

Mekong Environmental
Resilience Week

14 September 2023

Mekong Citizen Perspectives on Building Climate Resilience

Eastin Grand Hotel Sathorn
Bangkok, Thailand



Mekong Perspectives on Climate Change



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Centre

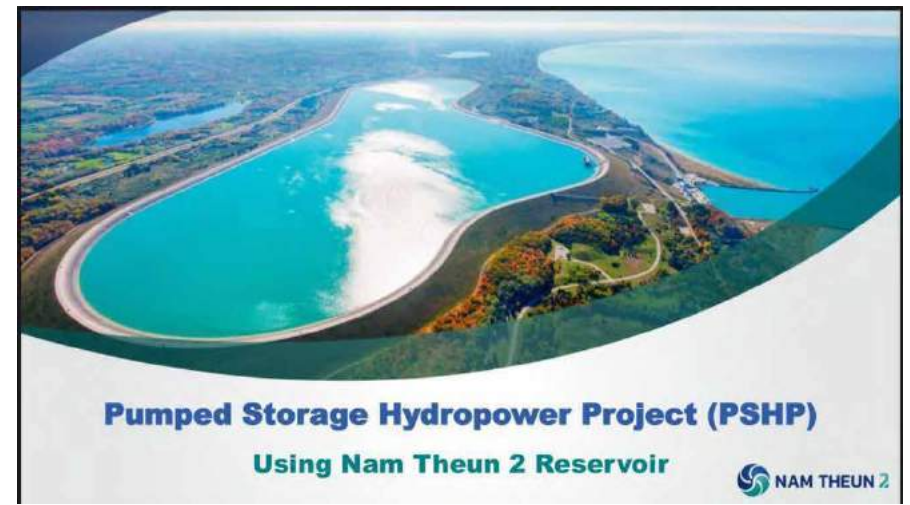
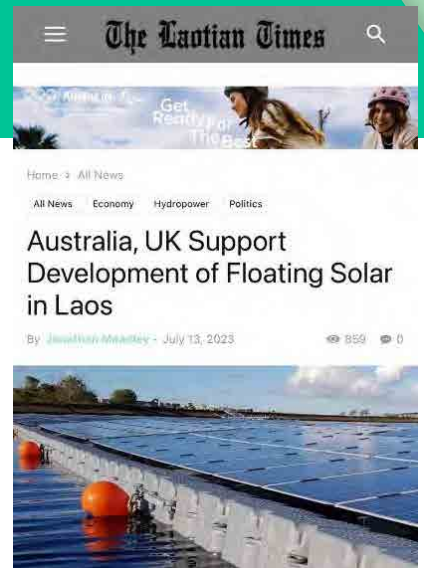




Lao-China high speed train



Monsoon Wind Project



Climate change in Mekong River region from hydroinformatics perspective

Dr. Sutat Weesakul




สถาบันสารสนเทศทรัพยากรน้ำ
Hydro - Informatics Institute



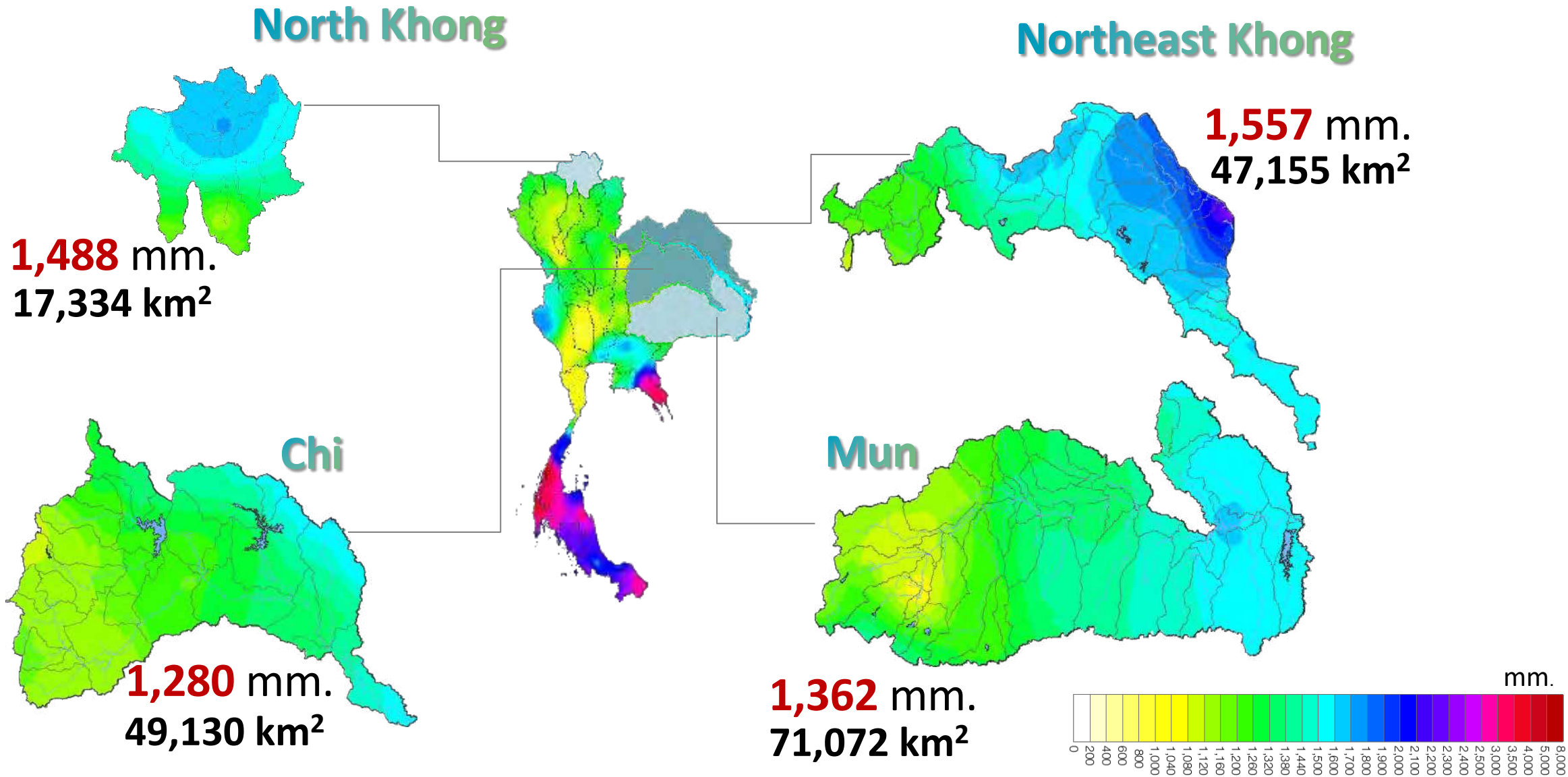
Outline

- Rainfall patterns of North Khong, Northeast Khong, Chi, and Mun river basins
- Future changes in extreme rainfall over MRC region using multi-bias corrected GCM rainfall data
- Climate change adaptation: Community Water Resources Management



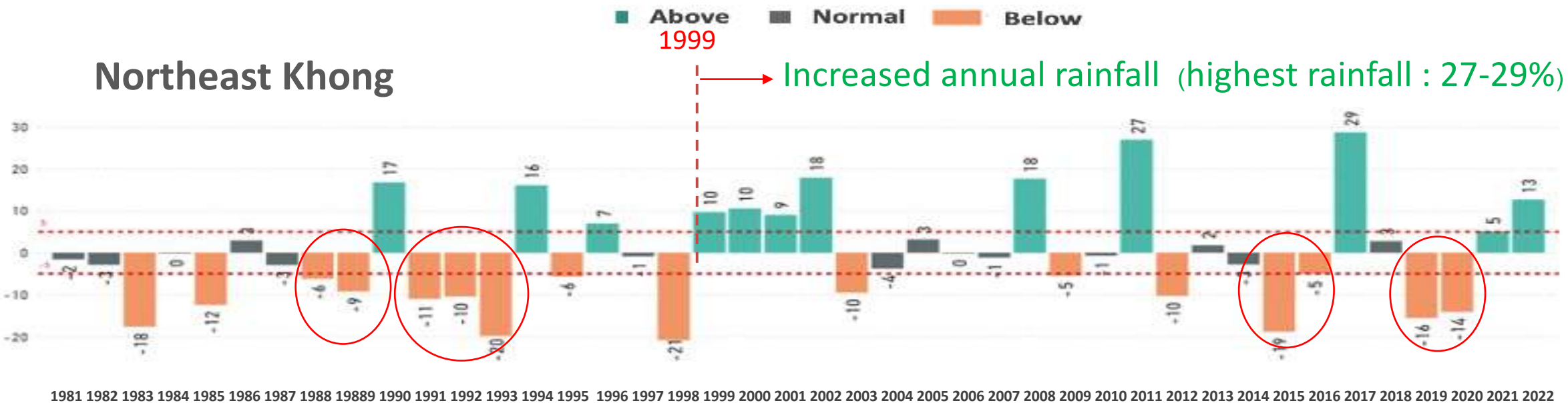
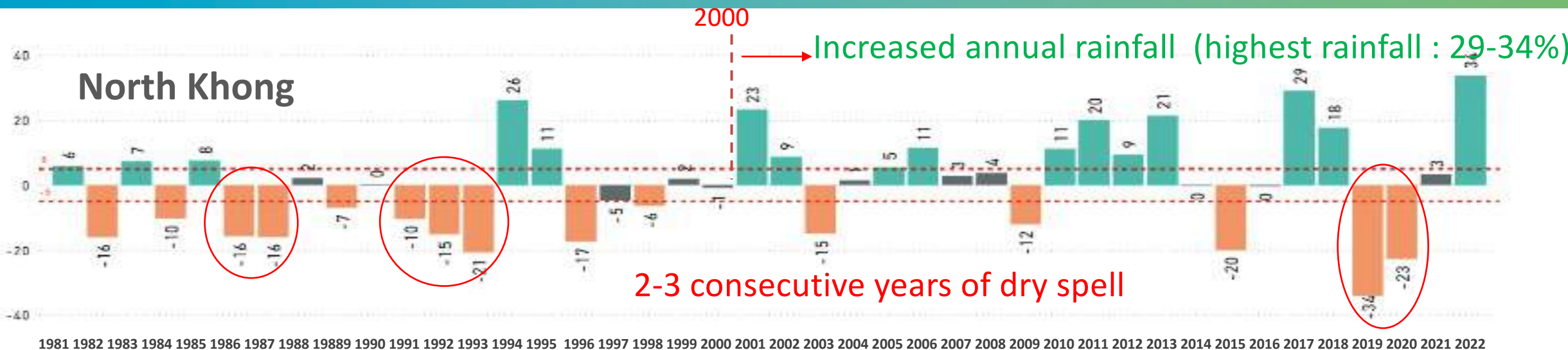
Rainfall patterns of North Khong, Northeast Khong, Chi, and Mun river basins

Average annual areal rainfall (30 years : 1991-2020)



Based on data from 101 Thai Meteorological Department stations

Annual rainfall between 1981-2022



Normal : Average 30 years annual areal rainfall between 1991-2020 (+/- 5%)

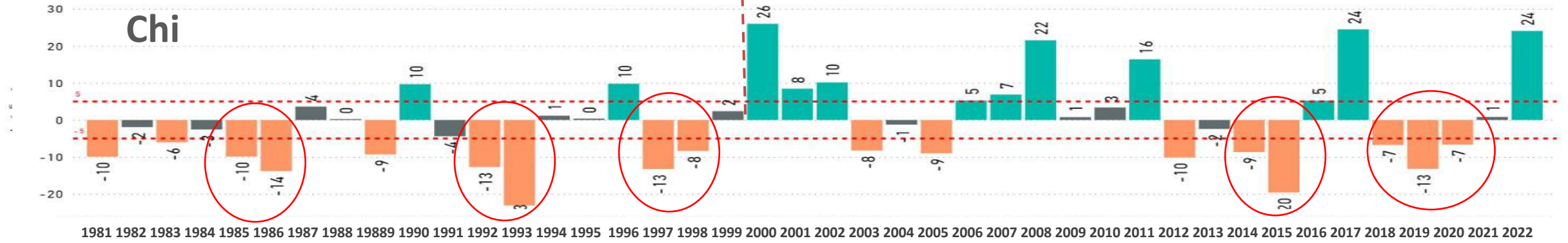
Annual rainfall between 1981-2022

% Anomaly

Chi

2000

Increased annual rainfall (the highest : 24-26%)



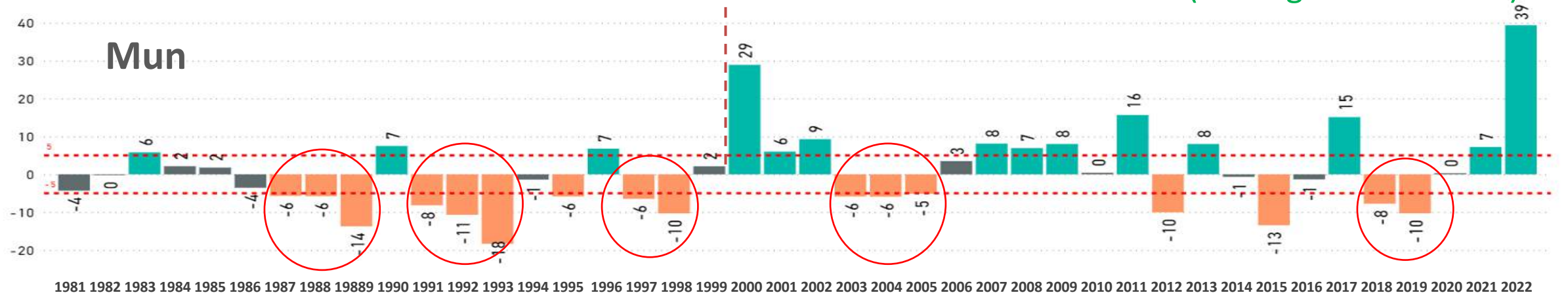
2-3 consecutive years of dry spell ■ Above ■ Normal ■ Below

% Anomaly

Mun

2000

Increased annual rainfall (the highest : 29-39%)



2-3 consecutive years of dry spell



**Future changes in extreme
rainfall over MRC region
using multi-bias corrected
GCM rainfall data**

Precipitation data

- Daily APHRODITE precipitation 0.25 deg covering MRC boundary (1,339 grids)
- Daily 19 CMIP5 GCMs precipitation : BCC-CSM1.1, BCC-CSM1-1-m, CanESM2, CESM1_BGC, CESM1_CAM5, CMCC-CMS, CNRM-CM5, CSIRO-Mk3.6.0, INMCM4.0, IPSL-CM5A-LR, IPSL-CM5A-MR, IPSL-CM5B-LR, MIROC5, MIROC-ESM, MIROC-ESM-CHEM, MPI-ESM-LR, MPI-ESM-MR, MRI-CGCM3, and NorESM1-M

Time periods

- Present period 1979 – 2005
- Near future period (NF) 2006 – 2039
- Mid future period (MF) 2040 – 2069
- Far future period (FF) 2070 - 2100

Future climate scenarios

- RCP4.5 (Medium green house gas emission)
- RCP8.5 (High green house gas emission)

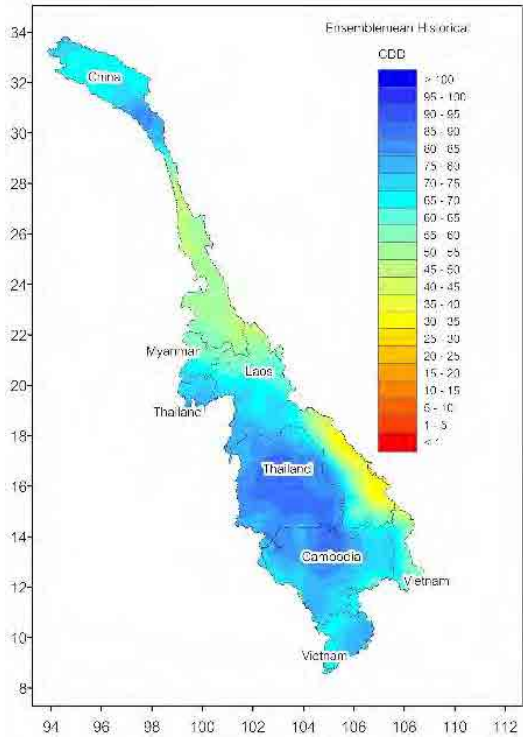
Methodology

- **Bias correction** of rainfall data using **Gamma-gamma transformation**
- **Changes in extreme rainfall index was tested by t test statistic (Fisher and Yates, 1963)**
- **Consistency index for change of extreme index (Chaowiwat et.al., 2019)**

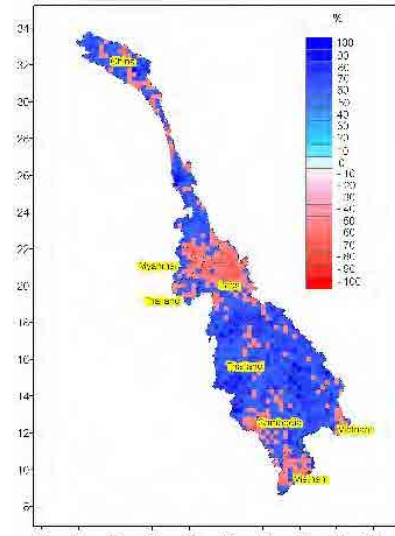
Consistency index for change in CDD

CDD

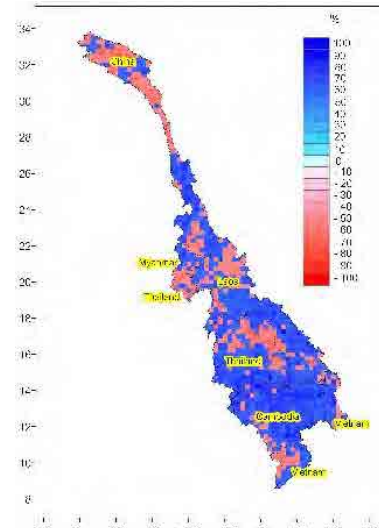
(Consecutive dry days)



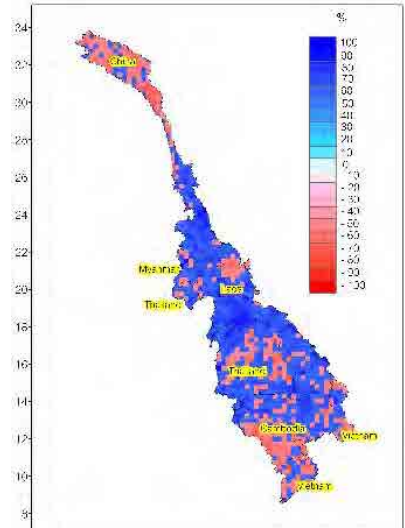
65 days



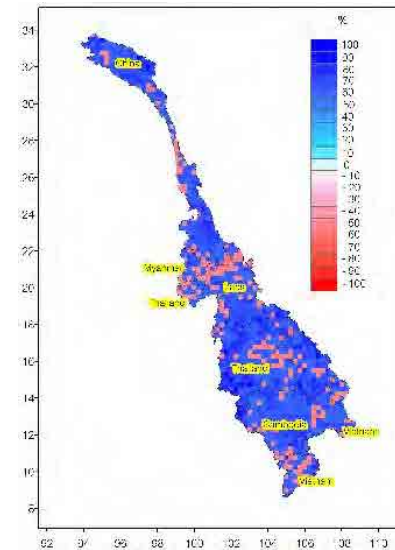
+29%
NF-RCP4.5



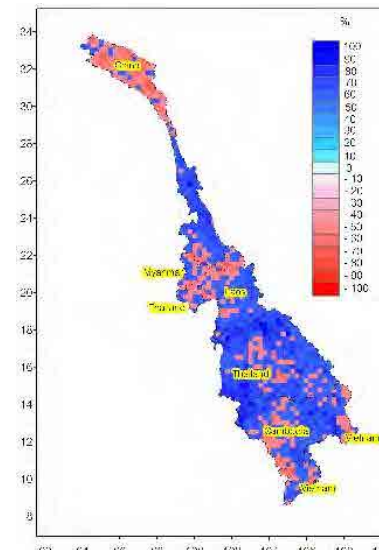
+23%
MF-RCP4.5



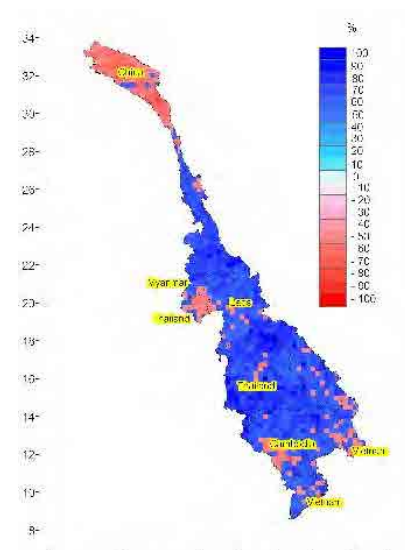
+19%
FF-RCP4.5



+40%
NF-RCP8.5



+25%
MF-RCP8.5

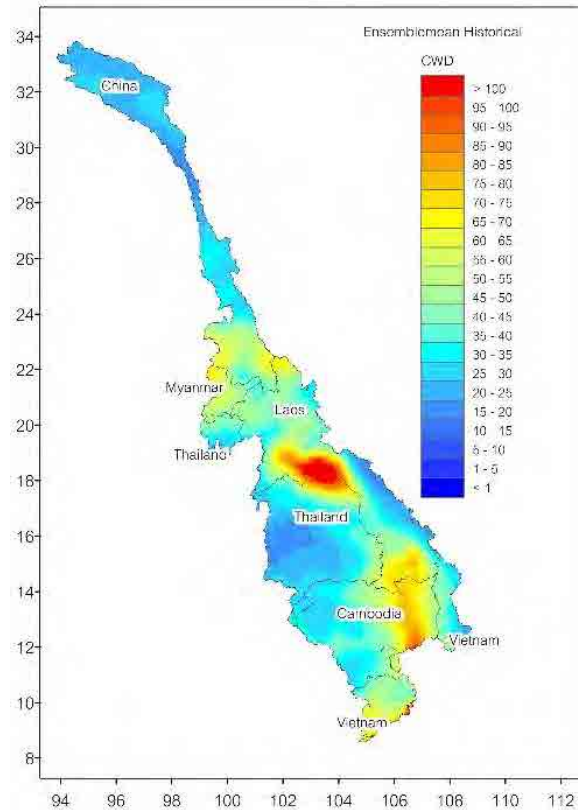


+38%
FF-RCP8.5

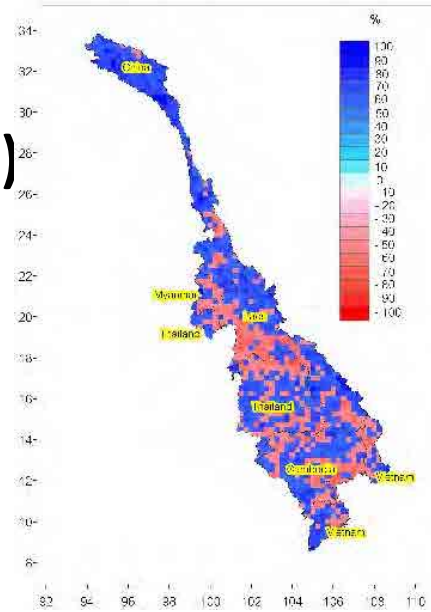
Consistency index for change in CWD

CWD

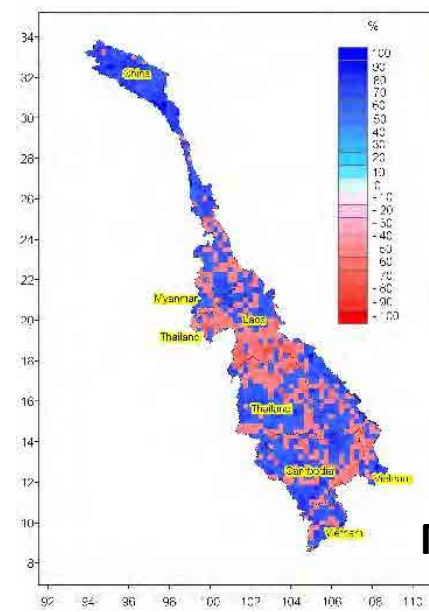
(Consecutive wet days)



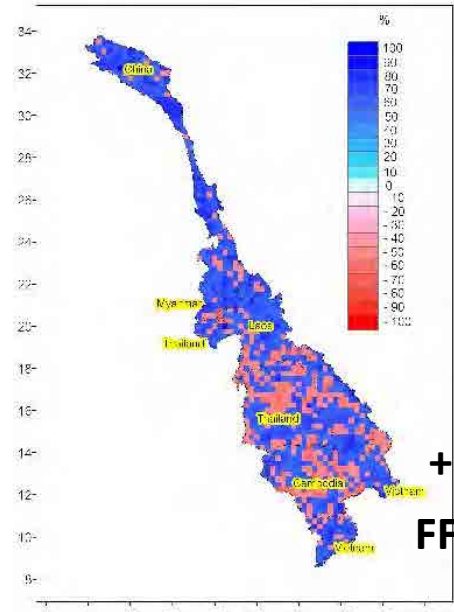
27 days



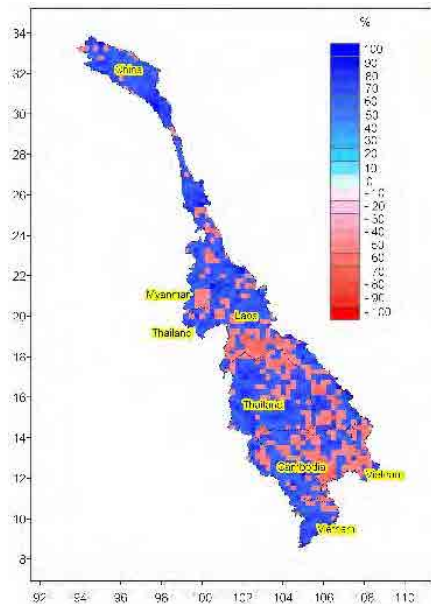
+21%
NF-RCP4.5



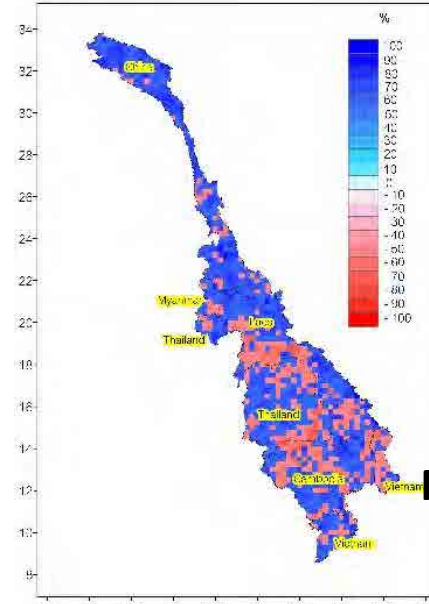
+19%
MF-RCP4.5



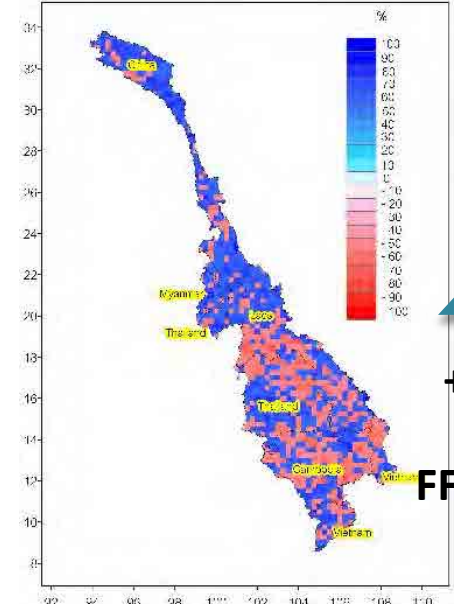
+26%
FF-RCP4.5



+27%
NF-RCP8.5



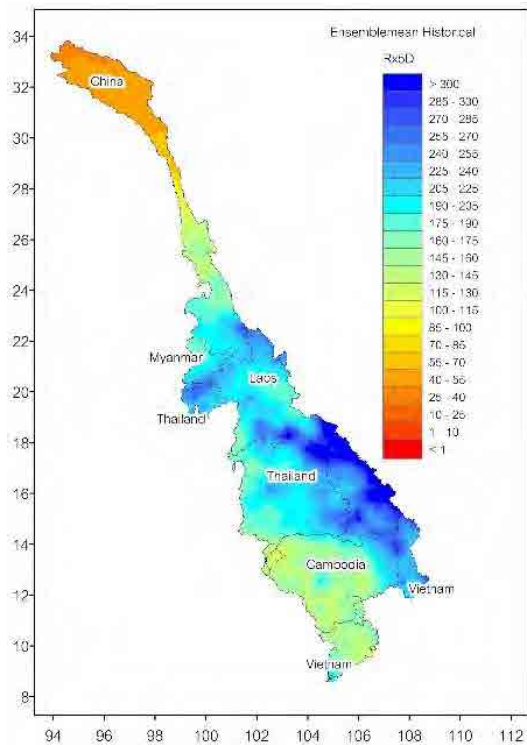
+26%
MF-RCP8.5



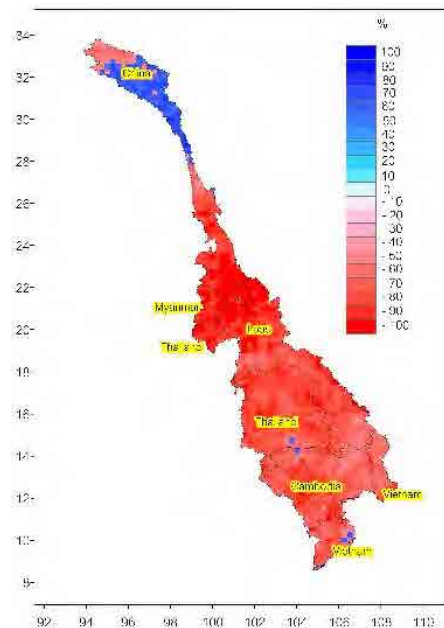
+15%
FF-RCP8.5

Consistency index for change in Rx5D

Rx5D (Max 5-day rainfall)

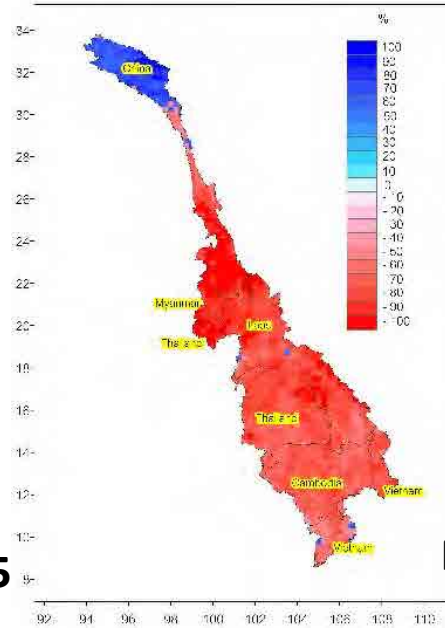


115 mm



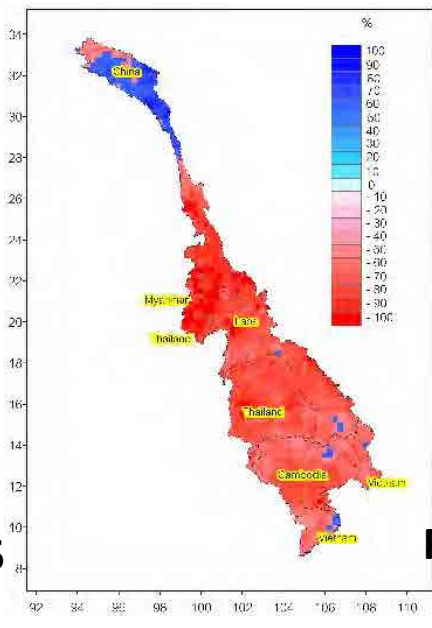
-70%

NF-RCP4.5



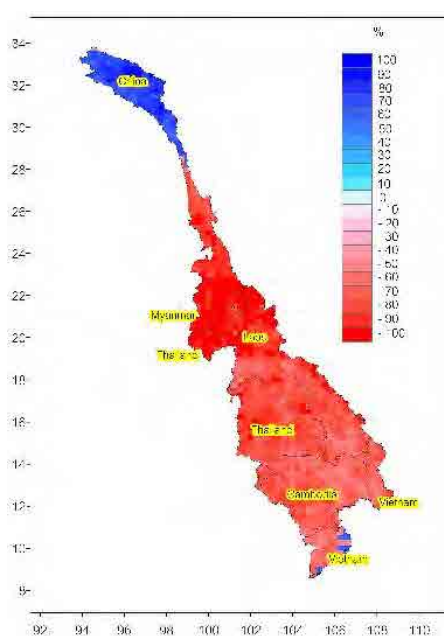
-65%

MF-RCP4.5



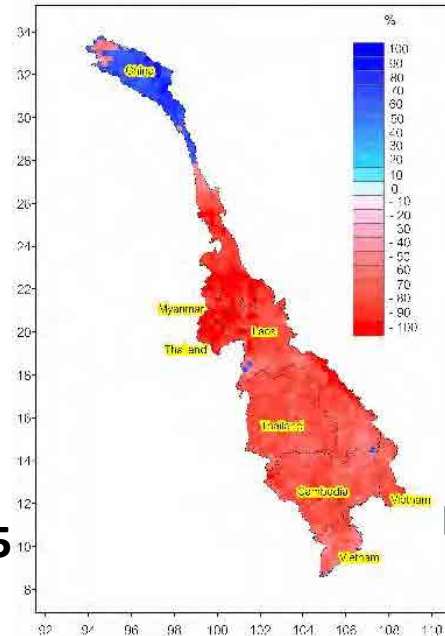
-64%

FF-RCP4.5



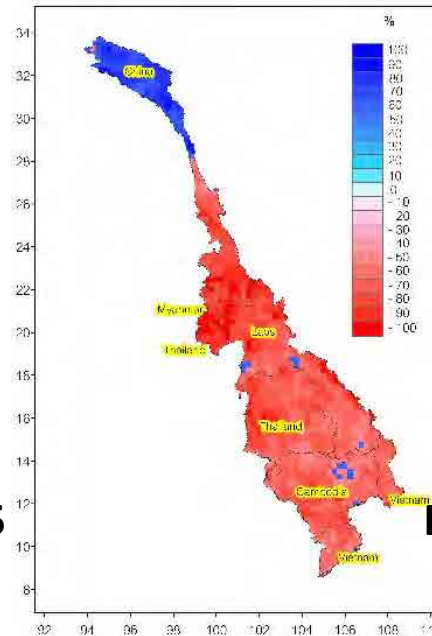
-63%

NF-RCP8.5



-64%

MF-RCP8.5

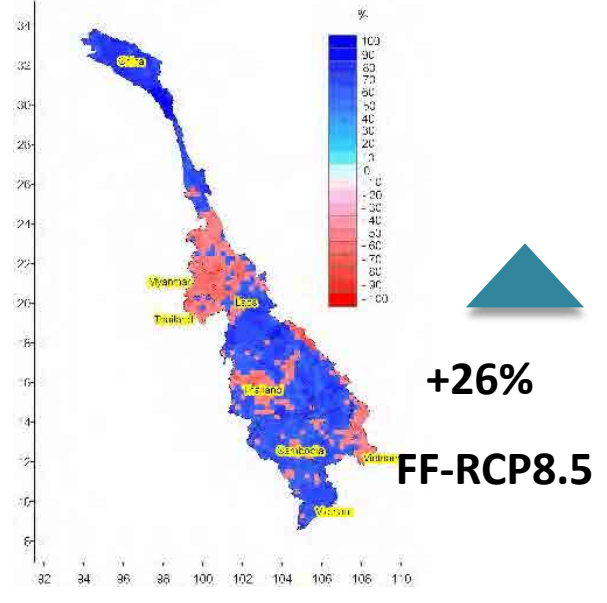
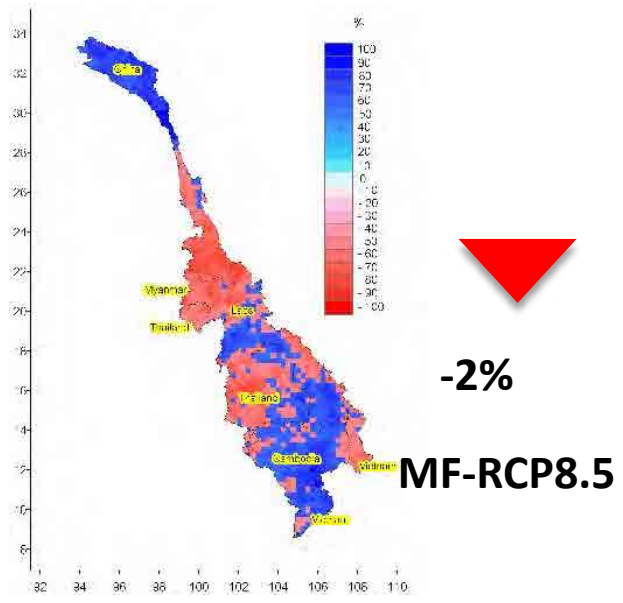
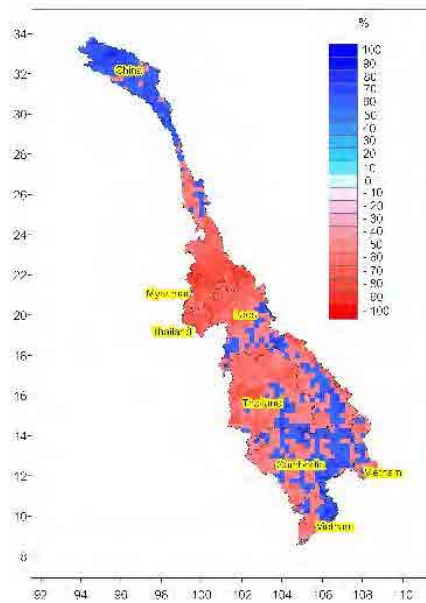
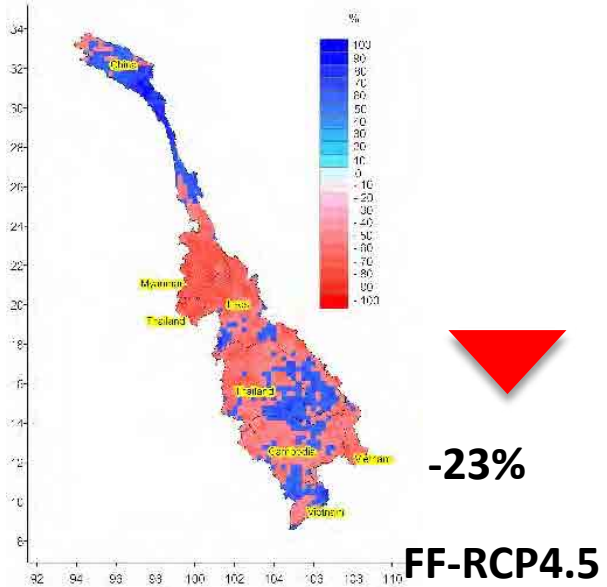
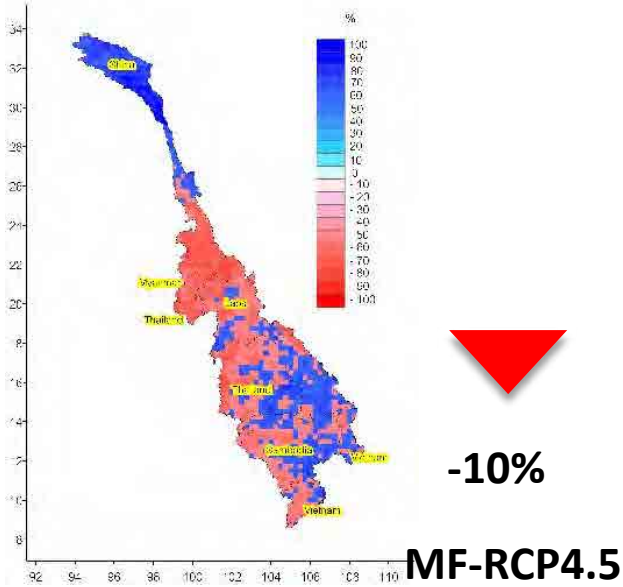
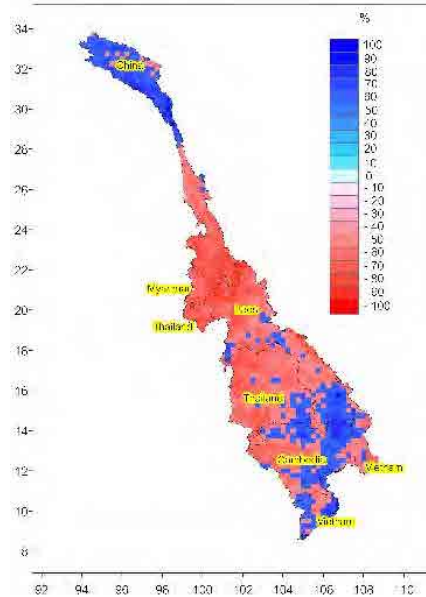
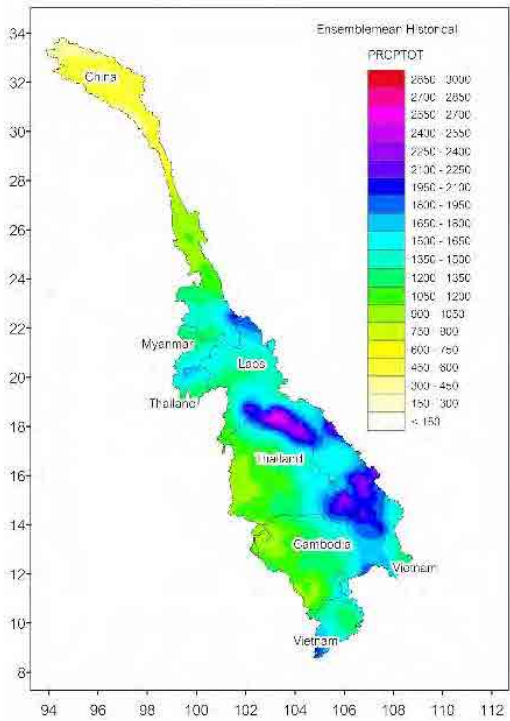


-57%

FF-RCP8.5

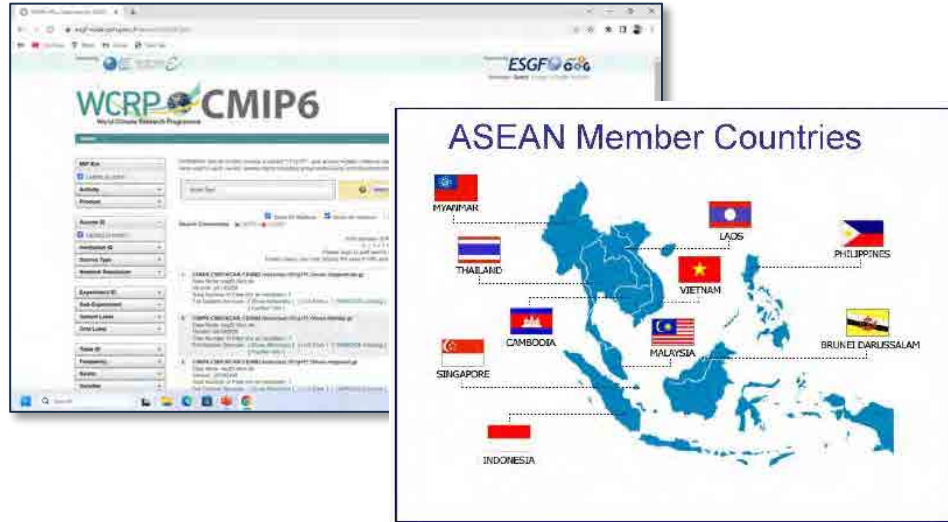
Consistency index for change in severity of PRCPTOT

PRCPTOT (Annual contribution from wet days)



Bias correction of CMIP6 GCM in ASEAN countries

Extracted GCM data from CMIP6 data portal



<https://esgf-node.llnl.gov/projects/cmip6/>

6 CMIP6 GCM

- CESM2
- MRI-ESM2-0
- BCC-CSM2-MR
- GFDL-ESM4
- Can-ESM4

Improved quality of GCM data

- Linear rescaling bias correction method by using raw GCM and CHIRPS (0.05 deg) (observed precipitation)
- Generate the output format

Contributed bias corrected GCM data

Bias corrected rainfall in ASEAN countries in format ESRI ASCII (resolution 5x5km) :

- Historical
- SSP126
- SSP245
- SSP370
- SSP585

Next planning

Visualize on Open data platform

Climate change adaptation

- **Community water resources management**

Community water resources management framework

Sufficiency Economy Philosophy (SEP) as a tool for Sustainable Development Goals



Knowledge : Learning and doing

Moral: Community's rule and regulation to collaborate together with fairness and transparency

Reason : Availability of information, fact, and analysis

Moderate : Management, planning, and monitoring

Immunity : Preparation for climate change and disaster risk reduction

Science and Technology transfer to create:

- Community's background information
- Water map
- Water chart
- Water balance

Knowledge transfer from 60 core communities

- Guideline on water resources development
- Guideline on water resources management

Security of Resources such as land, water, forest, & energy

- Water for consumption and agriculture

Food security

- Agroforestry and New-theory agriculture (Integrated agriculture) collaboration on planning, production and marketing

Economy security

- Reduce expenses, increase income, reduce debt, increase saving and community fund

Social security

- Better livelihood
- Good Governance, strong community and expandable network

The community can be **Self-management on soil, water, and forest**, increase water for drinking, consumption & agriculture, **Increase income, Risk management, Immunity**, lead to **Security and Sustainability of the people**



<< Chi River Basin >>

Map showing water management (with elevation)

Outcome

Water Security
in 13 villages of
Waeng Noi
District

Water capital increases
417,493 cubic meter

Food Security

Total of 69
households have
income 100,000
USD per year

**Natural
Resource
Security**

Benefit over
300,000 USD per
year

Expand the
success to
7 sub-districts

Total water capital
8.64 MCM.
(6.24 MCM.
increased)

2,152
households

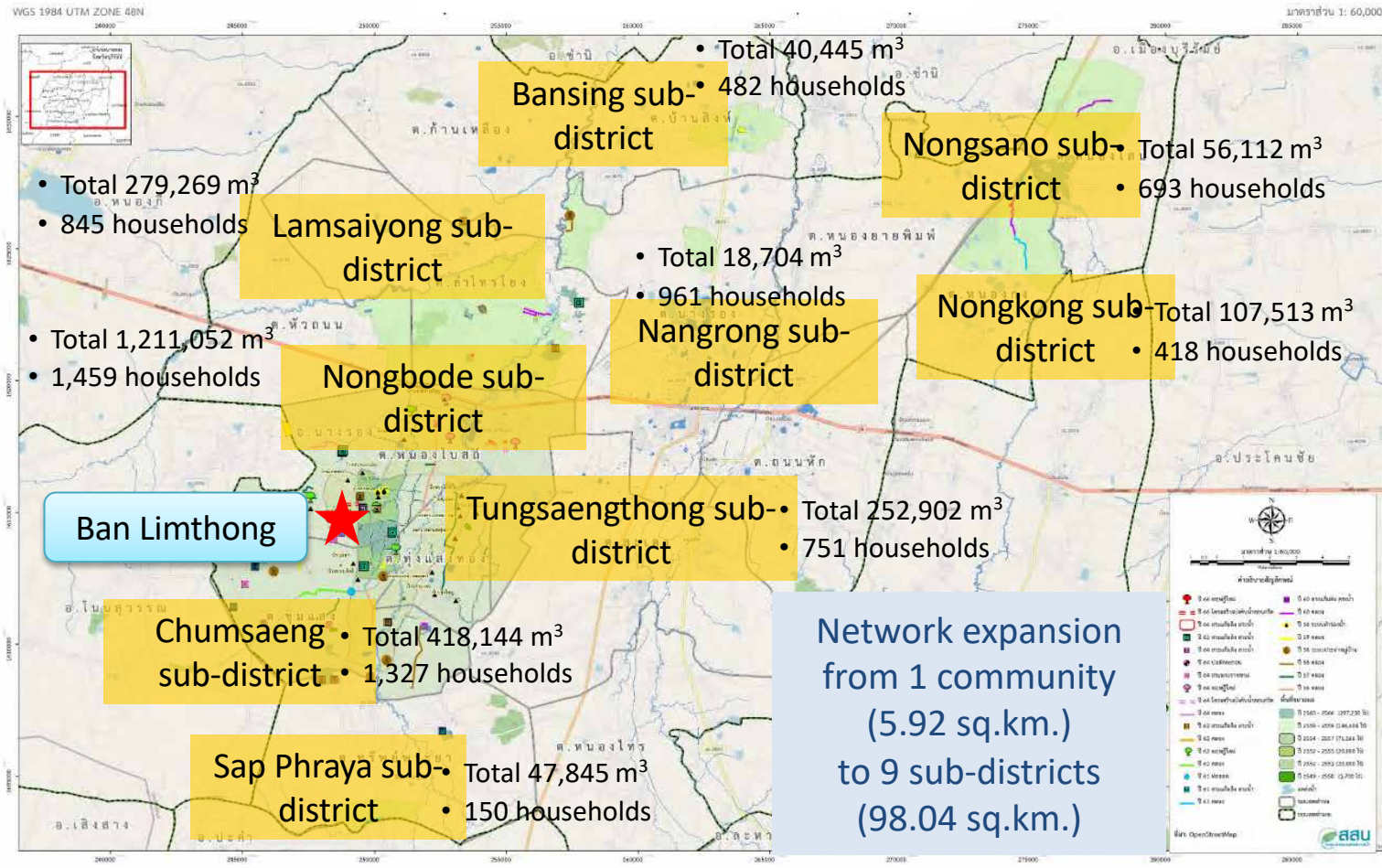
32 villages

14,430 acres
of agricultural
areas

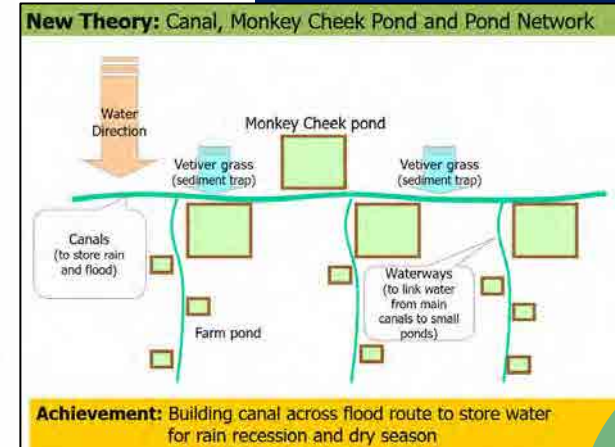


 = Metres Above Mean Sea Level (MASL)

<< Mun River Basin >>



Outcome



New Theory Agriculture
101 household self-expanded
224 households

Food Security
Additional income average **34.04 Million Baht/year**

Water Security
total 2.43 MCM. (1.44 MCM. increased)

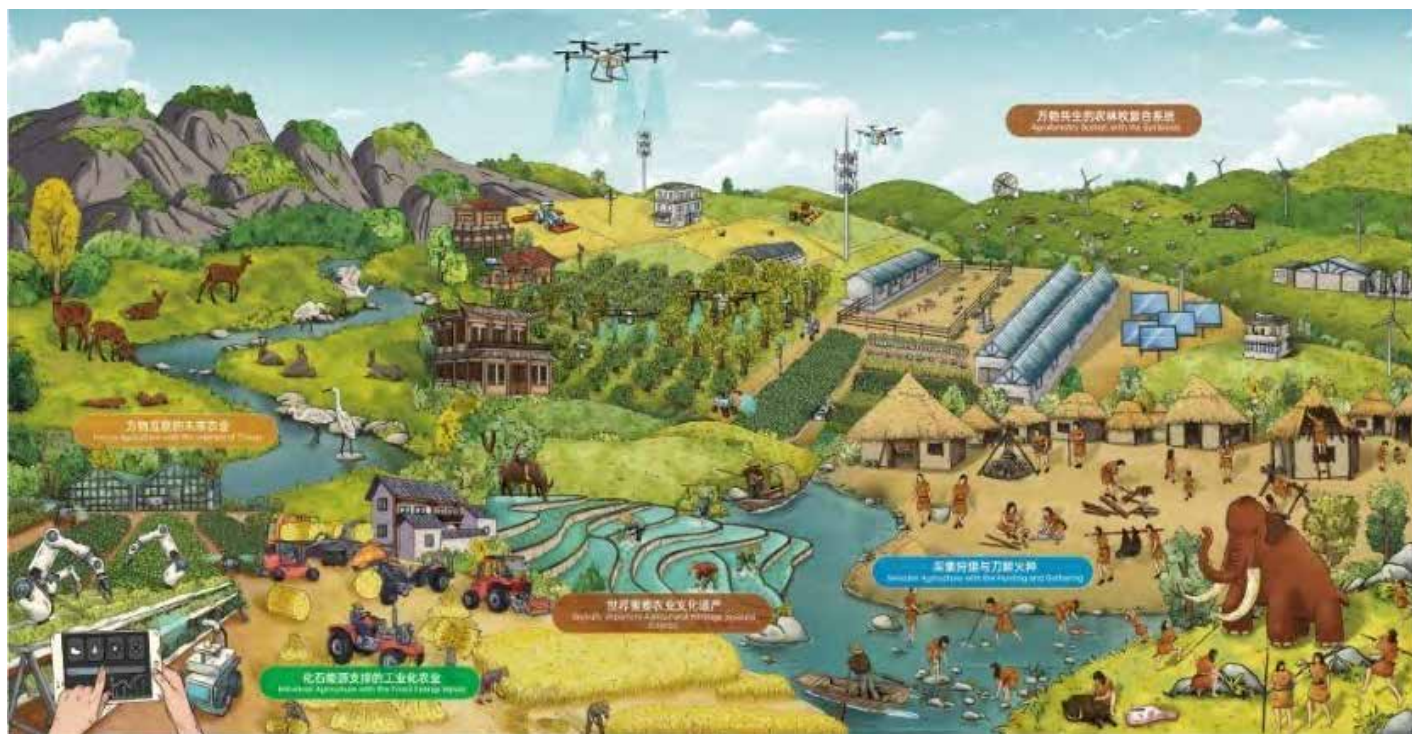
Beneficiary
7,318 household / area **97.96 sq.km.**

Reduced Expense
average **40.29 Million Baht/year**

Return to work at hometown
793 people

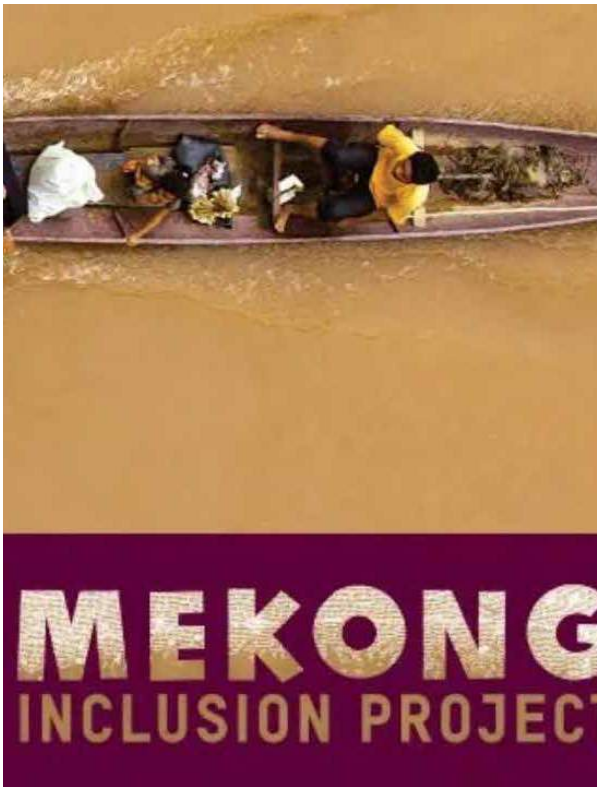


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Digitalization and Internet of Things (DIOt) in Agriculture:

金砖国家数字乡村与智慧农业白皮书
A Blueprint for BRICS Digital Villages and Smart Agriculture



KHMER TIMES

National June 13, 2022

Record rainfall floods capital, cause chaos

By Sith Kongnov / Khmer Times



Aquaponics at a Glance

- Aquaponics – a resilient farming system that simultaneously grows aquatic animals such as fish in tanks (aquaculture) and cultivates plants in water (hydroponics) in a symbiotic and controlled environment.



Ms. Doung Sokhaeun, tending to lush vegetables in her Greenhouse.

Thank you!

