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Model-based Estimation of Maximum Precipitation for the 1997 Storm Event Over American River Watershed, California, USA

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A model-based 72-hour maximum precipitation was estimated for American River Watershed (ARW) in California by means of the proposed methodology using a regional numerical atmospheric model, MM5. The NCEP/NCAR reanalysis data was dynamically downscaled by means of MM5 that was calibrated and validated by the PRISM data. Then, the 1997 storm event, one of the largest storm events over ARW in the recent history, was maximized by the modifications of the model boundary and initial conditions. The initial and boundary conditions in the outer domain of the atmospheric model were modified by three methods. The first method is maximizing the atmospheric moisture by setting the relative humidity hundred percent. Second, the storm event duration was examined with maintaining equilibrium atmospheric condition. Third, the boundary conditions are shifted northward and southward. It was found that these modifications of the model boundary conditions significantly increased the precipitation over ARW. These results clearly indicate the importance of wind and moisture conditions at the boundary of the atmospheric modeling domain. These artificially maximized storm yielded 549 mm of 72-hour precipitation depths by the combination of the humidity and storm duration maximization, and 541 mm by shifting the atmospheric conditions to the ones toward south by 5.0 degrees. Consequently, the 72-hour maximum precipitation of the 1997 event over ARW could be maximized up to 550 mm. As this study presents only a demonstrative maximization work, these results suggested that the numerical atmospheric modeling can be utilized as a potential alternative to the standard Probable Maximum Precipitation (PMP) estimation without depending upon the linear relationships required in the standard PMP method.