EGU General Assembly 2022

EGU22-10822

Extreme rainfall quantile estimation based on SSP scenarios: Focusing on the Hangang river basin

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Introduction

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Floods

Drought

Disaster

Methodology

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5 RCMs Ensemble Model
: 1km spatial resolution

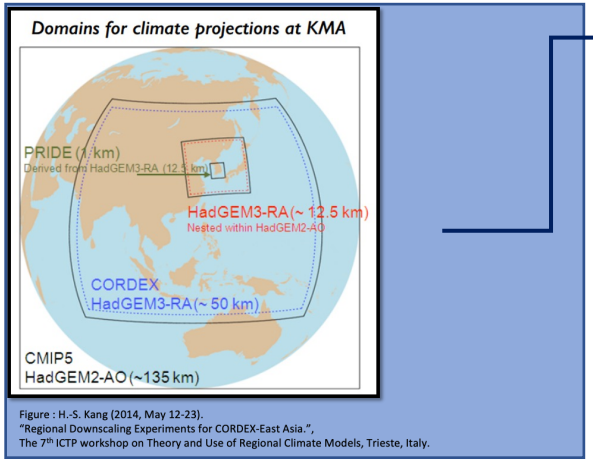
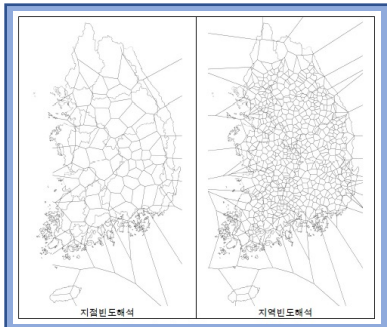


Figure : H.-S. Kang (2014, May 12-23).
"Regional Downscaling Experiments for CORDEX-East Asia.",
The 7th ICTP workshop on Theory and Use of Regional Climate Models, Trieste, Italy.



Regional Frequency Analysis (RFA)
: GEV distribution & L-moments

Climate Change Scenario
(Precipitation Data)

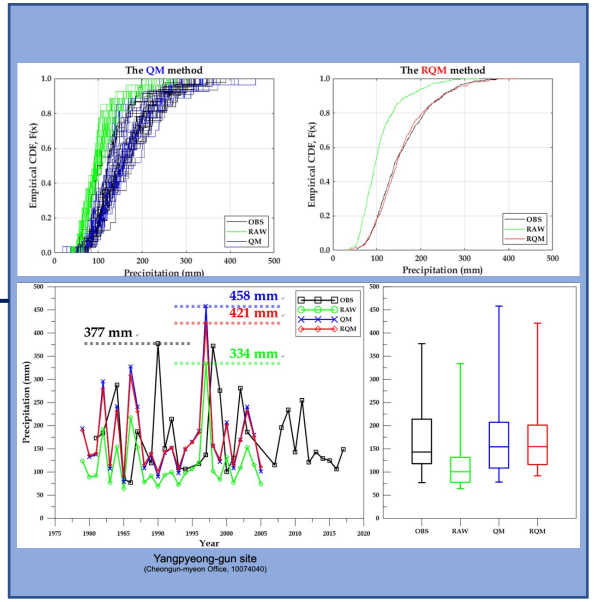
Extract AM Data

Bias Correction

Rainfall Quantile
Estimation

Comparison

Procedure of this study



Regional Quantile Delta Mapping
(RQDM, Kim et al., 2021)

Application

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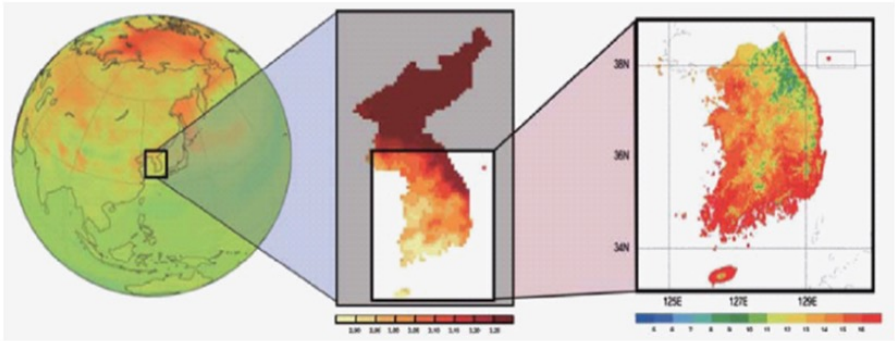
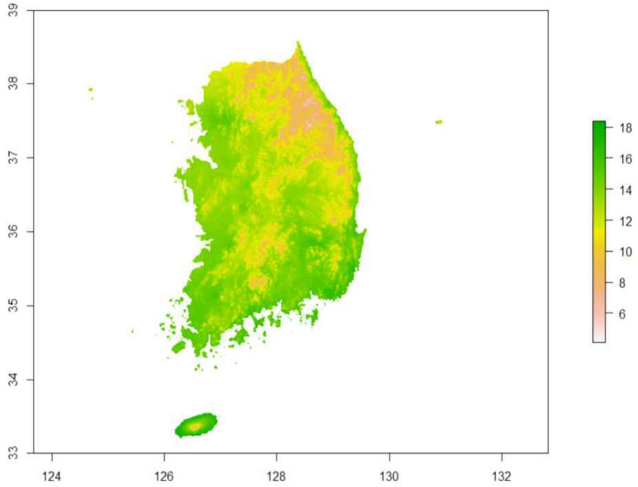




Ensemble GCM model (135km) : K-ACE UKSEM1

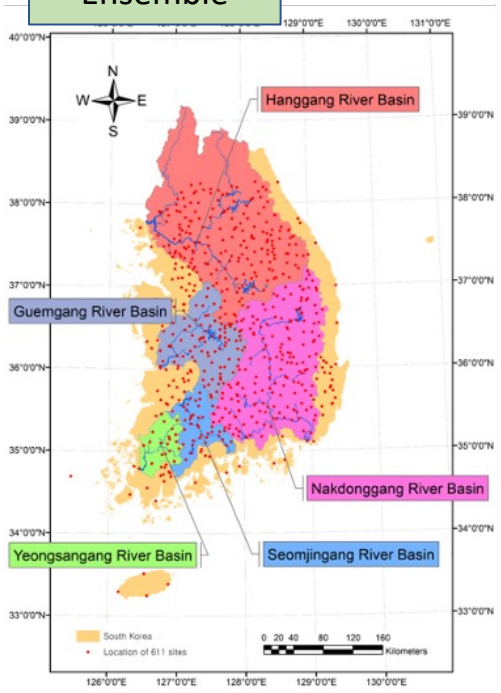
RCM models (25km) : HadGEM3-RA WRF CCLM GRIMs RegCM4

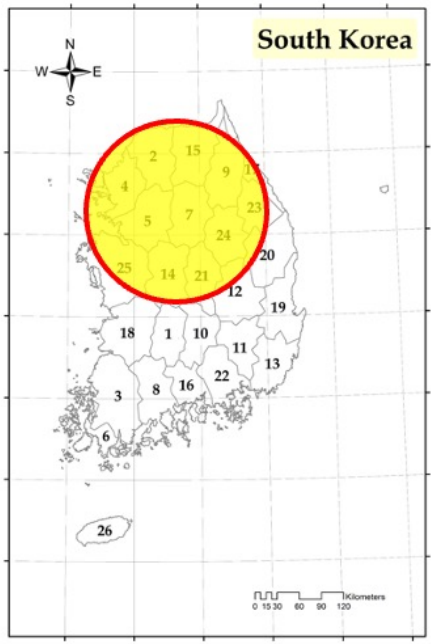
RCM models (1km) : HadGEM3-RA WRF CCLM GRIMs RegCM4

Ensemble

dynamic downscaling

statistical downscaling





Hangang river Basin

Region	R2	R4	R5	R7	R9	R14
no. of sites	26	22	36	26	31	4
Region	**R15**	**R17**	**R21**	**R23**	**R24**	**Total**
no. of sites	24	5	8	14	15	**211**

Results

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Historical period (S0: 2000-2019)

Mean value of statistical measures for 211 sites

SSP126

	2	3	5	10	20	30	50	70	80	100	200	300	500
RMSE	67.54	83.62	102.11	126.25	150.44	164.84	183.39	195.89	200.92	209.43	236.68	253.26	274.91
MAE	66.66	82.53	100.65	124.06	147.19	160.78	178.05	189.53	194.12	201.81	226.00	240.37	259.38
ARE	-0.455	-0.472	-0.487	-0.500	-0.509	-0.513	-0.518	-0.520	-0.520	-0.521	-0.523	-0.524	-0.523
RMSE	14.86	16.44	18.38	21.49	25.86	29.25	34.58	38.80	40.64	43.92	55.88	64.17	76.03
MAE	13.14	14.25	15.56	17.43	19.62	21.89	26.09	29.57	31.12	33.89	43.70	50.47	60.10
ARE	-0.090	-0.082	-0.075	-0.067	-0.061	-0.057	-0.051	-0.048	-0.047	-0.044	-0.036	-0.031	-0.024

SSP545

	2	3	5	10	20	30	50	70	80	100	200	300	500
RMSE	70.18	85.30	100.64	117.24	129.83	135.35	140.23	142.11	142.55	142.88	140.69	137.22	131.02
MAE	69.15	84.12	99.25	115.50	127.57	132.64	136.73	137.88	137.97	137.62	132.20	125.57	113.21
ARE	-0.472	-0.482	-0.482	-0.469	-0.446	-0.428	-0.403	-0.383	-0.375	-0.361	-0.311	-0.297	-0.278
RMSE	11.38	12.09	11.93	13.23	21.17	29.35	43.08	54.22	59.11	67.90	100.49	123.57	157.40
MAE	9.75	10.14	9.91	10.91	17.60	24.93	37.59	47.87	52.35	60.34	89.38	109.63	138.98
ARE	-0.051	-0.040	-0.020	0.012	0.050	0.074	0.108	0.131	0.141	0.158	0.214	0.231	0.249

Results

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Future period (S1: 2021-2040 / S2: 2041-2060 / S3: 2061-2080 / S4: 2081-2100)

Mean value of change ratio for 211 sites

	SSP126		SSP585	
	T=100yr	T=200yr	T=100yr	T=200yr
S0/OBS	-1.81	-2.27	-1.81	-2.27
S1/S0	**15.78**	**21.37**	-4.41	-3.62
S2/S0	4.41	4.54	-8.23	-9.05
S3/S0	-3.42	-4.33	**17.93**	**21.86**
S4/S0	-2.99	-2.25	5.32	6.38

Conclusion

In this study, we focused on the effects of extreme rainfall based on the SSP scenarios in Hangang river basin, South Korea.
In addition, the relative changes in each future period (S1, S2, S3, S4) were compared.

In the **SSP126** scenario of S1 period, the increasing tendency was expected about 16% (T=100yr). In the **SSP585** scenario of S3 period, the increasing tendency was expected about 18% (T=100yr). The largest increase was expected in the **SSP585** scenario of S3 period compared with other cases, however, the largest uncertainty was indicated in this scenario (**SSP585**) and period (S3).

Further studies will be conducted not only on the other major river basins, but also on the changes for the future flood quantiles.

Thank you.

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ACKNOWLEDGEMENT

This research was supported by Basic Science Research Program through the National Research Foundation of Korea(NRF) funded by the Ministry of Education (NRF-2021R1I1A1A01061272).