



Projection of local rainfall using SVD-based downscaling scheme

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Outline



★ **Introduction**

★ **Data and Method**



★ **Result**

★ **Summary**





Introduction

- ★ Many things are affected by the local precipitation, such as the agriculture, the society, the economy even travel and so on. Therefore, the water resources management as well as the study of the local precipitation has then become an important topic.
- ★ **GCM** has quite **limitation** on the area of **regional climate simulation** (Gortch and MacCracken 1991, Xu 1999).



Introduction

★ There are still some
limitations for GCMs in
simulating LOCAL climate



“Downscaling to local area” ??



Introduction

- ★ **Dynamic downscaling**

- => has potential in simulating extreme events
 - => relatively expensive

- ★ **Statistical method** based on model output has become a popular way to correct the systematic error and to **downscale climate rainfall predictions to regional area** in recent years. (Such as SVDA, EOF) *Feddersen et al. 1999 , Kang et al. 2004, Kim et al. 2004*

- => **relatively cheaper**



Data

1. **Downscaling method based on SVDA**
2. **Monthly rainfall over Yunlin County**
3. **Yunlin County precipitation (37 stations):**
1975~2000 monthly mean
4. **Model predictor (**V850** and **MSLP**):**
IPCC AR4 data base (20C3M, A1B, and B1)
5. **NCEP-Re monthly mean (**UV850**, **MSLP**)**

Model

Model name	Short name	Country	Atmospheric resolution	Reference
CGCM3.1(T63)	CCCMA	Canada	T63,L31	Flato (2005)
CSIRO-Mk3.5	CSIRO	Australia	T63,L18	Gordon et al. (2002)
ECHAM5/MPI-OM	ECHAM5	Germany	T63,L31	Jungclaus et al. (2006)
GFDL-CM2.0	GFDLCM20	U.S.A.	2.5°x2°,L24	Delworth et al. (2006)
GFDL-CM2.1	GFDLCM21	U.S.A.	2.5°x2°,L24	Delworth et al. (2006)
MRI-CGCM2.3.2	MRI	Japan	T42,L30	Yukimoto et al. (2002)
MIROC3.2(hires)	MIROC	Japan	T106,L56	K-1 model developers (2004)



Climate model and Downscaling

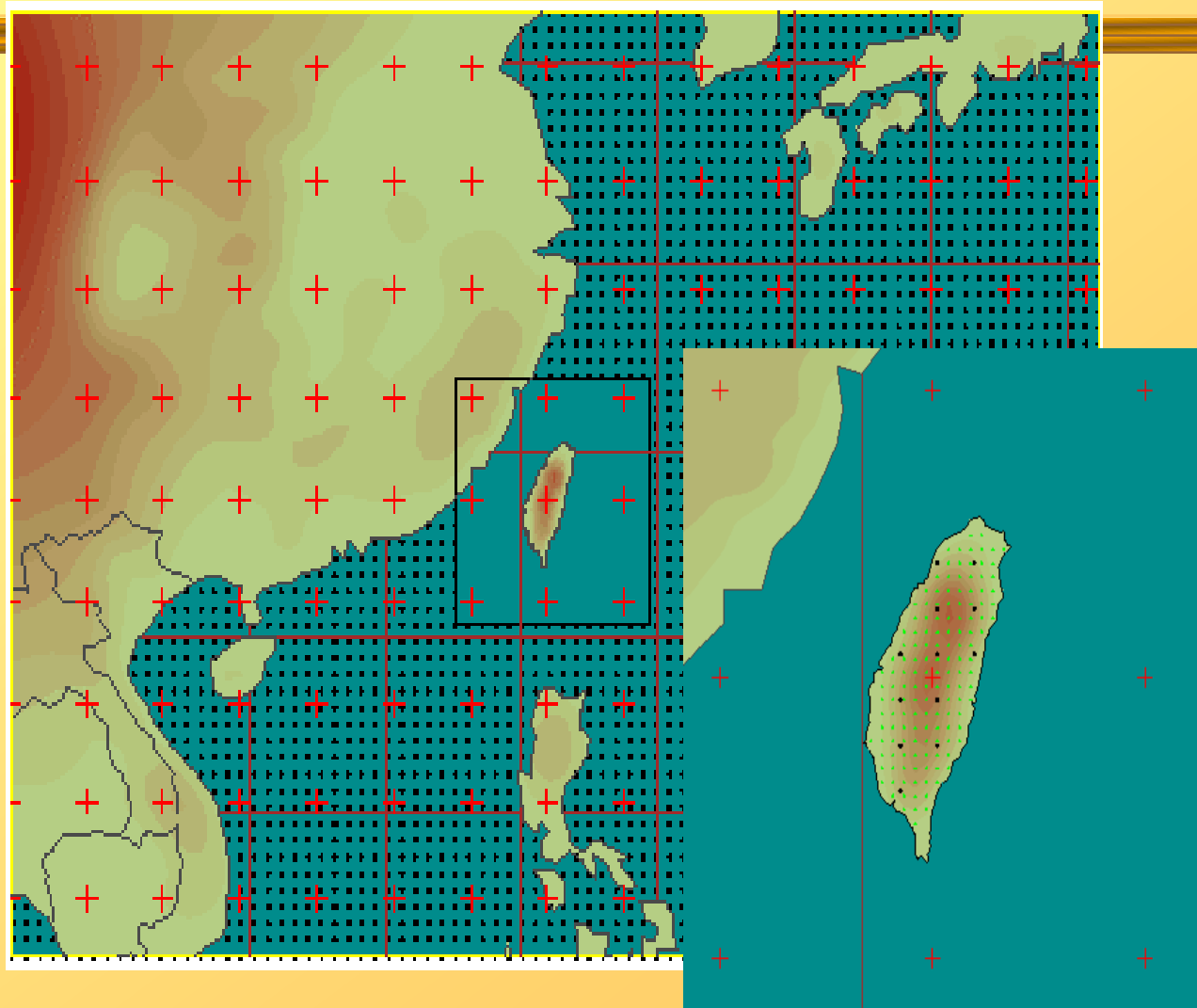
GCM
Projections



Downscaling



Local Climate
Projection

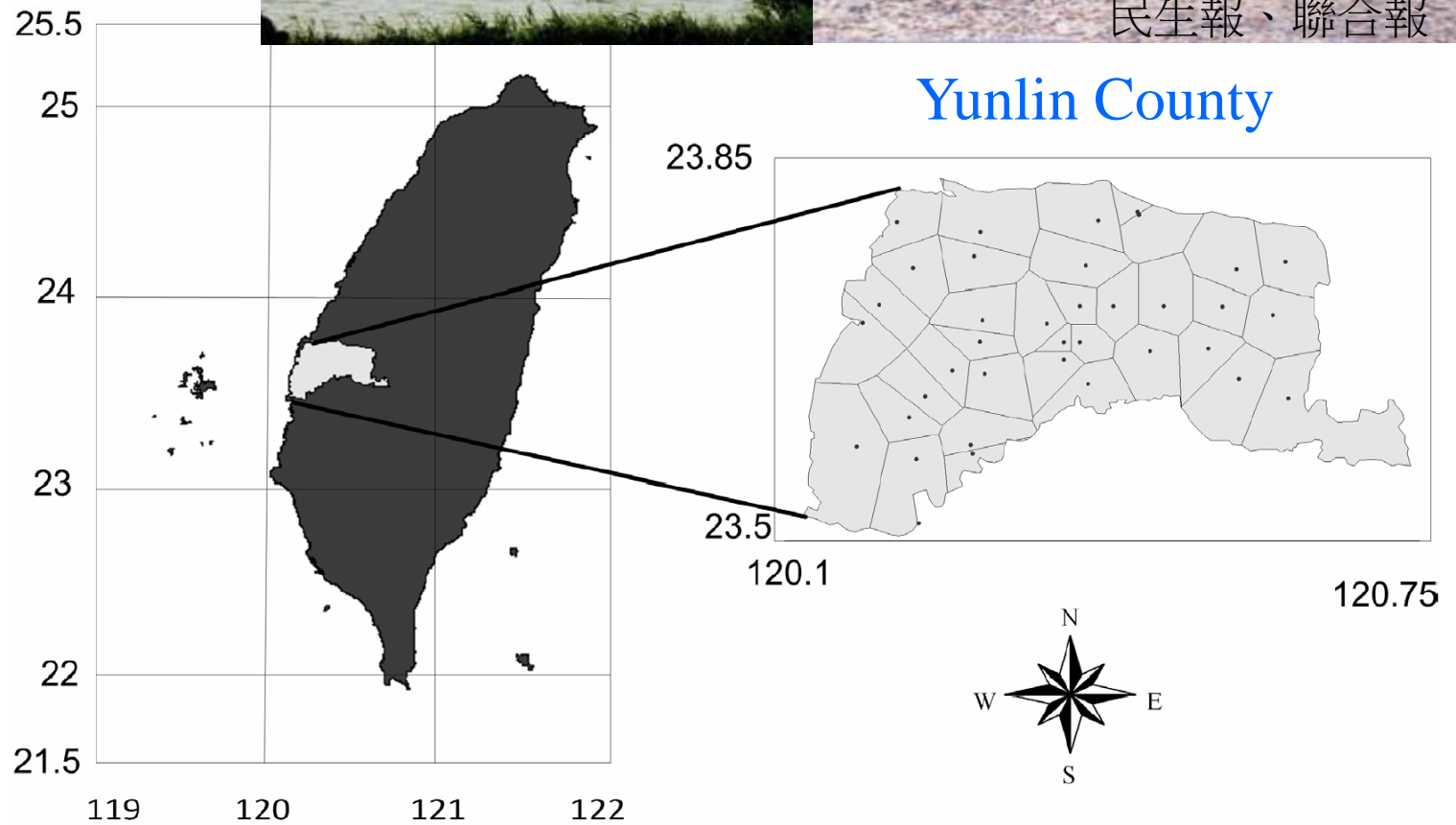


Study area

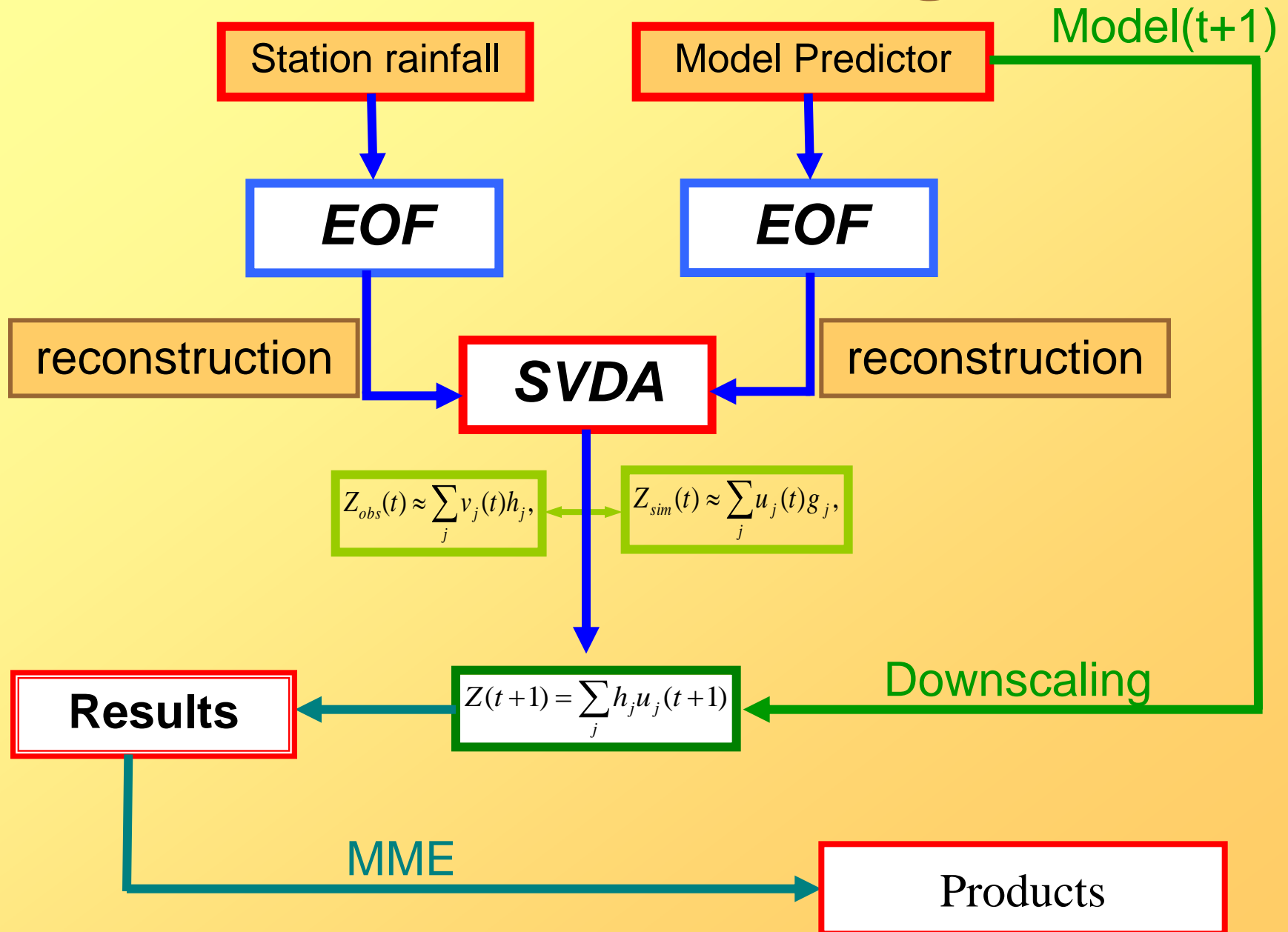


民生報、聯合報

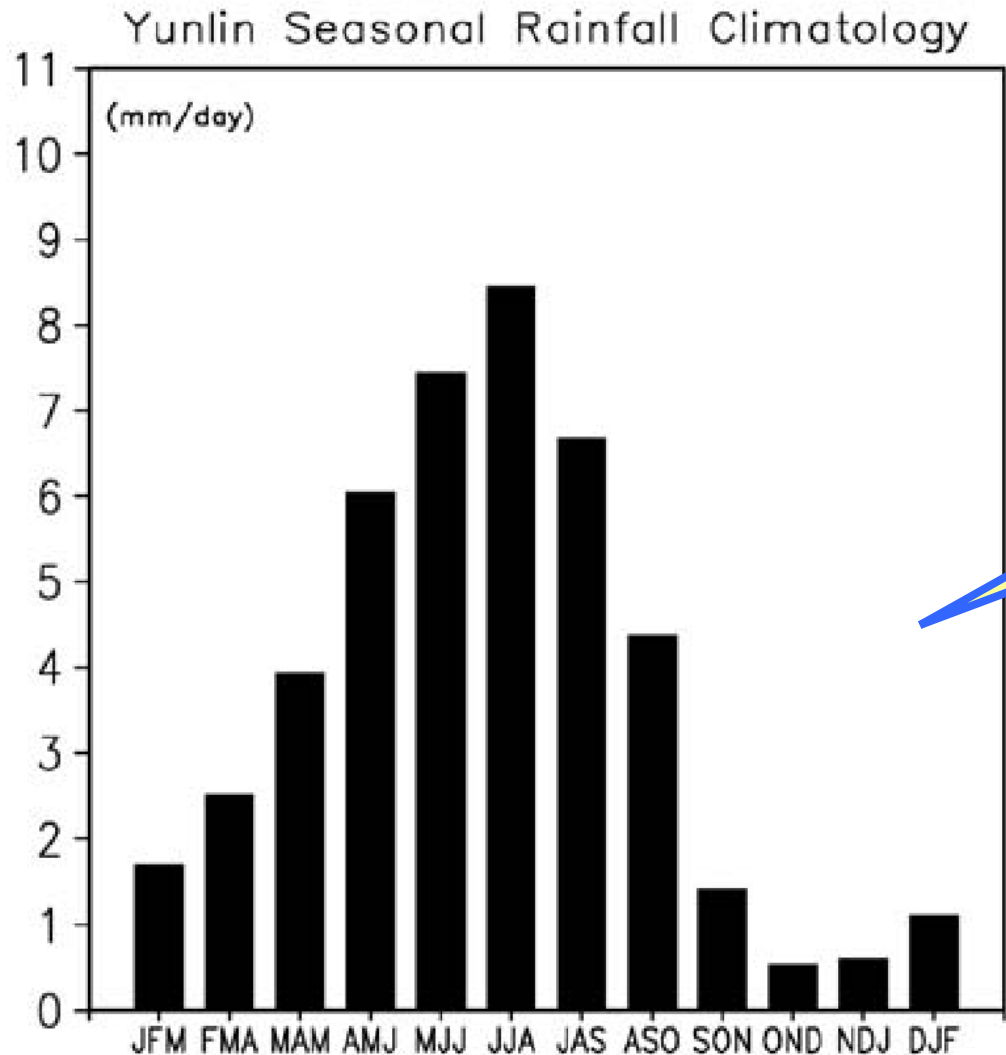
Yunlin County



Flow chart of Downscaling



Climatology of Seasonal rainfall over Yunlin County

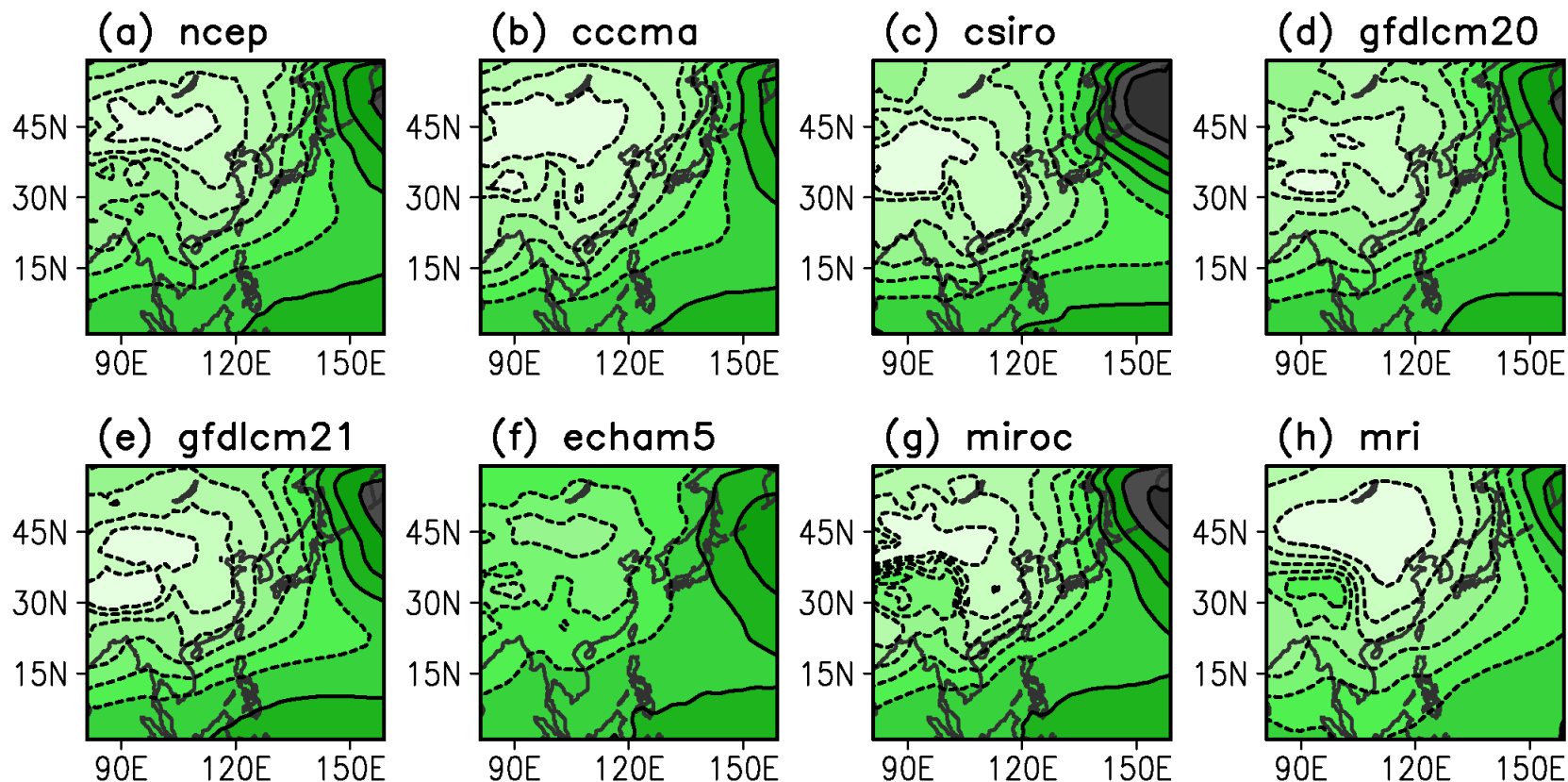


APR. ~ SEP. => **Wet**
Period

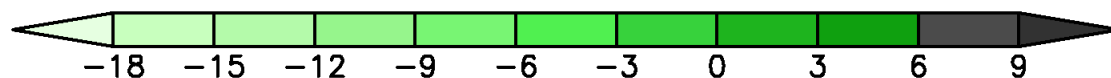
OCT. ~ MAR. =>
Dry Period



Wet-Dry Pattern for Large-Scale Circulation (Climatology) MSLP

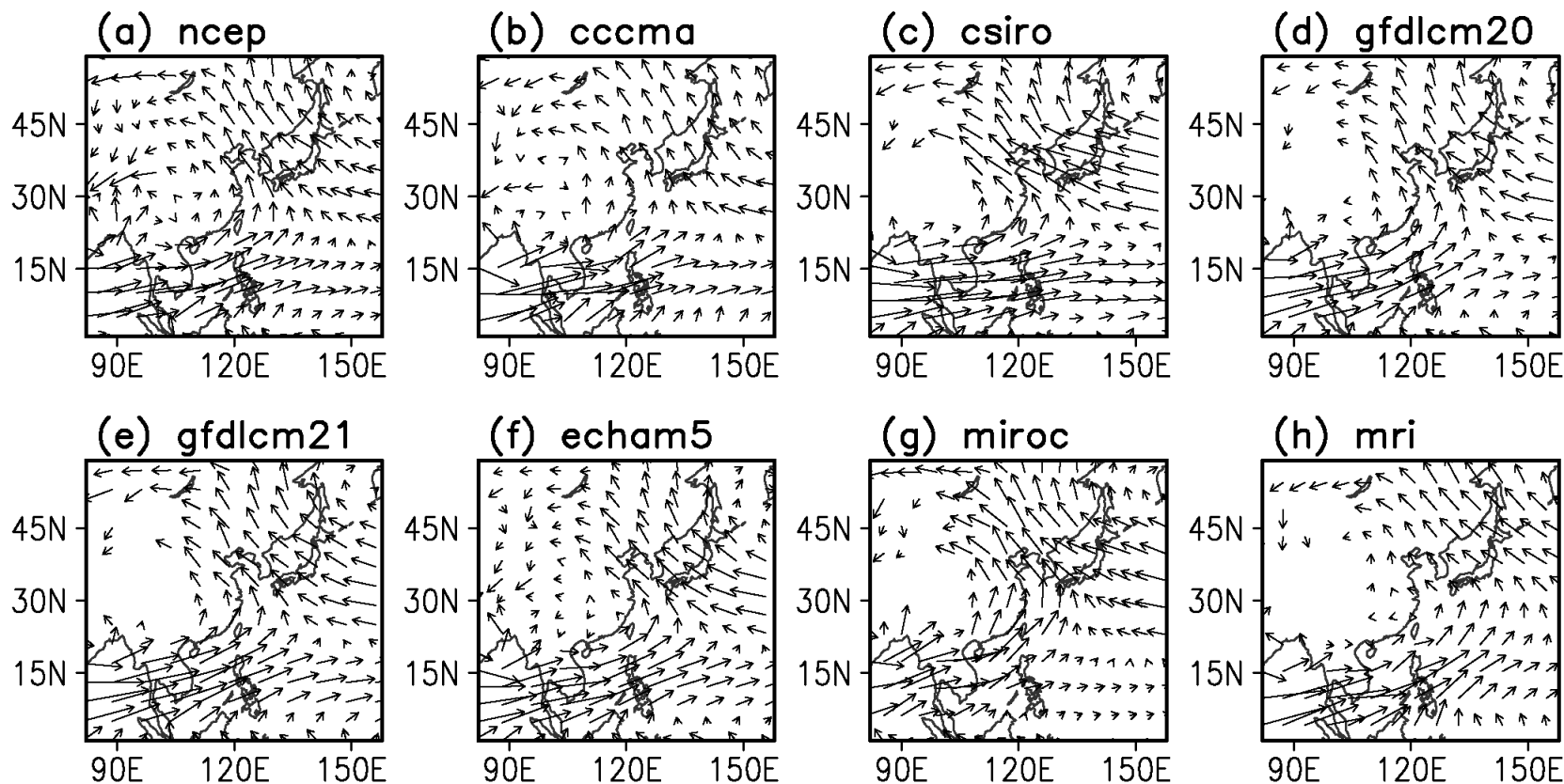


MSLP





Wet-Dry Pattern for Large-Scale Circulation (Climatology) UV850

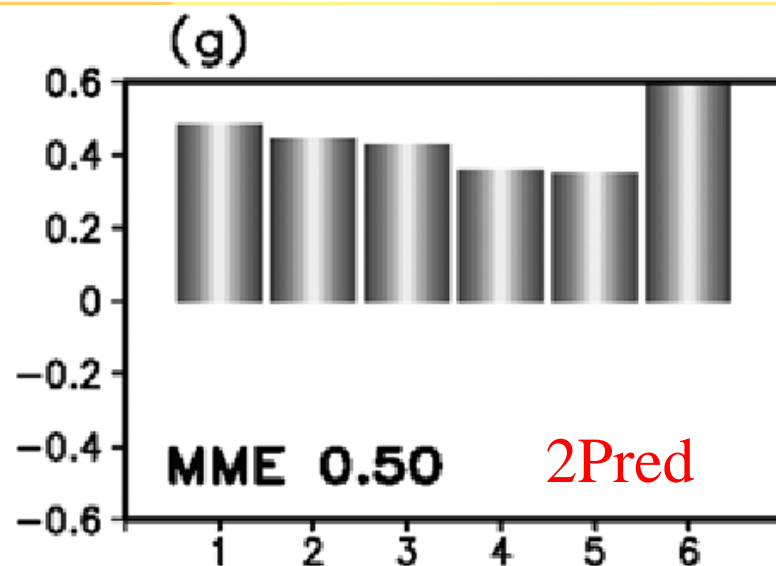
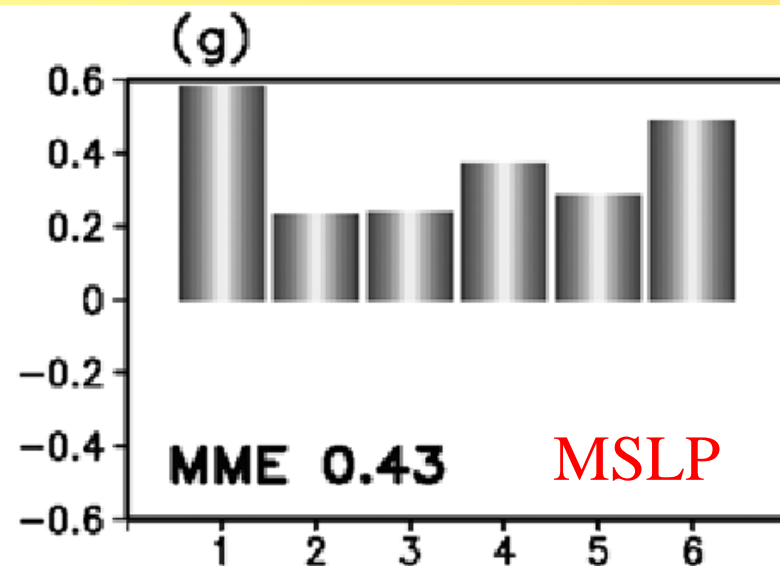
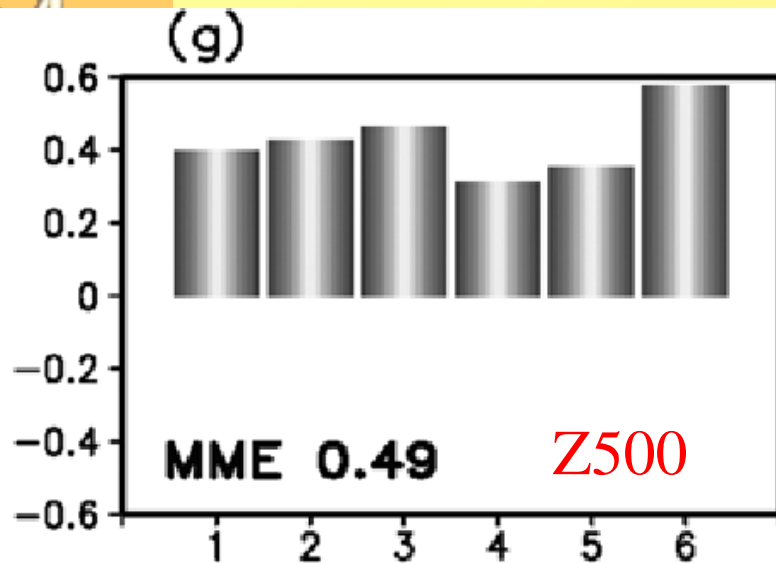


UV850



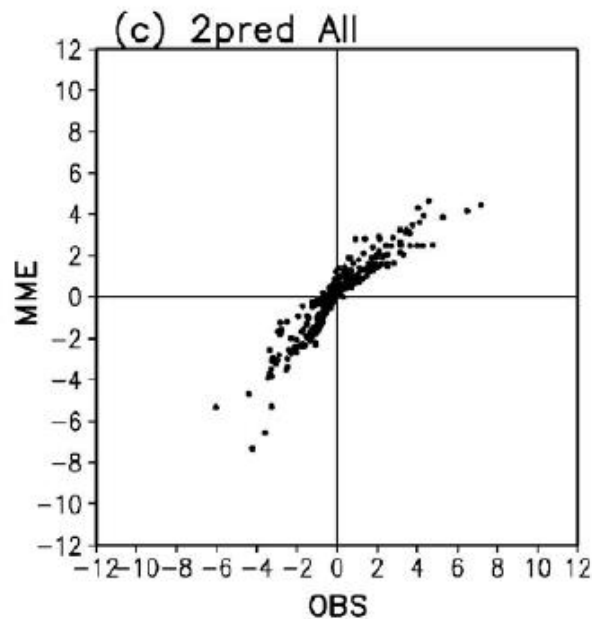
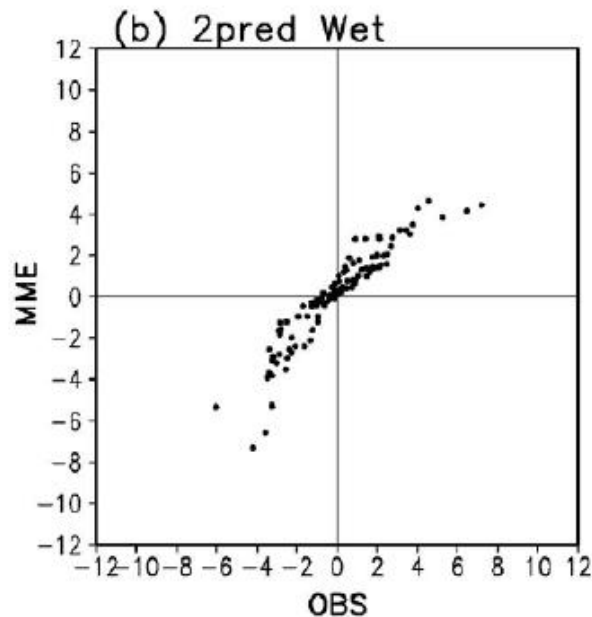
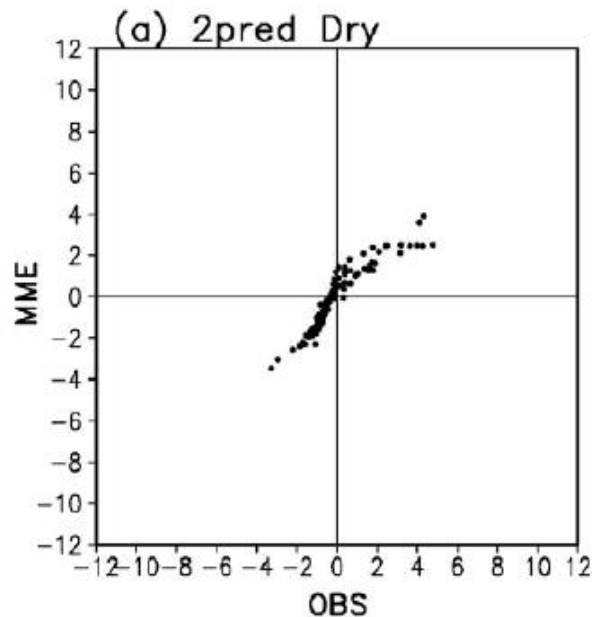


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- ★ Southwest (Northeast) wind prevails over the East-Asian Monsoon region during wet (dry) period.
 - ★ These characteristics are discernable in CGCMs.



Downscaled Results
based on **2 Predictors**
is more stable, when
compared with the
results based on single
predictor.

Chu et. al., 2008

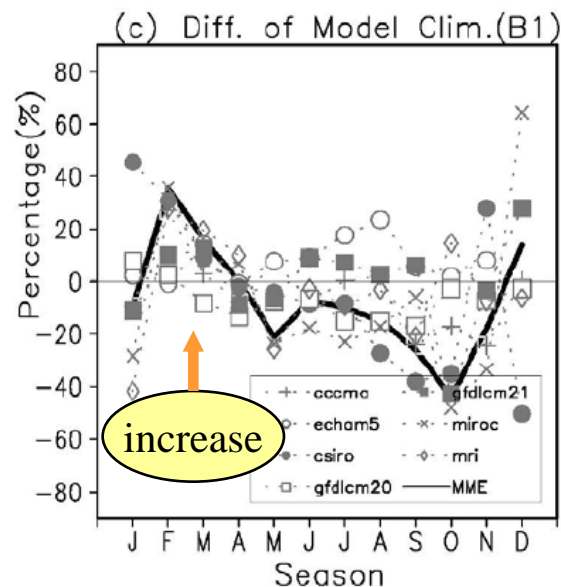
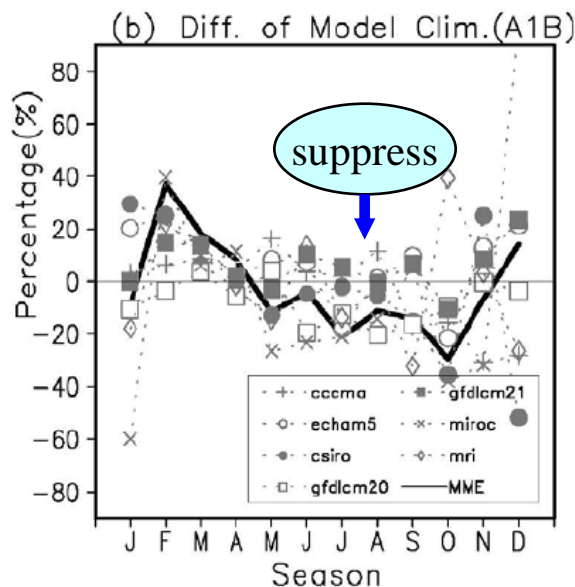
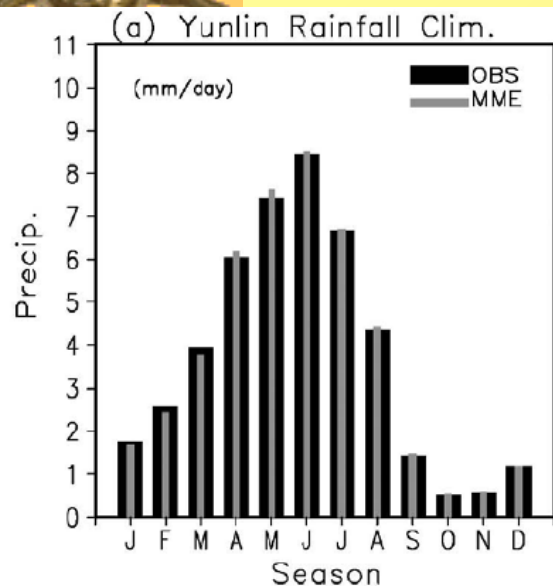


*Q-Q plot
information*

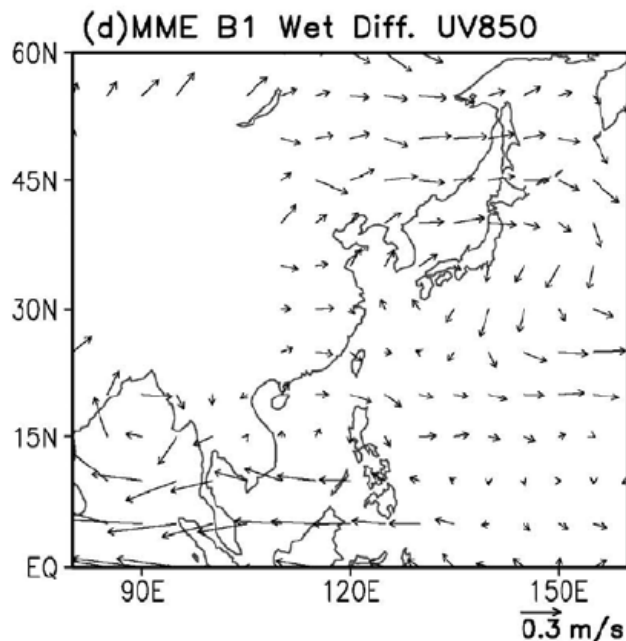
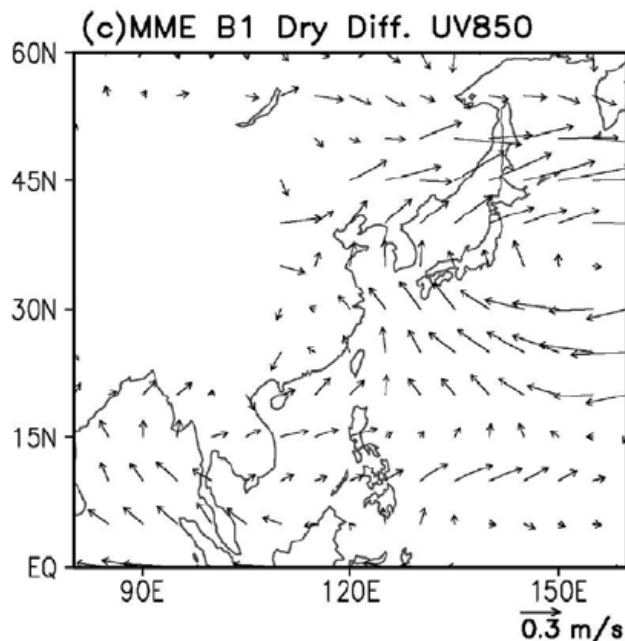
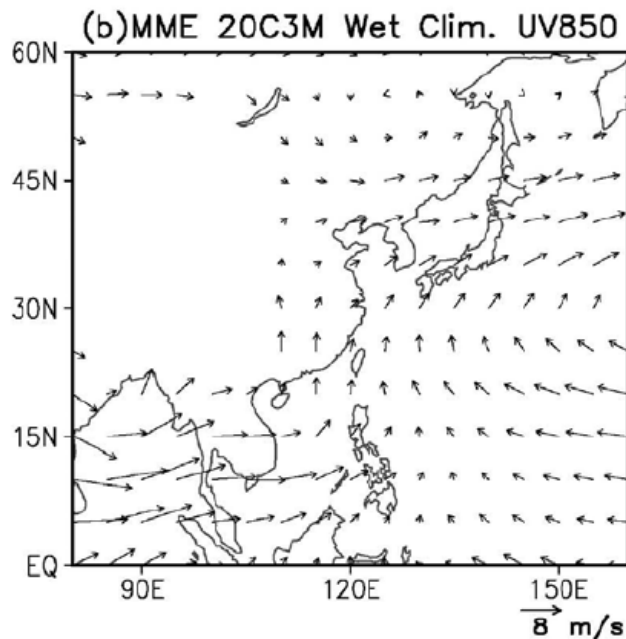
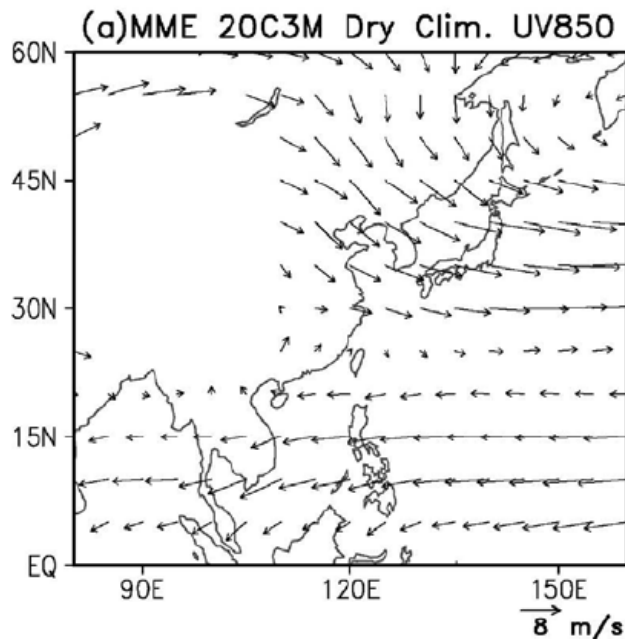
Results of SVD-downscaling based on 20C3M

1. distribute in first and third quadrant
2. Dry season more close to 0.
3. Wet season underestimate in extreme rainfall
4. Perform reasonably in negative rainfall anomalies

Change rate of projection rainfall for Yunlin County during 2010~2045



A suppressed
rainfall
during Wet
season
An **increasing**
rainfall
during Dry
season



Difference of
low level wind
clim. between
2 periods.

Clim(2010~2045)-
Clim(1975~2000)

**Southerly wind
strengthens
around**

**Taiwan=> more
feasible large-
scale cir. for
precipitation.**

**Anti-cyclonic
wind ano.**

Prevails over

WNP=>

**suppressed
rainfall maybe
expected.**



Summary

- ★ Downscaled results based on 2 predictors (MSLP, V850) and Multi-Model ensemble give **a more stable and skillful projection**.
- ★ In the coming 36 years,
The rainfall climatology tends to increase (**moderate decreasing**) during **Dry** (**Wet**) period.
- ★ Cyclonic (**anti-cyclonic**) anomaly circulation nearby Taiwan is found in both of A1B and B1 scenarios during **Dry** (**Wet**) period.



Thank you.