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APPLICATION OF COPULA-BASED MARKOV MODEL TO GENERATE MONTHLY PRECIPITATION

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In this study, a framework for stochastic simulation of monthly precipitation is presented. The framework incorporates the concept of Markov process and the copula function to preserve the first order persistence considering the dependent relationship of two successive monthly precipitations. Copula functions have the advantage of easily connecting individual marginal probability distribution functions. Typically, copula functions are more appropriate to generate random variate simultaneously due to their simplicity of determining the dependency structure between two or more variables. In this study, the proposed Copula-based Markov model is applied to several rainfall gauging stations in South Korea and their performance is evaluated using various performance measures. As a result, generated monthly rainfalls can represent more efficiently variability of precipitation.

Figure 1 compares the probability density functions of generated monthly precipitation with those of observed monthly precipitation. Table 1 also provides the brief summary of statistical properties of generated precipitations as well as observed precipitations.

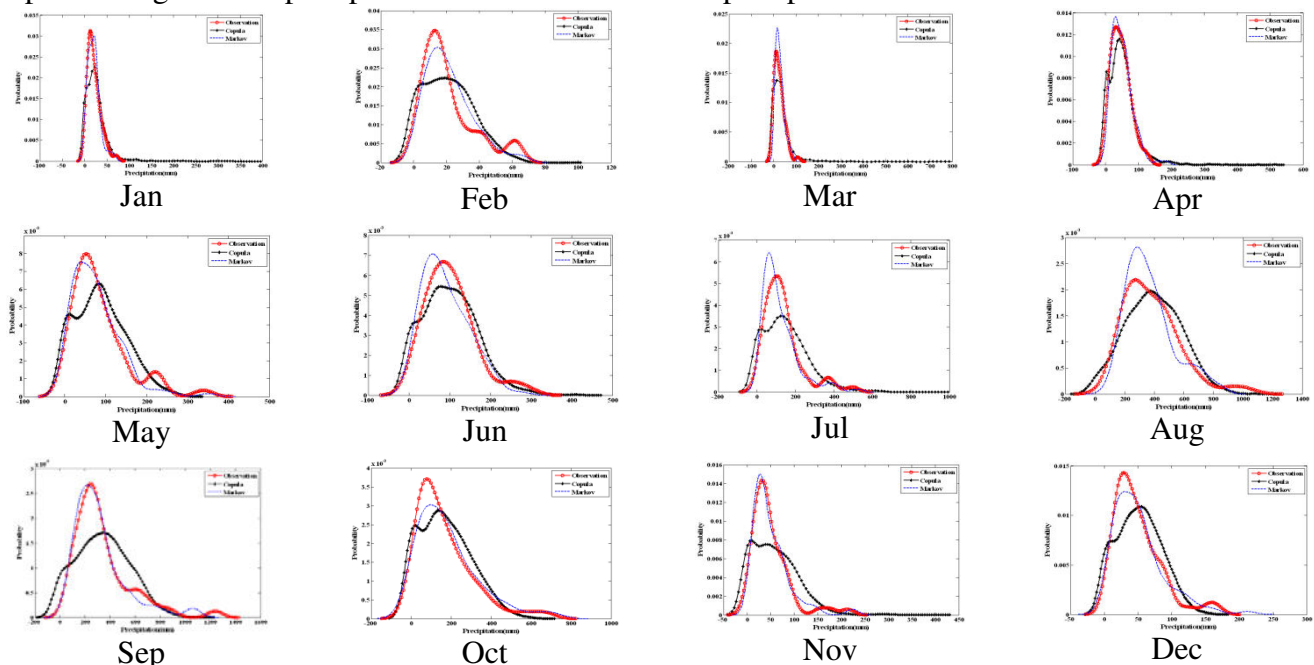


Figure 1 Comparison of the PDFs observed and generated precipitation.

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Table 1 Basic statistics of observed and generated precipitation.

	Month	Mean	Std	Skew	Max	25%tile	50%tile	75%tile	Serial CC
Observed precipitation	1	20.8	16.3	1.21	62.6	10.4	16.5	28.0	0.12
	2	25.	22.3	1.33	108.1	6.4	20.5	36.2	-0.03
	3	45.2	28.3	0.74	123.5	25.3	41.5	60.6	-0.14
	4	84.3	67.8	1.60	338.8	41.8	62.4	103.0	0.26
	5	100.7	60.5	1.02	291.3	59.6	85.5	126.6	0.01
	6	133.5	99.4	1.72	497.2	68.1	111.4	165.0	0.19
	7	383.4	187.0	1.21	1014.0	242.2	348.9	487.8	-0.26
	8	336.1	227.8	1.75	1237.8	193.3	271.7	418.8	0.13
	9	167.3	143.3	1.53	671.5	61.1	127.6	236.4	-0.02
	10	49.9	41.8	2.06	214.5	25.6	39.7	66.9	0.17
	11	49.5	34.9	1.43	164.8	26.4	41.1	66.6	0.22
	12	21.4	14.7	1.21	71.4	11.1	16.7	27.8	-0.26
Generated precipitation	1	20.9	15.2	0.51	88.1	8.4	19.8	31.4	0.02
	2	39.7	95.6	11.11	1775.1	5.7	25.0	43.2	-0.03
	3	50.6	47.7	3.15	513.9	23.5	43.9	68.1	-0.20
	4	87.5	61.8	0.44	282.6	39.4	83.2	129.0	0.21
	5	101.2	67.7	0.63	416.5	53.0	98.5	145.6	-0.01
	6	150.6	128.4	2.22	1443.9	61.1	135.0	215.5	0.22
	7	393.4	187.1	0.11	1081.8	256.2	391.1	528.7	-0.25
	8	341.4	211.0	0.24	1046.3	184.3	338.9	485.8	0.14
	9	170.0	127.7	0.51	605.7	69.6	156.7	255.8	0.00
	10	58.3	49.6	1.28	388.9	17.7	51.4	88.8	0.19
	11	51.3	32.7	0.25	155.1	26.9	50.9	74.9	0.09
	12	26.2	31.1	7.86	585.9	10.4	22.0	33.8	-0.27