Probabilistic description of probable maximum precipitation

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Probable Maximum Precipitation (PMP) is the key parameter used to estimate probable Maximum Flood (PMF). PMP and PMF are important for dam safety and civil engineering purposes. Even if the current knowledge of storm mechanisms remains insufficient to properly evaluate limiting values of extreme precipitation, PMP estimation methods are still based on deterministic consideration, and give only single values. This study aims to provide a probabilistic description of the PMP based on the commonly used method, the so-called moisture maximization. To this end, a probabilistic bivariate extreme values model is proposed to address the limitations of traditional PMP estimates via moisture maximization namely: (i) the inability to evaluate uncertainty and to provide a range PMP values, (ii) the interpretation that a maximum of a data series as a physical upper limit (iii) and the assumption that a PMP event has maximum moisture availability. Results from simulation outputs of the Canadian Regional Climate Model CanRCM4 over North America reveal the high uncertainties inherent in PMP estimates and the non-validity of the assumption that PMP events have maximum moisture availability. This later assumption leads to overestimation of the PMP by an average of about 15% over North America, which may have serious implications for engineering design.