

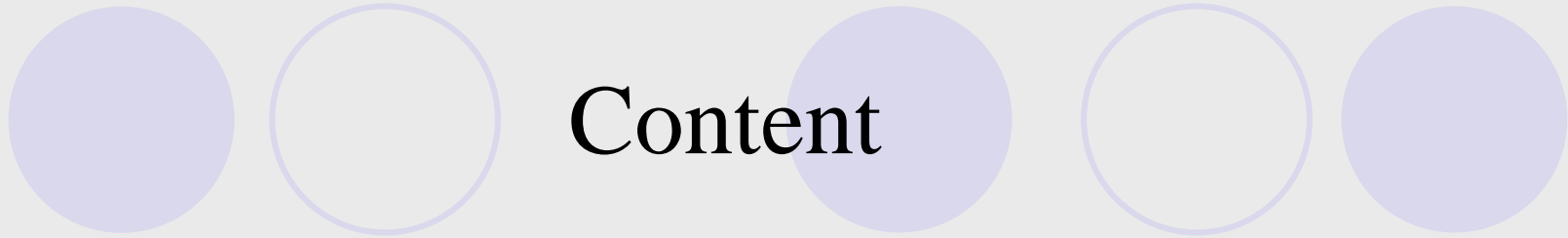
Implementation of Global-regional Climate Model for Seasonal Forecasting

APCC Member Working Group Report

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Hong Kong, China

18-20 September 2007



- Brief Introduction
- Evaluation of seasonal forecast performance (Verification)
- Future Plans

Brief introduction

- ★ **Both global & regional climate models were originated from NCEP**
- ★ **Global model were used in NCEP/NCAR re-analysis**
- ★ **Regional model was derived from a version originally used in weather forecasting**
- ★ **Perturbation method applied to reduce computational error**
- ★ **Very good reference obtained from <http://g-rsm.wikispaces.com/References>**

Operation of Global Model in Hong Kong

Data used for the computation of model climate and verification

- ❖ 1948-2006 (00UTC, Day 1 of each month)
- ❖ NCEP/NCAR re-analysis - Initial conditions for global model
- ❖ 1948-2006 Daily sea surface temperature analysis – boundary condition for global model
- ❖ 1948-2006 Daily sea ice analysis – boundary condition for global model
- ❖ Download from tsuzumi.ucsd.edu (Hideki - <http://g-rsm.wikispaces.com/ECPC+data+server>)

Data required for routine operations

- * “Real-time” Daily NCEP/NCAR re-analysis

- * Download from NOMADS

 - (<http://www.nomad3.ncep.noaa.gov>)

- * Alternative is from NCEP GFS output

- * Download from NCEP

 - (<ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/gfs/prod>)

- * (Different set of model code is required)

NOMADS – NOAA Operational Model Archive Distribution System

GFS – Global Forecast System

Data Required for Routine Operations

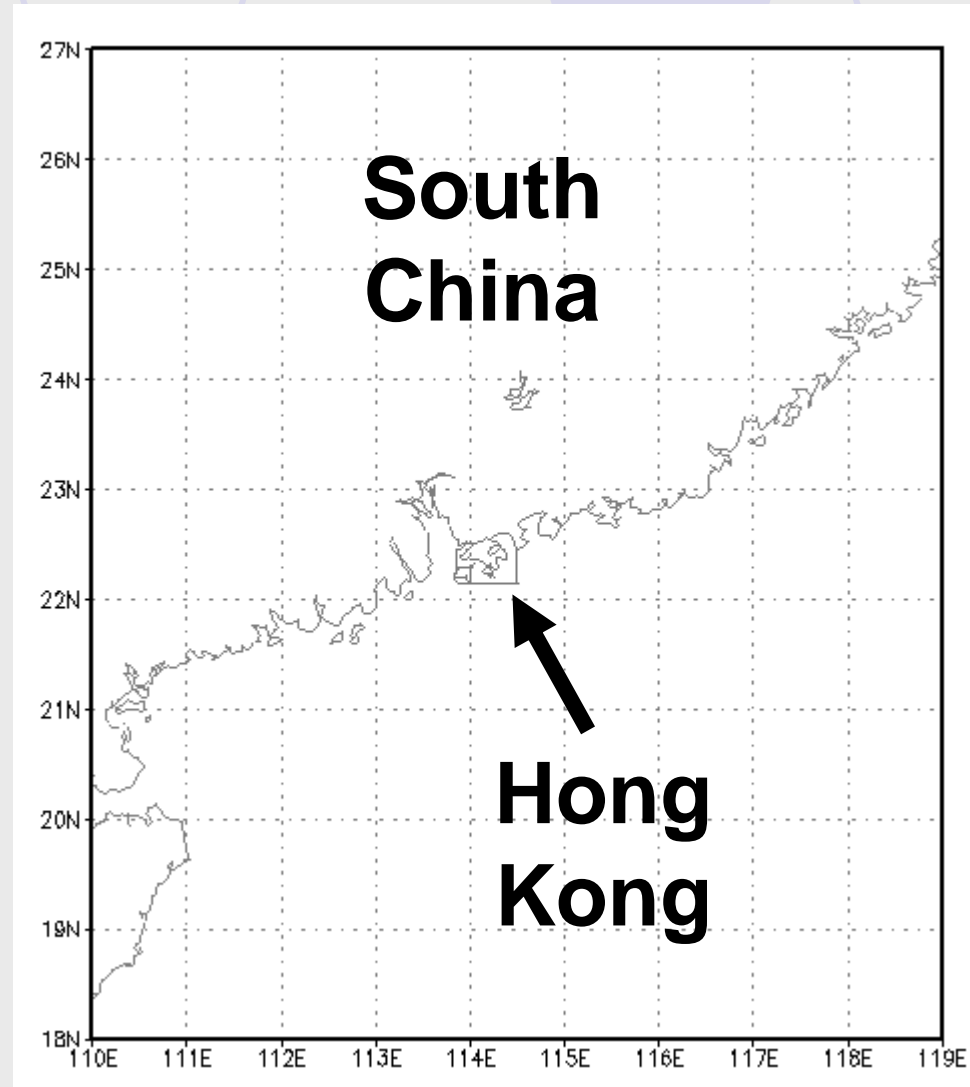
* “Real-time” 9 month sea temperature forecast

* Download from NCEP
(<http://cfs.ncep.noaa.gov>)

Global—Regional model Configuration used in Hong Kong Observatory

Computer	IBM p630 (4 CPUs)
Resolution of Global model	T62 Horizontal ~ 200km Verticle = 28 layer
Resolution of Regional Model	Horizontal ~ 15km Verticle = 28 layer
Terrain resolution	0.5 degree lat/long
Version	MPI

Domain of Regional Model



Global—Regional model Forum

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香港天文台
HONG KONG OBSERVATORY

Traditional Verification Method

- Assumption :
Real climate and Model Climates ~ Normally Distributed

Category	Definition
Above normal	anomaly > 0.5 std dev
Below normal	anomaly < -0.5 std dev
Normal	-0.5 std dev < anomaly < 0.5 std dev

If forecast category = observed category, then forecast is correct

- ❑ Evaluate scaled Hanssen and Kuipers score
- ❑ $K_s = (\text{POD} - \text{FAR} + 1) / 2$
- ❑ $K_s = 1$: best skill $K_s = 0$: worst skill

Data used for verification

- ◆ 9 weather stations from South China
- ◆ 1991-2006 model predictions

	Weather station data	Model output
1961-1990	Evaluate actual climate	Evaluate model climate
1991-2006	Verification period	

Model skill in forecasting above-normal rainfall

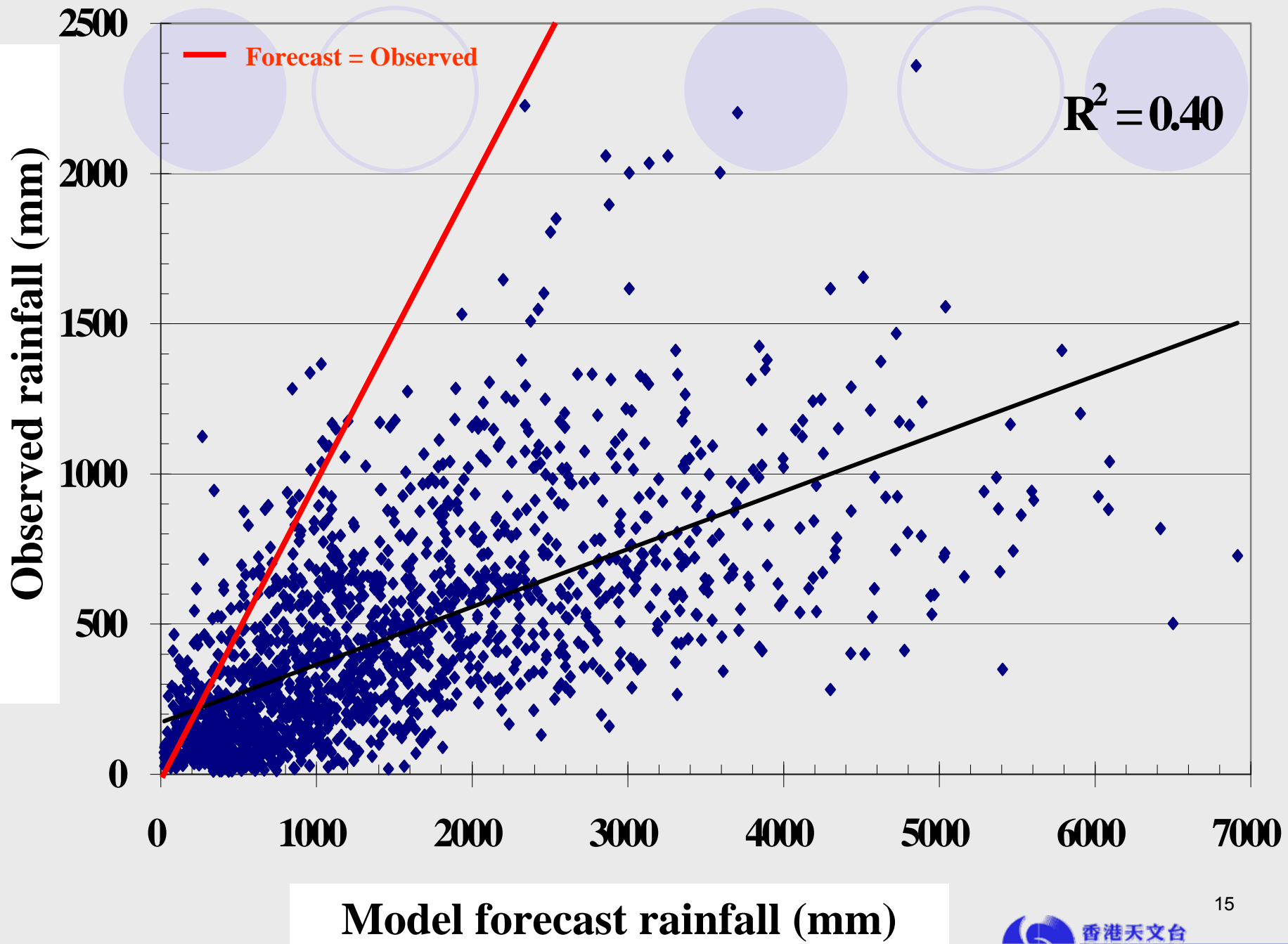
	Ks
Spring (MAM)	0.51
Summer (JJA)	0.51
Autumn (SON)	0.48
Winter (DJF)	0.66

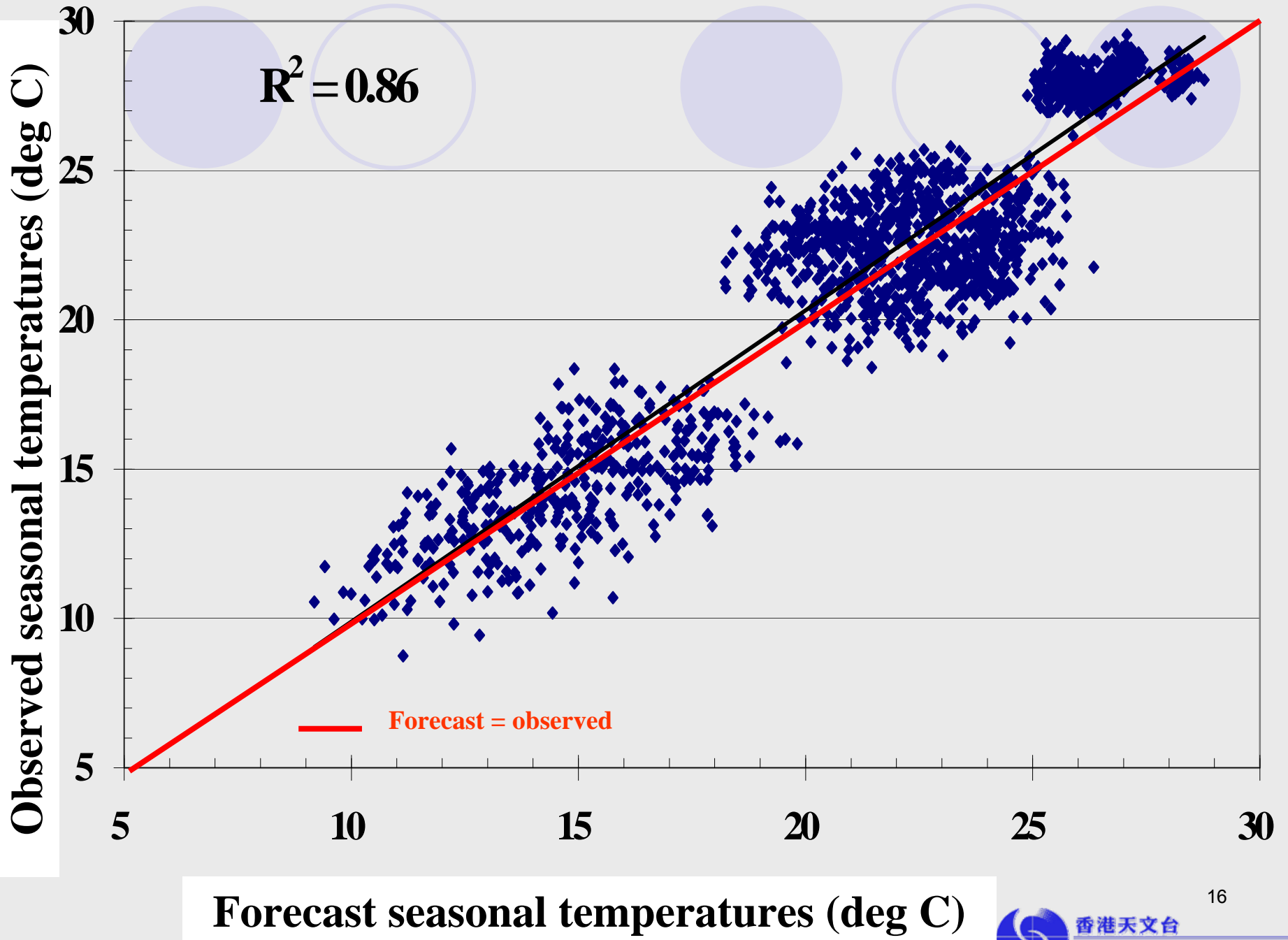
Model skill in forecasting below-normal rainfall

	Ks
Spring (MAM)	0.54
Summer (JJA)	0.48
Autumn (SON)	0.49
Winter (DJF)	0.59

Model skill in forecasting above-normal temperatures

	Ks
Spring (MAM)	0.69
Summer (JJA)	0.58
Autumn (SON)	0.52
Winter (DJF)	0.55





Assessment of accuracy of numerical seasonal temperature forecasts

- Verification period 1981-2006
- Weather station — only Hong Kong Observatory
- | model forecast - observed | ≤ 0.5 C \rightarrow acceptable forecast

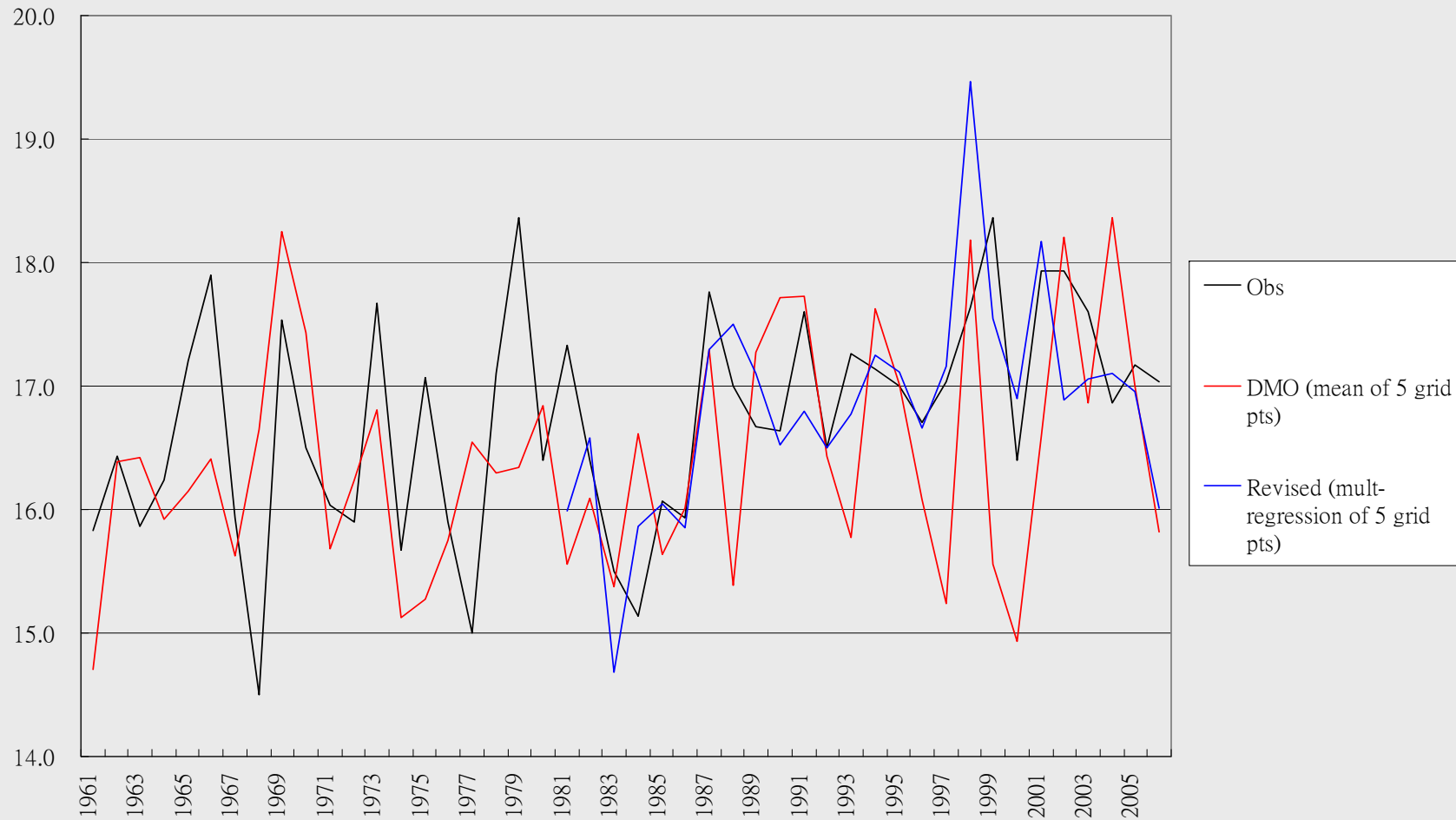
Direct model forecast:

- ❖ Nearest grid point value ; or
- ❖ Mean value of nearest 5 or 9 grids

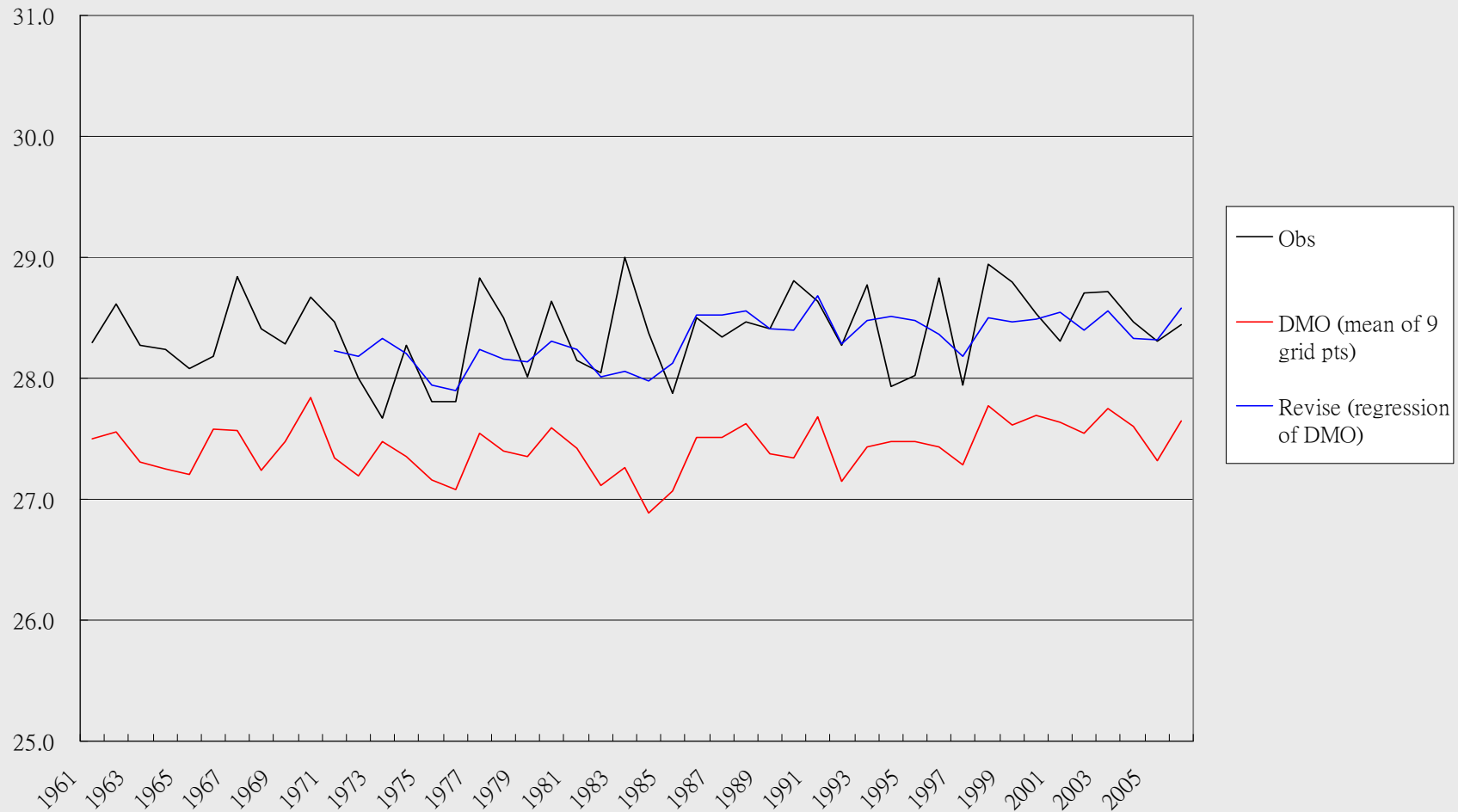
Model Output Statistics Corrected forecast

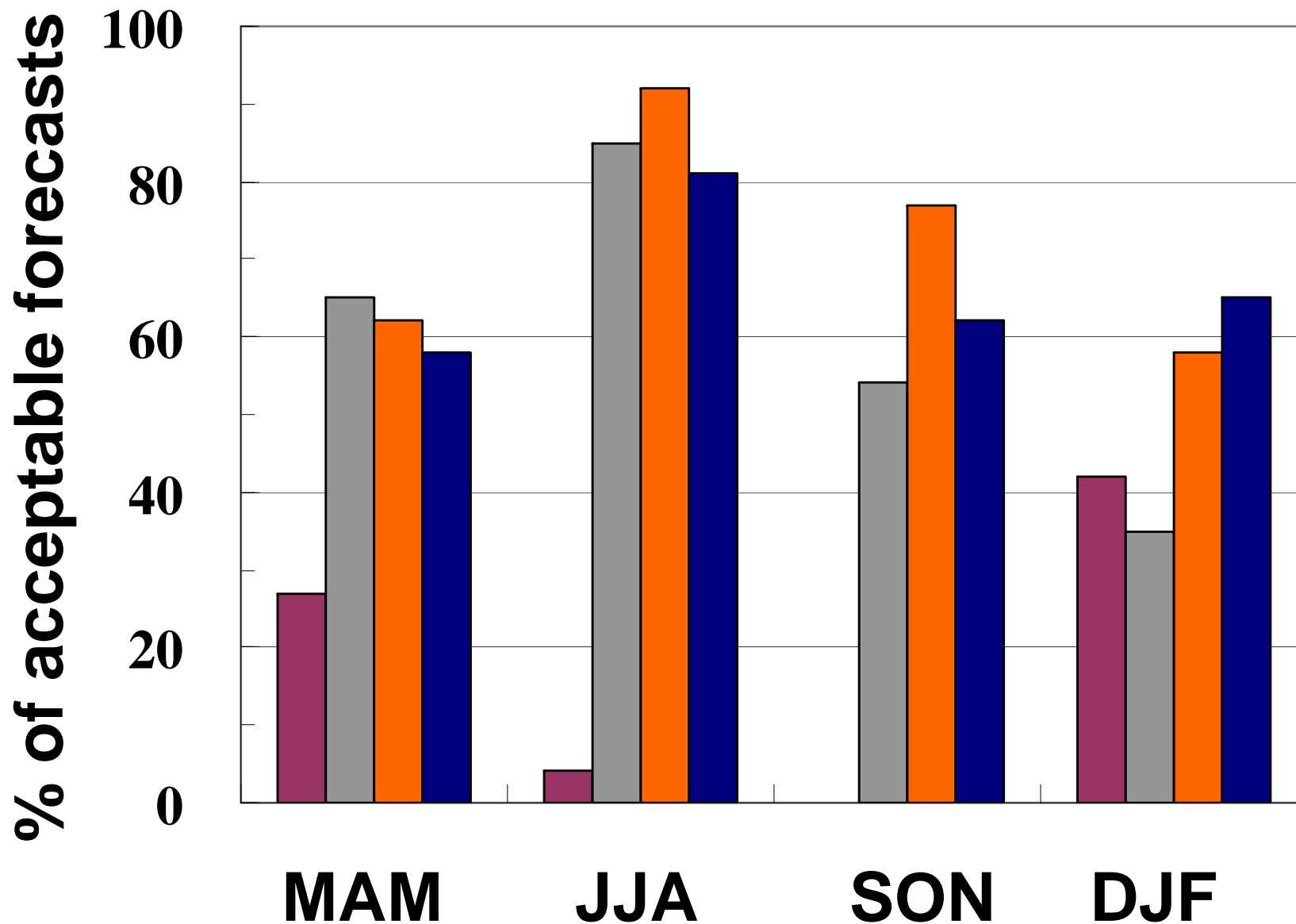
- ❖ Kalman filter
- ❖ Single and multiple regression

Comparison of direct and MOS-corrected model outputs against observed seasonal temperatures (**Winter**)



Comparison of direct and MOS-corrected model outputs against observed seasonal temperatures (**Summer**)





scaled Hanssen and Kuipers score

Average of 4 seasons

Temperature		BN	NN	AN
KS	DMO	0.57	0.51	0.59
KS	MOS	0.66	0.66	0.71
Rainfall		BN	NN	AN
KS	DMO	0.5	0.47	0.54
KS	MOS	0.59	0.63	0.62



Future Plans

- Provide monthly temperature and if possible rainfall predictions for Hong Kong
- Explore the possibility of predicting frequency of occurrence of tropical cyclones

Thank you