Introduction to NAMEM long-term Prediction system based on PNU CGCM

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PNU Global Ocean-Atmosphere Prediction System

AGCM Initialization

Reproduction : 1980~2016
Initial Condition for CGCM:
Daily atmospheric fields of each year

LSM Initialization

Reproduction : 1980~2016
Initial Condition for CGCM:
Daily land fields of each year.

OGCM/Sea ice Initialization

Spin-up : 100 - year
Reproduction : 1980~2016
Initial Condition for CGCM:
Daily ocean fields of each year

EVP Sea Ice
LSM
AGCM
OGCM

PNU CGCM

(No Flux Adjustment)

Ocean Data Assimilation

Variational method (VAF) for T and S
Background field :
OGCM reproduction (1980~2016)
OBS : ARGO, XBT, TAO, GODAS pentad

CGCM Hindcast

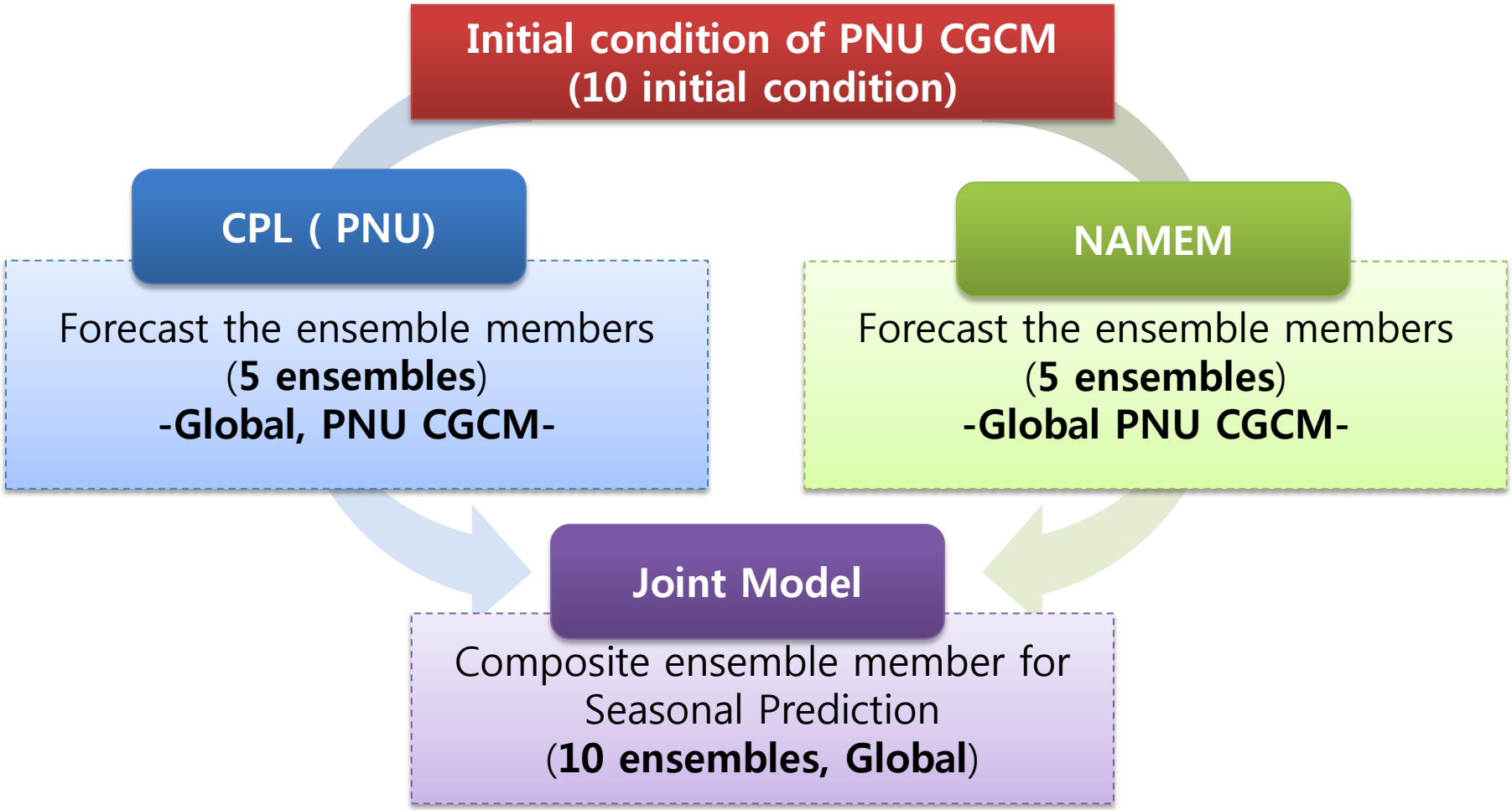
37-year (1980~2016) CGCM
12-Month Lead Hindcast
starting at every months of each year

Single Model Ensemble

10-members ensemble
✓ PNU v1.2 -> 5 members at NAMEM
✓ PNU v1.2 -> 5 members at CPL
Ensemble Method : scm

	Lead0	Lead1	Lead2	Lead3	Lead4	Lead5	Lead6	Lead7	Lead8	Lead9	Lead10	Lead11
JAN RUN	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
DEC RUN	Dec	Jan	Feb	Mar	Apr	Mar	Jun	Jul	Aug	Sep	Oct	Nov

>> Sharing Initial Conditions with PNU

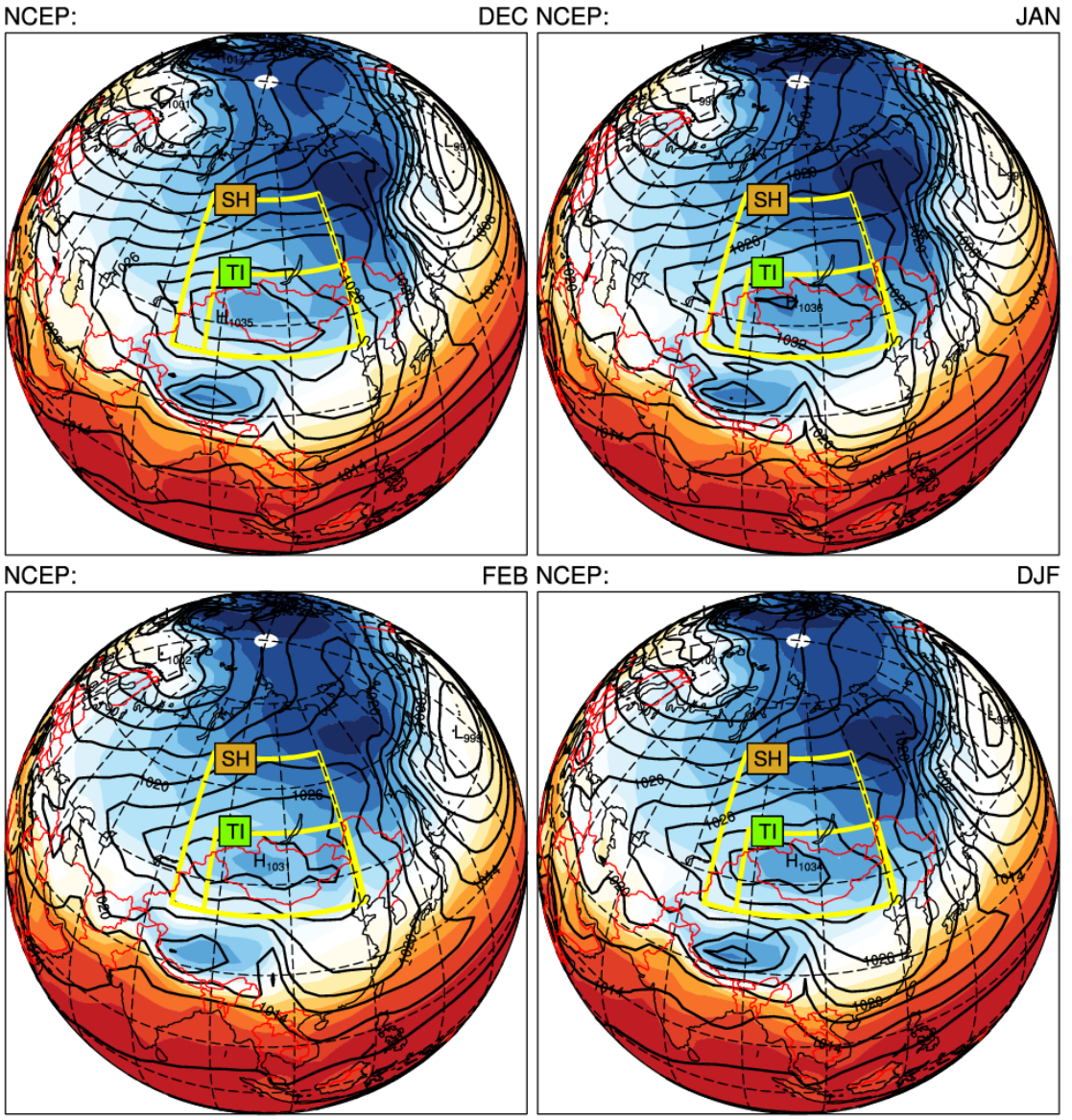


How to find signal from PNU CGCM for local scale climate prediction

T2m and MSLP from NCEP II

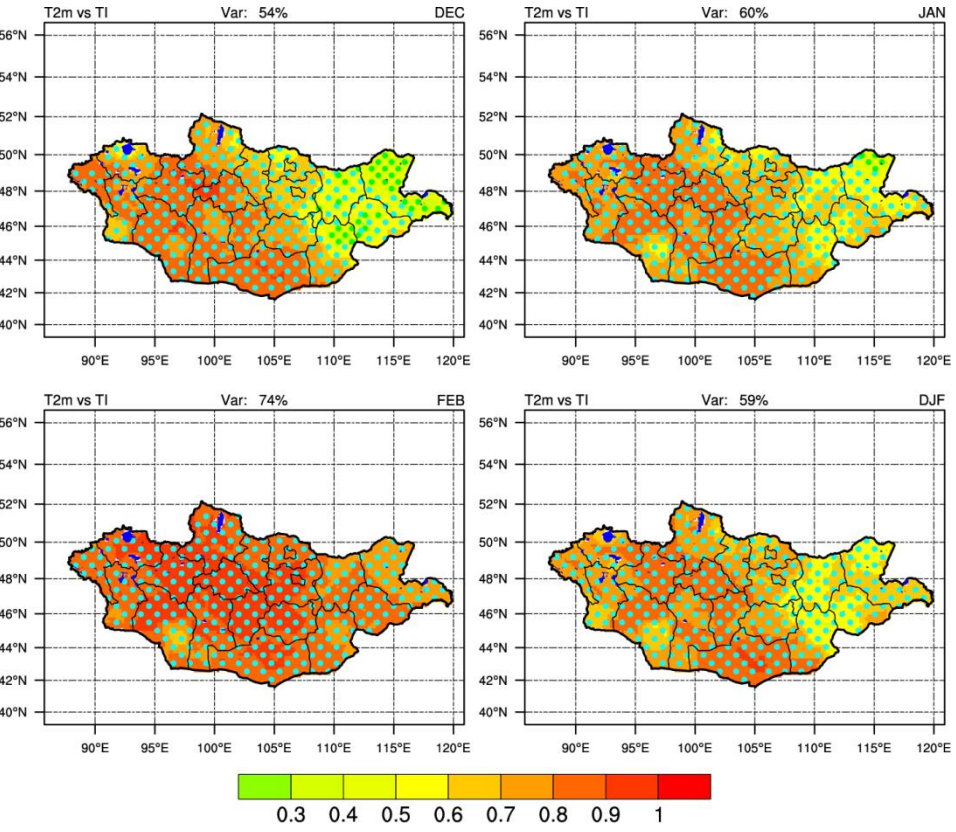
TI is defined as area (87-121E and 40-53N) averaged monthly mean temperature at 2 meter

SH is defined as area (80-120E and 40-65N) averaged monthly mean SLP (Jhun and Lee, 2004; Wu et al., 2006)

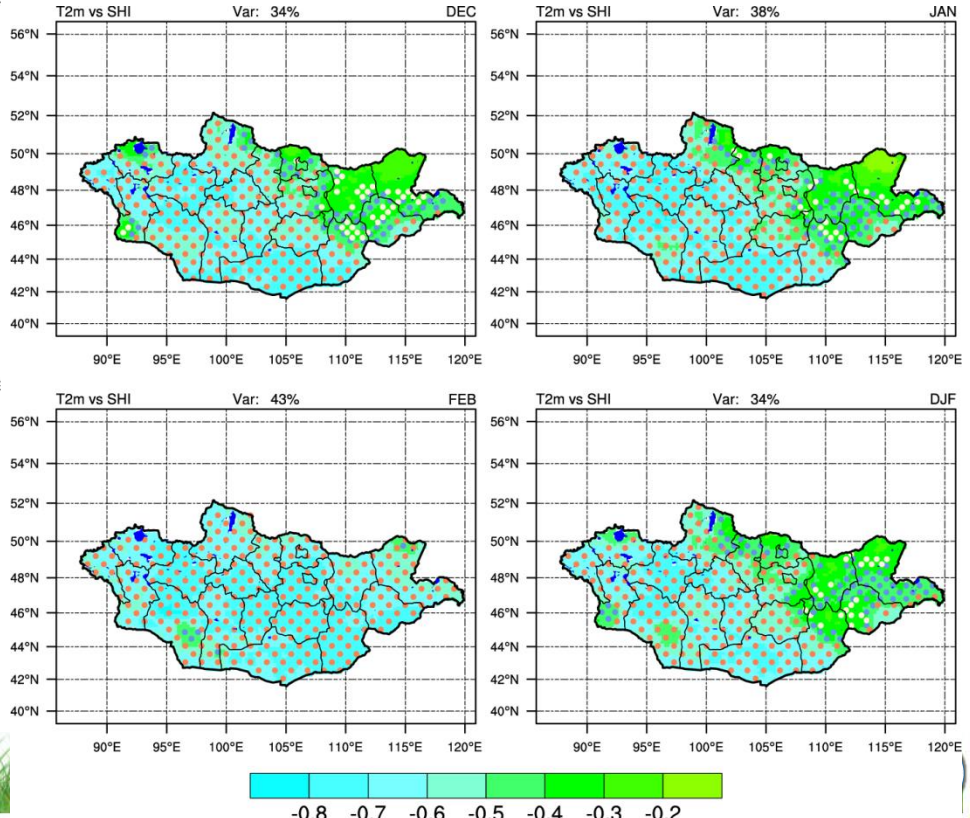


Linear Reg Coef of T2m against to TI and SHI for winter

T2m vs TI



T2m vs SHI

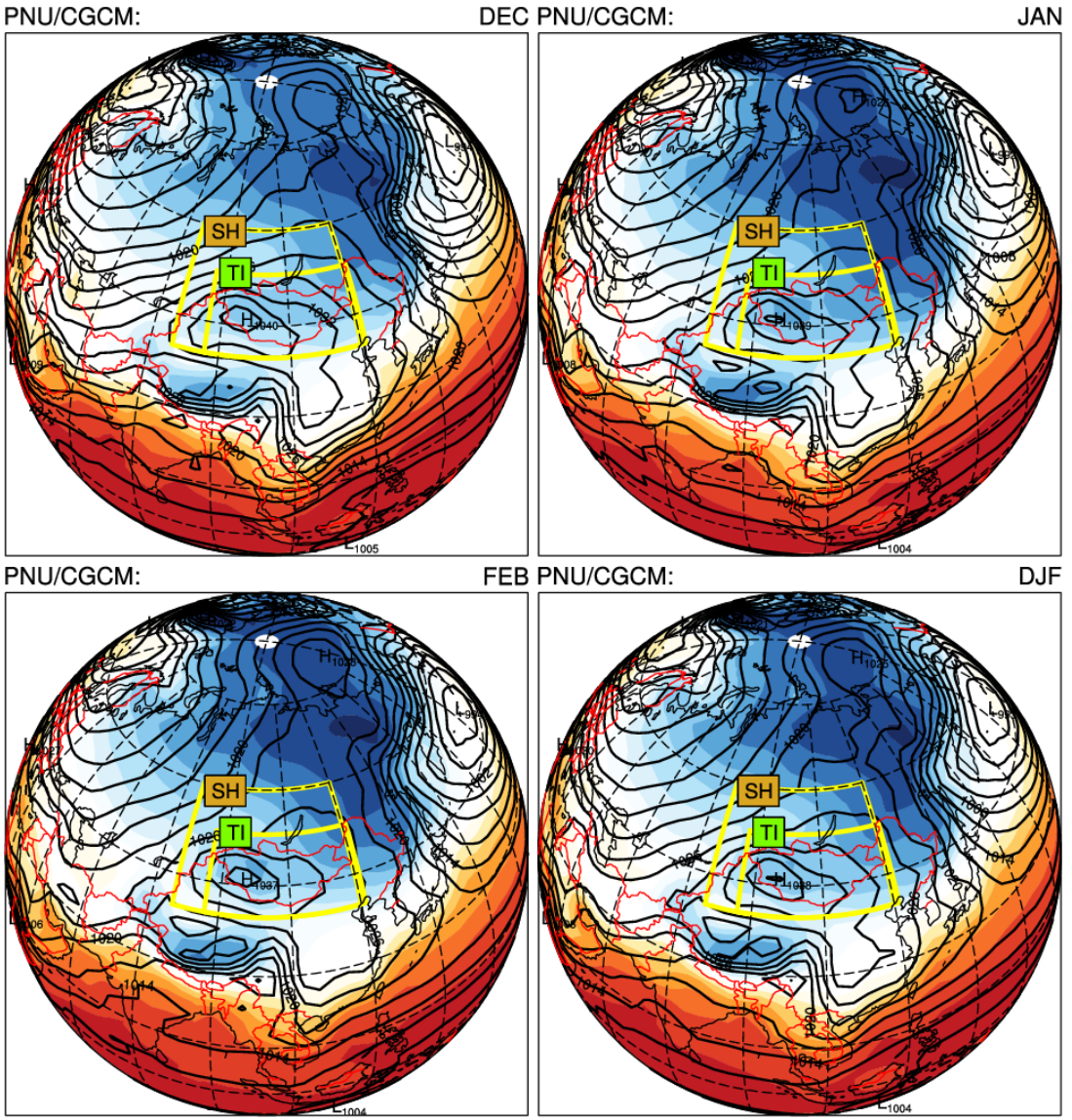


Hindcast experiment:

TI and SH simulated by PNU CGCM

TI is defined as area (87-121E and 40-53N) averaged monthly me an temperature at 2 meter

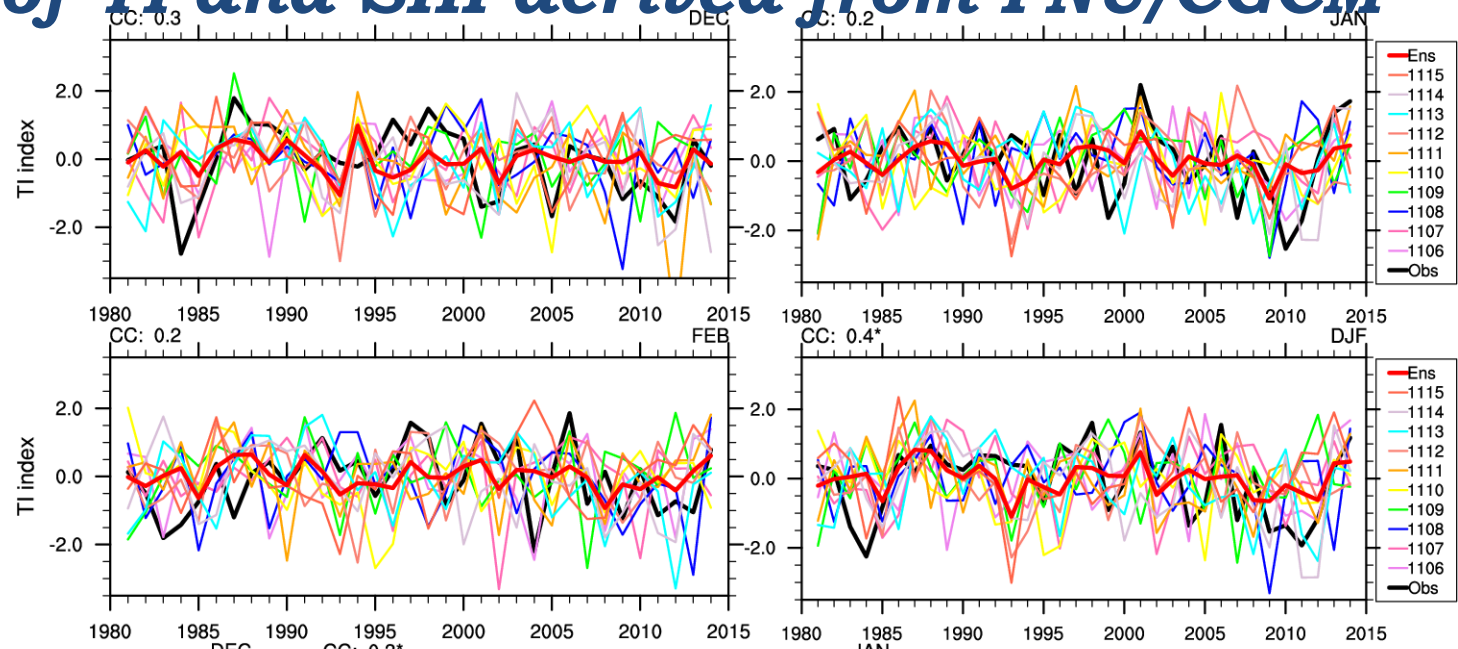
SH is defined as area (80-120E and 40-60N) averaged monthly mea n SLP



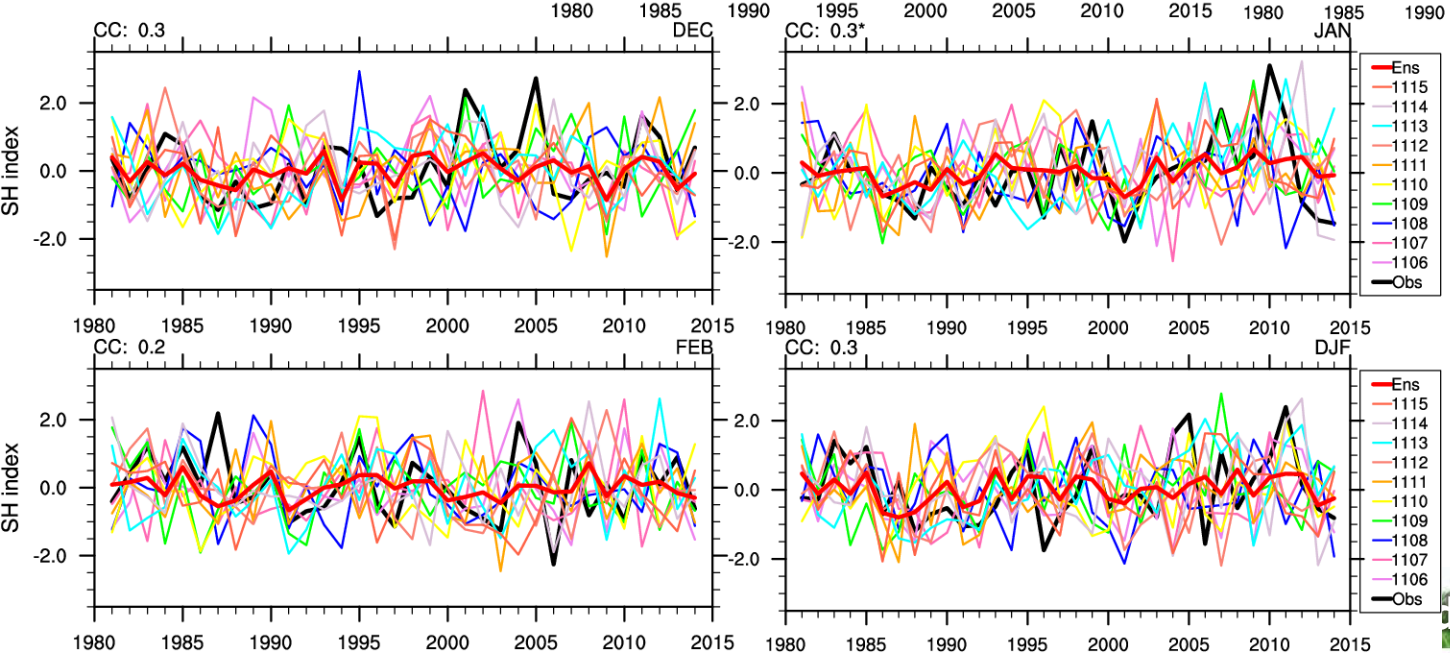
Hindcast experiment:

Time series of TI and SHI derived from PNU/CGCM

T index



SH index



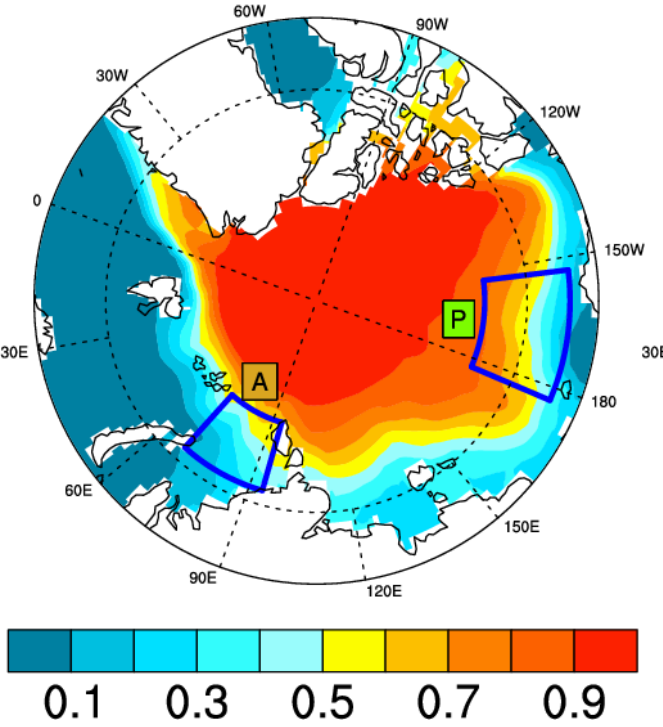
Previous studies on relationship between winter SH & Autumn SI

Honda et al, (2009) showed that significant cold anomalies over East Asia in early winter and zonal cold anomalies from Europe to the Far East in late winter are associated with a decrease in Arctic sea ice in previous September, which tends to strengthen the SH.

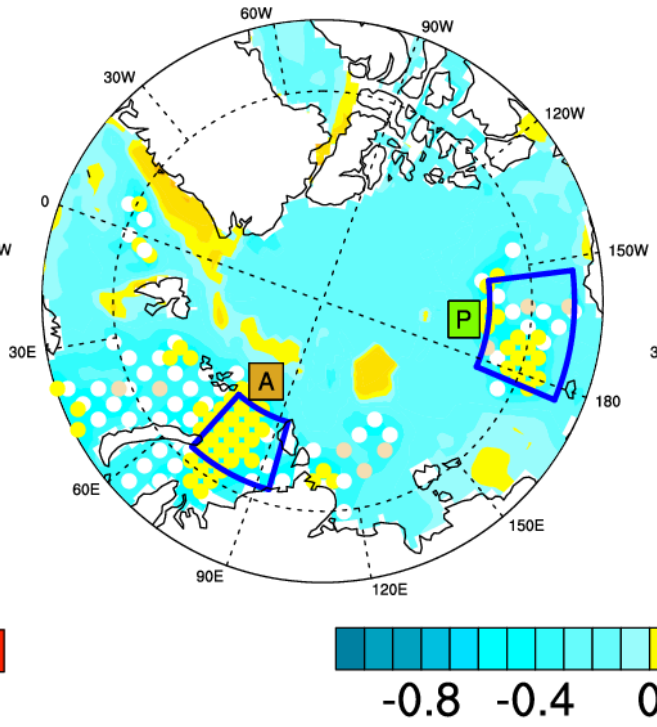
Wu B Y et al., (2011) concluded that the coherent variations in Arctic SIC from autumn to winter provide a possibility for seasonal predictions of winter SH and EAWM.

Relationship between precursor SST (SO) and TI & SH

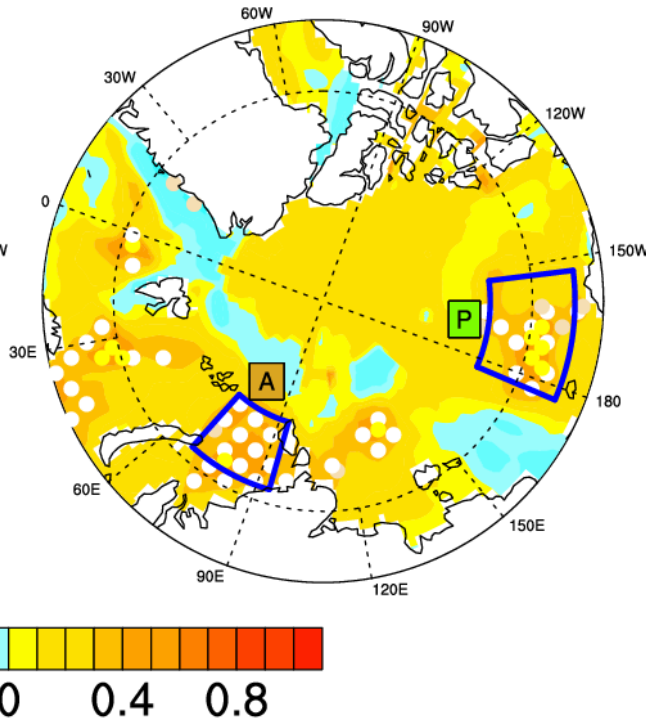
Mean sea ice cover in SO (1981-2014)



SST in OS vs TI in winter



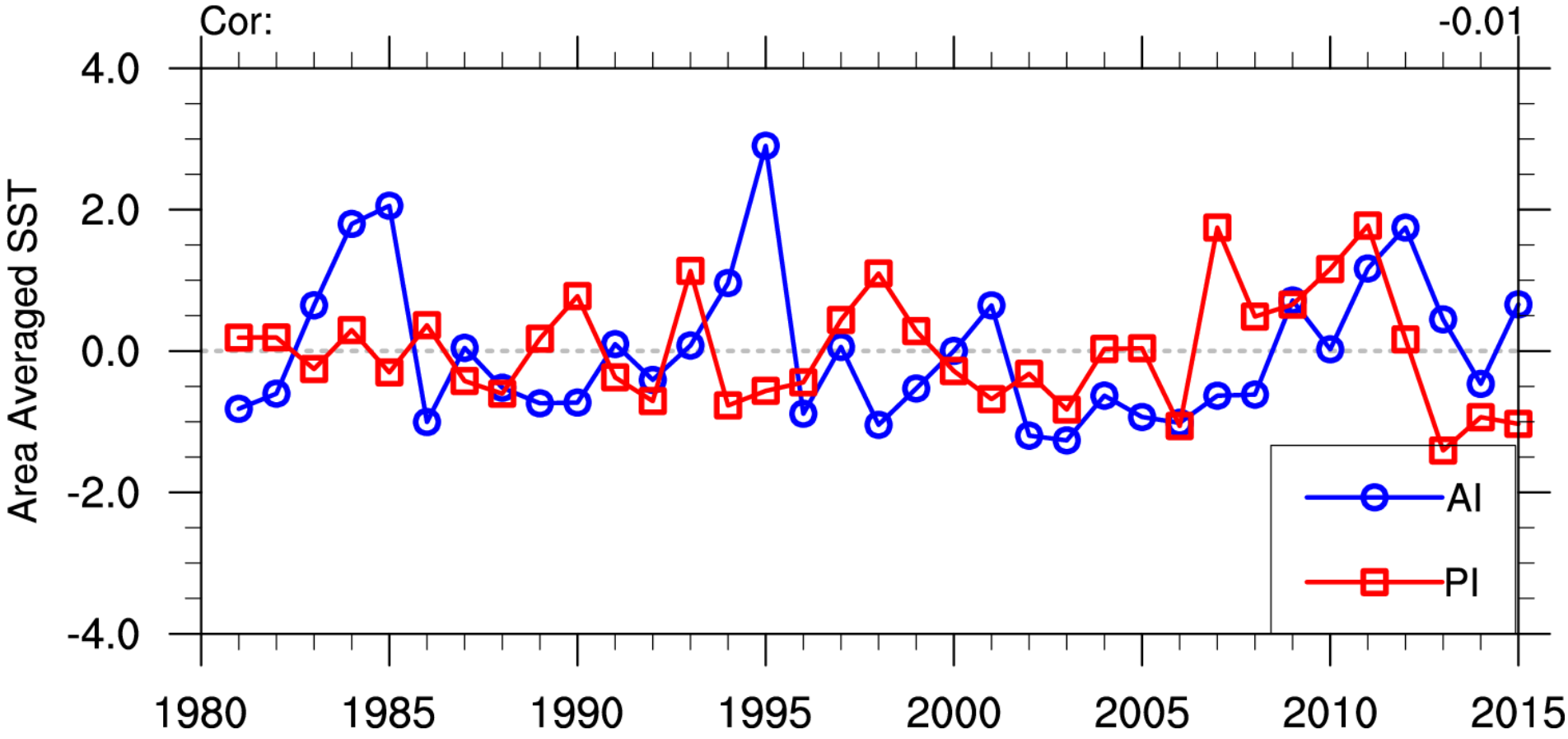
SST in OS vs SH in winter



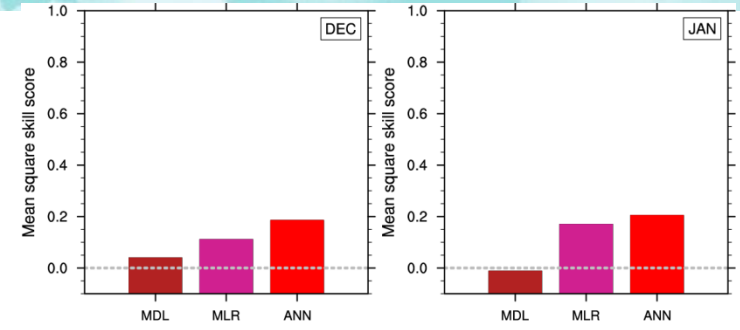
A	North Atlantic Ocean	Area: 76N:81N - 68E:94E
P	North Pacific Ocean	Area: 72N:78N - 177E:207E

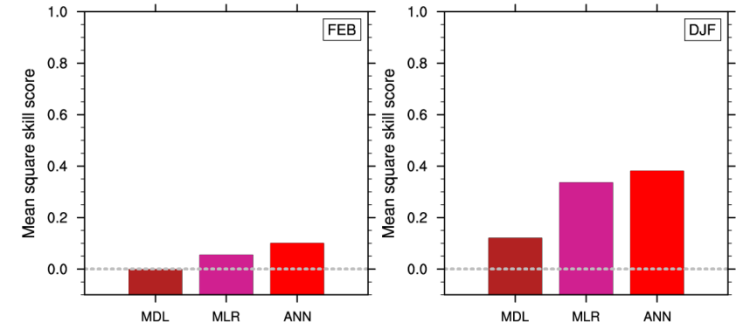
Relationship between precursor SST (SO) and TI & SH

Cor bet two indices based SST over Northern Atlantic and Pacific

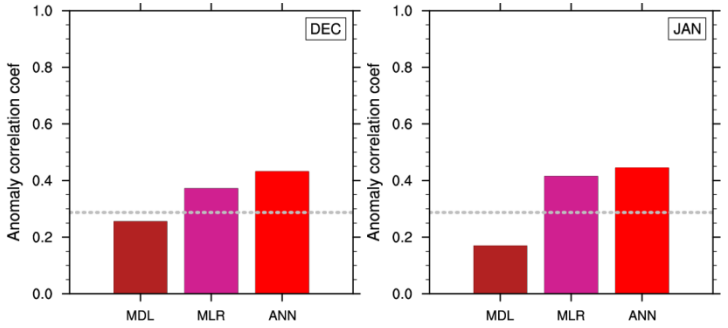


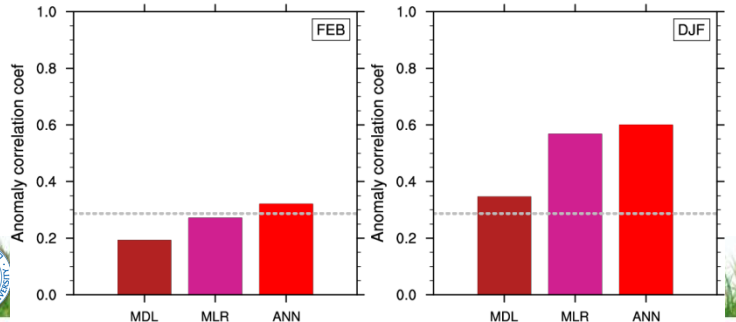
Verification of TI & SHI:



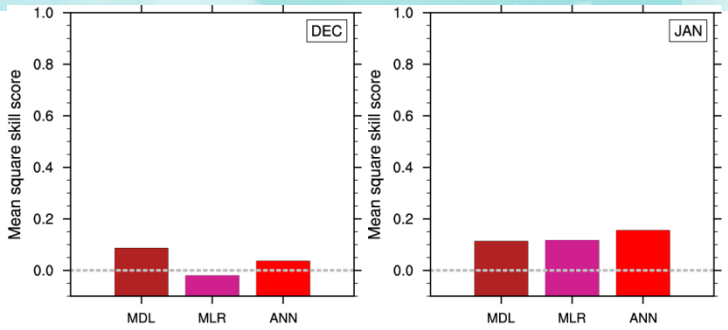


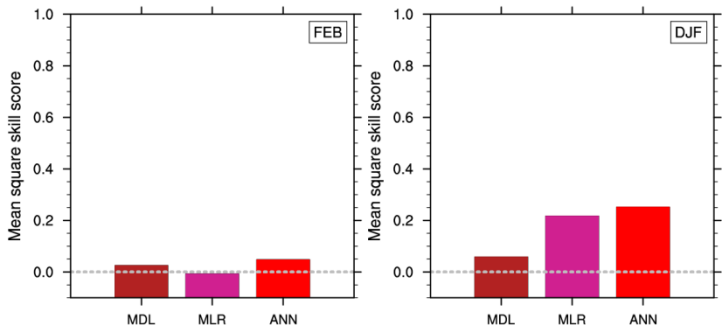
Mean square skill score

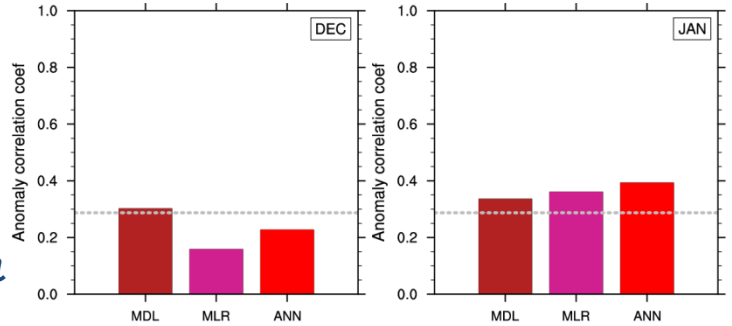


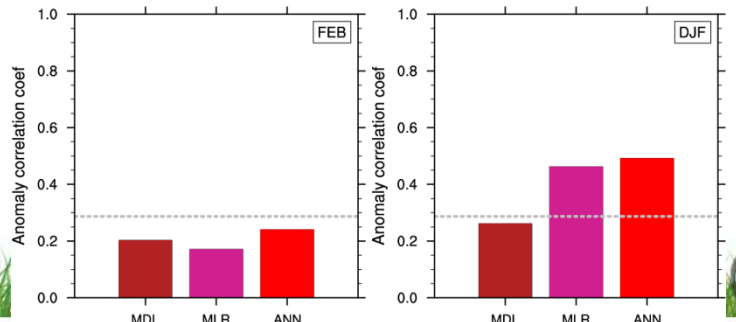


Anomaly correlation coef



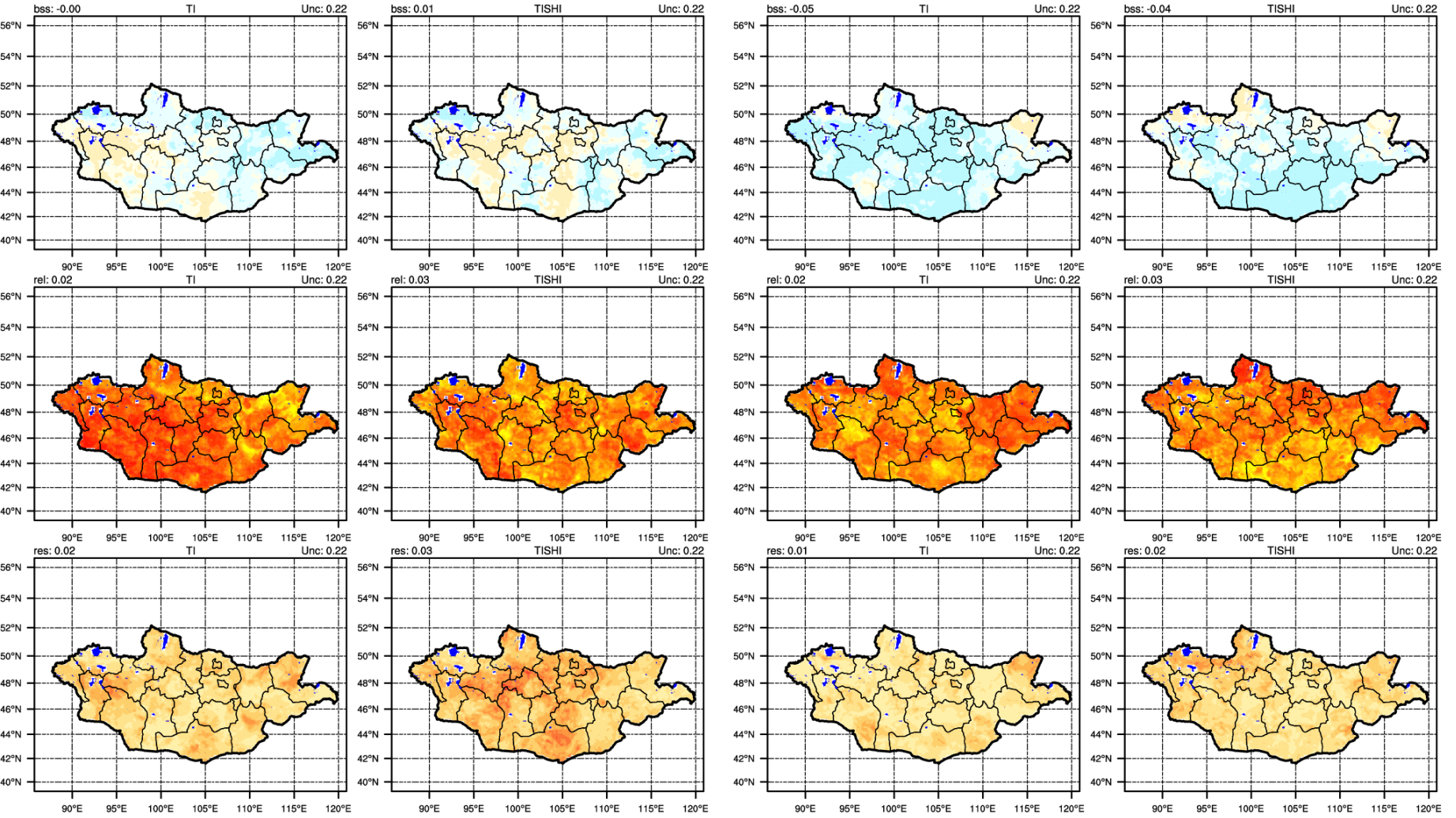






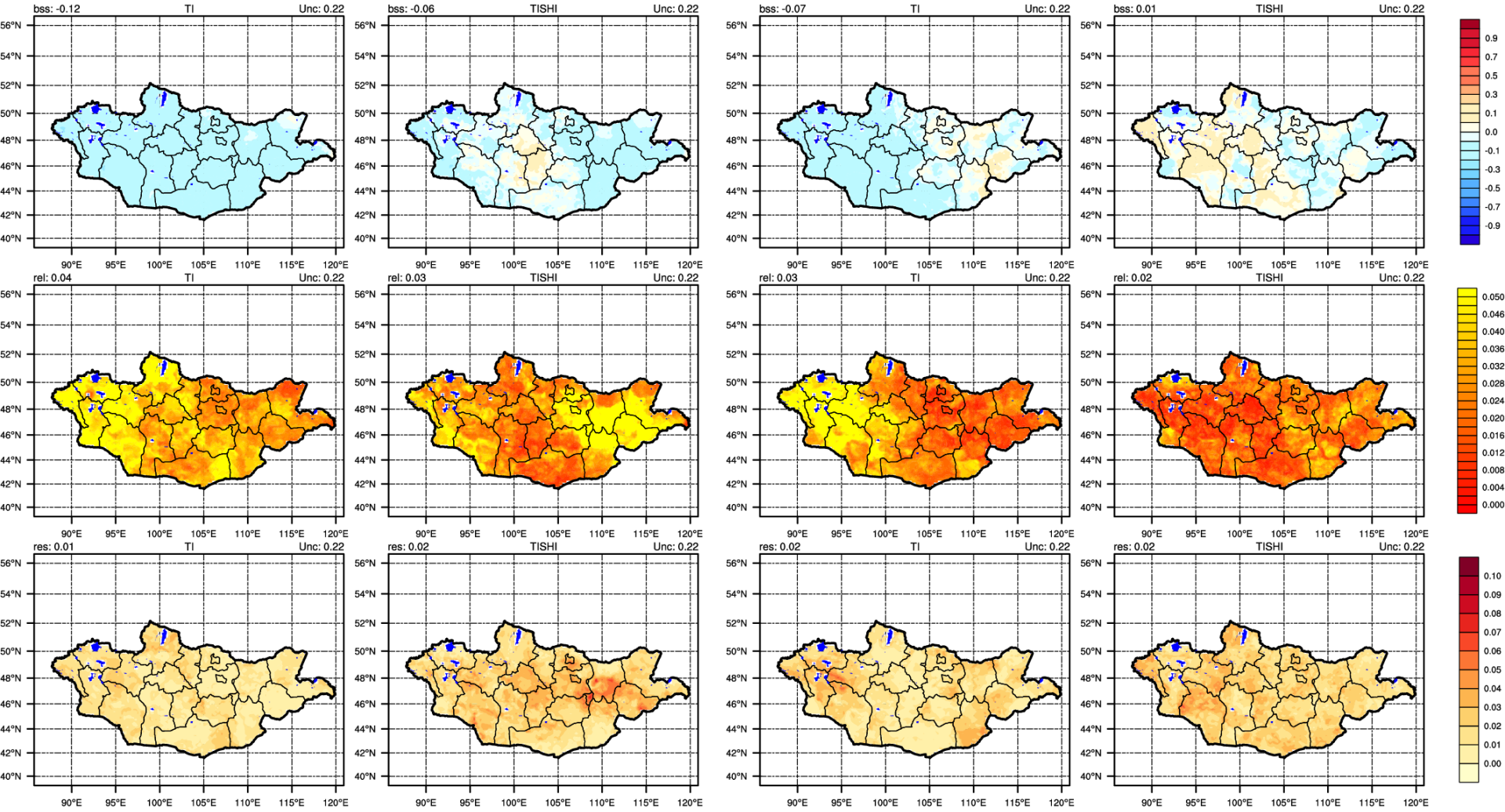
Verification of T2m over Mongolia

Brier skill for DEC and JAN

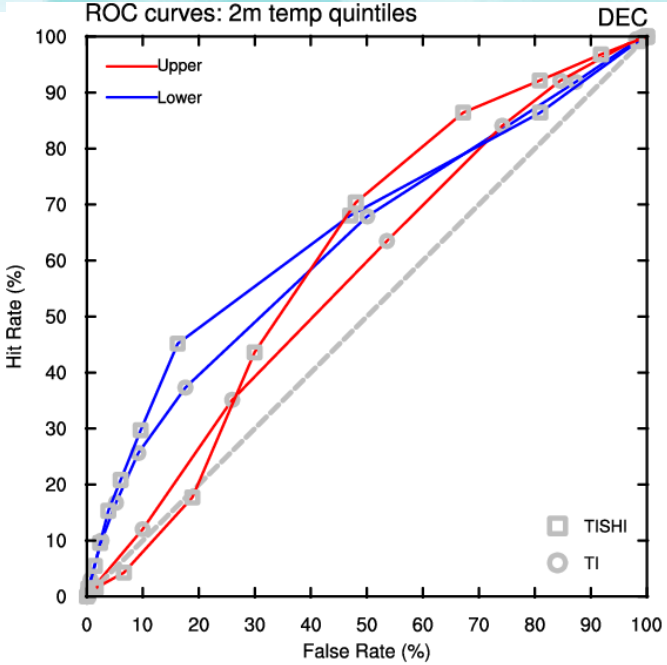


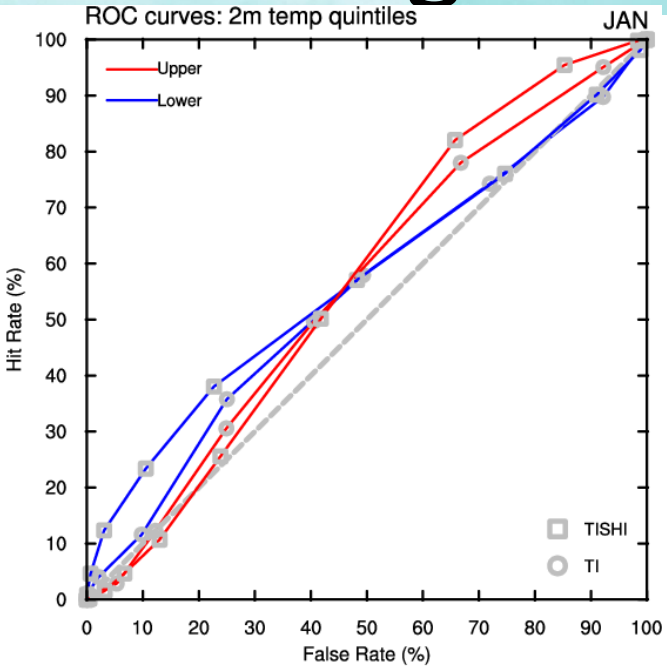
Verification of T2m over Mongolia

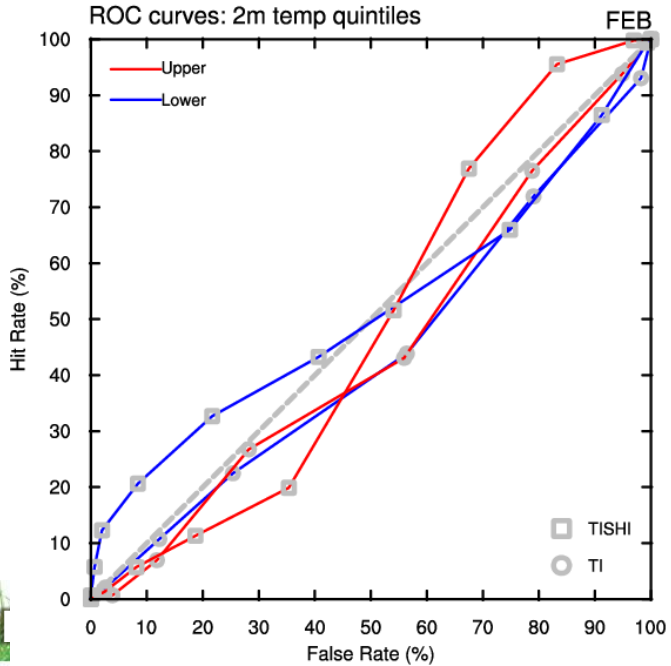
Brier skill for FEB and DJF

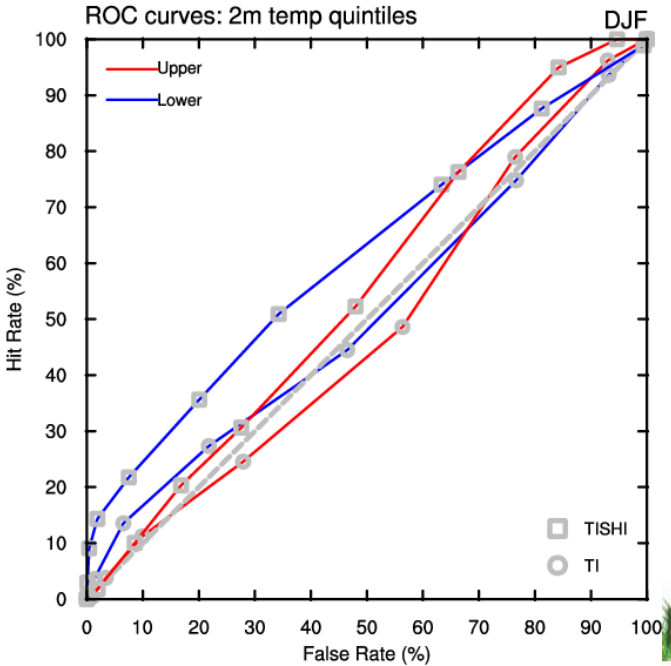


Verification of T2m over Mongolia









Summary

Large scale climate variables such as TI and SHI can explain more than 50% and 30 % of temperature variability over Mongolia in winter, respectively.

Large scale variables are obtained from PNU CGCM and MLR based AI and PI indices found from Arctic ocean SST in SO, which are ingested into input layers of ANN and the results are verified by ACC and MSSS suggested by WMO.

The probabilistic forecast of aT2m over Mongolia in winter can be predicted by prediction system considered in this study.

Thank you for attention