# Decadal Prediction Skill of BCC-CSM1.1 Climate Model in East Asia

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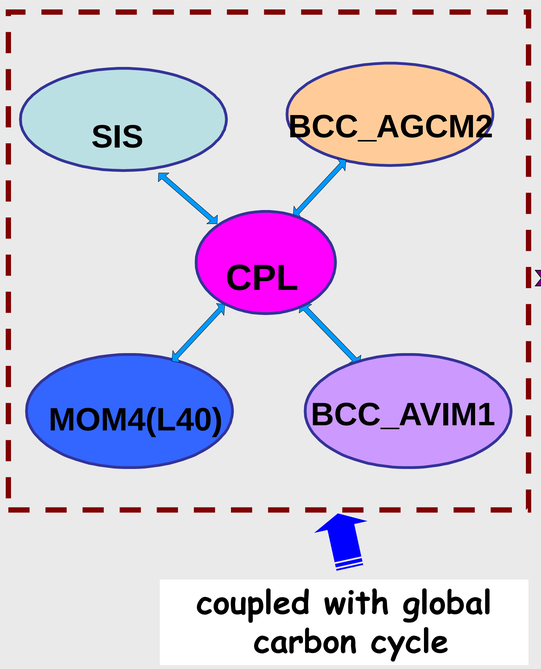
## BCC-CSM1.1 Model




**BCC_AGCM2.1 (T42L26):**
**Originated from CAM3.**
**Developed by BCC.**

**BCC_AVIM1.0:**
**Developed by BCC.**
**Coupled with the dynamic vegetation and land carbon cycle processes.**

**MOM4_L40 and SIS (gx1v1):**
**Developed by GFDL.**
**Modified by BCC.**
**A carbon cycle module (from OCMIP2) with simple biogeochemical processes was introduced.**

**Detailed description of BCC-CSM1.1 is introduced in Wu et al (2013).**

## Experiments

➢Initial condition: full-field ocean temperature relaxed to SODA reanalysis.

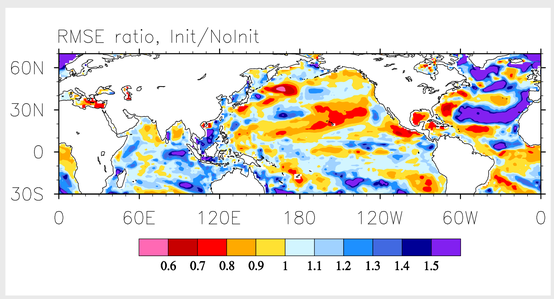
➢Decadal experiments (Init): starts annually during 1960-2005, 10 years' forecast with three ensemble members.

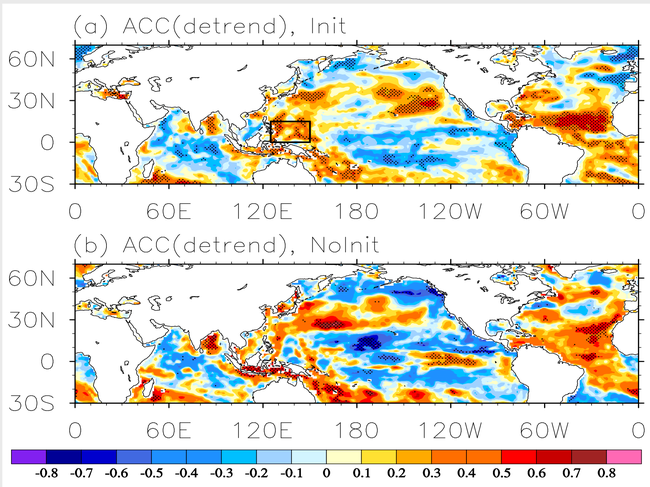
**Method:**
- ➢ Compare the anomalies after removing the climatology of both experiments.
- ➢ Focus on 2-5 forecast year, a 4-yr running mean is applied to the observed and history simulated anomalies.

**Observation data:** CRU-TS3.23, HadISST, NCEP/NCAR reanalysis

## Results

**RMSE ratio (Init/NoInit) of SST, JJA** **ACC of JJA SST**

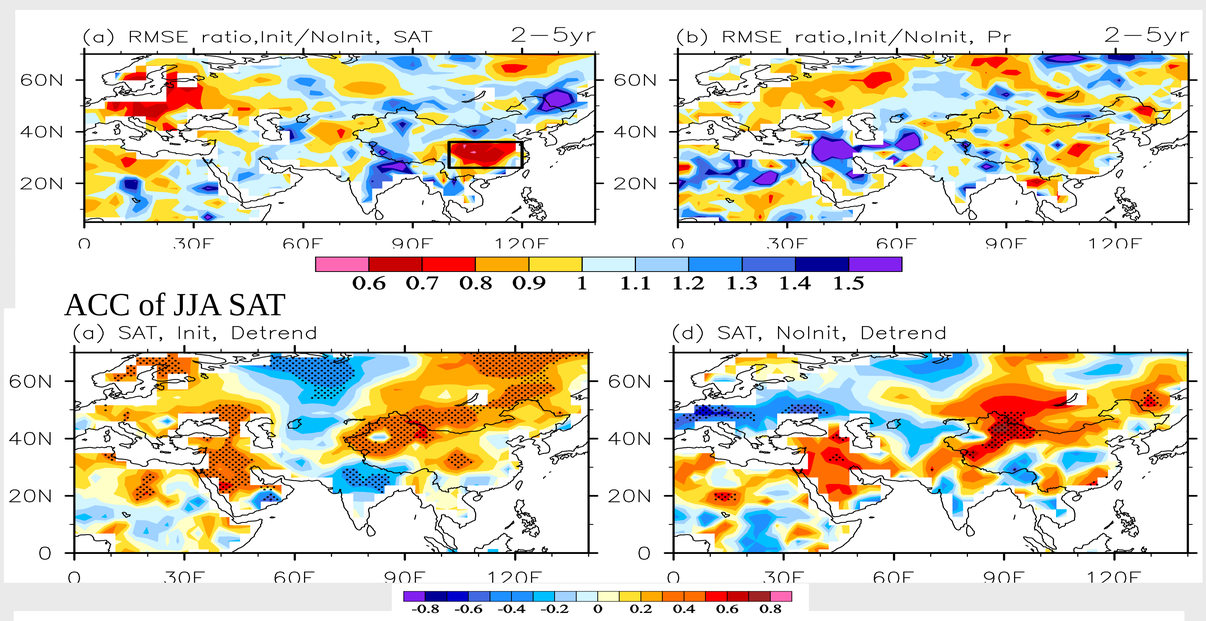



2-5 year's forecast

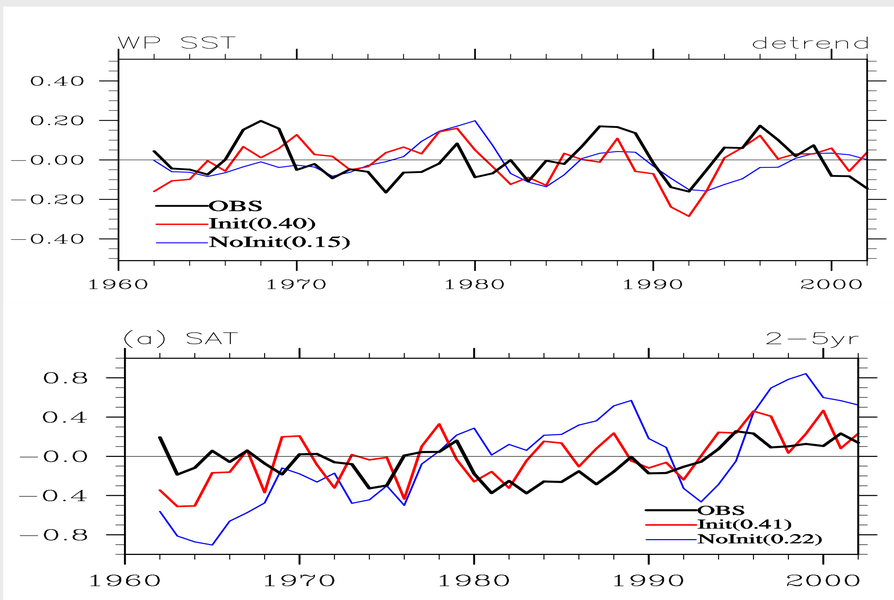
➢ Init has less RMSE over most area of the Pacific Ocean than NoInit.

➢ACC (anomaly correlation coefficient) is improved in the western Pacific (WP), as well as in the tropical Atlantic in the Init prediction.




➢Less RMSE of JJA surface air temperature (SAT) and improved ACC is found over Europe and central eastern China in the Init prediction.

➢Less RMSE of JJA precipitation is found over Europe and most area of China in the Init prediction.

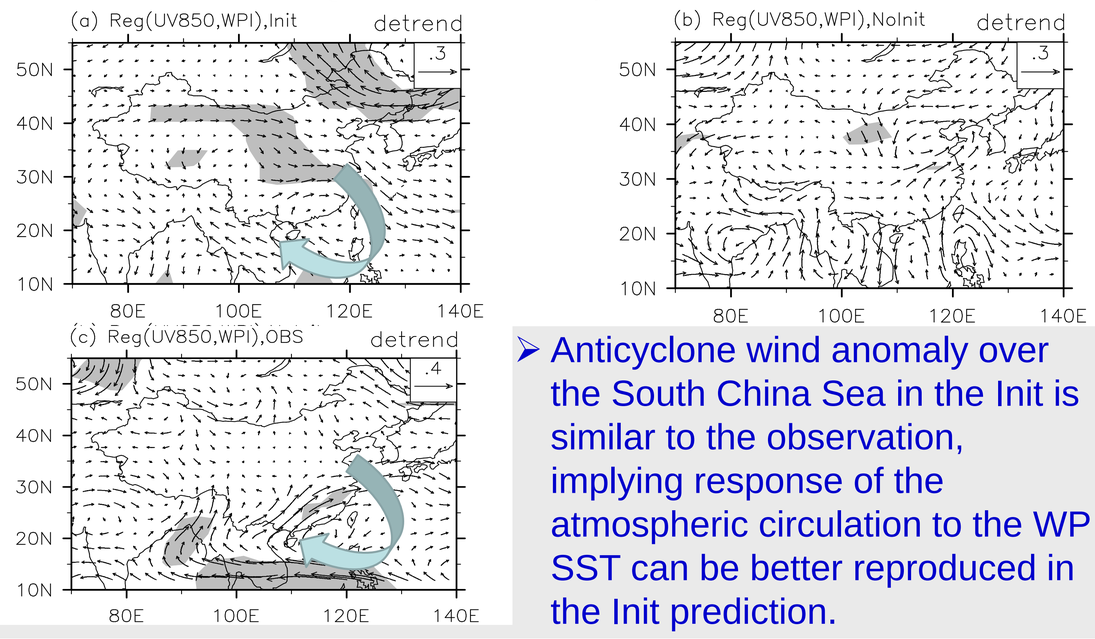



WP SST
(125-150E, 0-15N)

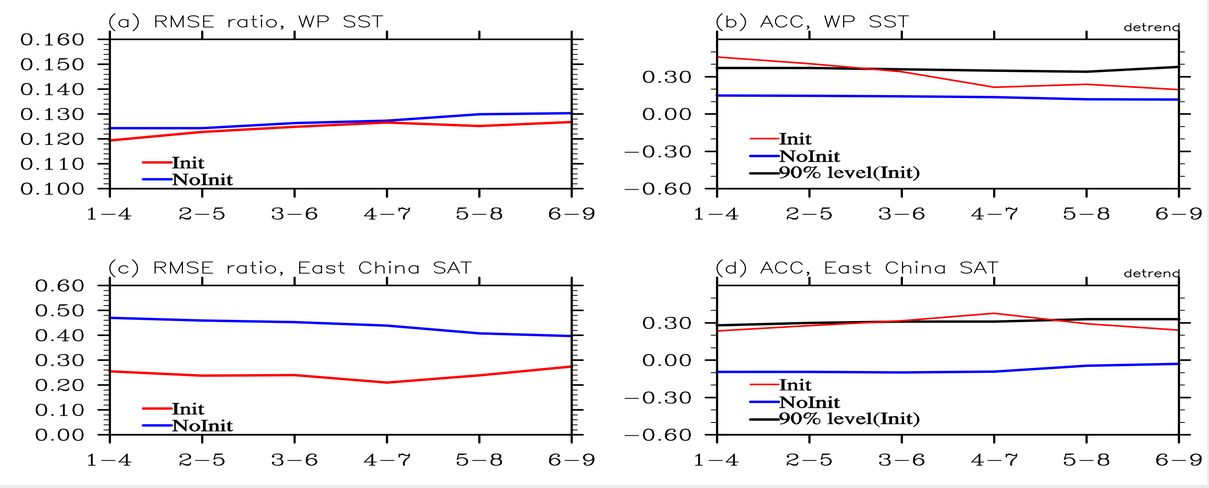
Central eastern China
(100-120E, 25-35N)

➢Both WP SST and central China SAT in the Init agree better with the observations than those in the NoInit.

**Regression of UV850 upon WP SST**




➢ Anticyclone wind anomaly over the South China Sea in the Init is similar to the observation, implying response of the atmospheric circulation to the WP SST can be better reproduced in the Init prediction.




The RMSE skill of WP SST and SAT in central eastern China improves up to forecast years 6–9 in the Init prediction. The significant ACC skill of the Init prediction exists in forecast years 4–7 for central eastern China SAT, indicating the robust influence of the initialization.

## Summary

- ➢ Improved decadal prediction skill is found for summer SAT in central China for the forecast years 2-5 compared to the NoInit hindcast by BCC-CSM1.1.
- ➢ Enhanced skill is also found for western Pacific SST in the decadal prediction relative to the NoInit hindcast.
- ➢ Analysis shows that the Init prediction could more realistically reproduce the anticyclone in East Asia related to the warm western tropical Pacific SST. This is the main reason for the improved decadal prediction skill of summer SAT in central eastern China.

*This study is published in Xin et al (2018). Decadal prediction skill for North Atlantic SST and AMO is improved by using EnOI method in the initialization of BCC-CSM1.1 (Wei, et al., 2017)*

## References

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Wu T W, Li W P Ji J J, Xin X G, et al. 2013: Global carbon budgets simulated by the Beijing Climate Center Climate System Model for the last century. *J. Geophys. Res.,* 118: 4326-4347.

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