WATER – POSTER #40

An assessment of the hydrologic impacts of climate change in the Snake River Basin

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In this research we assess the hydrologic impacts of climate change in the Snake River basin (SRB). The SRB is a major residential and agricultural area located in southern Idaho. It is a managed watershed with numerous hydraulic structures to regulate streamflow. We used the climate model data sets developed based on the Multivariate Adaptive Constructed Analogs (MACA) (Abatzoglou, Brown, 2011) method. MACA is a statistical downscaling method which has been used to downscale 14 Global Climate Models of the Coupled Model Intercomparison Project 5 (CMIP 5) to 1/24th degree spatial resolution for historic periods and future Representative Concentration Pathway (RCP) scenarios. We use this data set to obtain minimum and maximum daily temperature, daily mean wind components and daily precipitation. The MACA data is then upscaled to 1/16th degree resolution using bilinear interpolation for use as the driving inputs to the Variable Infiltration Capacity (VIC) macroscale hydrologic model. To account for major interactions between groundwater and surface water (gw/sw) in the basin, the VIC model is coupled with the United States Geologic Society's MODFLOW model on a two week time step over the Eastern Snake Plain Aquifer (Jin and Sridhar, 2010). This coupled model is used to generate naturalized streamflow to a few selected locations throughout the basin in order to integrate flows in the planning model. The Shuffled Complex Evolution (Duan, 1994) method was used to calibrate the streamflow. The calibrated naturalized streamflow is used for routing through the managed river and reservoir network. To model this system, we used the SRB planning model (SPM), developed by the United States Bureau of Reclamation, which has been used for water management planning in the Snake River basin. Our results of this study show how the basin might respond to climate variability via streamflow, demands, and gw/sw interactions.