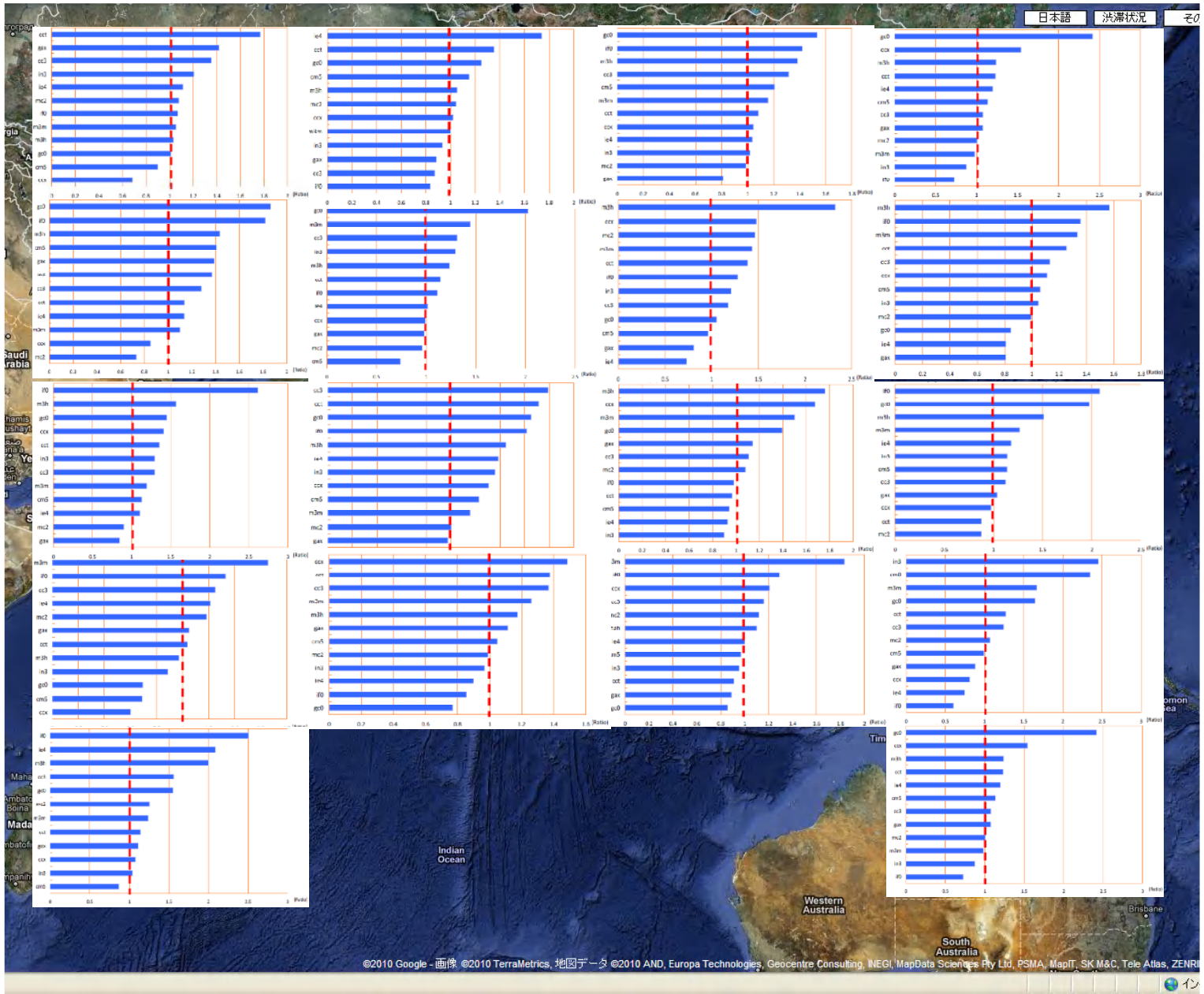
The 7th International Coordination Group (ICG) Meeting
GEOSS Asian Water Cycle Initiative (AWCI)

Multi-model applications to the assessment of the climate change impacts on floods

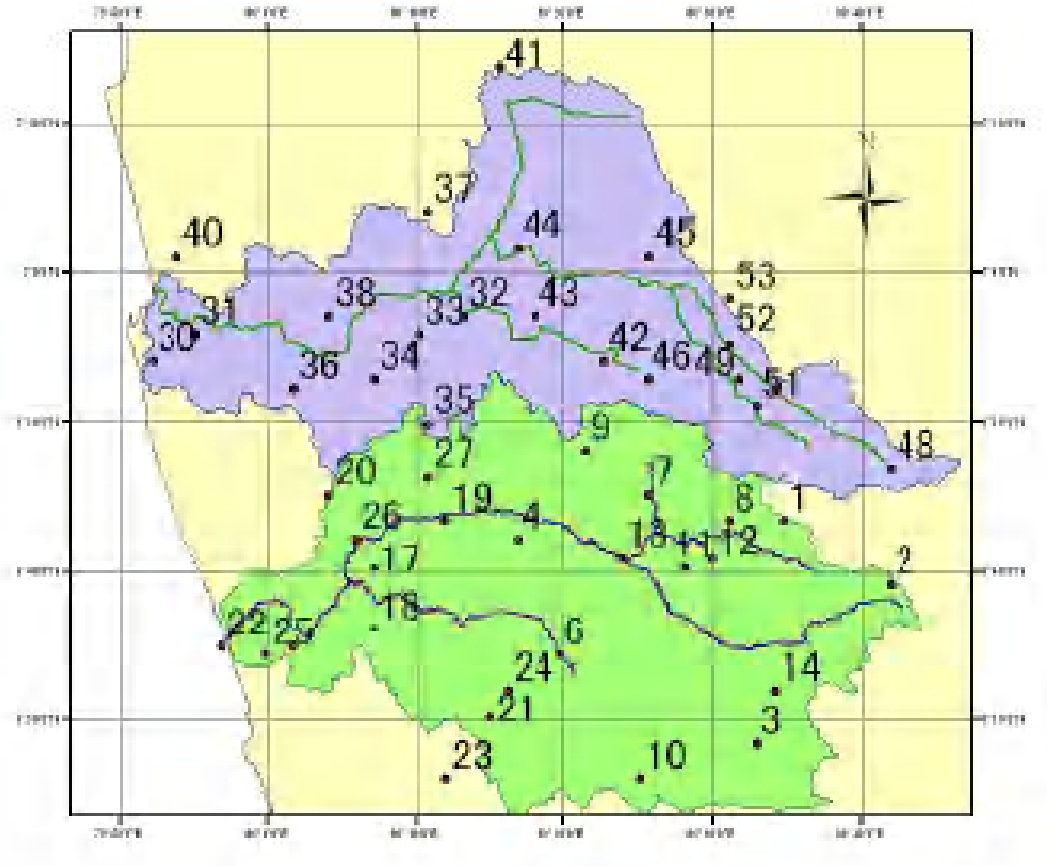
T. Koike, L. Wang, K. Yoshimura, H. Yamamoto
The University of Tokyo

Demonstration River Basins



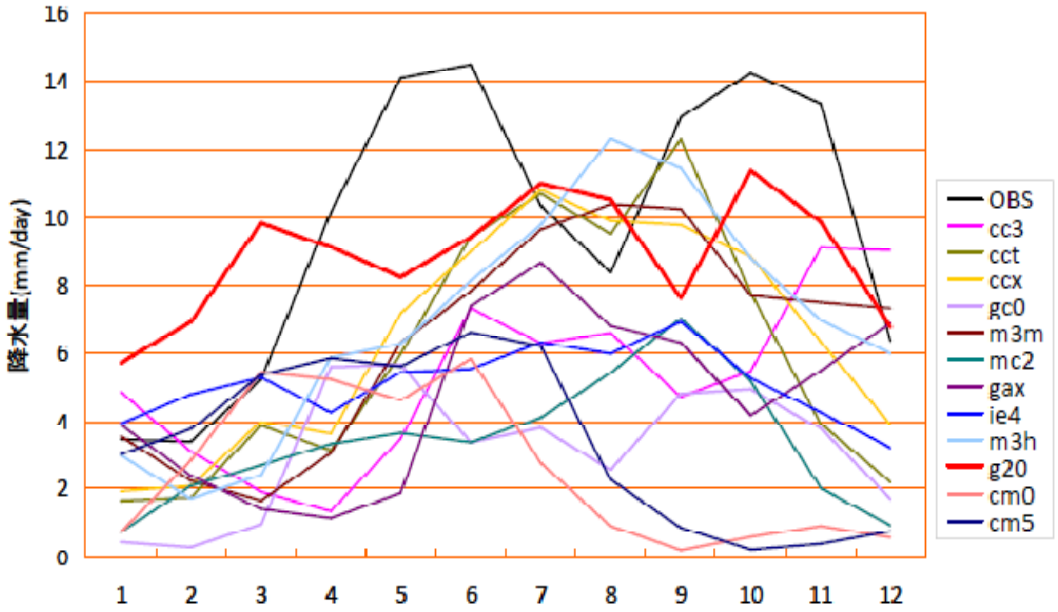
Asian Water Cycle Initiative

Country: Sri Lanka
River basin name: Kalu Ganga
Basin Area: 2720 [km2]

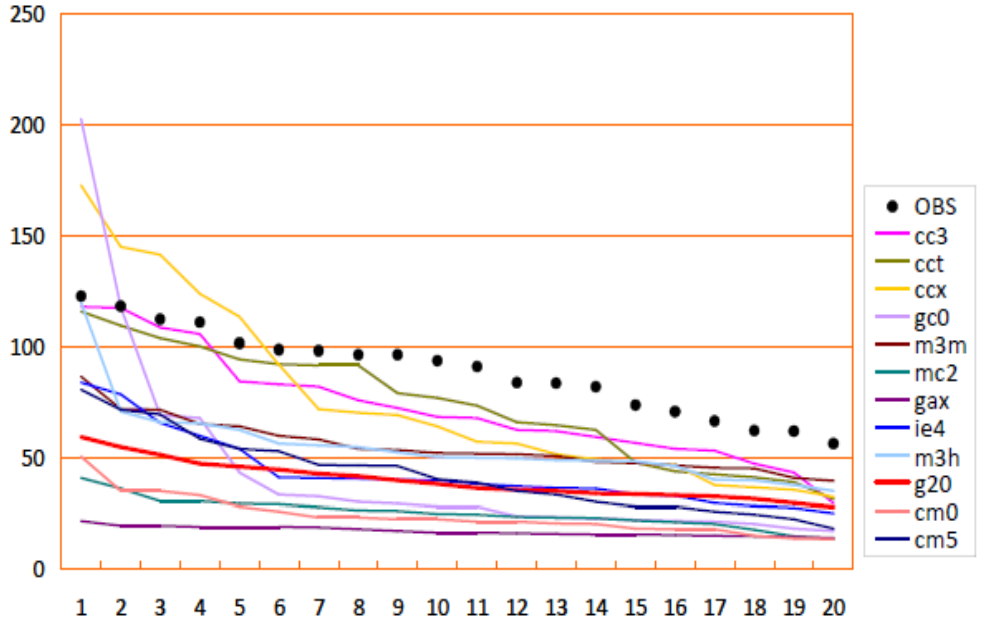


CMIP3

France	CNRM-CM3	cc3
Canada	CGCM3.1(T63)	cct
Canada	CGCM3.1(T47)	ccx
Australia	CSIRO-Mk3.0	cm0
Australia	CSIRO-Mk3.5	cm5
USA	GISS-AOM	gax
USA	GFDL-CM2.0	gc0
Italy	INGV-SXG	ie4
Japan	MIROC3.2(hires)	m3h
Japan	MIROC3.2(medres)	m3m
Japan	MRI-CGCM2.3.2	mc2
Japan	GCM20	g20



Evaluation of the 20 Year Average of
Monthly Rainfall and Its Seasonal Variation

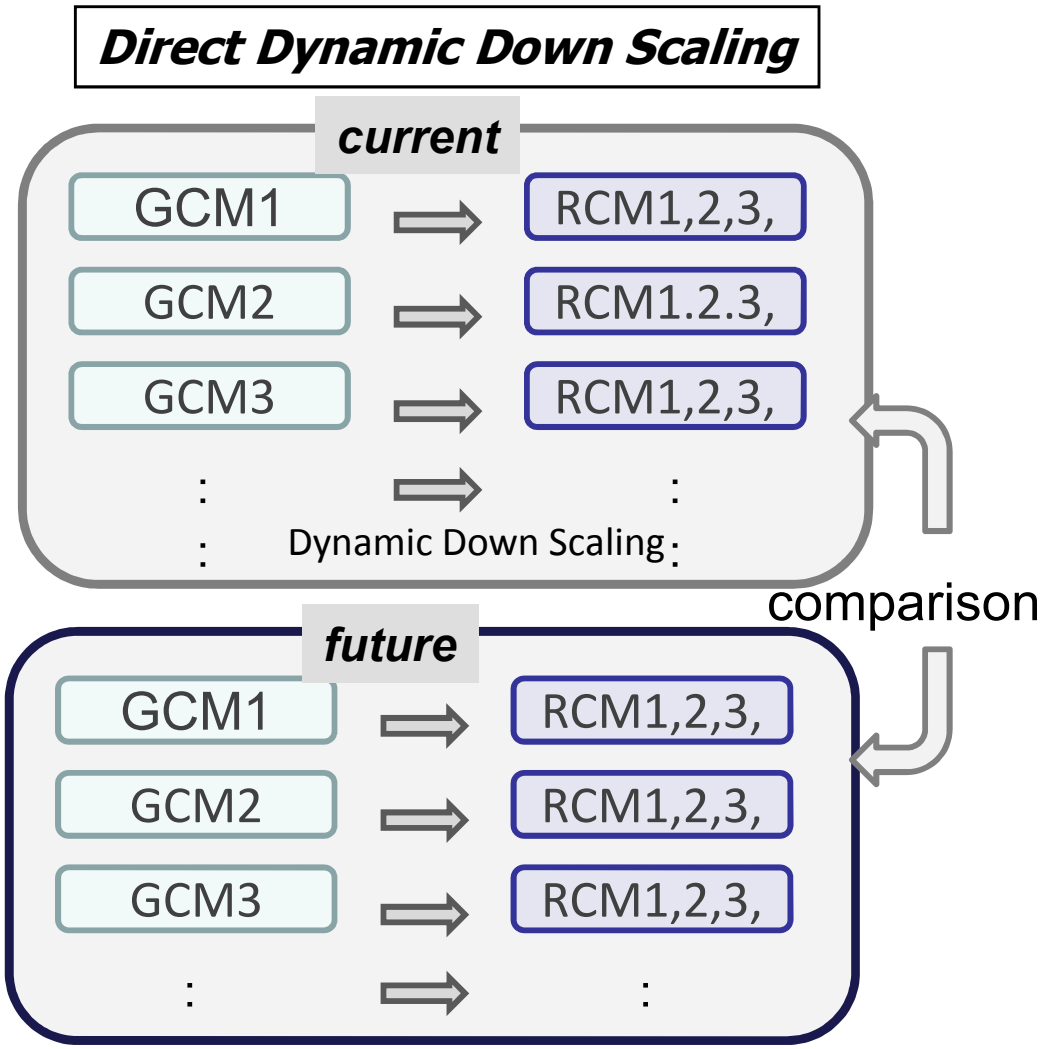


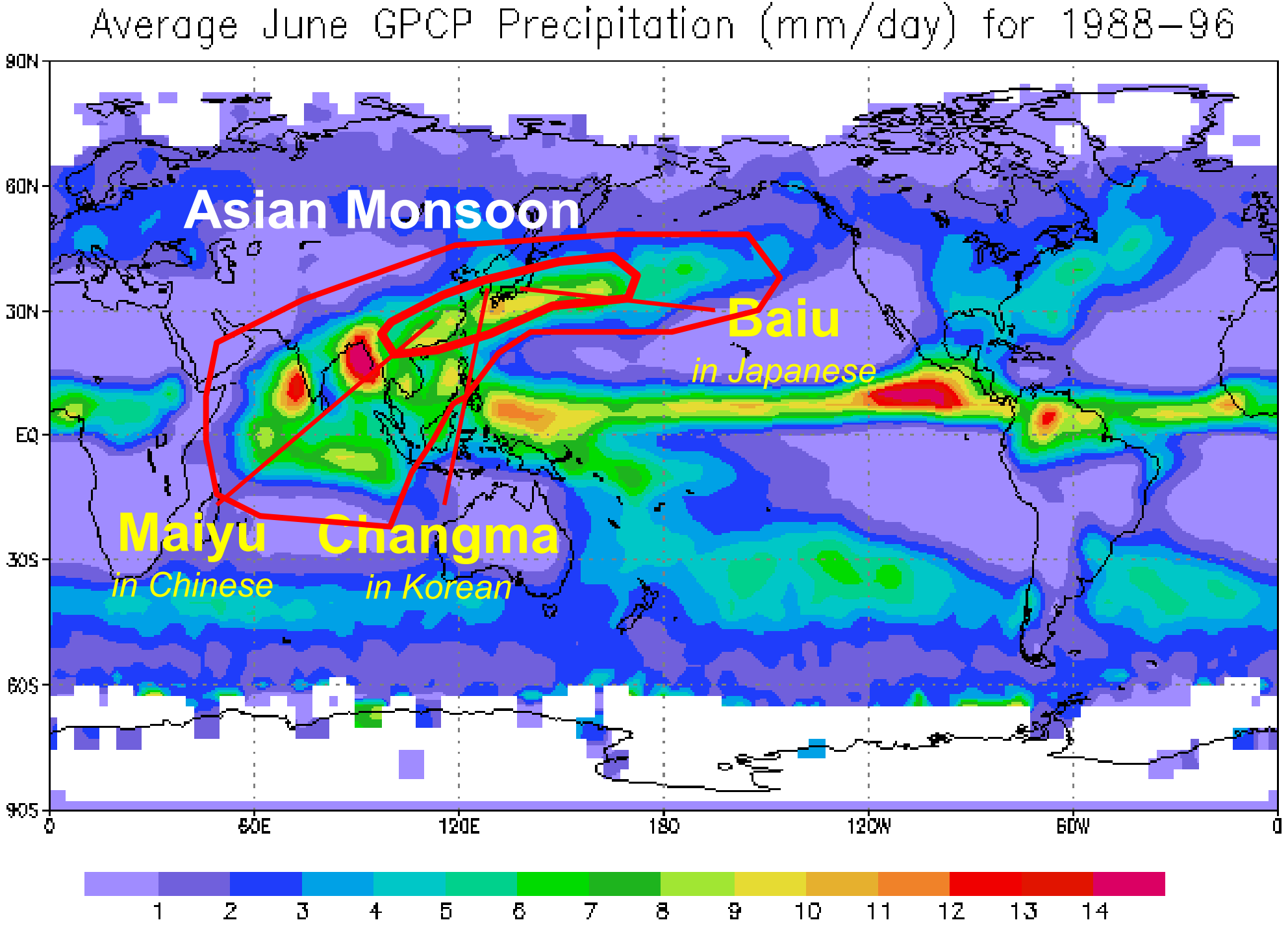
Evaluation of the 20 Year Average of
Monthly Rainfall and Its Seasonal Variation

Main Problems with the GCM Outputs:

- Large Diversity
- Low Seasonal Representation
- Low Extreme Heavy Rainfall Rate
- Small Number of No Rainfall Day but Long Drizzle
- Low Spatial Distribution

→**Bias Correction, Downscaling, Multi-model Analysis**
Coupling with Hydrological Models


Direct Dynamic Down Scaling
current
GCM1
RCM1,2,3,
GCM2
RCM1.2.3,
GCM3
RCM1,2,3,
Dynamic Down Scaling
comparison
future
GCM1
RCM1,2,3,
GCM2
RCM1,2,3,
GCM3
RCM1,2,3,

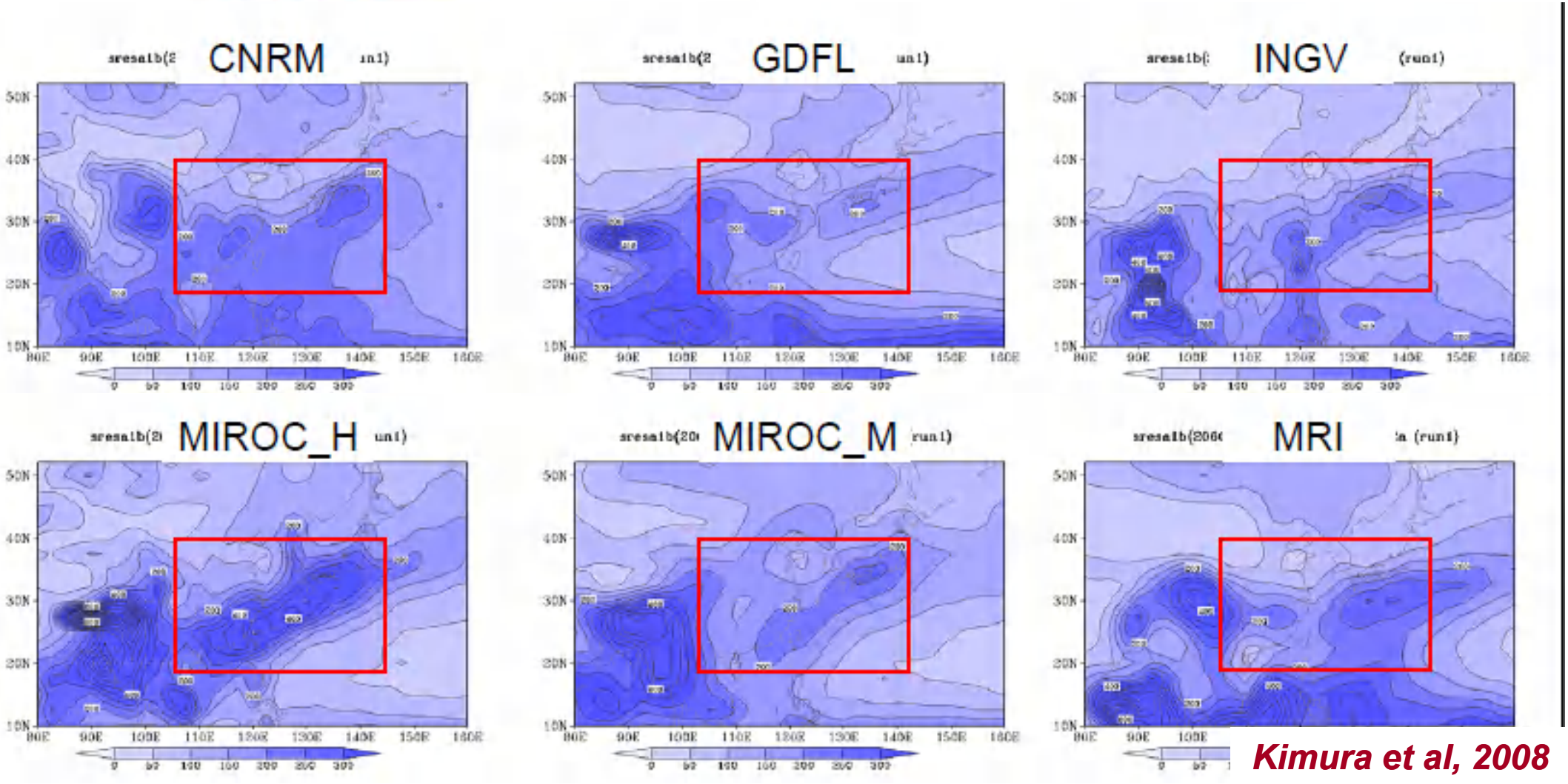

Average June GPCP Precipitation (mm/day) for 1988–96
90N
60N
30N
EQ
30S
60S
90S
0
60E
120E
180
120W
60W
0
Asian Monsoon
Baiu
in Japanese
Maiyu
in Chinese
Changma
in Korean
1
2
3
4
5
6
7
8
9
10
11
12
13
14

Averaged Total Rainfall in June

(A1B:2060-2089)

Enclosed Area: 18N-40N, 105E-145E

GCM

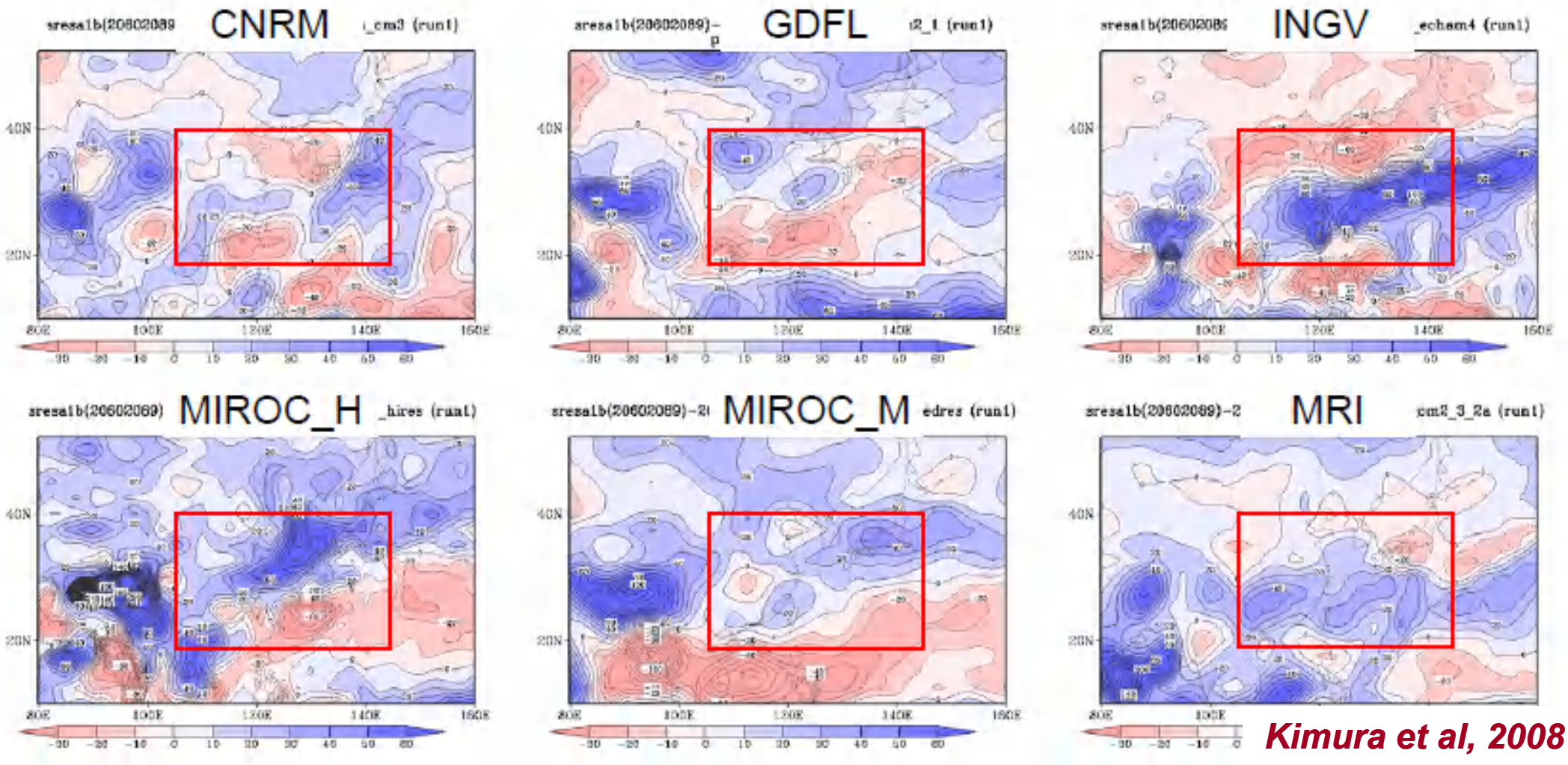


Kimura et al, 2008

Averaged Total Rainfall in June

A1B (2060-2089) – 20C3M (1970-1999)

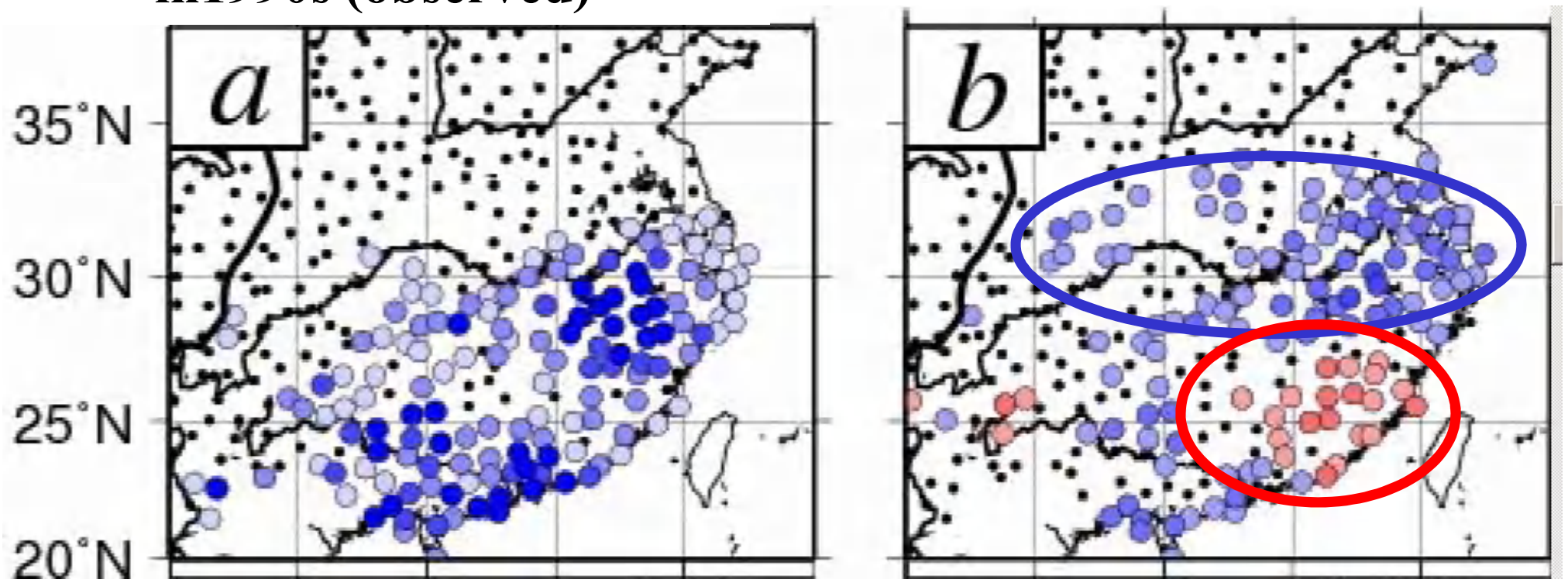
GCM

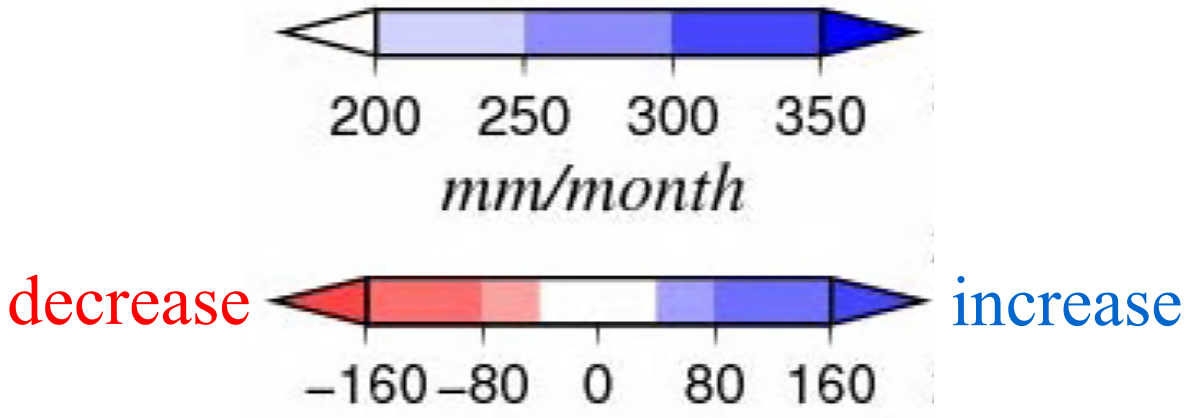


Kimura et al, 2008

Averaged Total Rainfall in June in1990s (observed)

(1960s – 1990s)



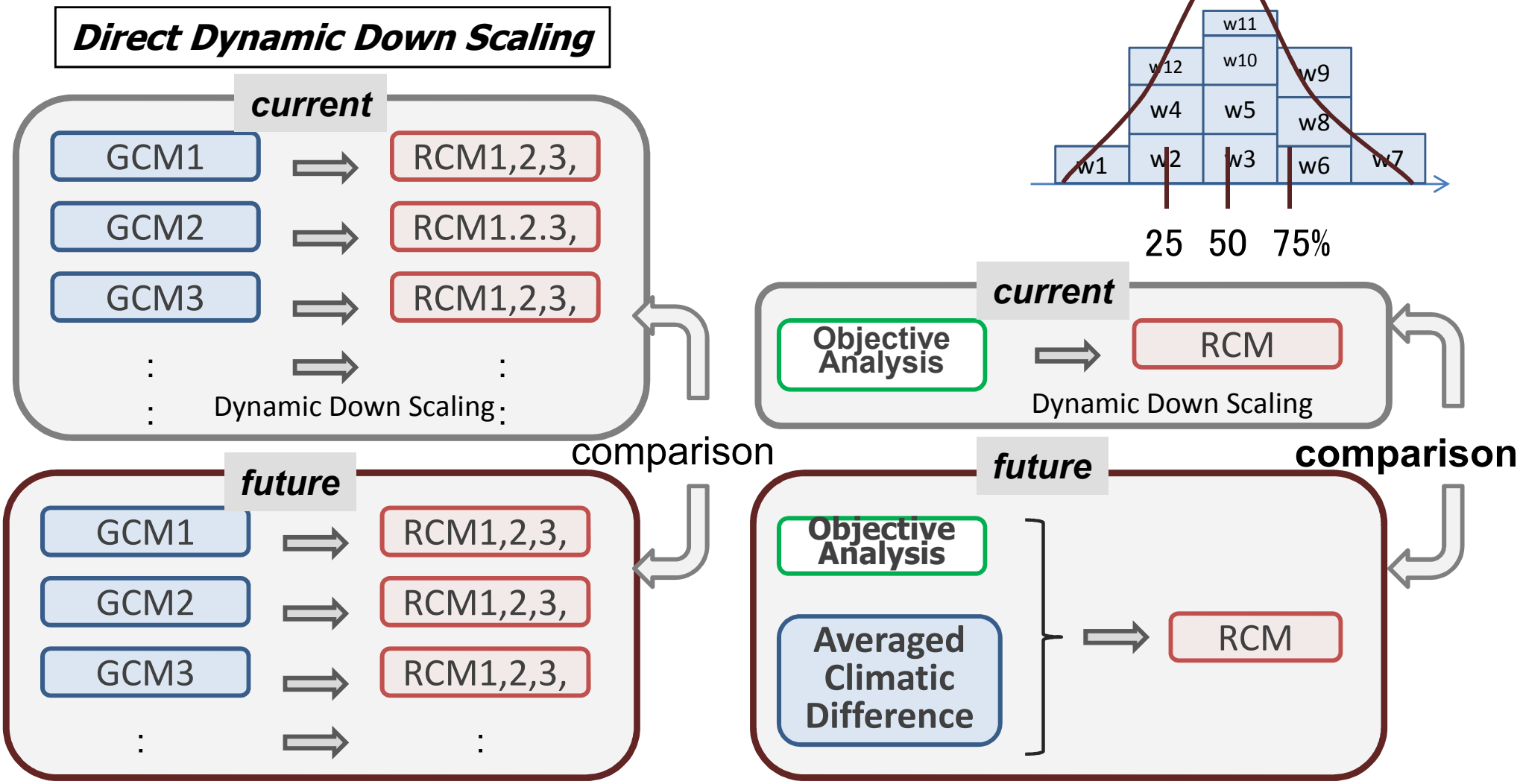


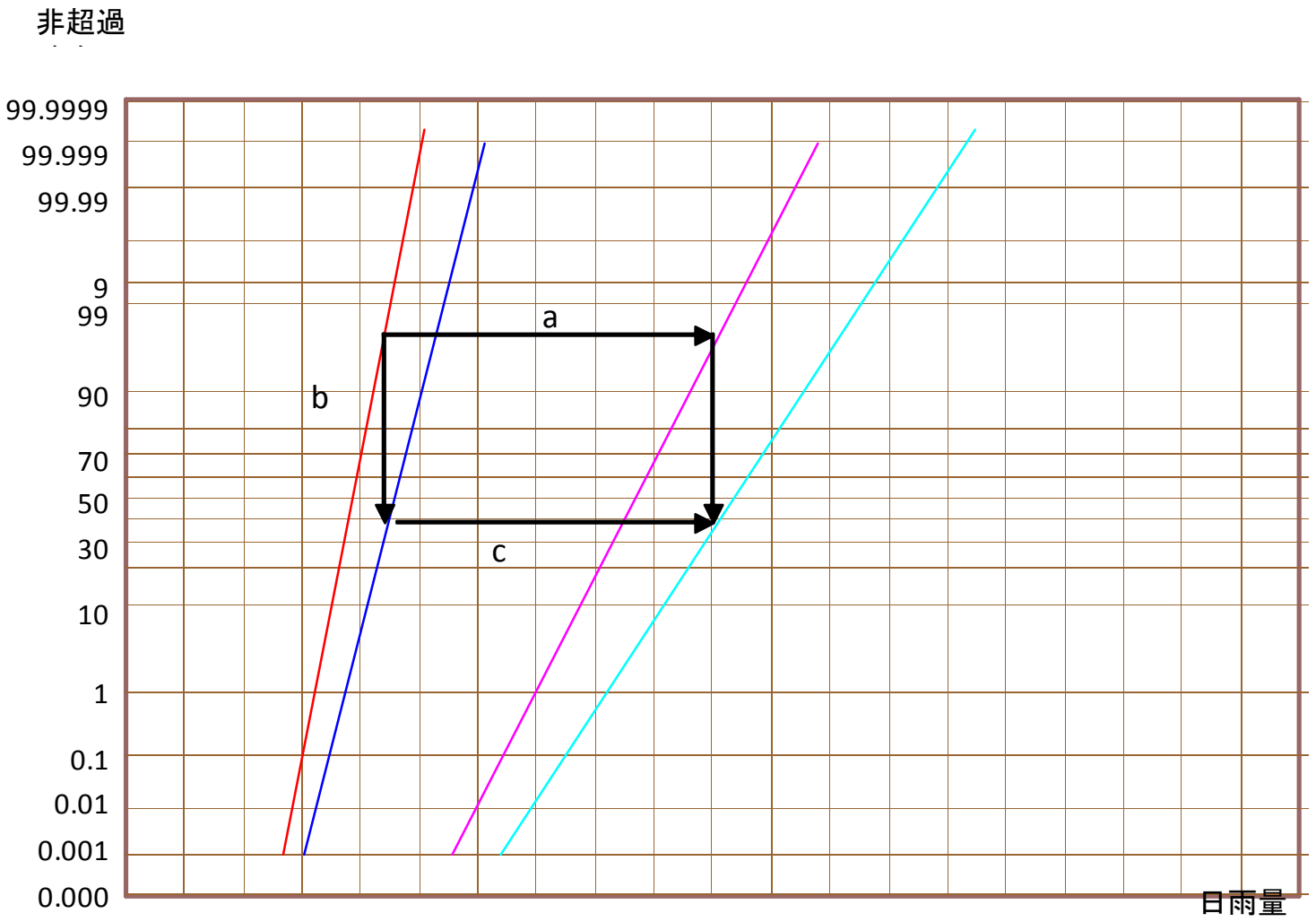
Kimura et al, 2008

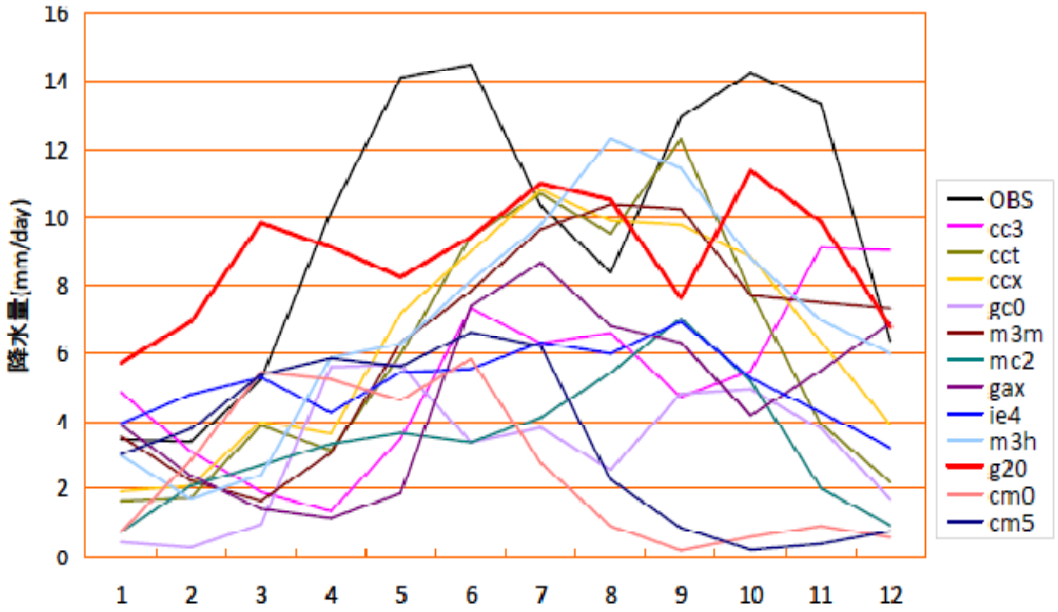
Pseudo Global Warming (PGW) Experiment

Regional Climate Model (RCM) by Using the Horizontal Boundary Condition Derived form Current Objective Analysis + Averaged Climatic Differences between current and future.

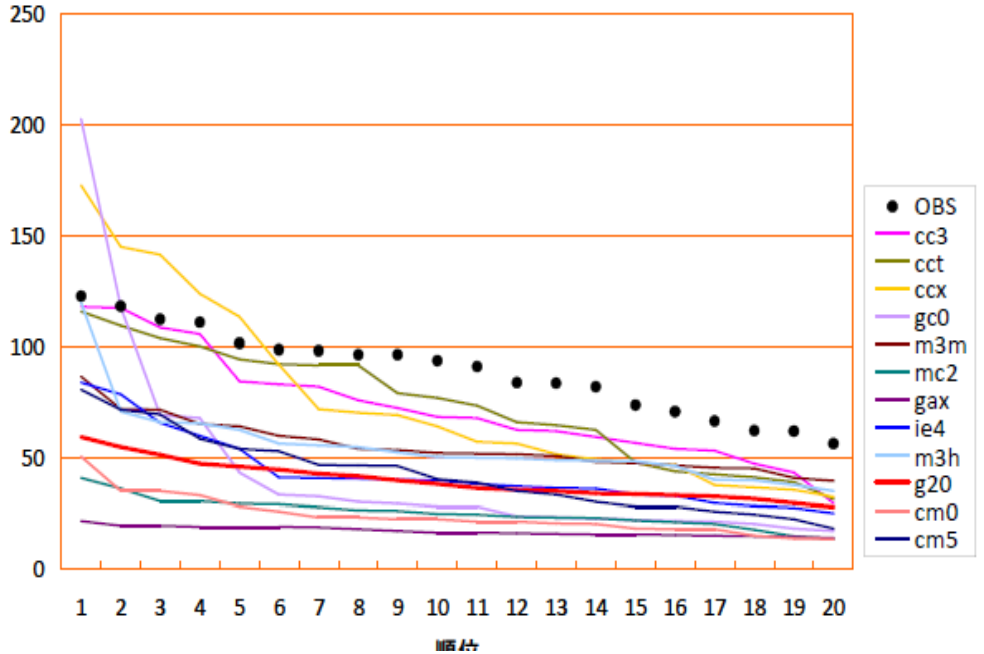
Merits: Reduction of model bias and computational costs



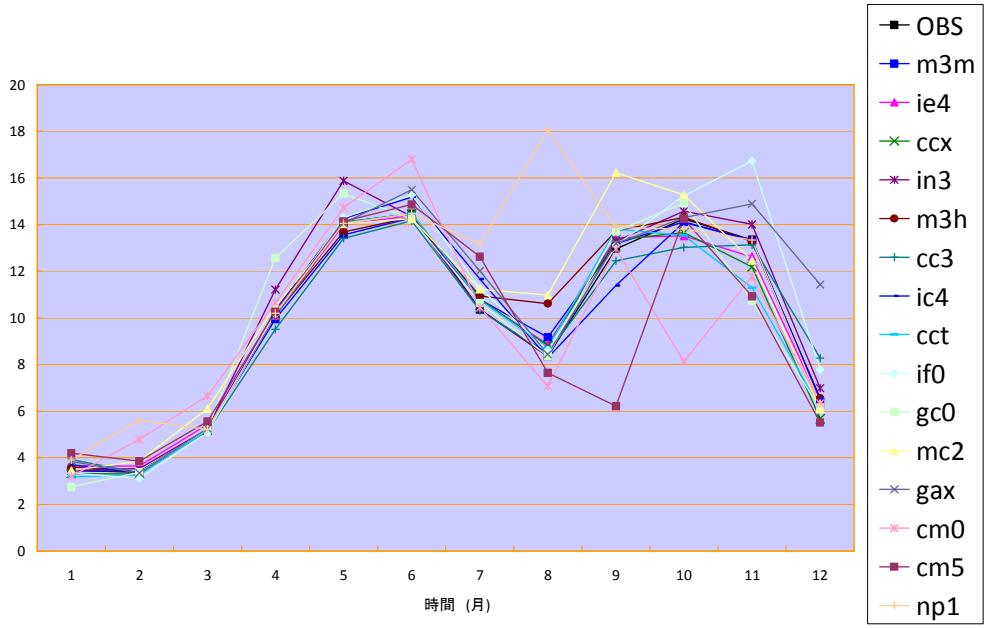

非超過
99.9999
99.999
99.99
9
99
90
70
50
30
10
1
0.1
0.01
0.001
0.000
a
b
c
日雨量

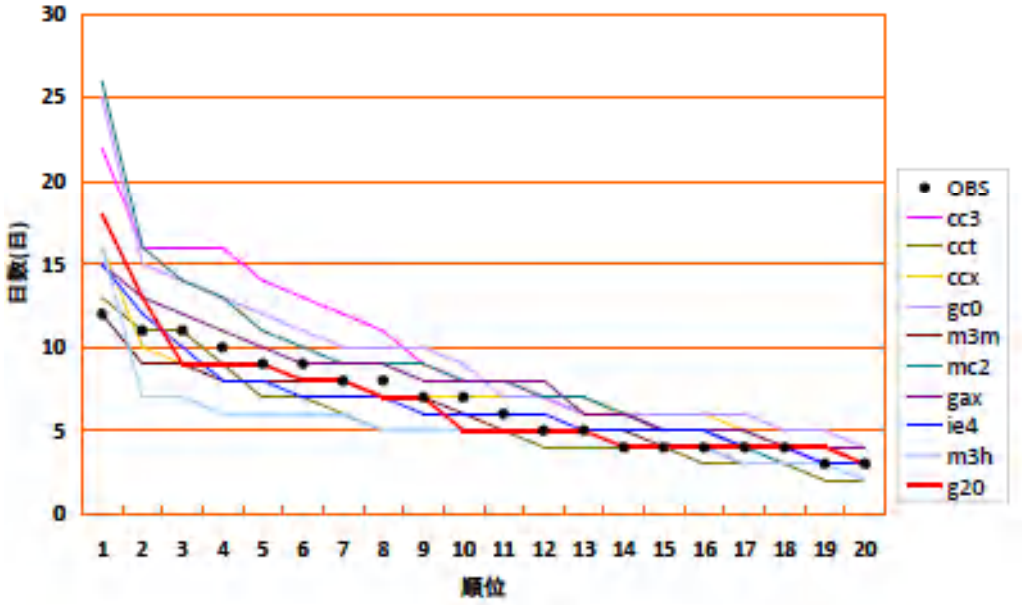


Evaluation of the 20 Year Average of Monthly Rainfall and Its Seasonal Variation

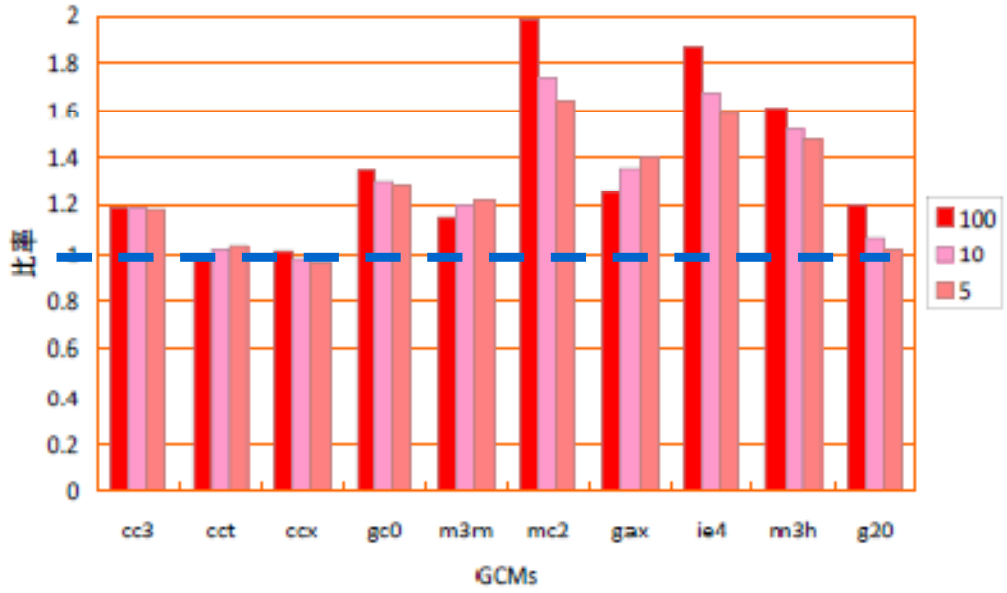


Evaluation of the 20 Year Average of Monthly Rainfall and Its Seasonal Variation

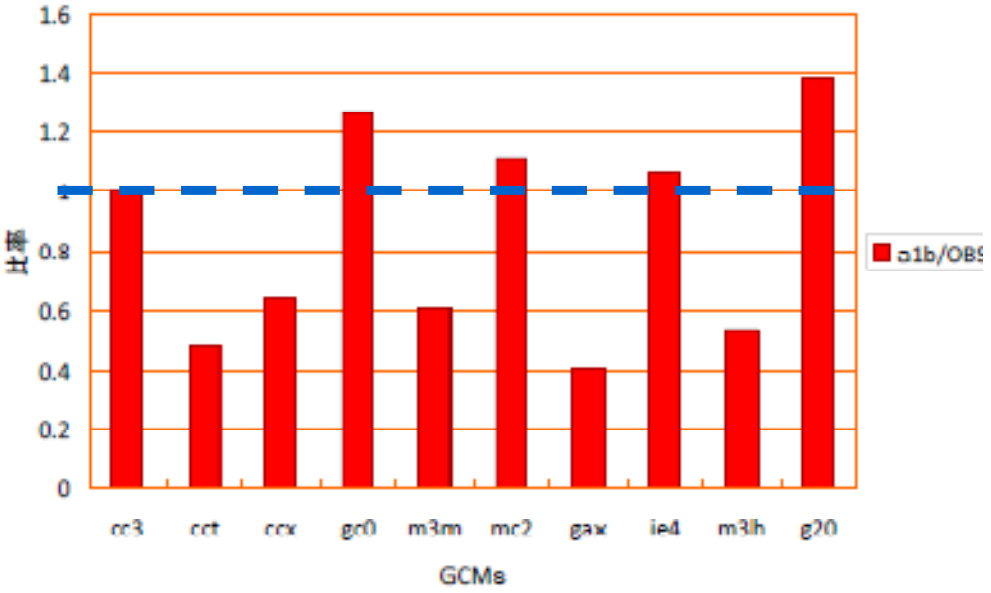




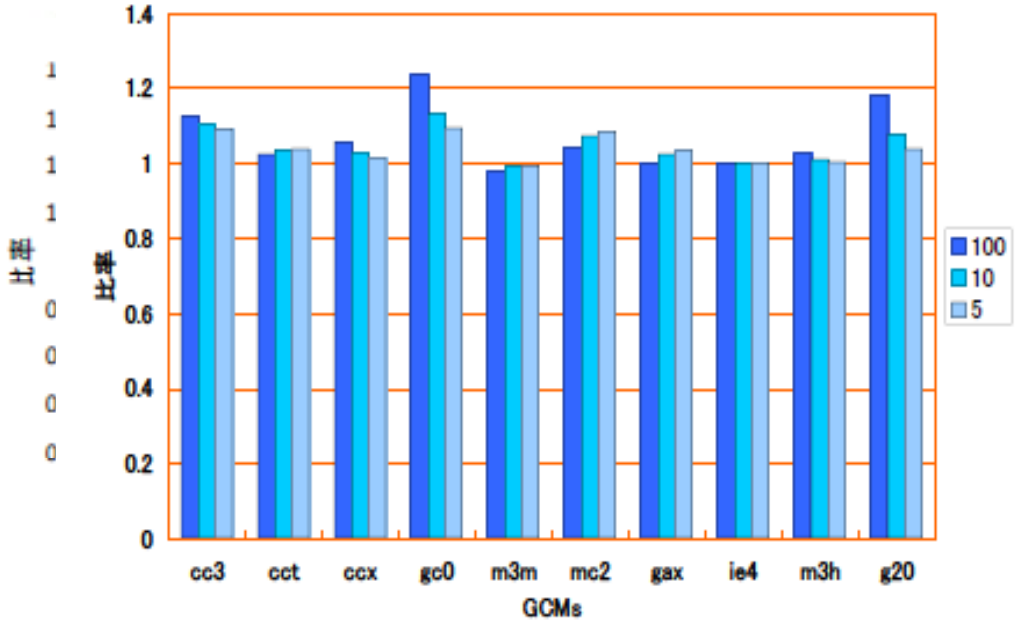
Changes between 1980-2000 and 2090-2100



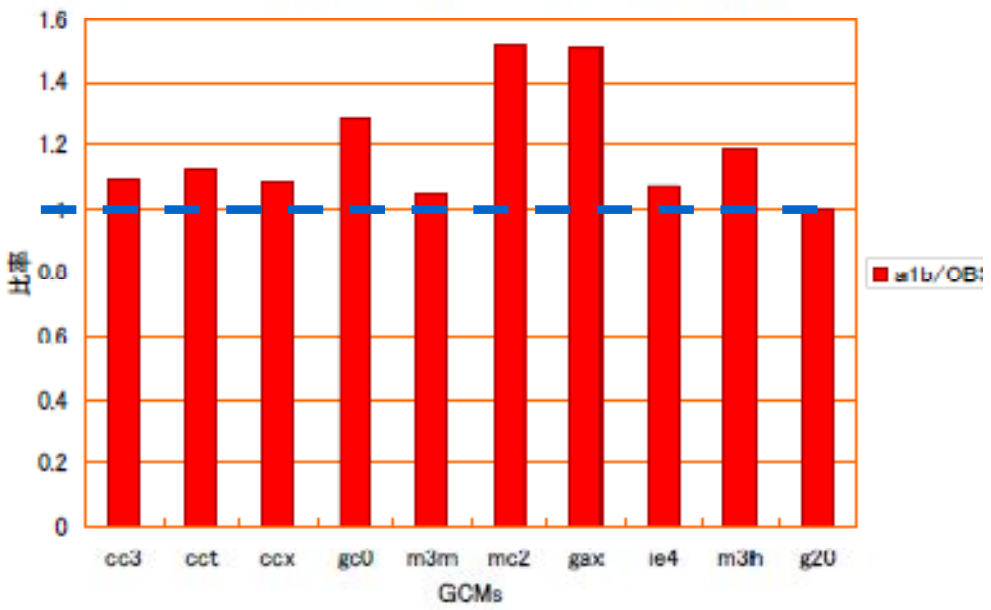
Change in the Probable Annual Max Daily Rainfall



Change in the Continuous No Rainfall Days



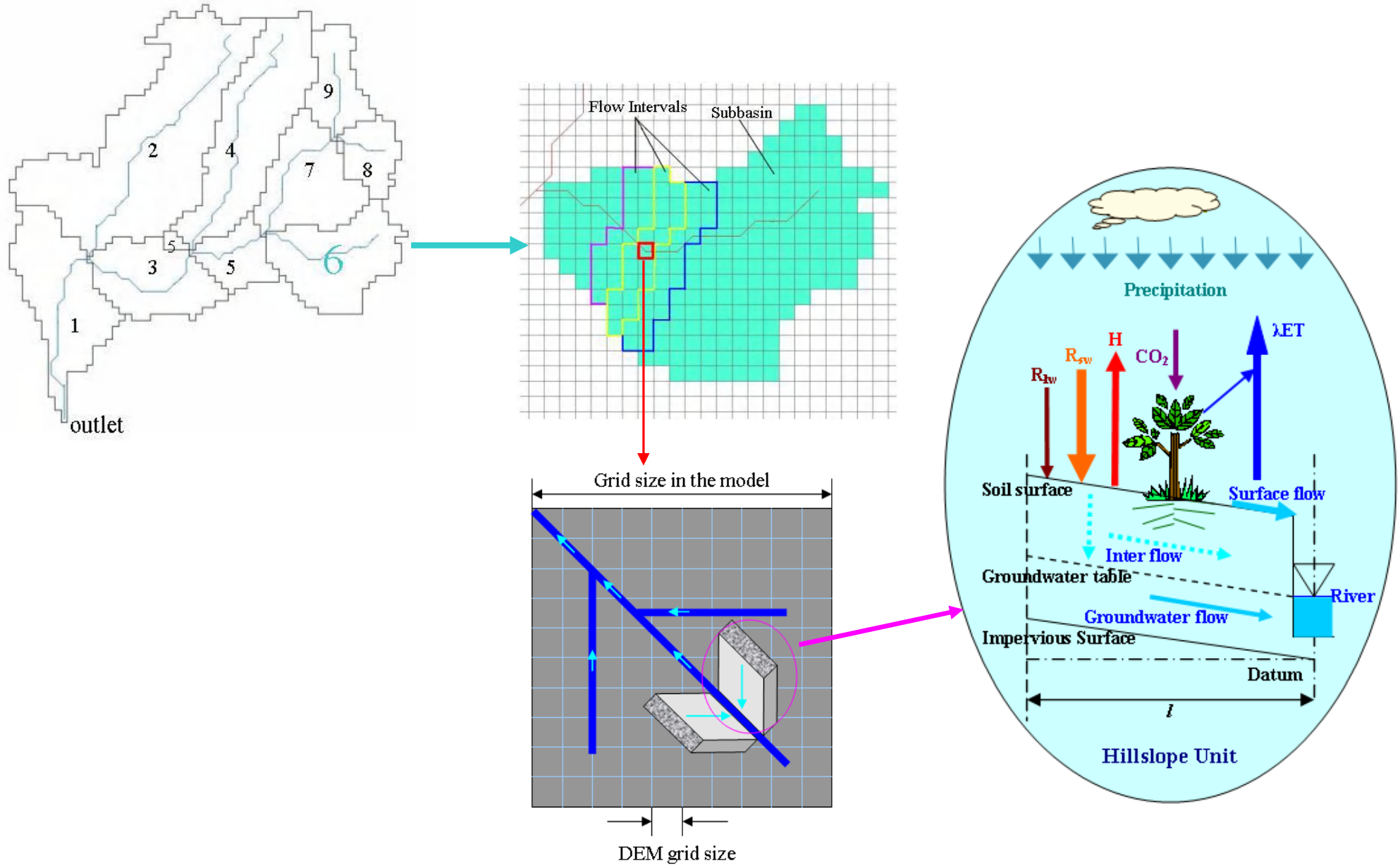
Results of the Bias Correction



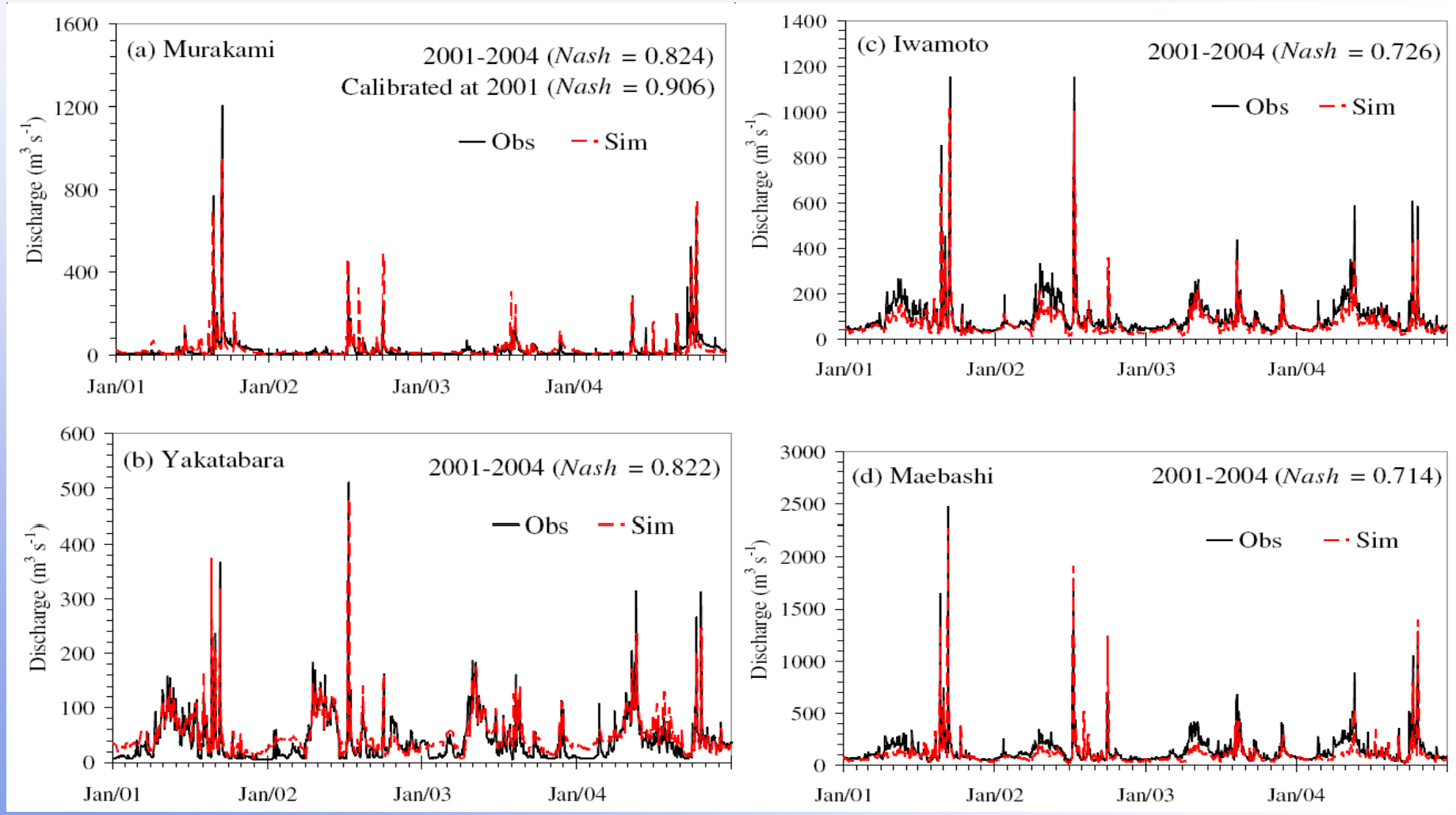
Change in the Annual Rainfall

Wang, Koike et al. 2009

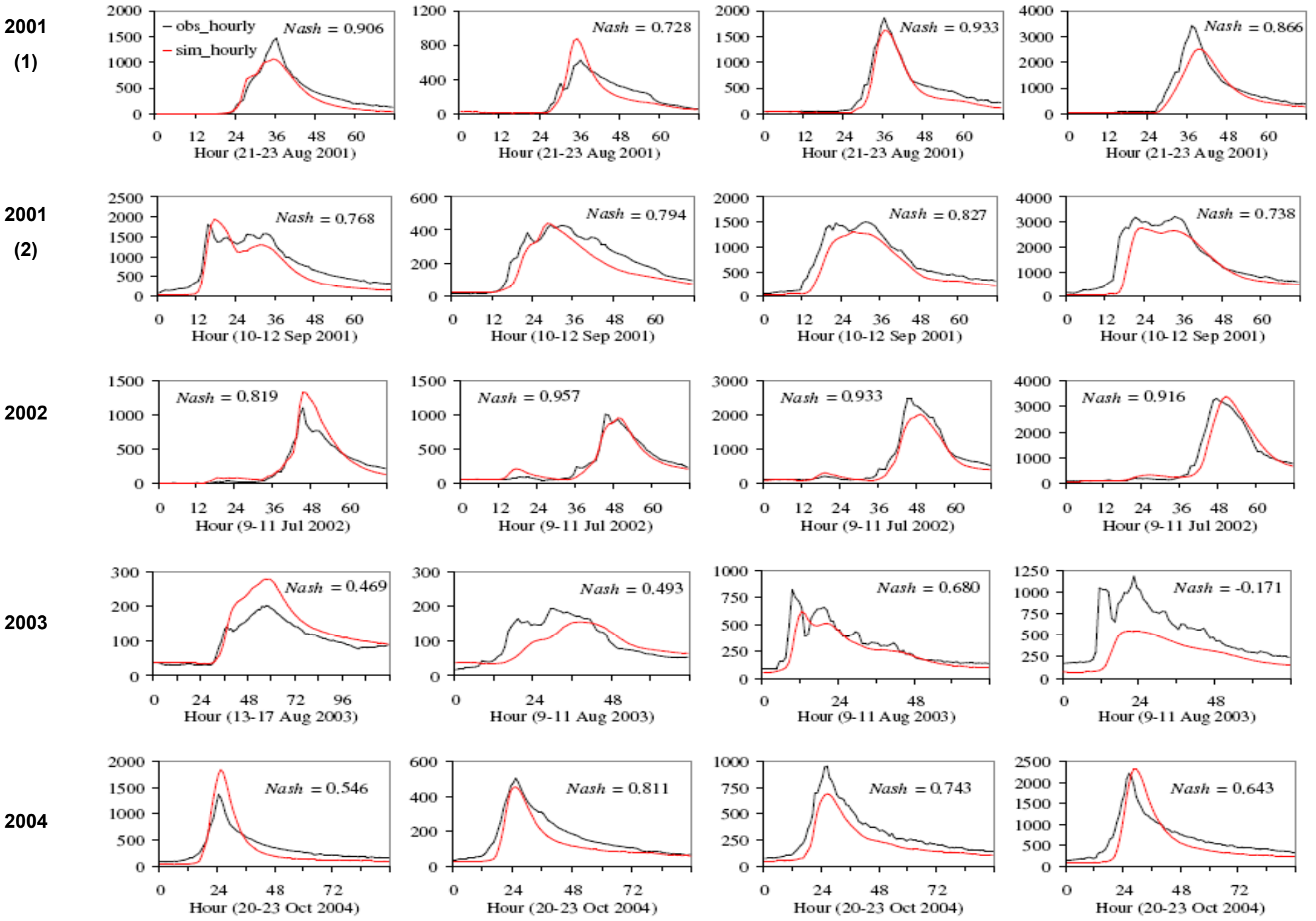
WEB-DHM
(Water and Energy Budget-based Distributed Hydrological Model)



Calibration and validation with discharges at main stream gauges

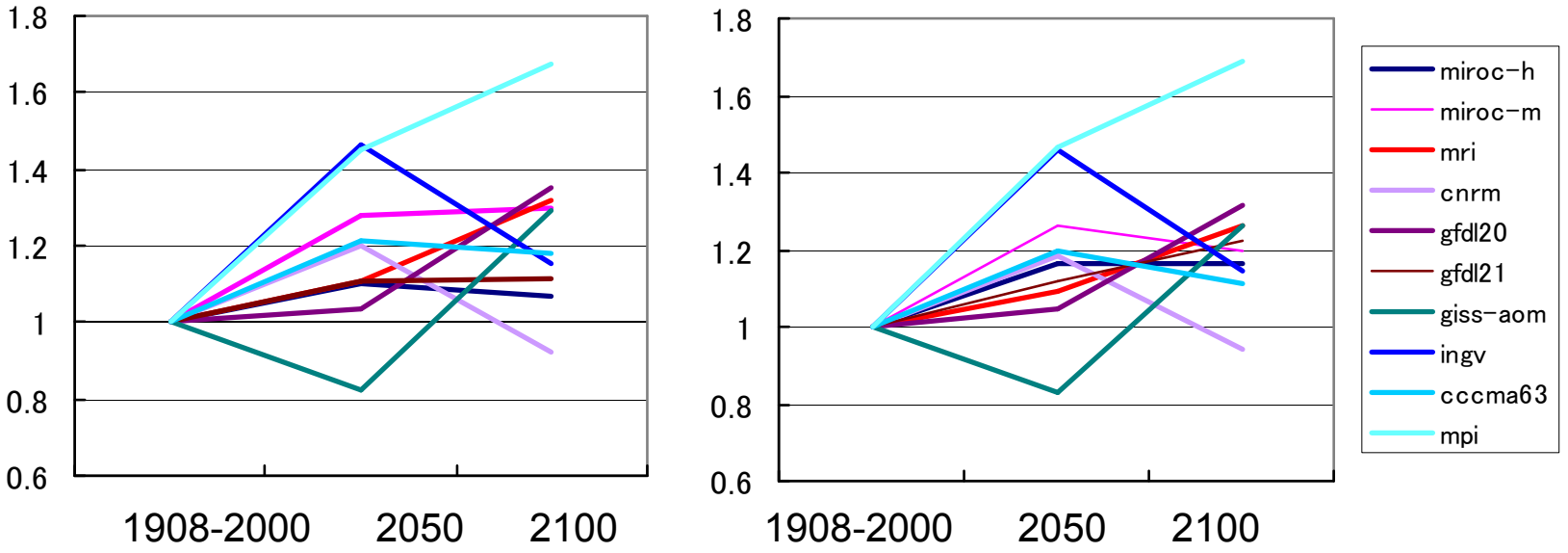


Annual Largest Flood Peaks



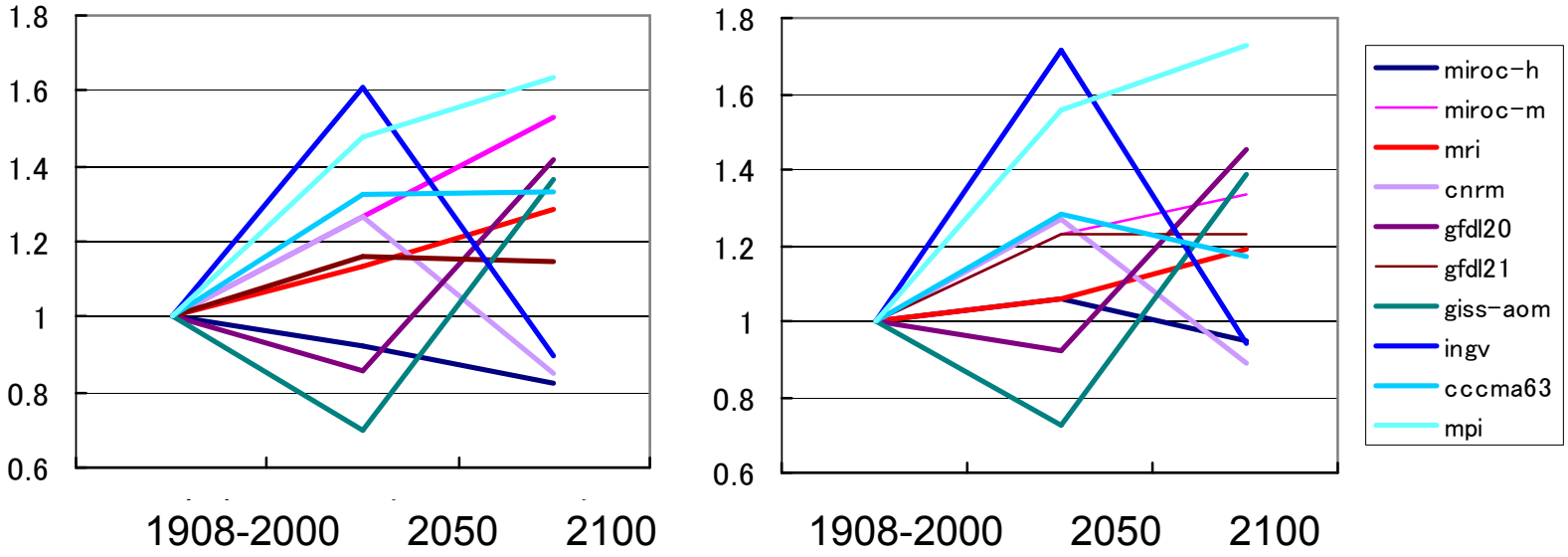
(a) Murakami **(b) Yakatabara** **(c) Iwamoto** **(d) Maebashi**

MIROC3.2(hires)	Japan	miroc-h
MIROC3.2(medres)	Japan	miroc-m
MRI-CGCM2.3.2	Japan	mri
CNRM-CM3	France	cnrm
GFDL-CM2.0	USA	gfdl20
GFDL-CM2.1	USA	gfdl21
GISS-AOM	USA	giss-aom
ECHAM5/MPI-OM	Germany	mpi
CGCM3.1(T63)	Canada	cccma63
CGCM3.1(T47)	Canada	cccma47
INGV-SXG	Italy	ingv



Left: Downstream Right: Upstream

Change in the 30 Year Probable Flood Peak



Left: Downstream Right: Upstream

Change in the 150 Year Probable Flood Peak