

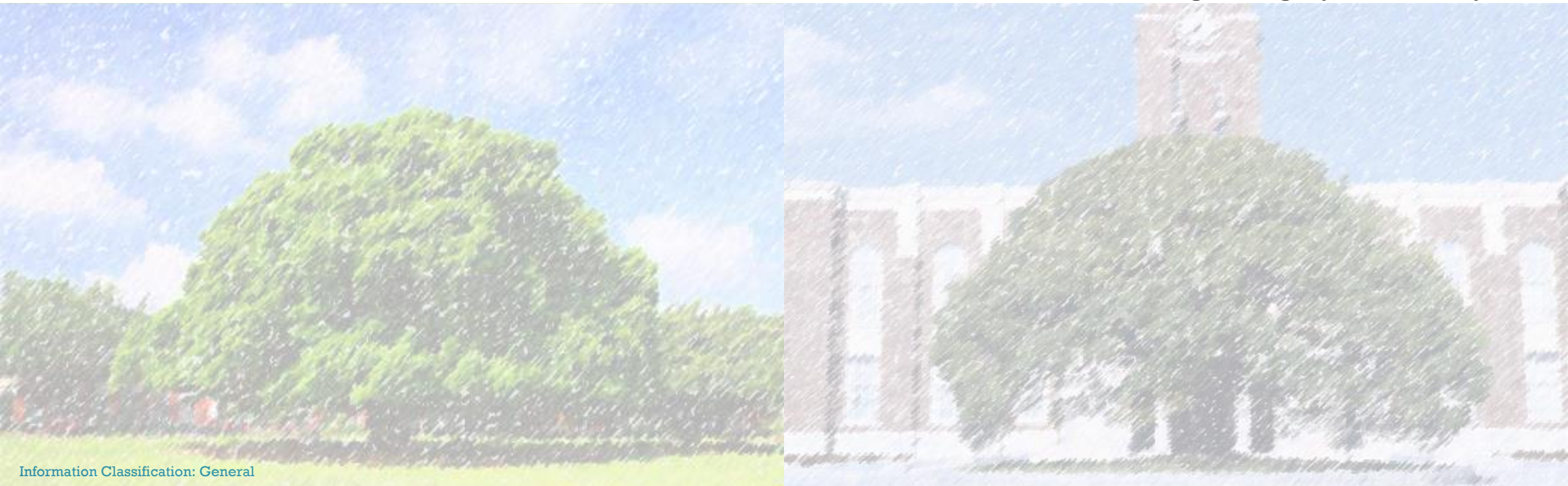
ANALYSIS OF FUTURE PRECIPITATION CHANGES IN TAIWAN USING ENSEMBLE CLIMATE CHANGE SCENERIO DATABASE, D4PDF.

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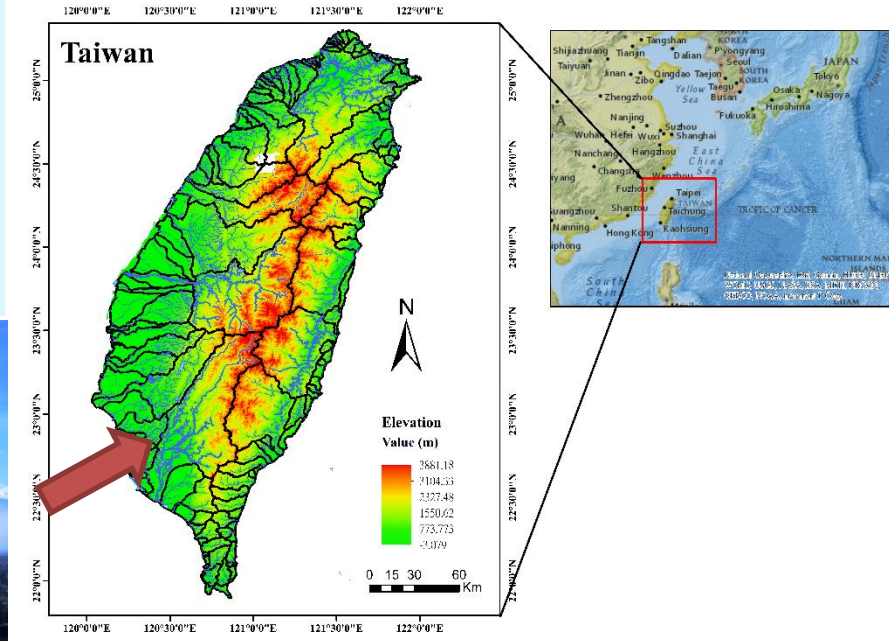
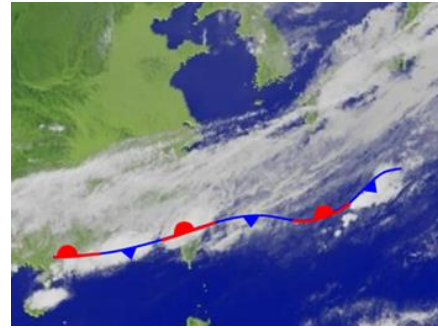


Atmospheric

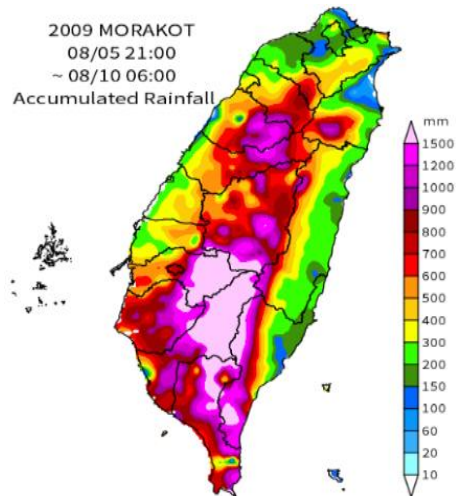
- 1) Stationary front (May - June)
- 2) Typhoon (July - October)
- 3) **Monsoon - Southwest monsoon**
(June - September)

Geographical

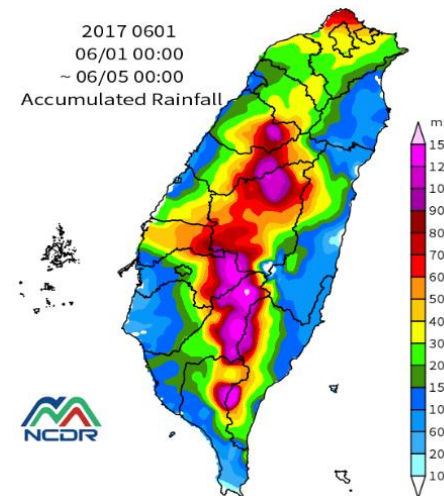
- 1) **Mountain range direction**
Mountains elevation > 3000m : 268



□ 2009 莫拉克 (MORAKOT Typhoon)



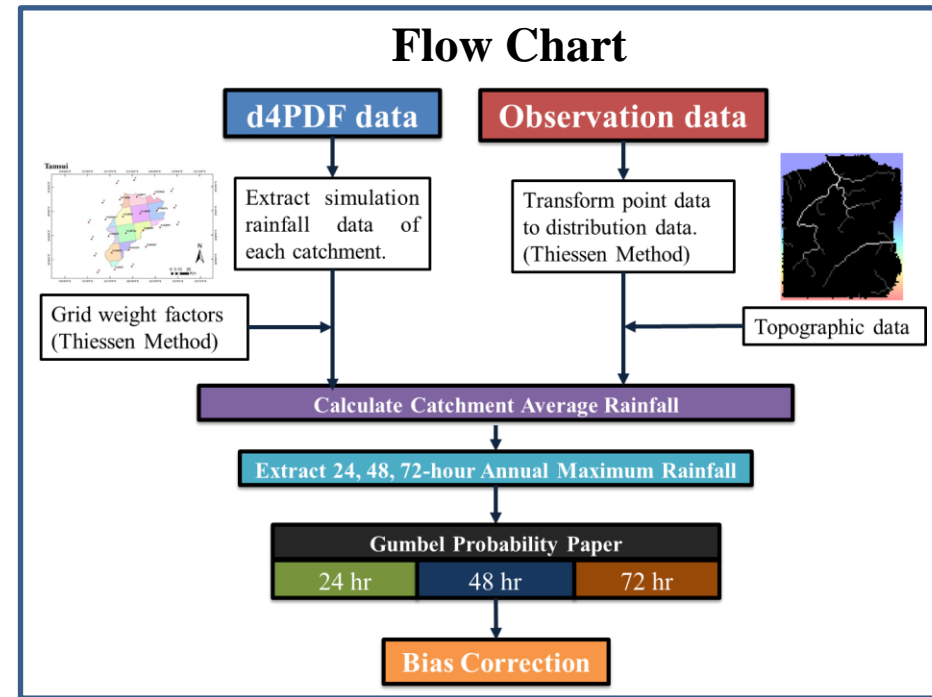
□ 2017 0601豪雨 (0601 Heavy Rainfall)



➤ Introduction

Research Motivations

- ❑ There is no doubt that **climate change** will impact **future rainfall patterns**. **Simulation data (d4PDF)** provides a great **database** to **estimate the future climate and related potential disasters**.
- ❑ **Rainfall design** is a critical part of flooding research. Therefore, **replacing the traditional rainfall design method with the latest simulation data** would give an opportunity to **promote flooding research** especially under high uncertainty climate change situations.
- ❑ There still **lacking a mature simulation dataset for future climate studies in Taiwan**. Therefore, Introducing the latest simulation dataset (d4PDF) for future climate studies may benefit in many aspects.



Prospective Results

- ❑ Showing the possibility of using the simulation dataset (d4PDF) in Taiwan research.
- ❑ Understanding the extreme rainfall situation in the future under climate (+4 K temperature increasing) in Taiwan.
- ❑ Proving that the d4PDF dataset could be adopted in countries outside of Japan.

➤ Study Area

Choshui River Basin (Mid)

Area: 3,157 km²



Tamsui River Basin (North)

Area: 2,726 km²



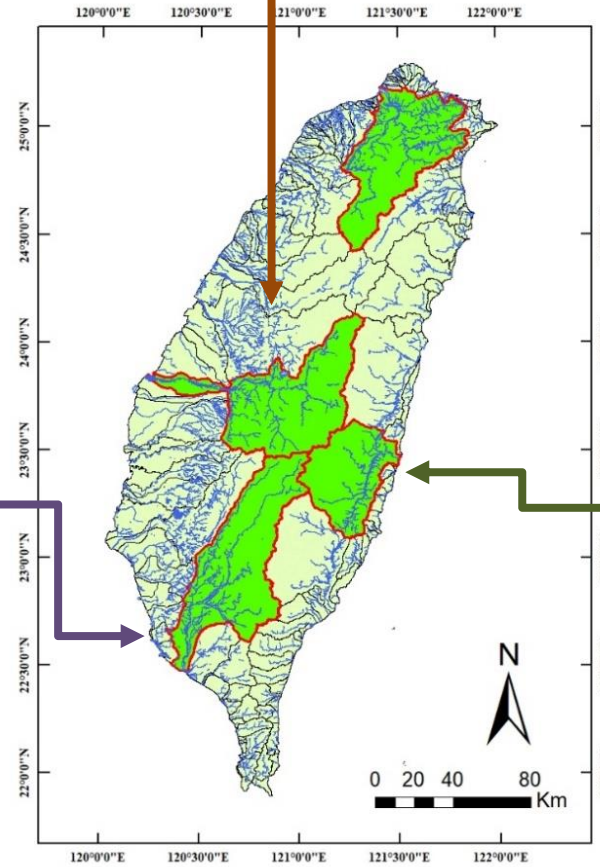
Kaoping River Basin (Southwest)

Area: 3,257 km²



Xiuguluan River Basin (East)

Area: 1,790 km²



d4PDF (Database for Policy Decision Making for Future Climate Change)

Historical Climate Simulation:

Duration: 60 years (1951 - 2010)

Members (RCM): 50

Total data year: 60 years × 50 members = 3000 years

Greenhouse gases: Observed

+4K Future Climate Simulation:

Duration: 60 years (2051-2110)

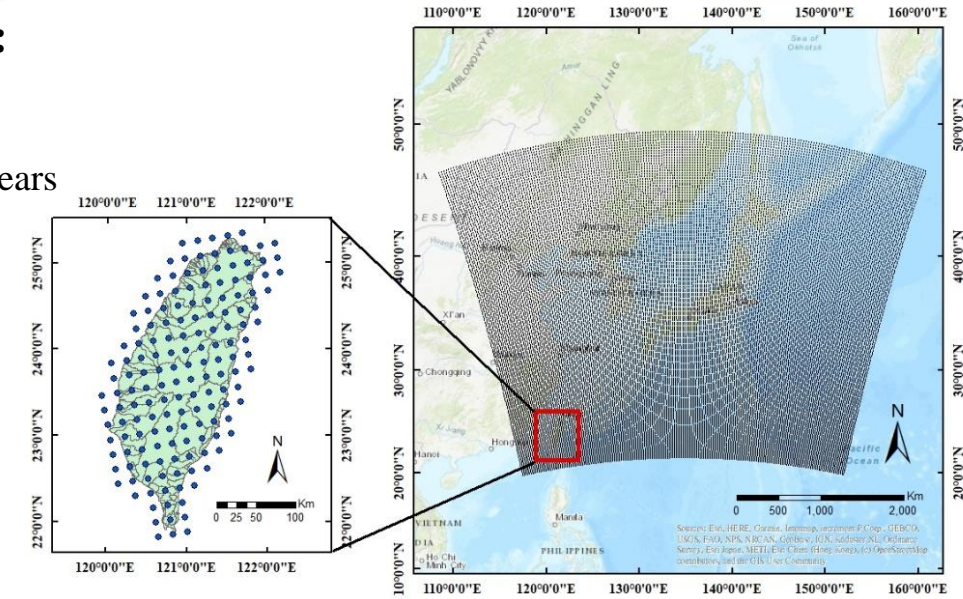
Members (RCM): 15 × 6 scenario

Total data year: 60 years × 15 members = 900 years

Resolution: 20 km

Greenhouse gases: Value at 2090 of RCP8.5

CMIP5 models used for obtaining SST changes			
CCSM4	CC	National Center for Atmospheric Research	United States
GFDL CM3	GF	National Oceanic and Atmospheric Administration (NOAA) GFDL	United States
HadGEM2-AO	HA	Met Office Hadley Centre	United Kingdom
MIROC5	MI	AORI, NIES, JAMSTEC	Japan
MPI-ESM-MR	MP	Max Planck Institute for Meteorology	Germany
MRI-CGCM5	MR	Meteorological Research Institute	Japan

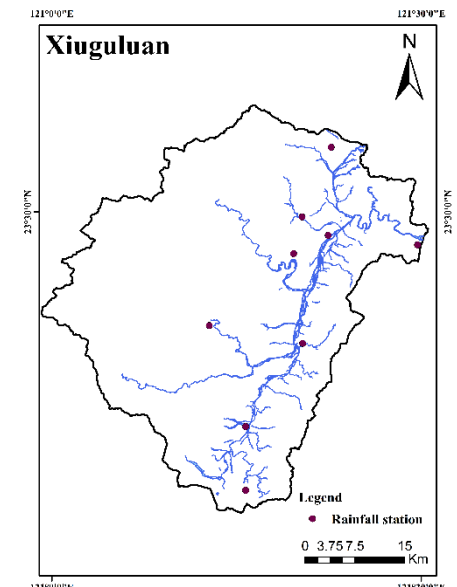
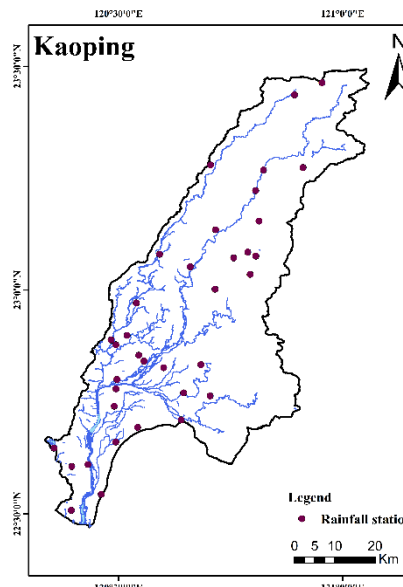
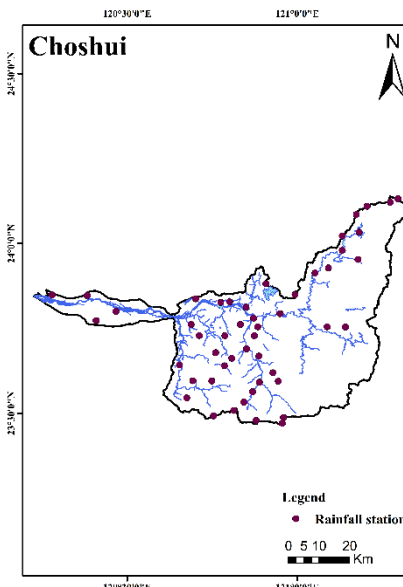
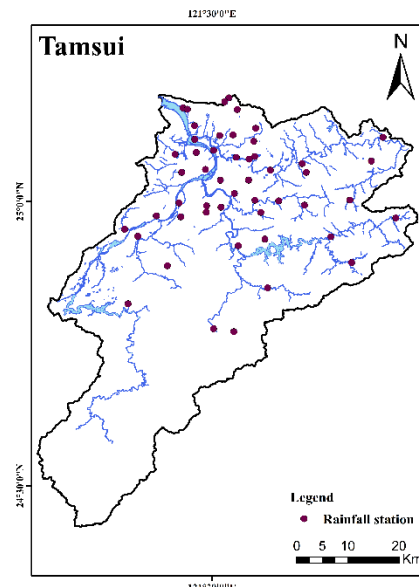


Observation Data

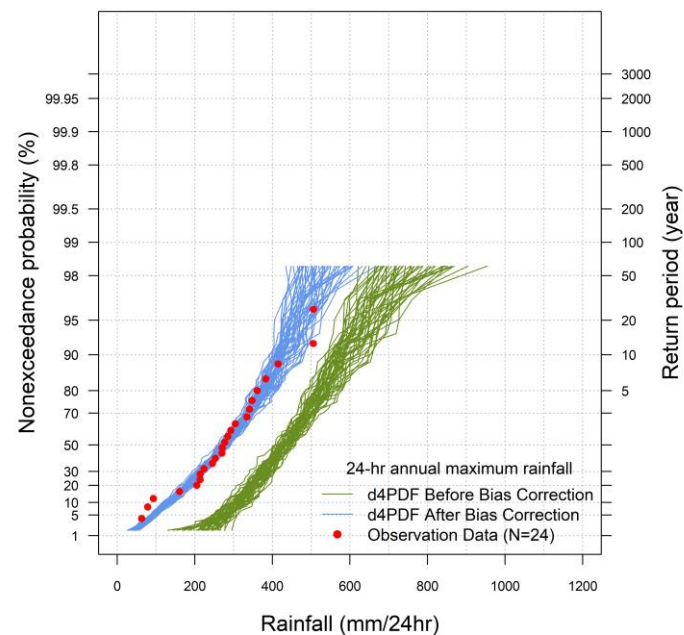
Data type : Hourly Rainfall Data

Sources : Central Weather Bureau

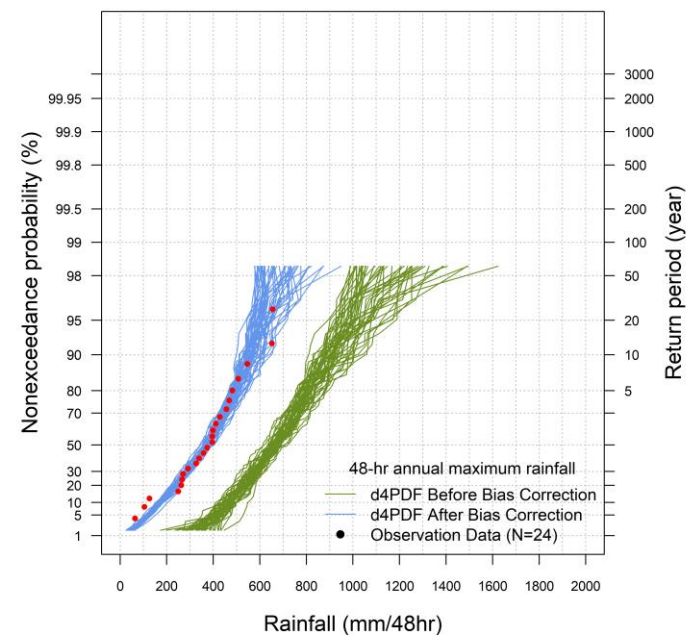
Basin	Numbers	Period
Tamsui	52	1987 ~ 2020
Choshui	50	1992 ~ 2020
Kaoping	37	1992 ~ 2020
Xiuguluan	9	1997 ~ 2020



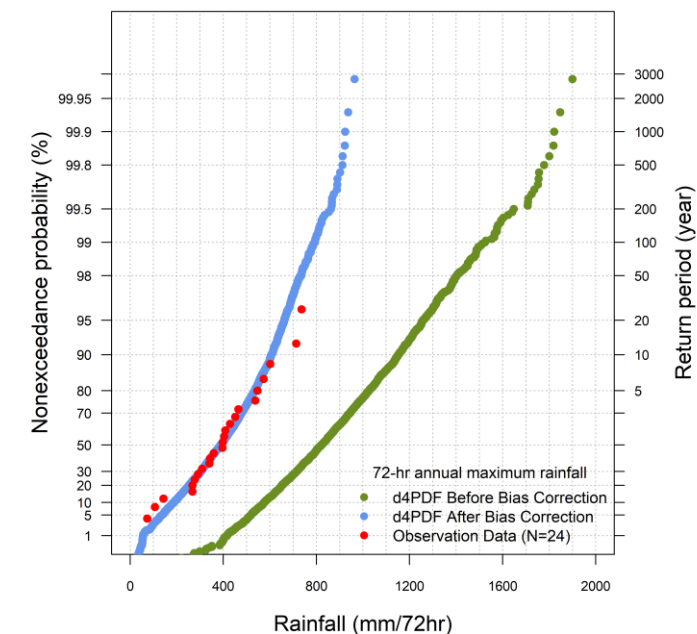
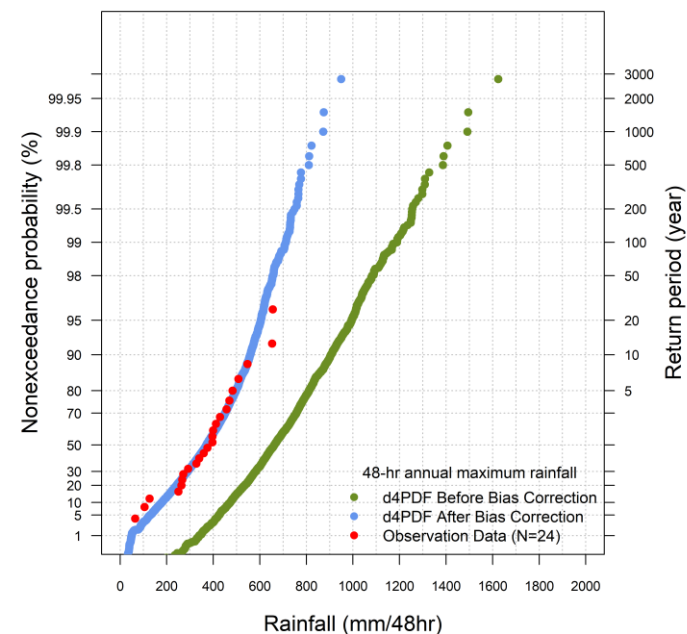
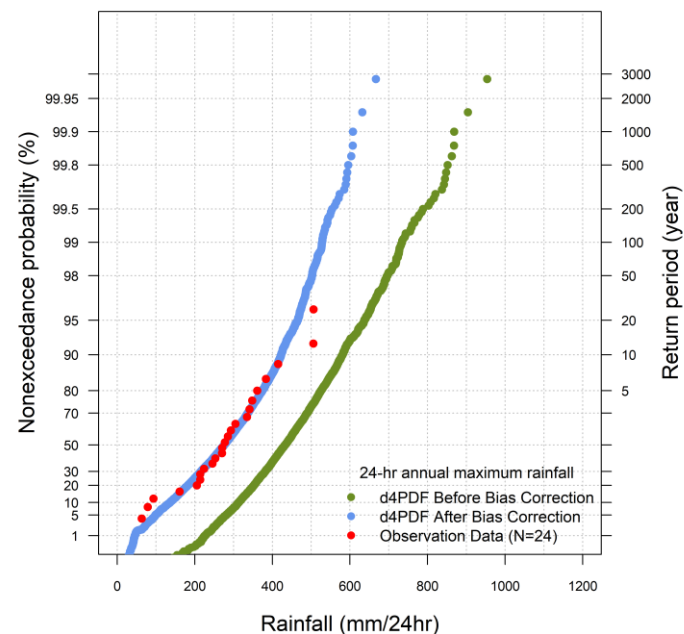
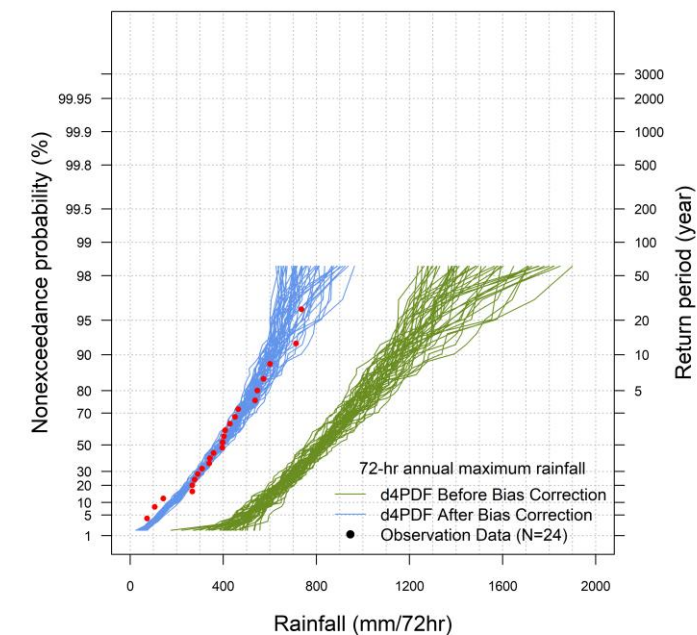
Xiuguluan (T=24hr)



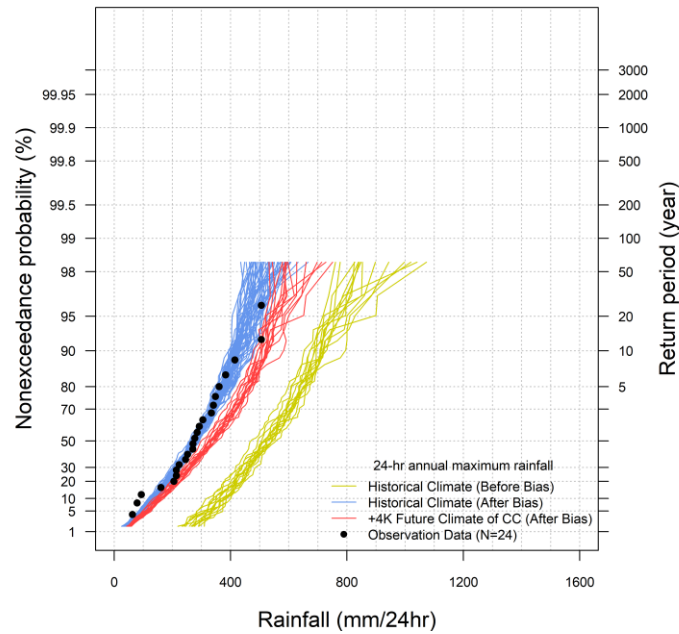
Xiuguluan (T=48hr)



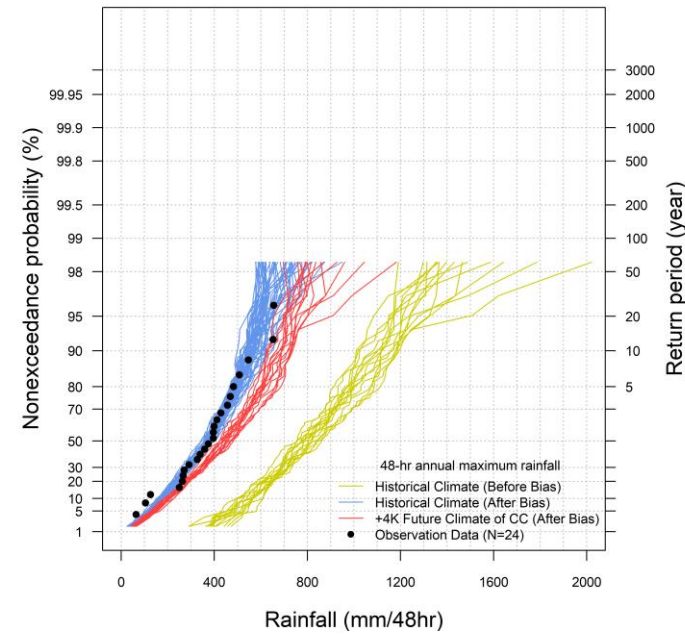
Xiuguluan (T=72hr)



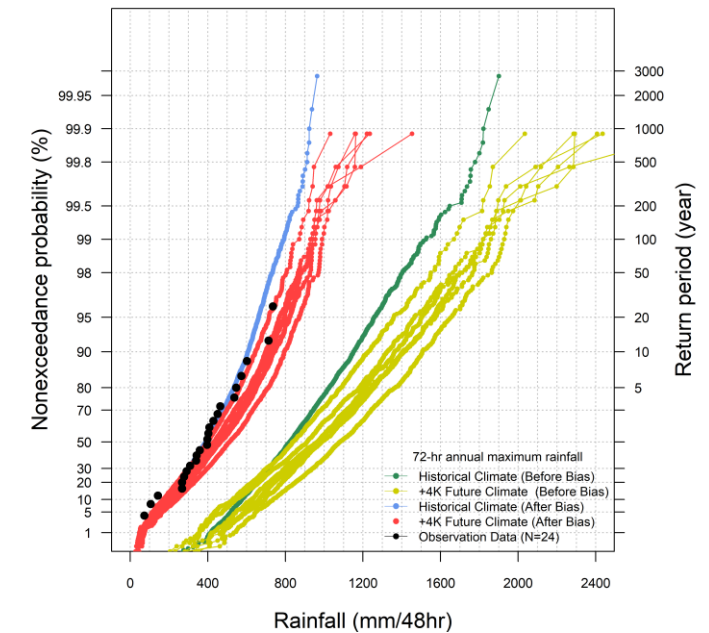
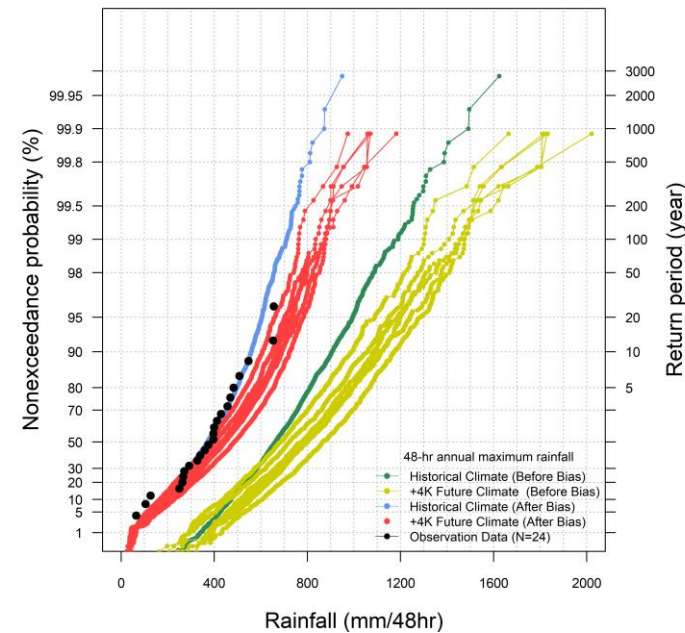
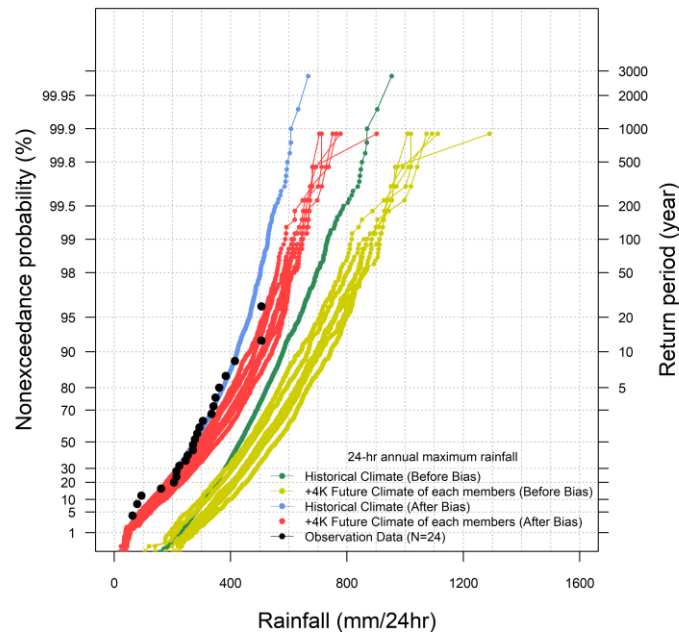
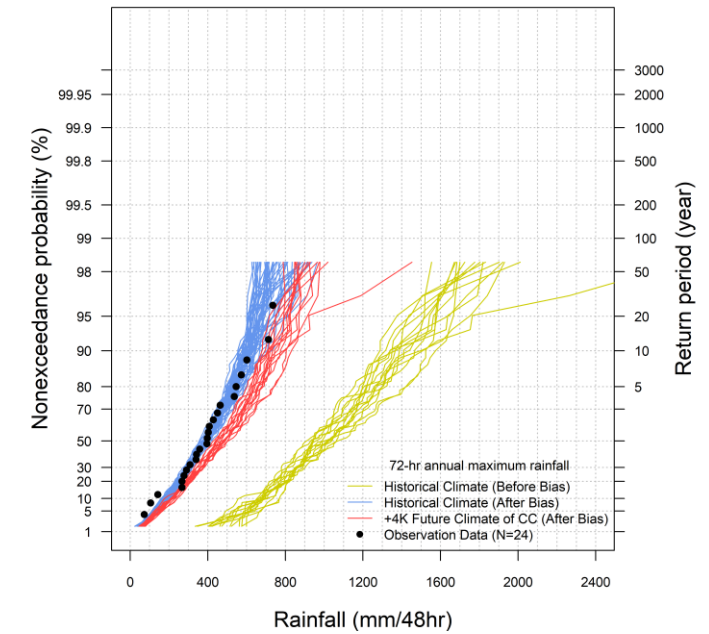
Xiuguluan (CC)



Xiuguluan (CC)



Xiuguluan (CC)



Focal Points

- ❑ The results of d4PDF simulation data show that the **amount of rainfall under 4K temperature increase scenarios** has an **obvious increase** in all selected study areas.
- ❑ The observation data shows a **great agreement** with d4PDF simulation data in Tamsui (2,726 km²), Choshui (3,157 km²), and Kaoping (3,257 km²) river basins (**larger catchments**) in Taiwan.
- ❑ d4PDF simulation dataset **overestimates** the observation data in the Xiuguluan (1,790 km²) river basin (**smaller catchment**). Therefore, bias correction is necessary.
- ❑ d4PDF data could nearly represent the real situation in selected catchments in Taiwan. Therefore, can prove that it owns a **high potential** could be used in **Taiwan's future climate research**.

Prospect

- ❑ Extend the experiment in all catchments in Taiwan to provide more cases experience, and further optimize rainfall analysis techniques.
- ❑ Utilize non-parametric method to estimate the extremely rainfall by simulation data (reduce the limitation of observation data)
- ❑ Exploit a robust and reliable future climate simulation dataset (d4PDF) into hydrology-related disaster research, such as risk assessment, prevention, and mitigation.

Thank you for your attention.

