

Future Change in Spring Drought and Its Impact on Water Resource in Taiwan

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2019 TCCIP International Workshop on Climate Change
Taipei, 22 October 2019



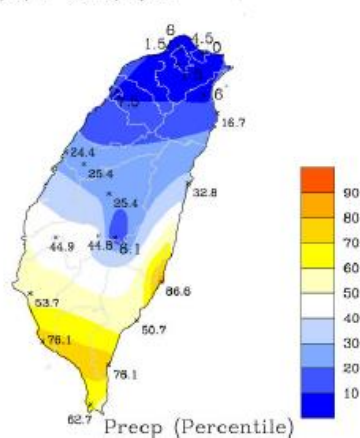
Spring Drought is a Critical Issue for Water Resources and Agriculture

Spring Drought 2018



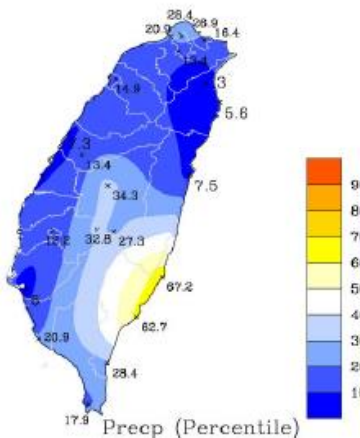
March 2018
Rainfall (%)

2018/3/1-2018/3/31



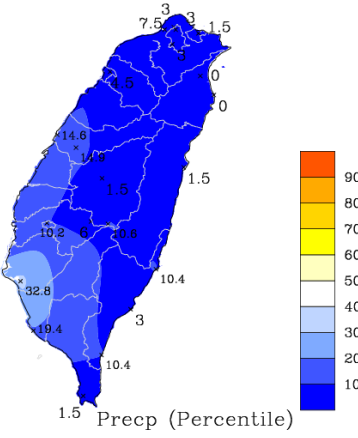
April 2018
Rainfall (%)

2018/4/1-2018/4/30

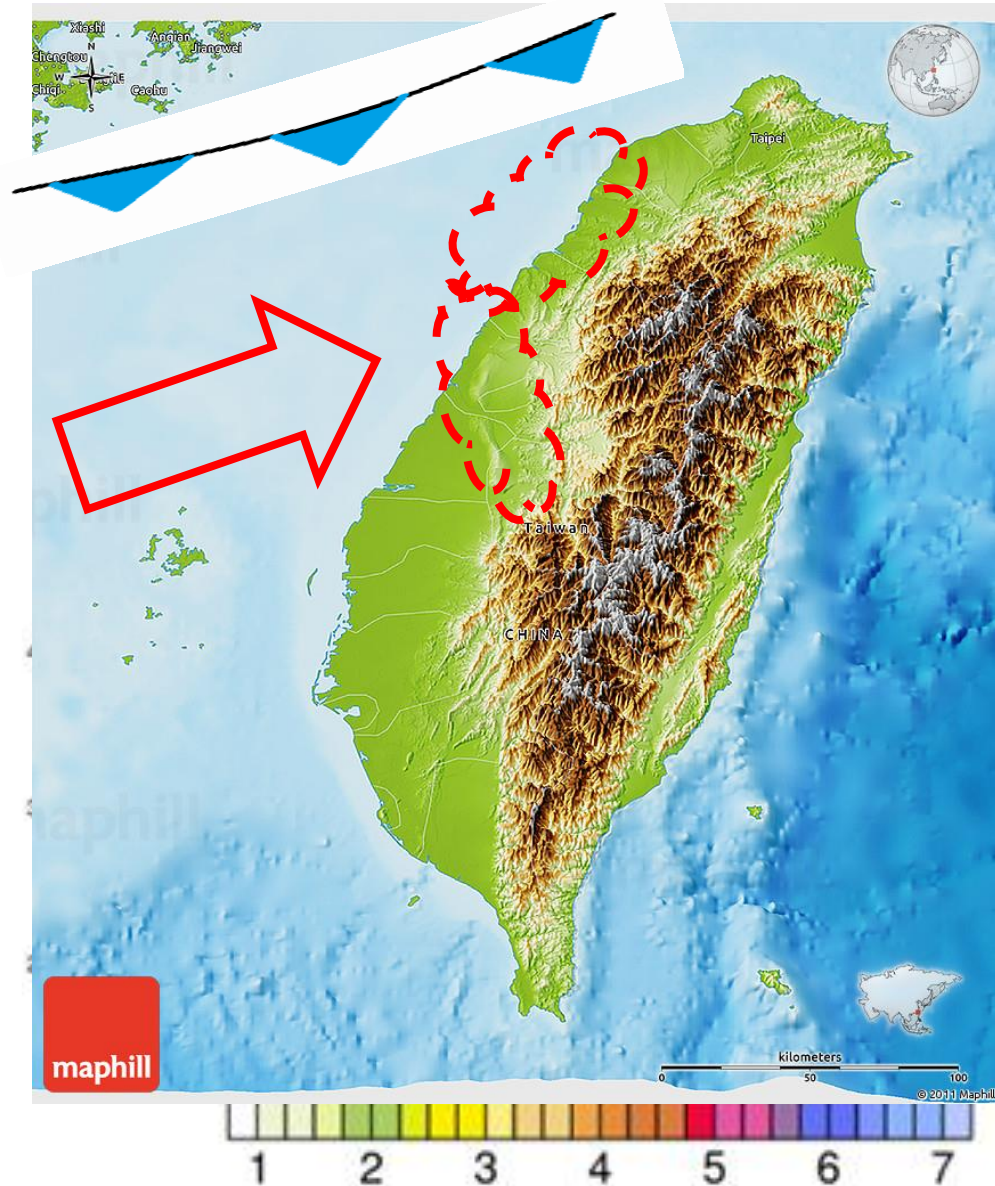


May 2018
Rainfall (%)

2018/5-2018/5



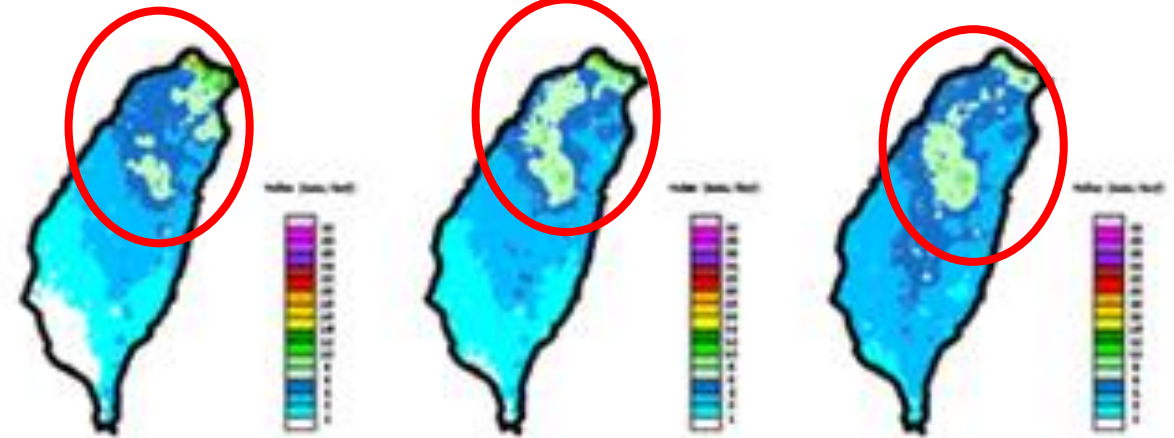
Topographically induced rainfall



February

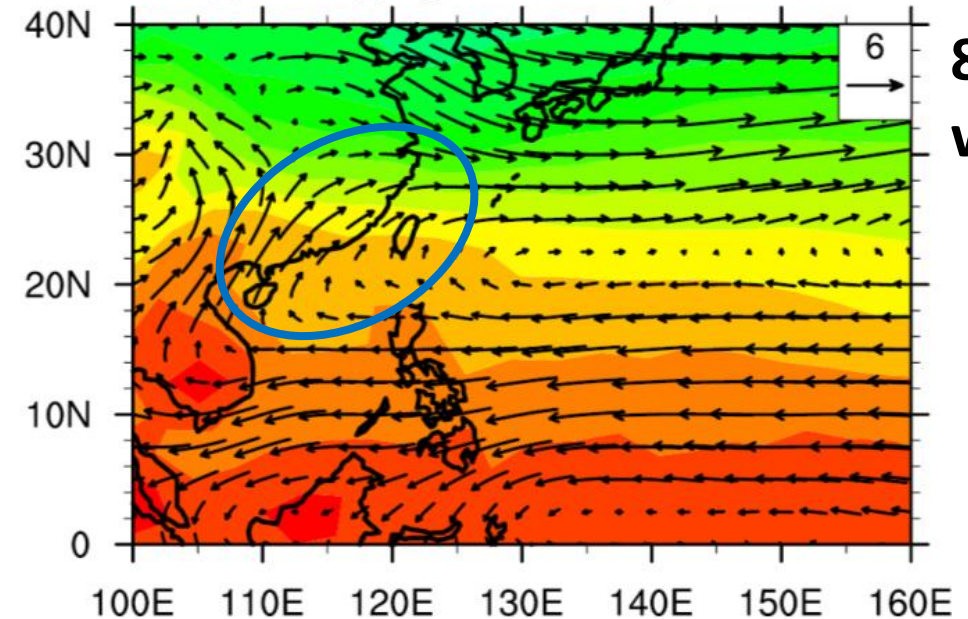
March

APRIL



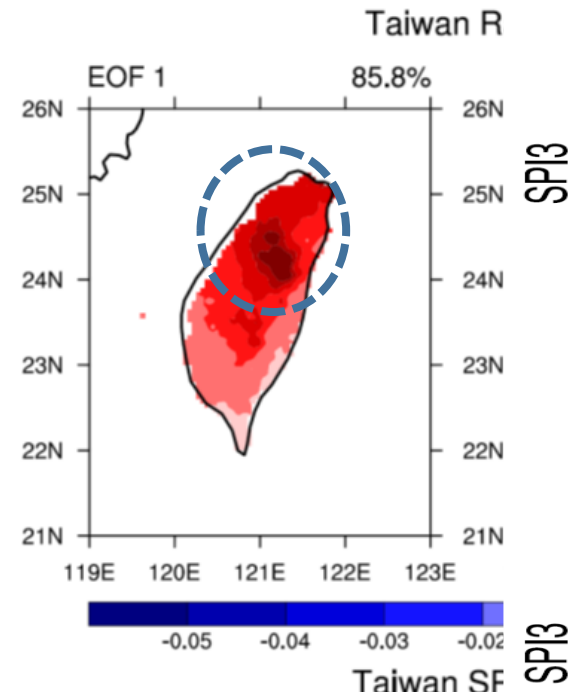
FMA

NCEP_R1-Shum_UV_850 Mean Feb-Apr 1960-2012

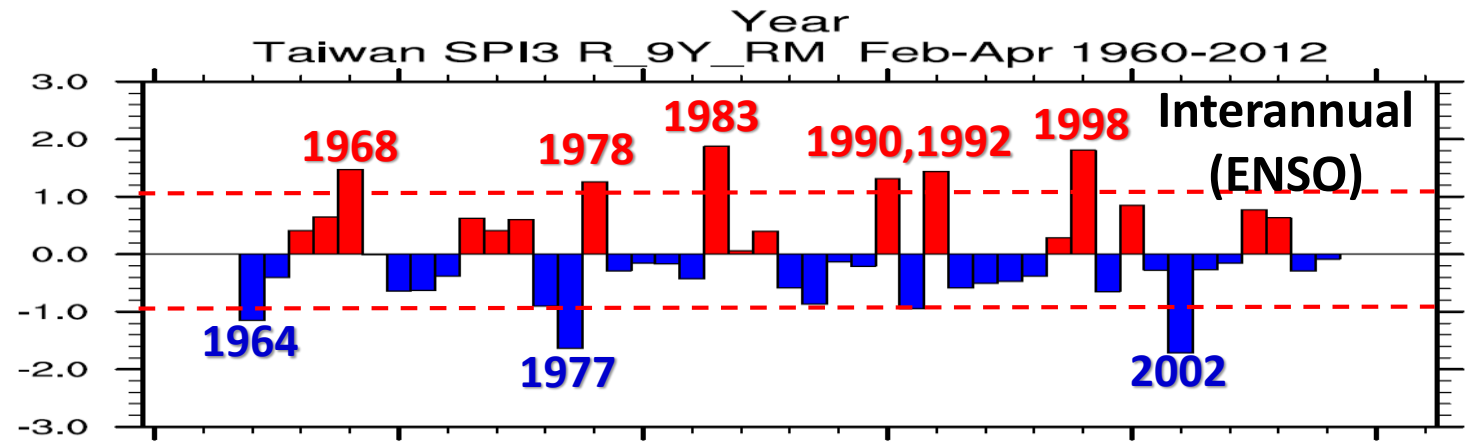
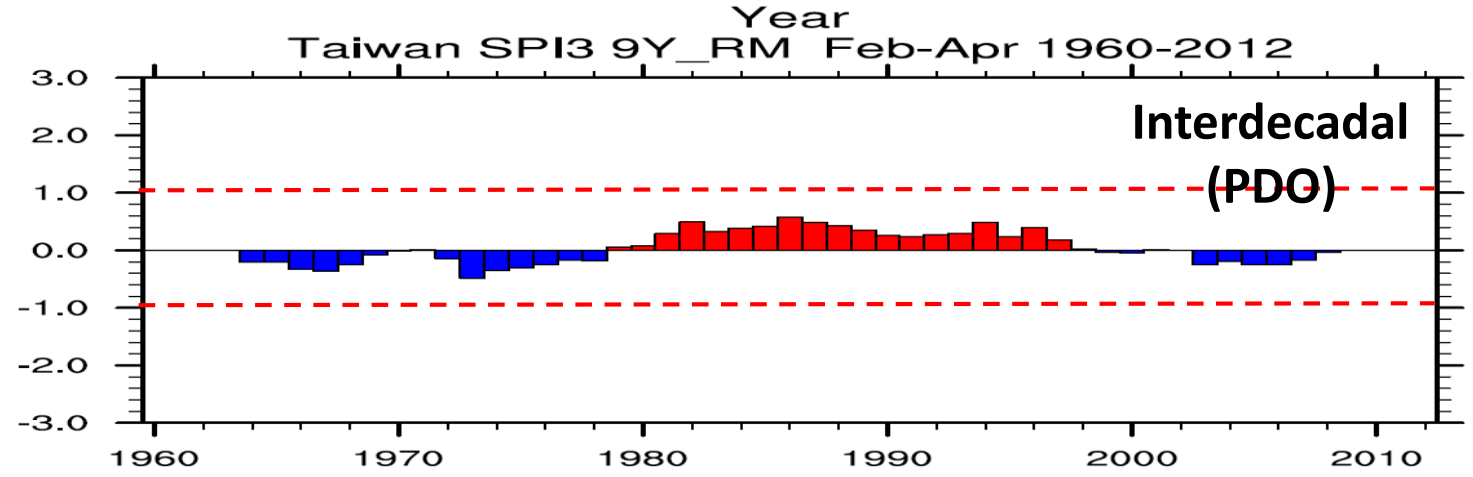
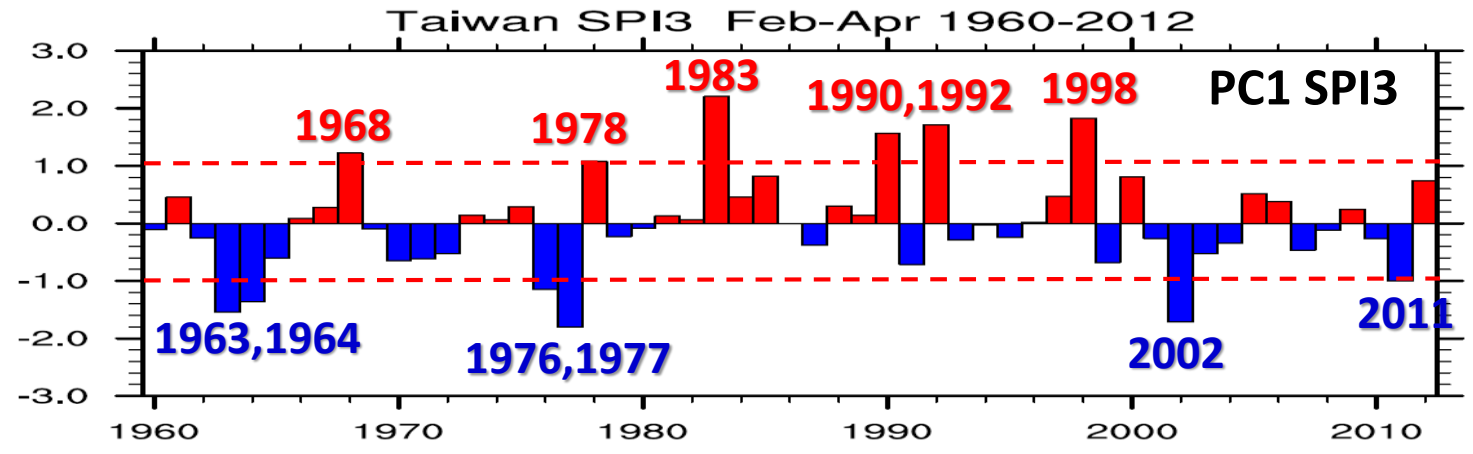
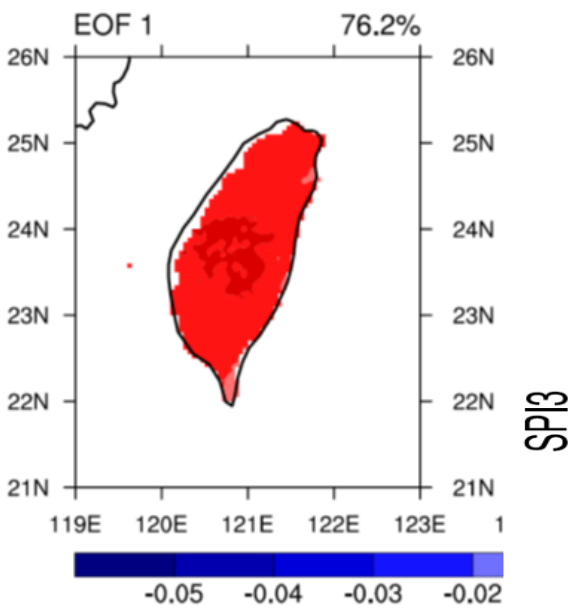


850 hPa
winds

Rainfall
EOF1
85.8%

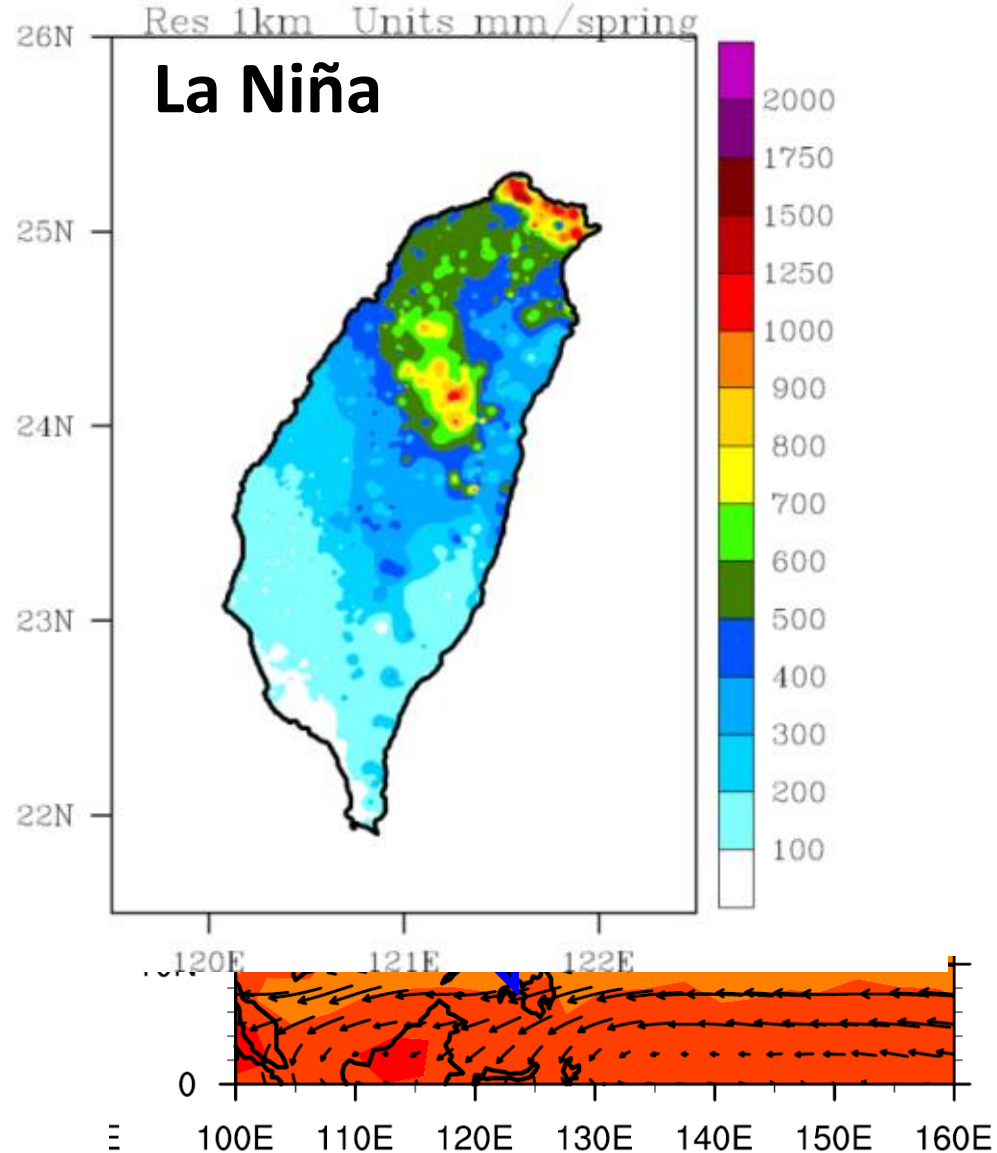


SPI3
EOF1
76.2%



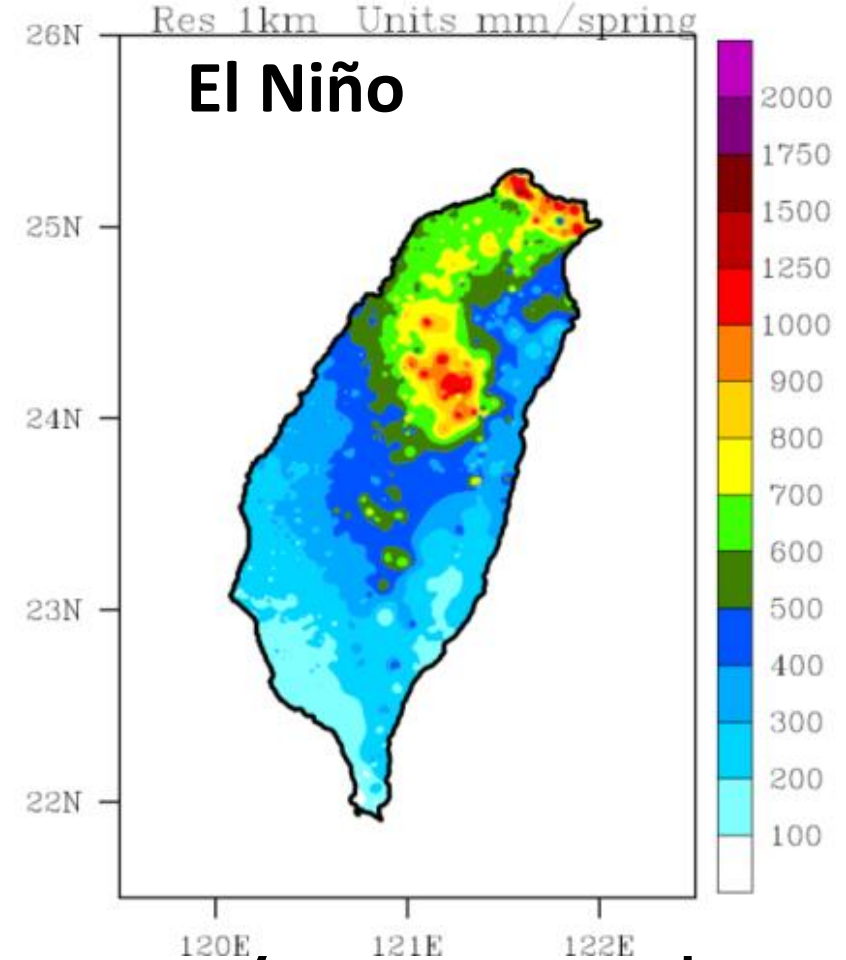
Dry

Spring Rain in La Nina Years(84,85,89,96,99,00,01,08)



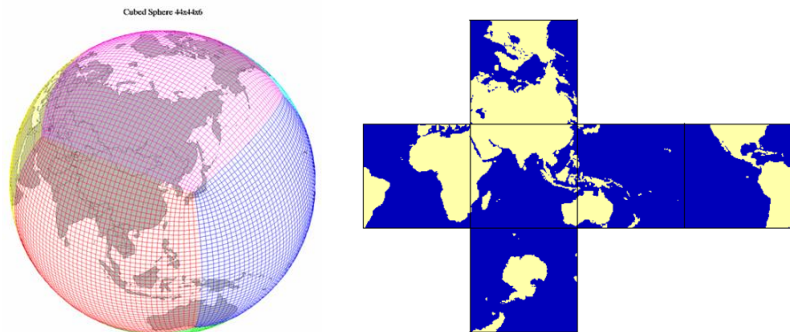
Wet

Spring Rain in El Nino Years(83,87,88,92,95,98,03,07)



SST anomaly:

- La Niña/PDO-like → Dry
- El Niño/PDO-like → Wet



C384, $\Delta x = \sim 25$ km

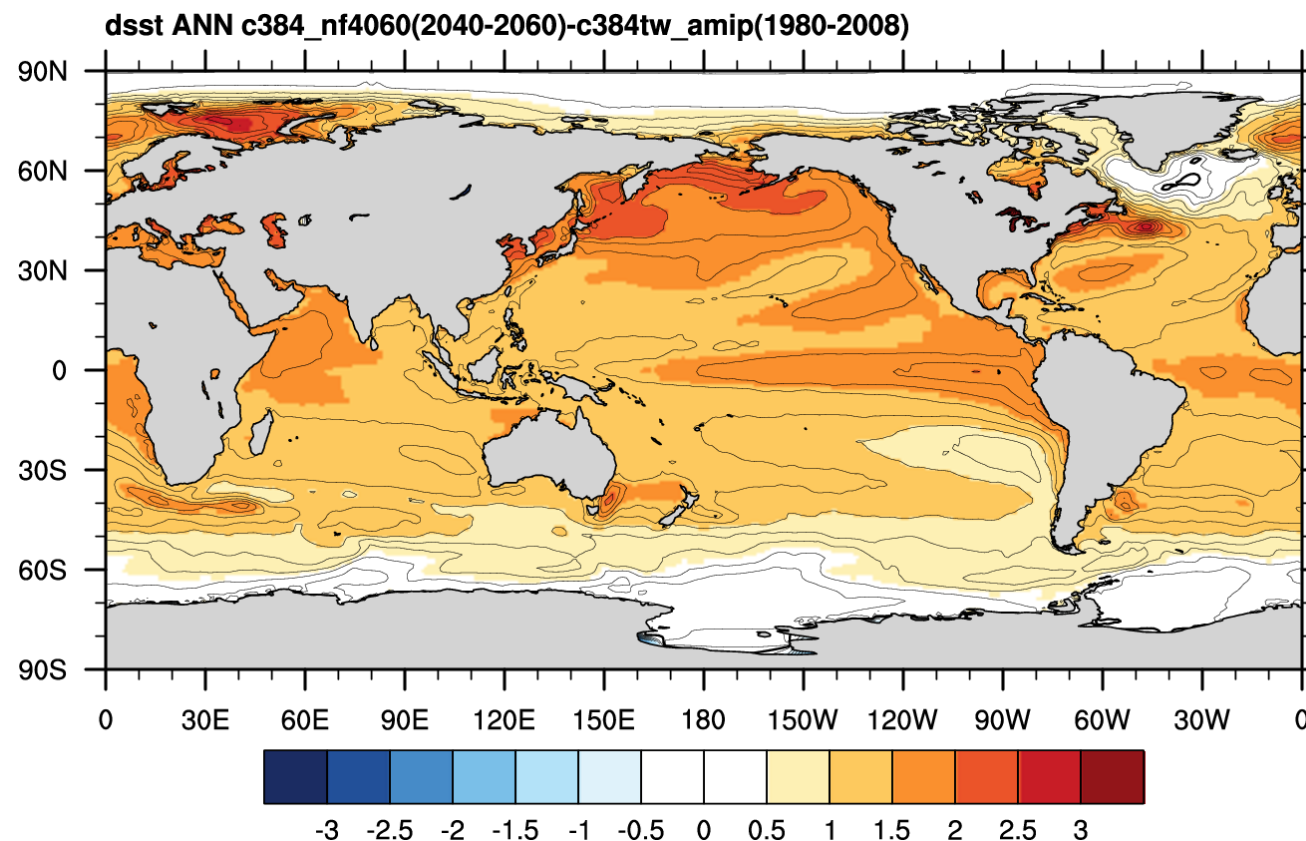
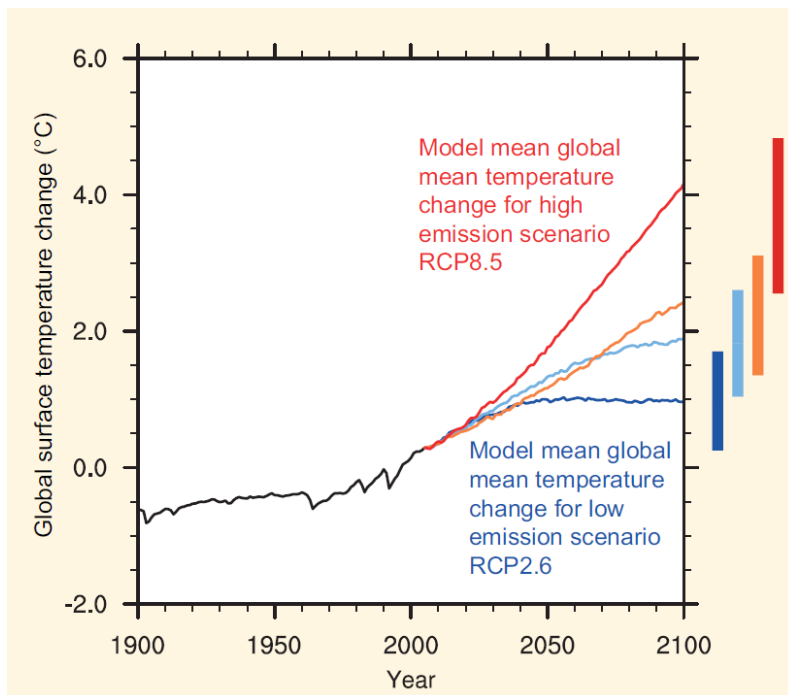
Future Projections

1. CMIP5: CCSM4, GFDL_ESM2M, IPSL_CM5A_LR, MIROC5, MPI_ESM_LR

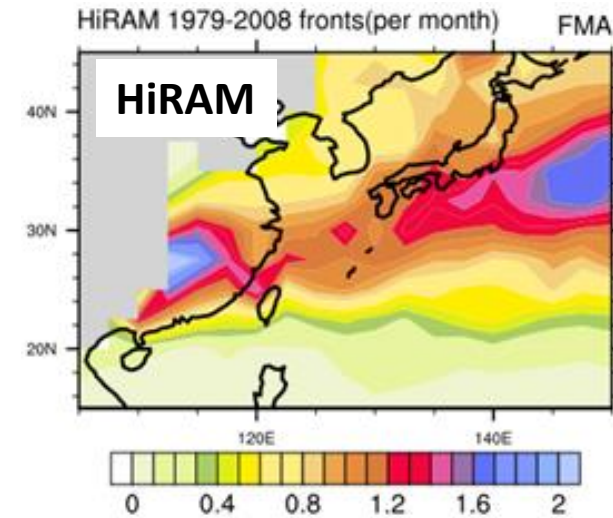
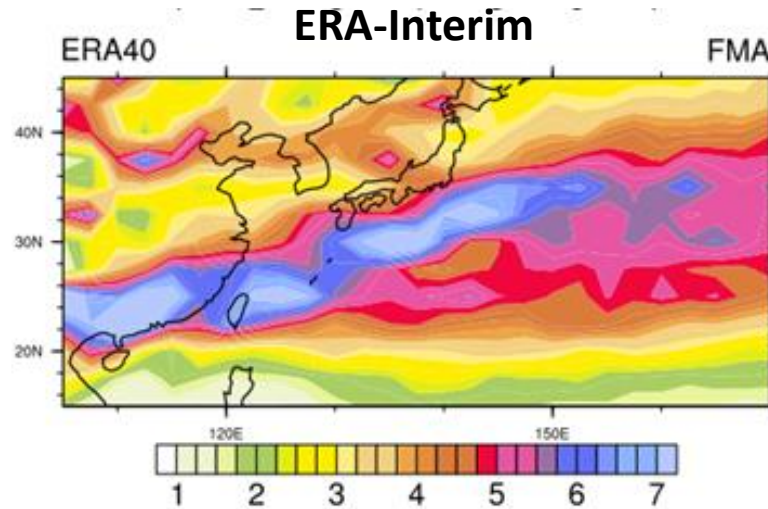
2. High-res. Climate Simulation and Projection

HiRAM/GFDL: 1979-2008, 2040-2060

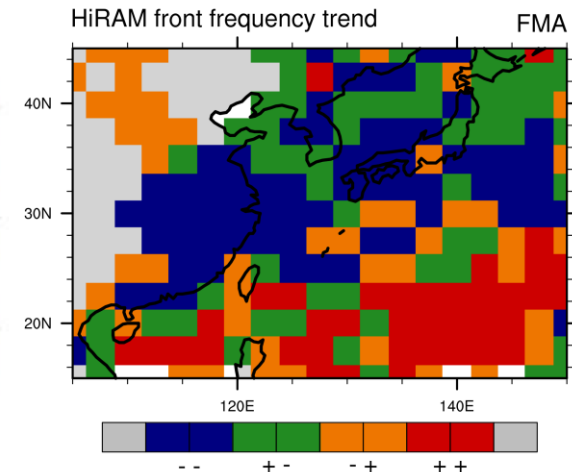
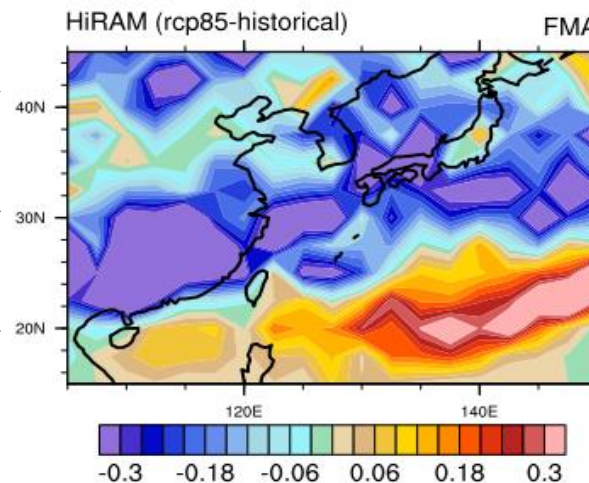
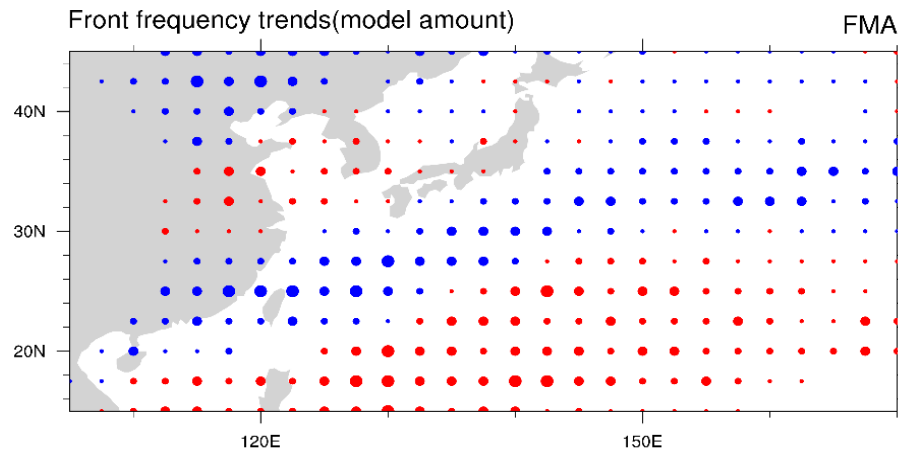
**Deviation of Ensemble-mean SST (RCP8.5) from present
Used in time-slice experiment**



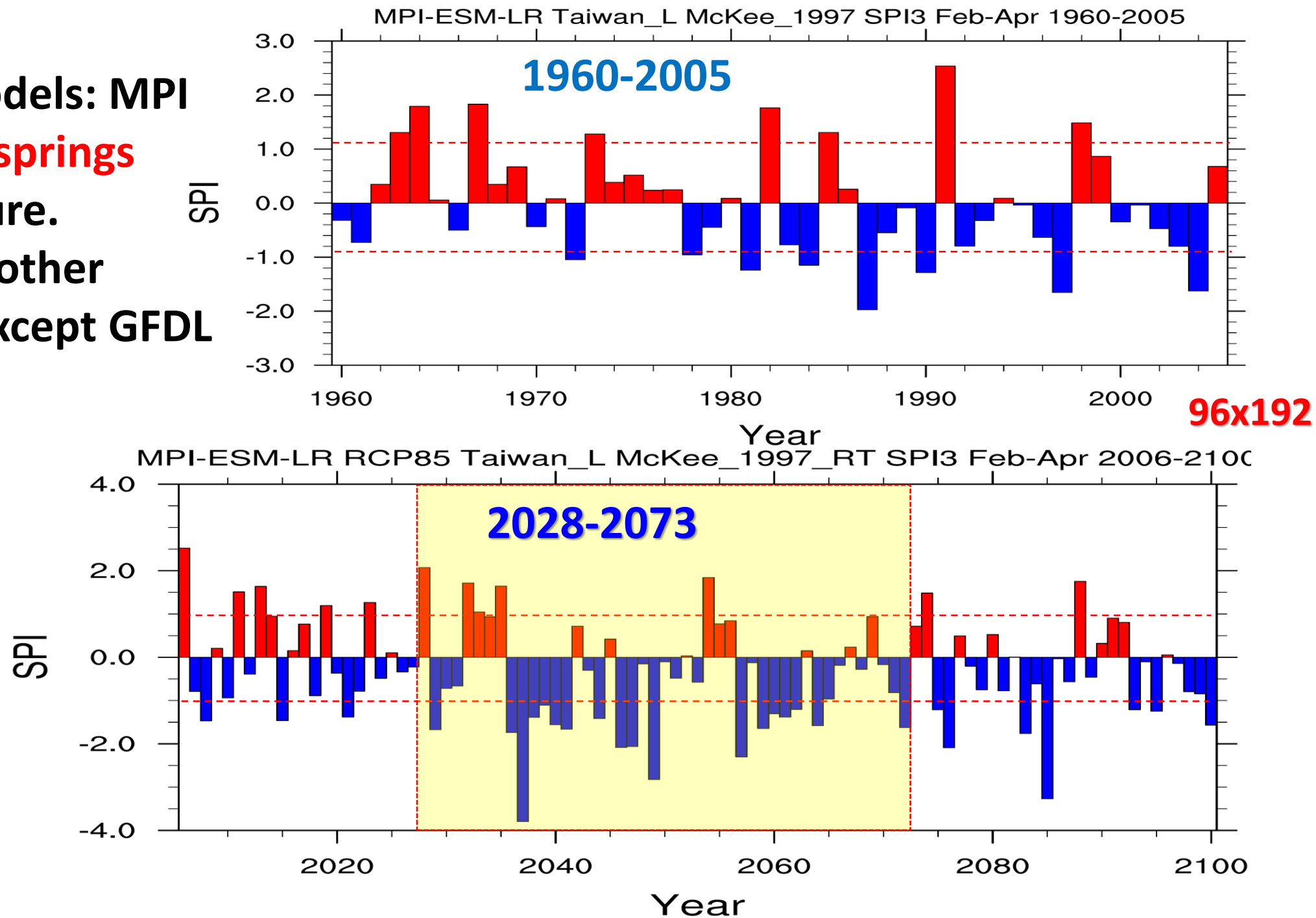
FMA Front frequency is **projected to reduce** under RCP8.5 Scenario



HIRAM(RCP8.5-historical) (NF-historical) (RCP8.5-NF)
2075-2100 **2040-2060**



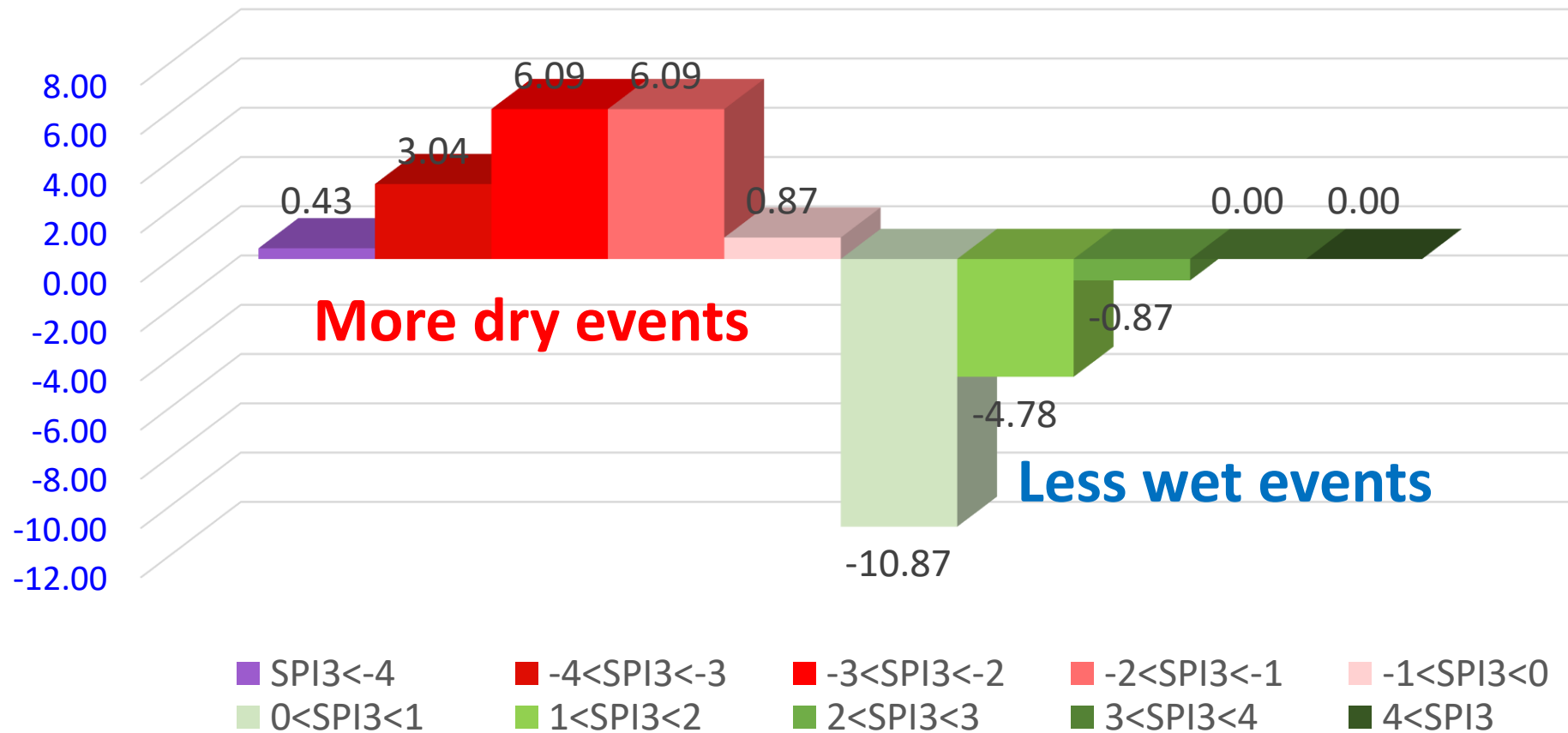
CMIP5 models: MPI
More dry springs
in the future.
Similar in other
models, except GFDL



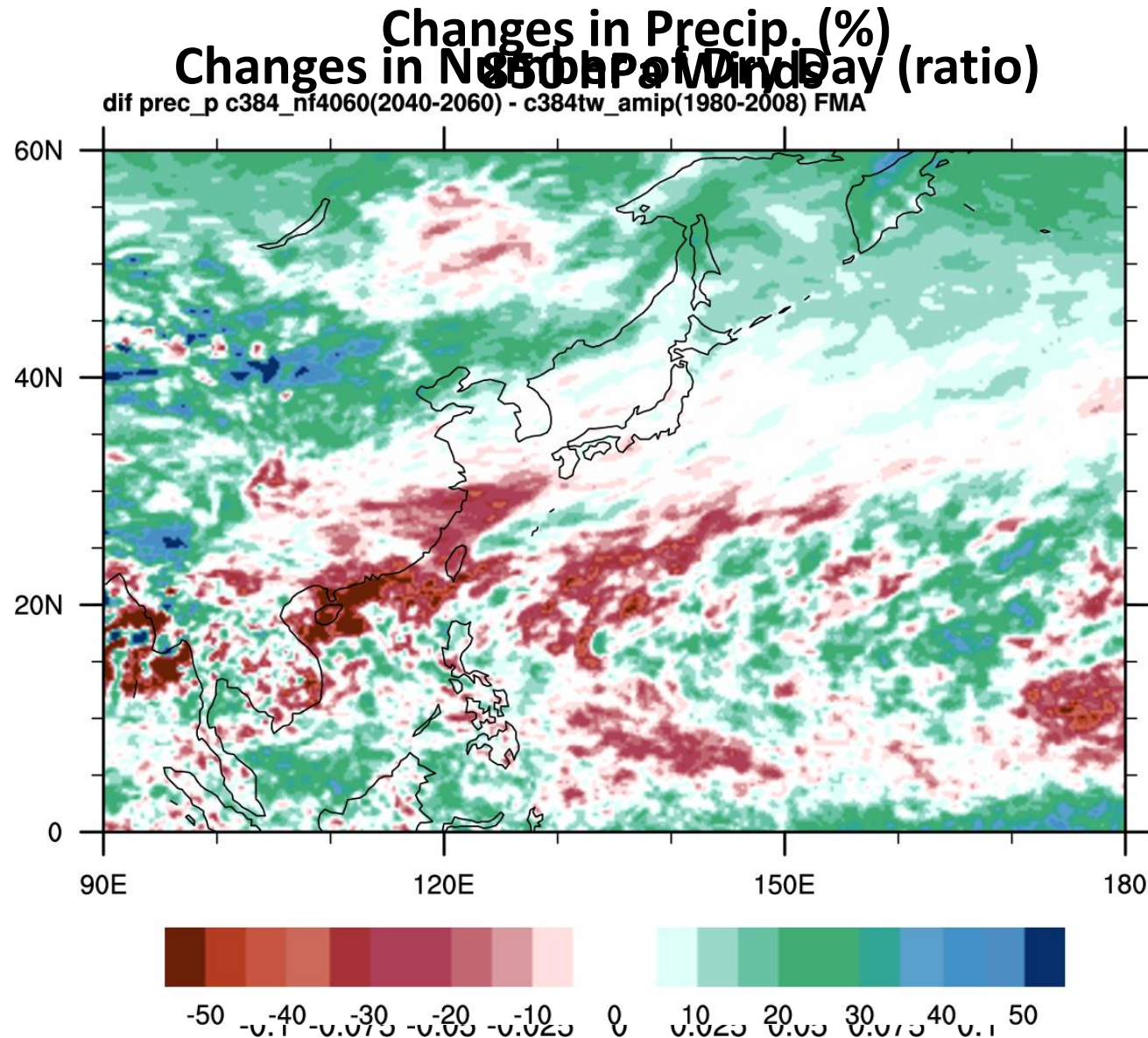
Spring in Southern China and Taiwan (21°N-28°N,110°E-123°E) projected to **become drier.**

Five CMIP5 models (best models for spring rainfall)

Changes in Probability of different **SPI3** categories in Spring Season
(RCP85-Historical, %)



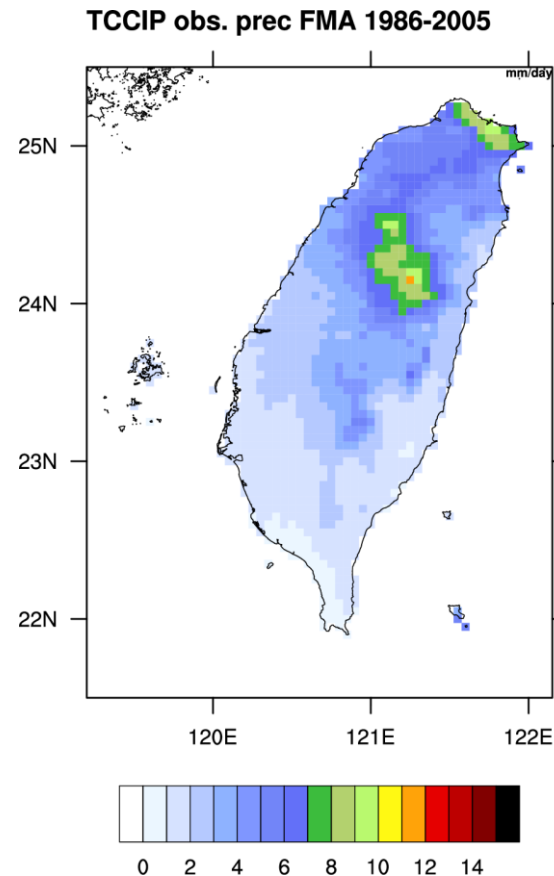
HiRAM Projection of Spring Precip (2040–2060)



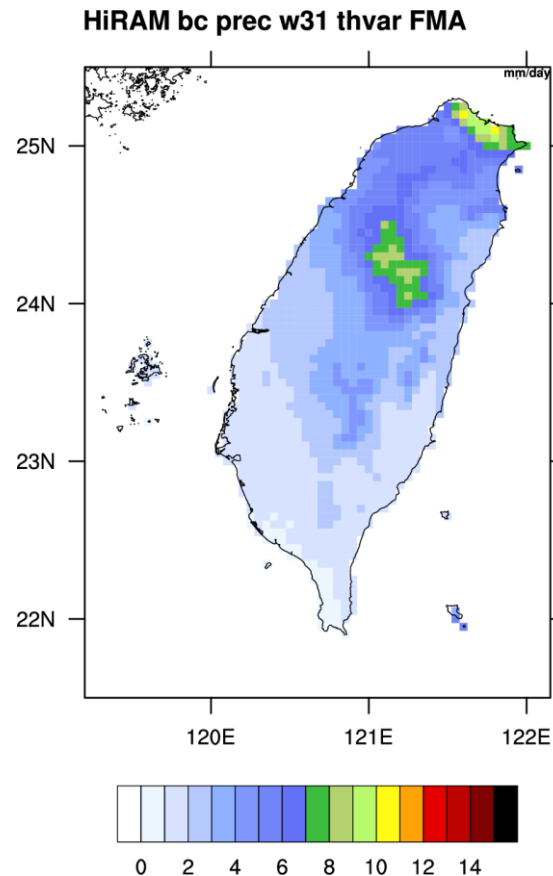
- Weaker southwesterly
- Less Precip.
- More dry days

Precipitation Changes in Taiwan: Drying in Northern Taiwan

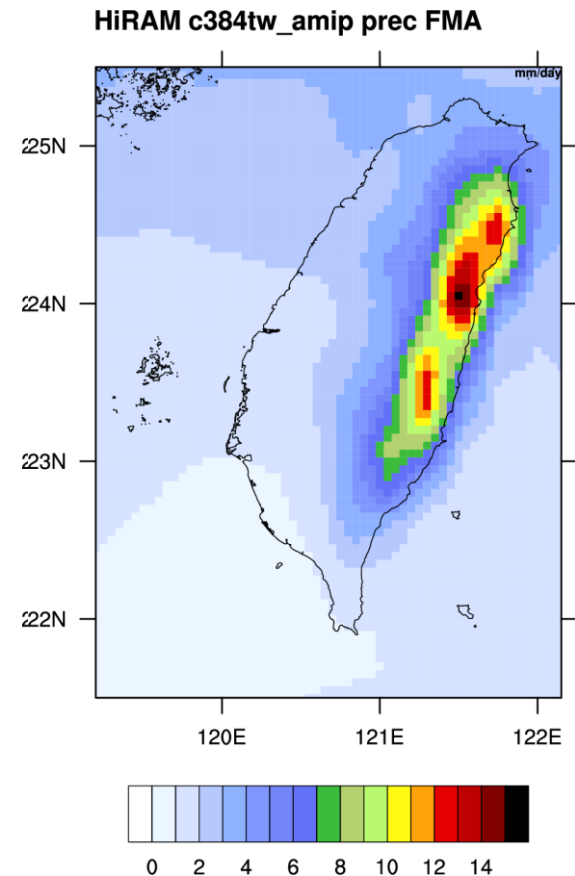
Observation

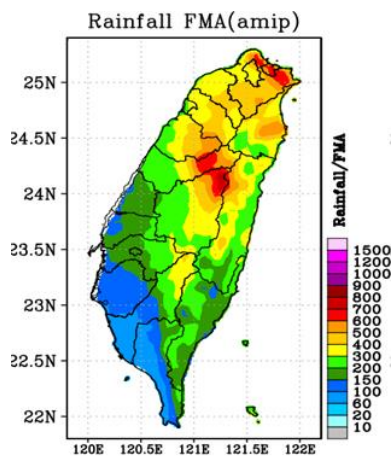


HiRAM (bias corrected)



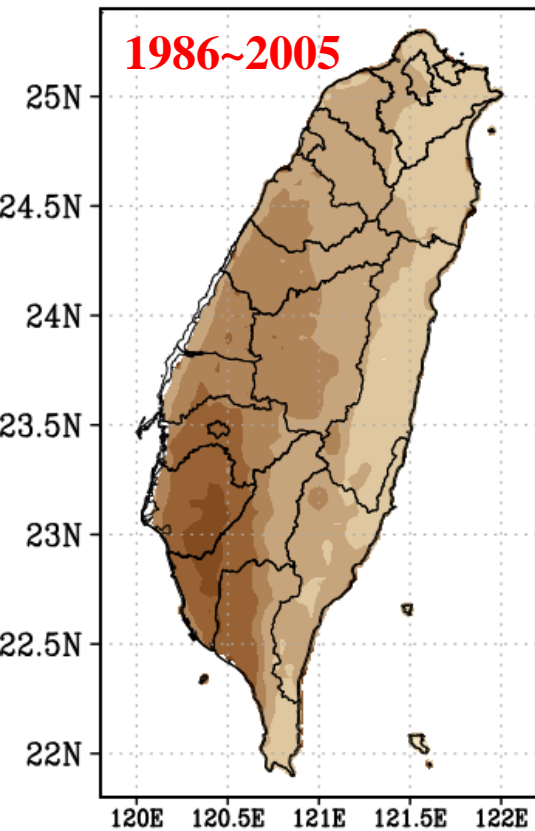
Projected Changes



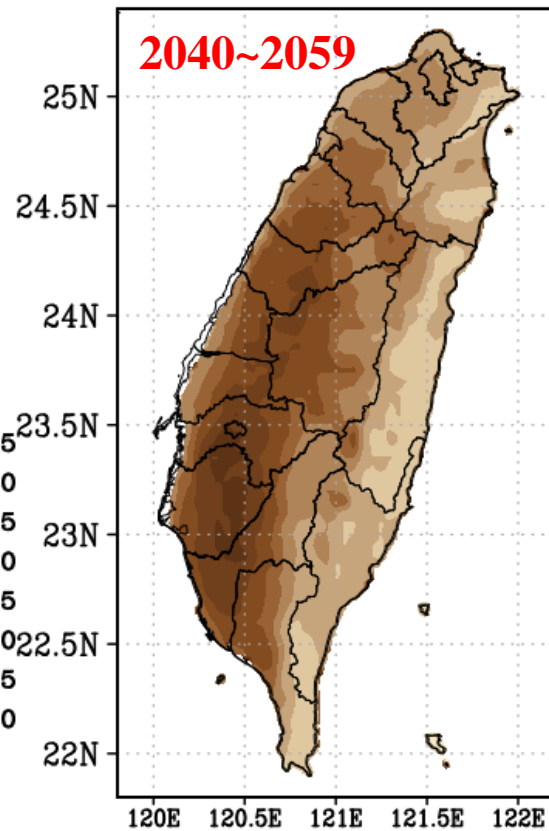


WRF downscaling: Maximum Continuous Dry Day (<0.1mm) (5-km, driven by HiRAM outputs)

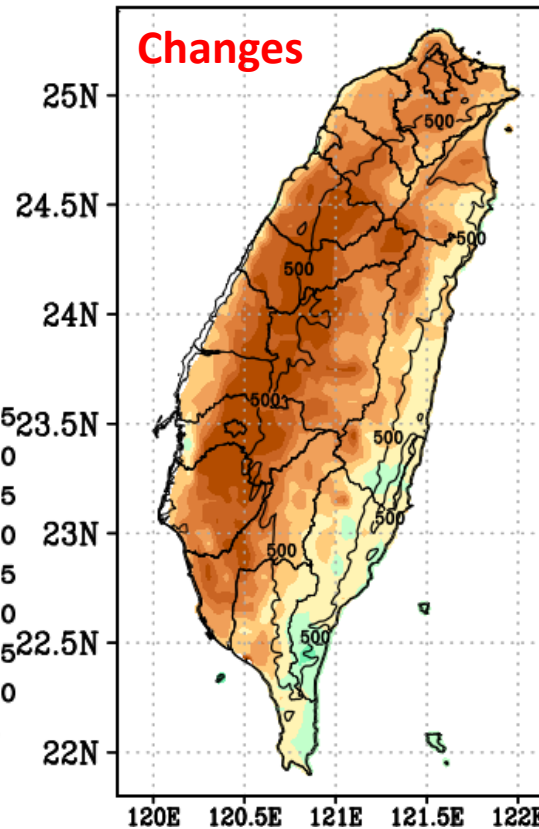
CDD FMA(amip)



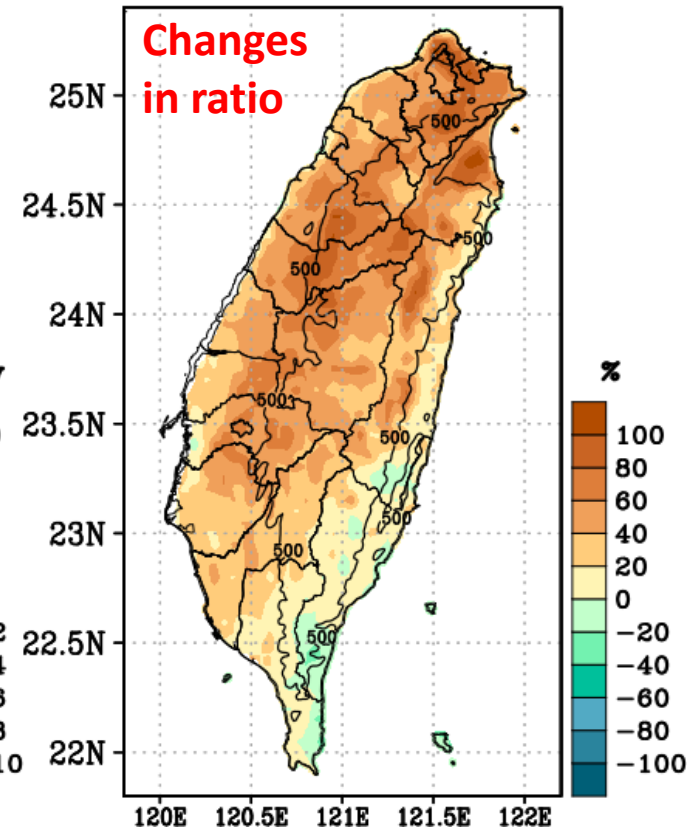
CDD FMA(nf)



Diff. in CDD per FMA
(nf-amip)



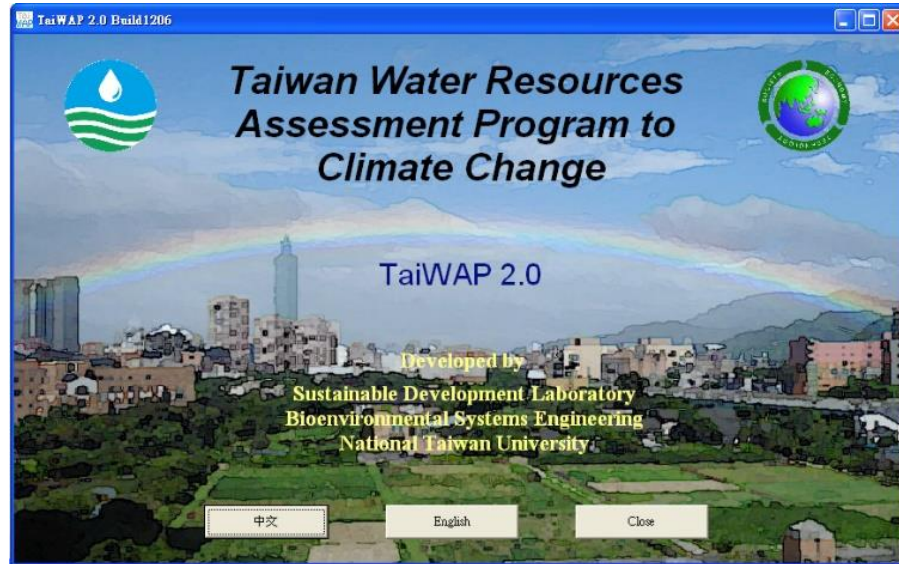
Change_Rate in CDD per FMA
(nf-amip)



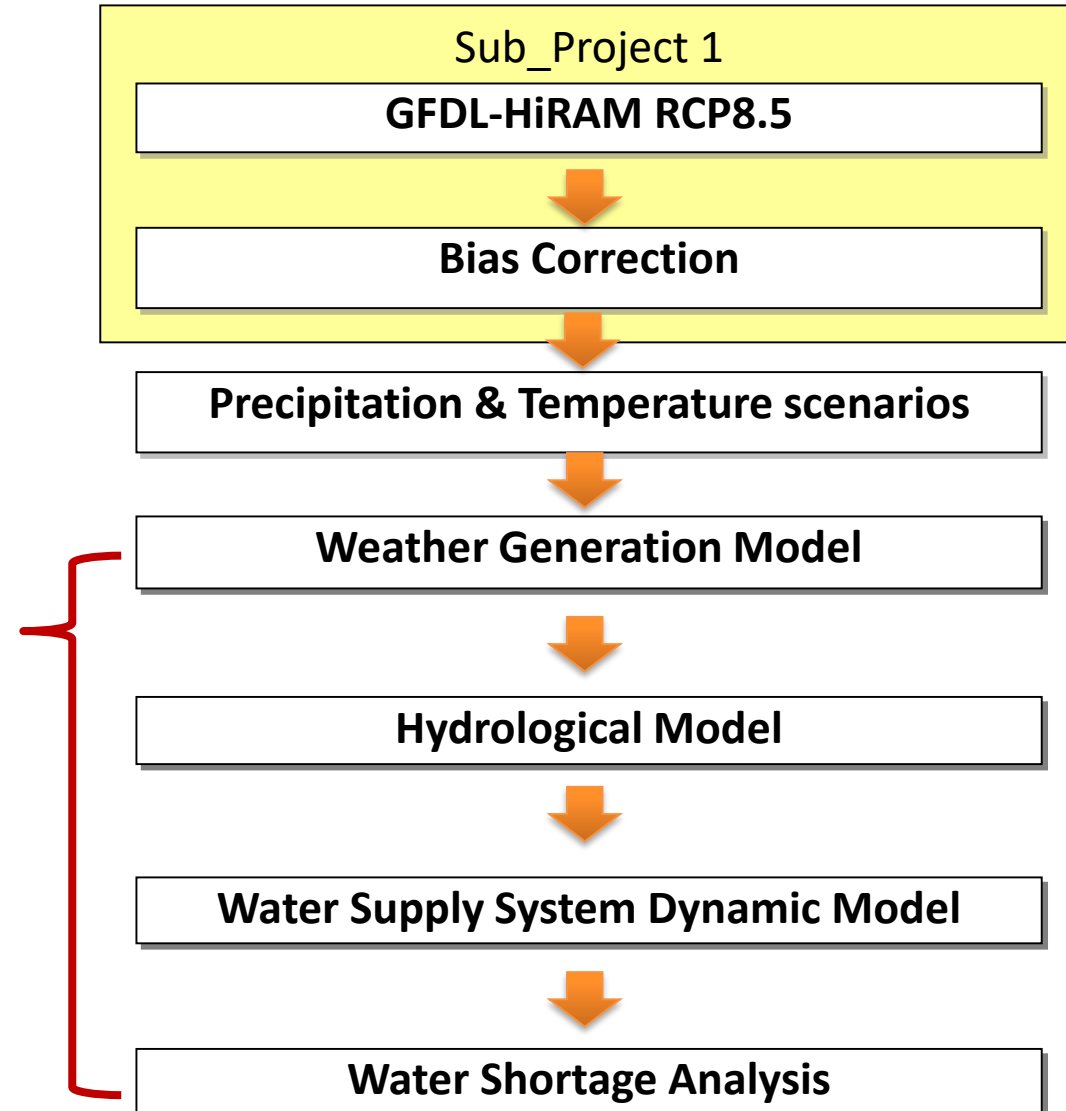
Accessing the Impacts on Water Resources in northern Taiwan

- Framework and tool -

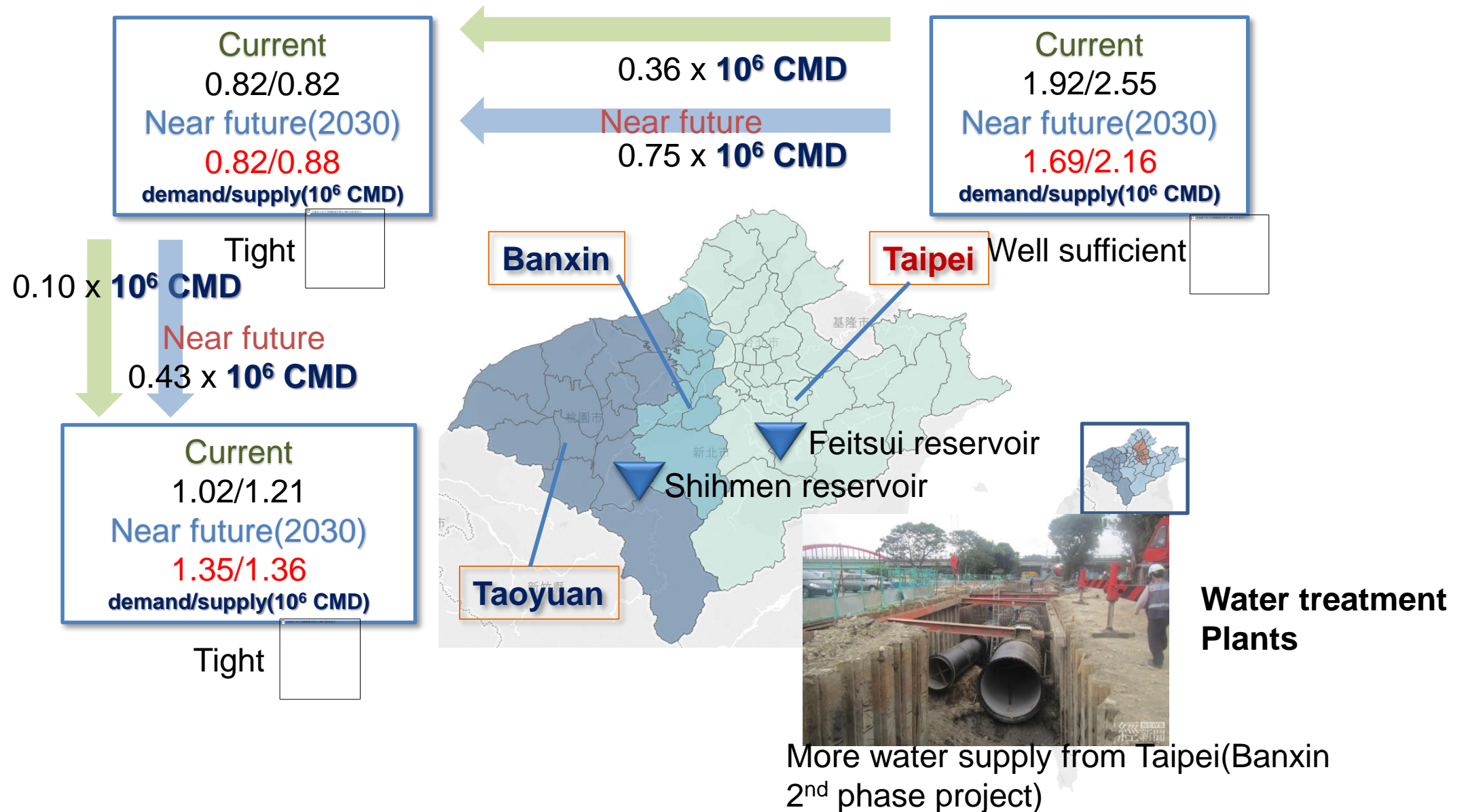
Integrated assessment tool TaiWAP



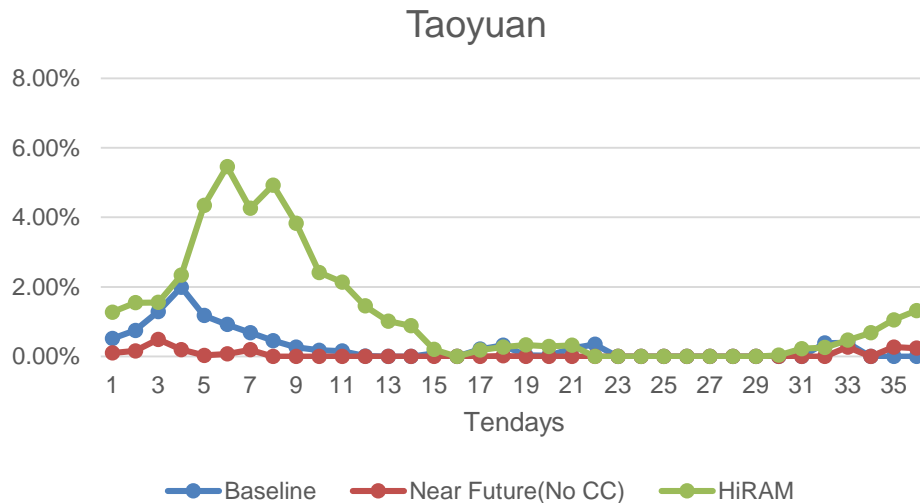
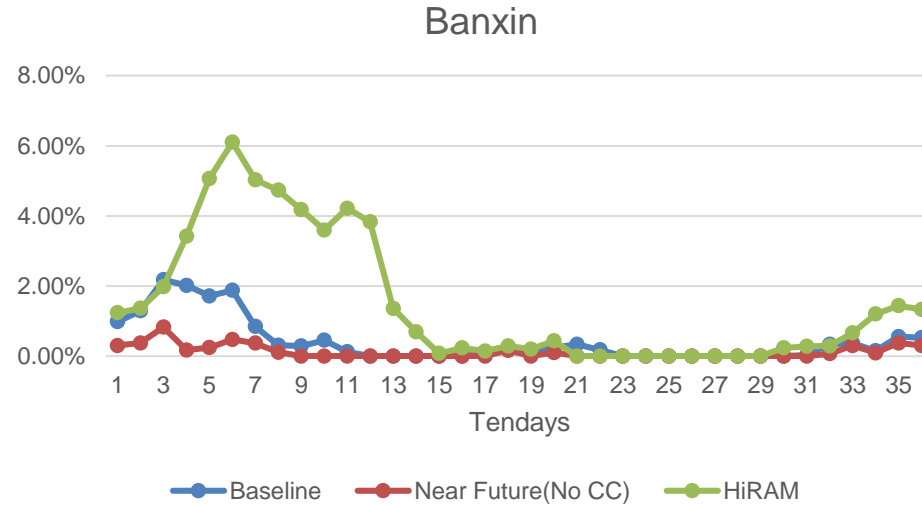
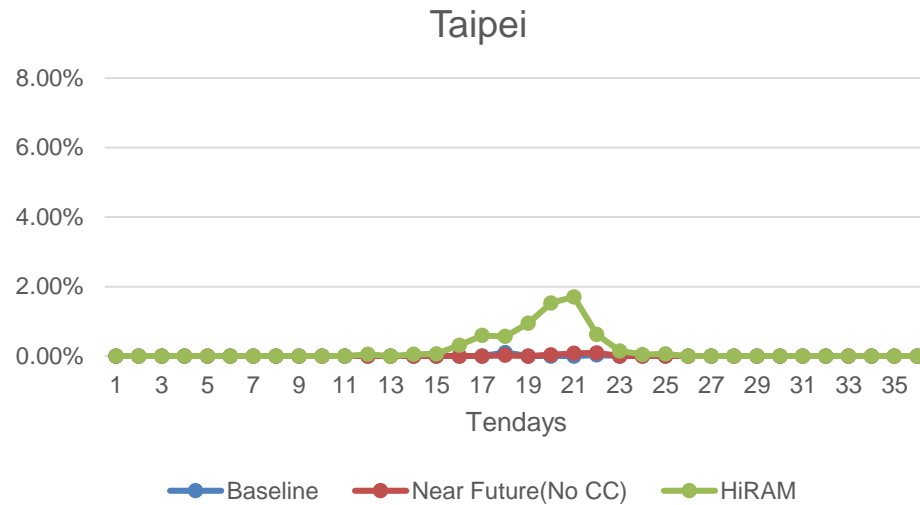
<http://sdl.ae.ntu.edu.tw/TaiWAP/>



Current and Planned Water Supply - Northern Taiwan



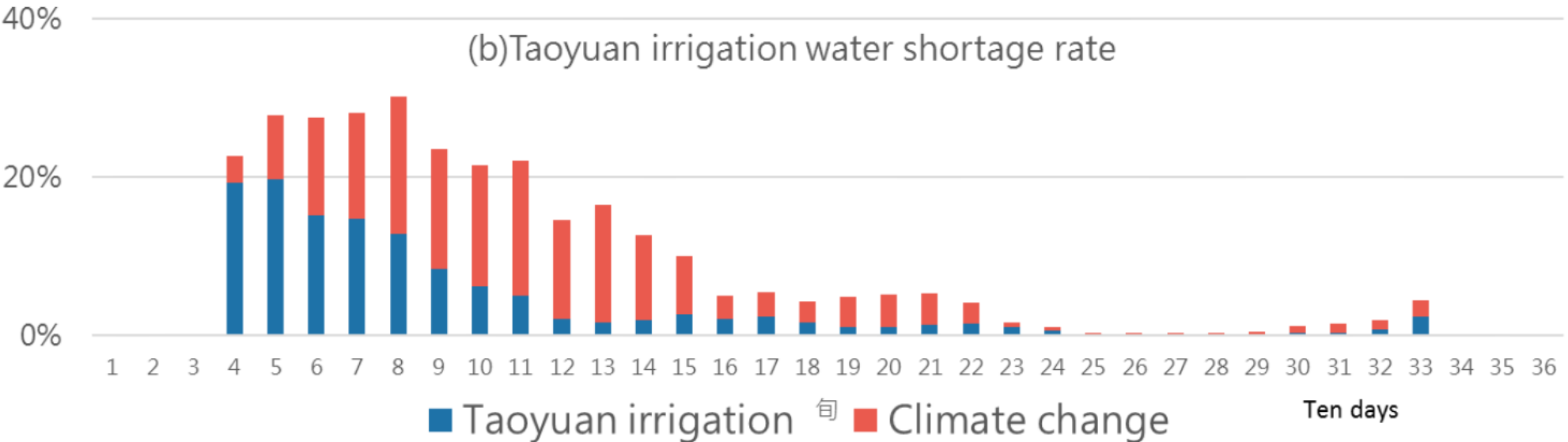
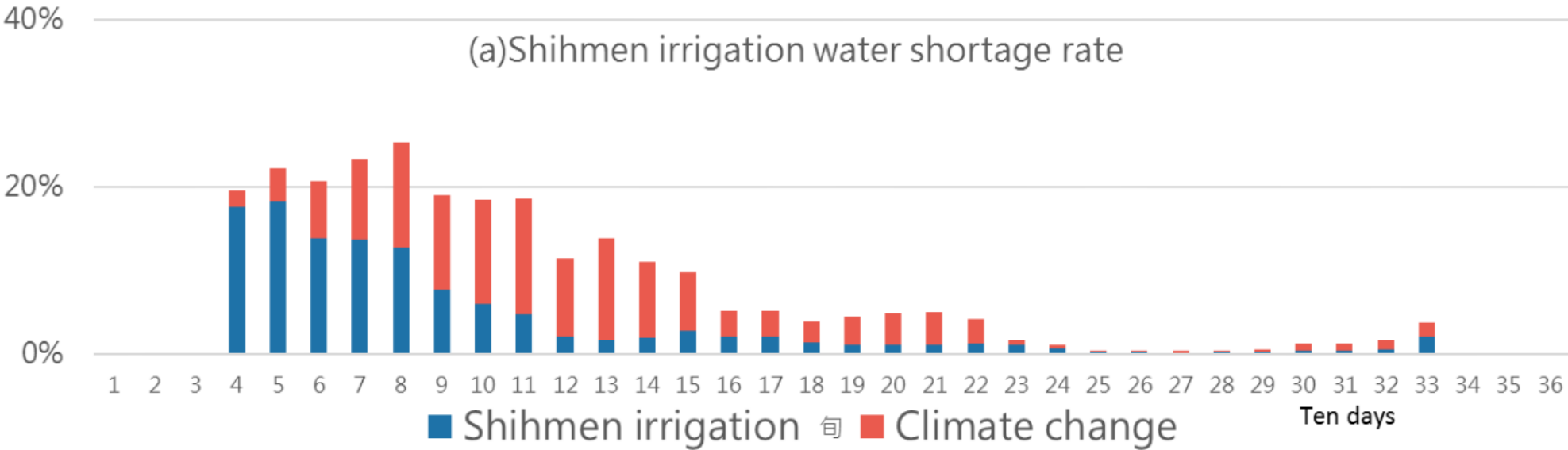
Average Water Shortage Rate



On average

- Three systems all have very low water shortage rate
- The Banxin 2nd phase project can reduce the water shortage in the near future
- Climate change effect likely increases the water shortage rate

Larger Impact on Irrigation Water Shortage

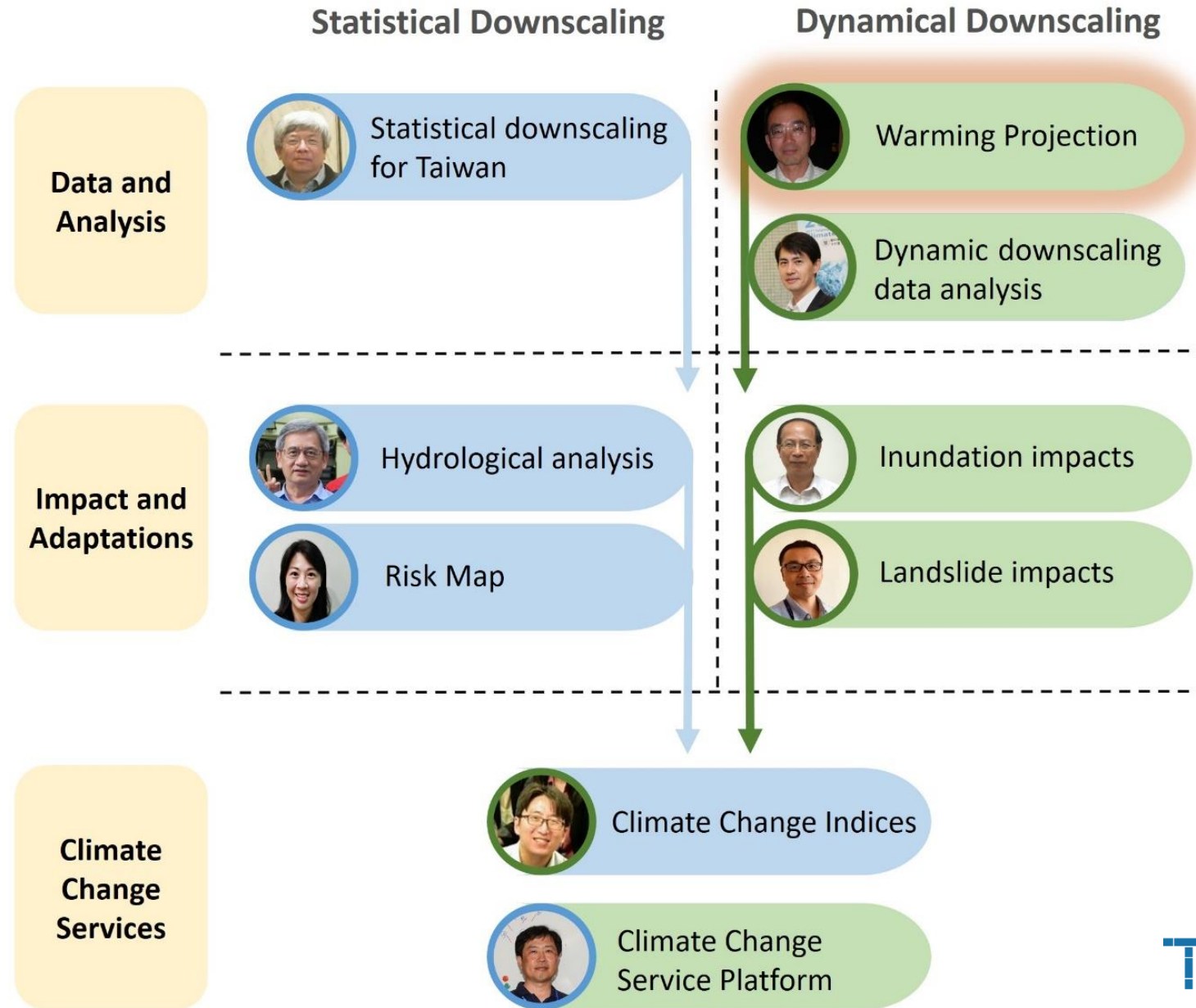


Summary

- Weaker moist southwesterly is projected in the warming future.
- Spring rainfall in Taiwan is likely to decrease.
- Spring drought likely to occur more frequently.
- Certain regions in northern Taiwan will likely suffer from water resource shortage without proper adaptation measures.



TCCIP Oral Presentation outline



Thank you for Your Attention
Questions and Comments?

