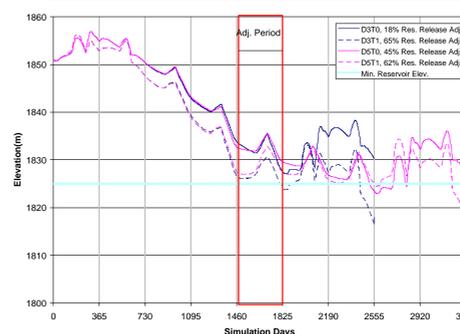


Global warming and drought can go hand in hand. Model calculates the combined effect of global warming in conjunction with 3, 5 years drought on the water surface elevation of Navajo Reservoir. The required minimum pool elevation is 1825 meters above MSL.

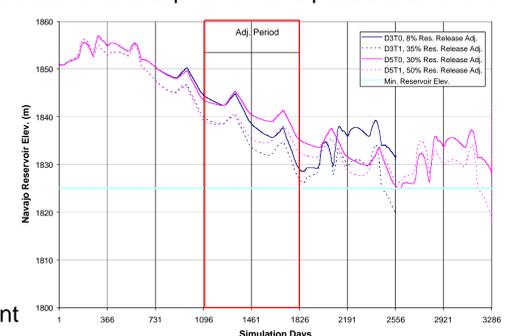


The model also calculates the water shortage at various sub-regions of San Juan Basin under various scenarios of global warming + drought sequence.

5 Adaptive operational adjustment

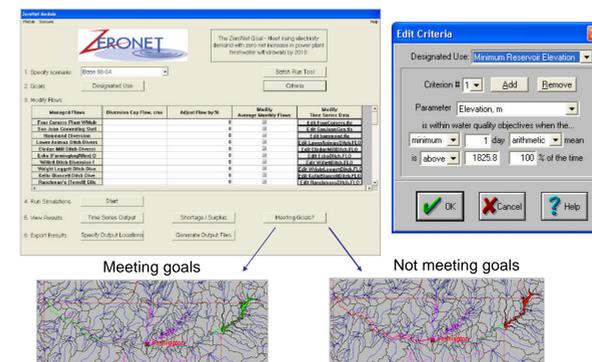


The DSS forecasts problem and possible solutions.



Early decision reduces the need for drastic adjustment

6 Water shortage sharing plan



- Stakeholders can propose a water shortage sharing plan (reduce reservoir releases and diversions).
- The DSS determines whether the plan can meet the water quantity and quality goals of intended uses.
- The river sections meeting goals are shown in green and the sections not meeting goals are shown in red on GIS maps to show the plan's acceptability.
- The conflict of the needs to maintain reservoir elevation and/or water diversions are negotiated in the participatory decision making process.