

Use of Regional Climate Information for Hydrologic and Water Resources Applications

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In the western U.S., water is a scarce, and often limiting resource. Growth of population, both within the region and elsewhere, has created pressures for more efficient management of water. Many of these efforts focus, with considerable justification, on management of water demand, and development of better tools, like water marketing, that have the potential to reduce water demand conflicts. Management of water supply is more problematic, as the total amount of water available for beneficial use is more or less constrained, and opportunities for creation of additional storage facilities that might help to better align supply and demand in terms of point and time of use are now minimal. However, there is considerable opportunity for more efficient management of both water supply and demand if more accurate forecasts of future runoff could be provided. Much of the annual runoff of most western rivers (by some accounts, over 70% for the West as a whole) originates as snowmelt. In many cases, quite accurate forecasts of runoff of snowmelt-dominated rivers can be made at or near the time of maximum snow accumulation in early spring. However, prior to the beginning of winter snow accumulation, the accuracy of methods currently used in practice is no better than climatology. There appears to exist considerable potential for development of streamflow forecasting methods that make use of climate information, with lead times of several months to a year or so.

Nonetheless, notwithstanding recent improvements in climate forecast skill, climate forecast information is only occasionally used by water resources managers. Instead, traditional forecast methods continue to be the primary means by which seasonal runoff forecasts, and associated water management decisions (like winter drafting of reservoirs for flood protection, and hydropower marketing) are made. A major hurdle in use of climate forecasts for water management is lack of regional specificity, and spatial resolution sufficient to allow use of forecast information at the river basin scale. An approach developed by the University of Washington's Climate Impacts Group in collaboration with NCEP's Environmental Modeling Center is designed to remove this constraint. Six month lead ensemble climate forecast information derived from NCEP's Global Spectral Model (GSM) downscaled to drive the Variable Infiltration Capacity (VIC) macroscale hydrology model at one degree spatial is described. The study area is the Columbia River basin upstream of The Dalles, OR (about 500,000 km² drainage area). GSM six month forecasts are downscaled directly to the 1/8 degree VIC scale. Preliminary ensemble forecasts produced using this method during an evolving regional drought are reviewed; as are a number of issues associated with bias in the GSM forecast ensembles.