


The development of Non-hydrostatic Regional Climate Model in SOUSEI program

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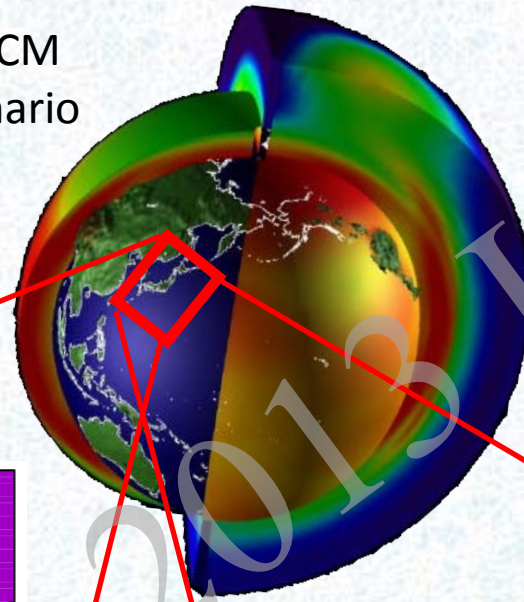
Atmospheric Environment & Applied Meteorology
Research Department
MRI

The future climate change projection using NHRCM (5km grid spacing)

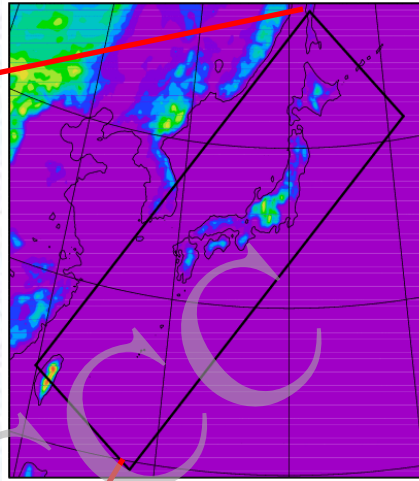
Program name	Agency	Operation term	Grid number	Integration term
KAKUSHIN program	Ministry of Education, Culture, Sports, Science and Technology	FY2007-2011	669*527	25 years (Only warm season)
Information of the future climate change projection due to global warming (IFCC)	Japan Meteorological Agency	Published in FY2012	661*211 (multi nesting)	20 years
				
SOUSEI program	Ministry of Education, Culture, Sports, Science and Technology	FY2012-2016	527*804 + 2km model	25 years

IFCC

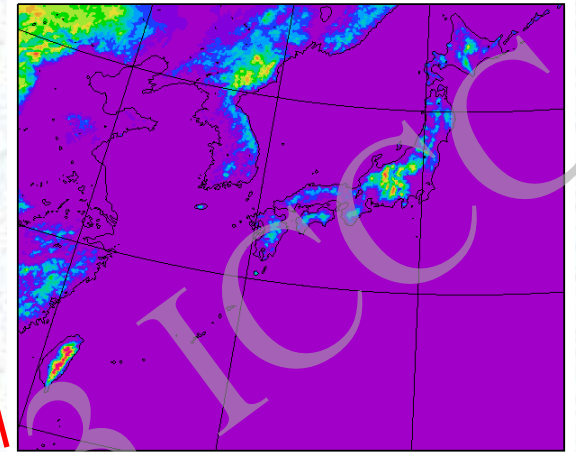
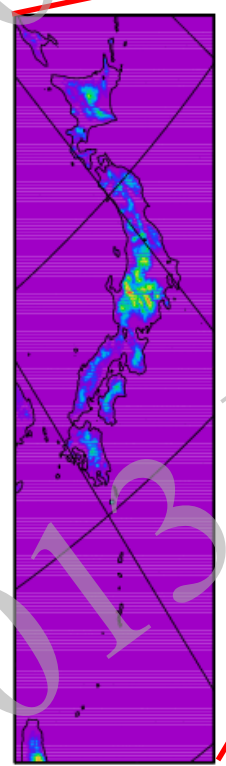
20kmAGCM
A1B scenario



MRI-NHRCM
(15km-mesh)



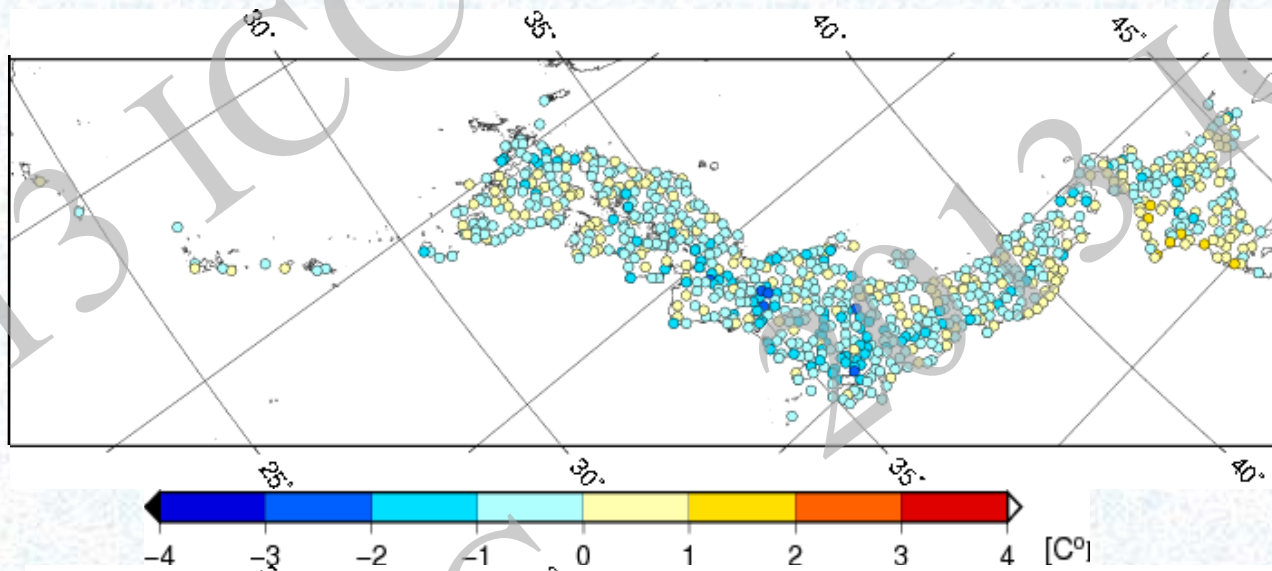
MRI-NHRCM
(5km-mesh)



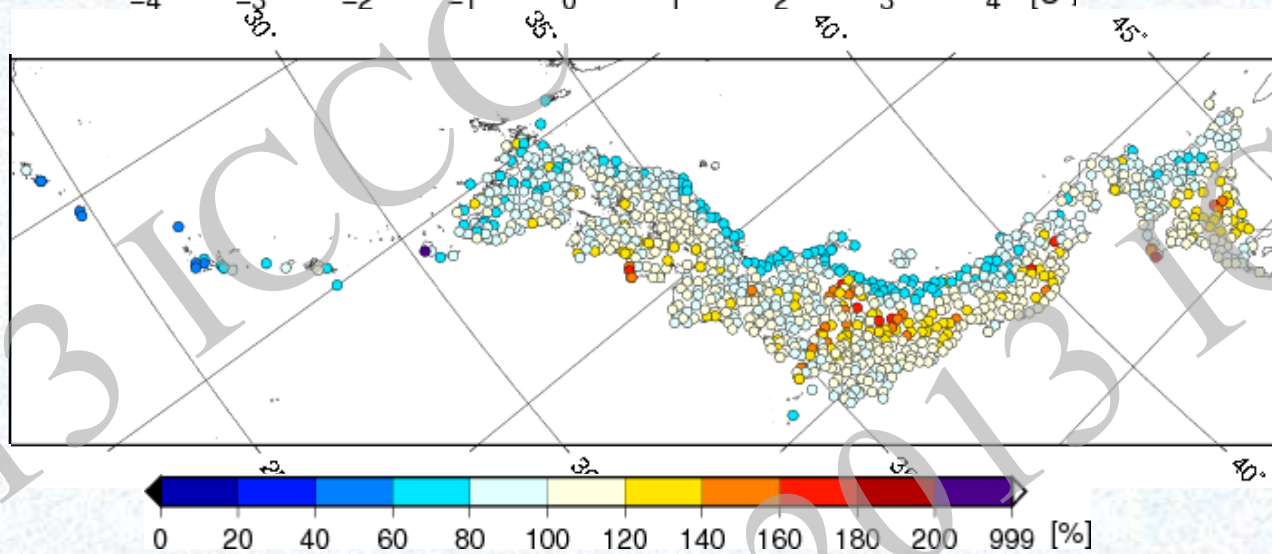
KAKUSHIN
(5km-mesh)

Difference between NHRCM and AMeDAS (present)

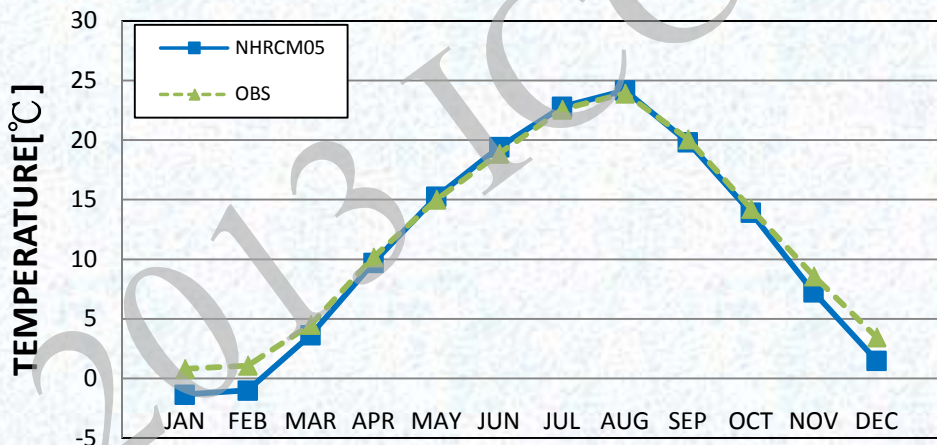
temperature



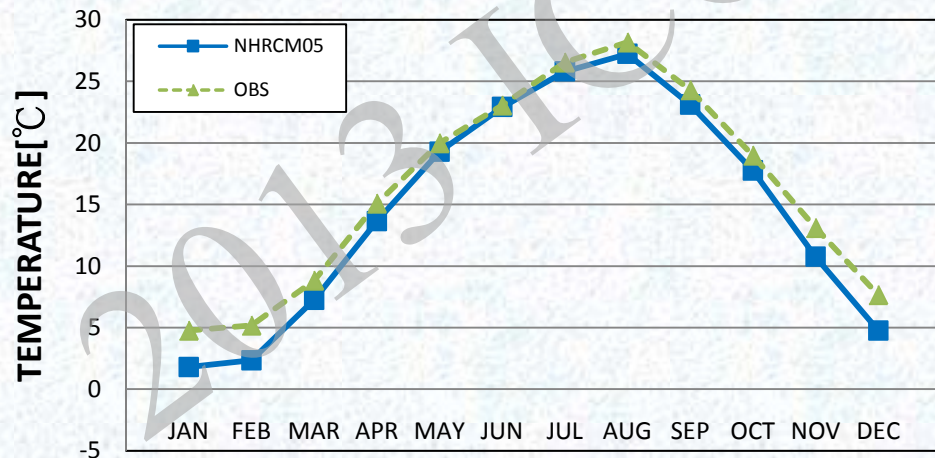
precipitation



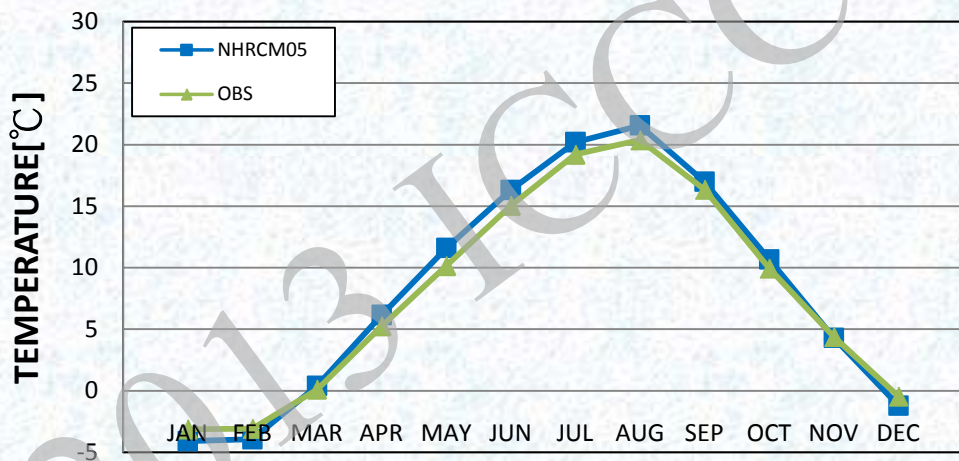
Monthly temperature and precipitation



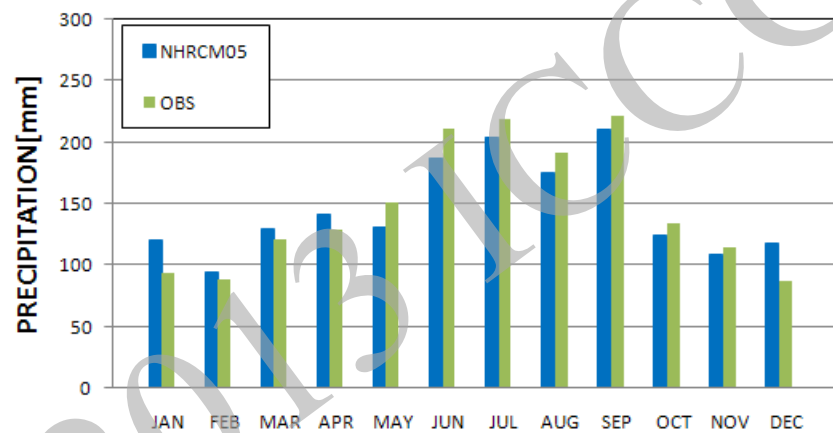
mean temperature



maximum temperature

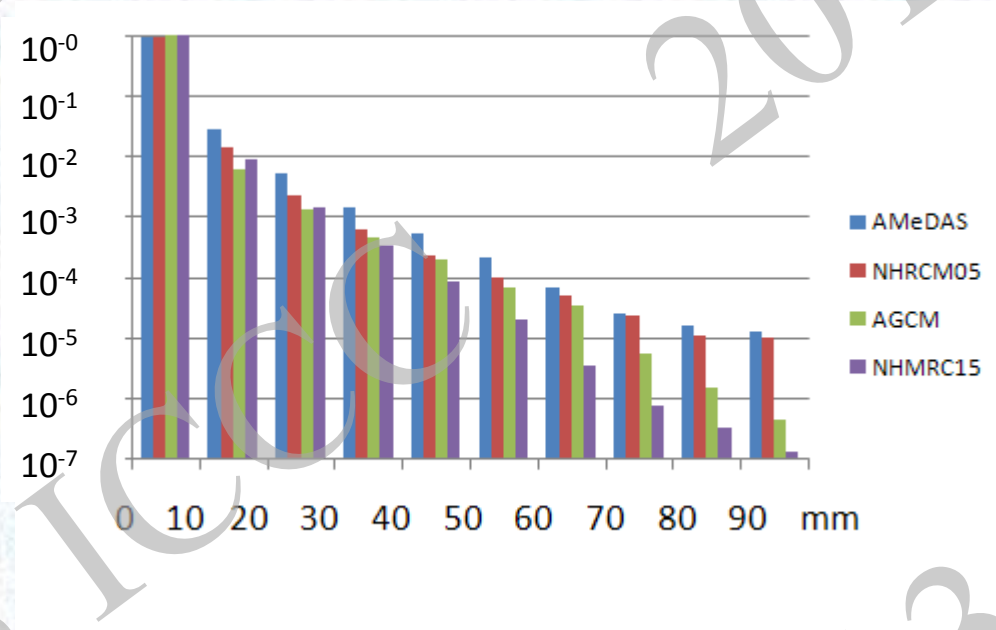


minimum temperature



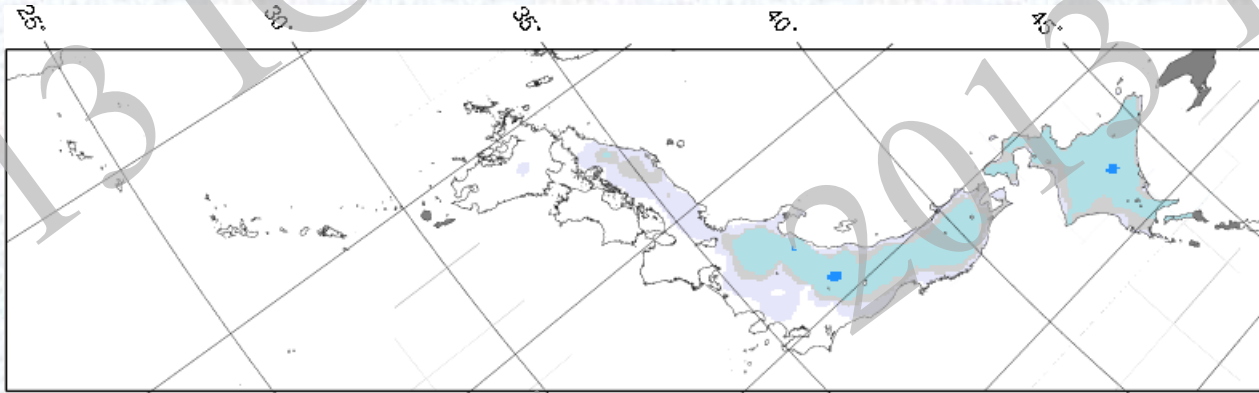
precipitation

Probability density function of hourly precipitation intensity

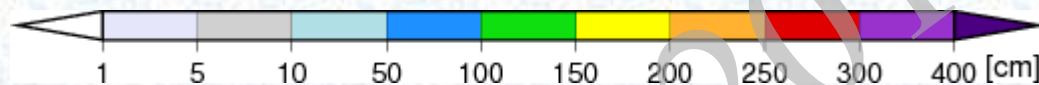
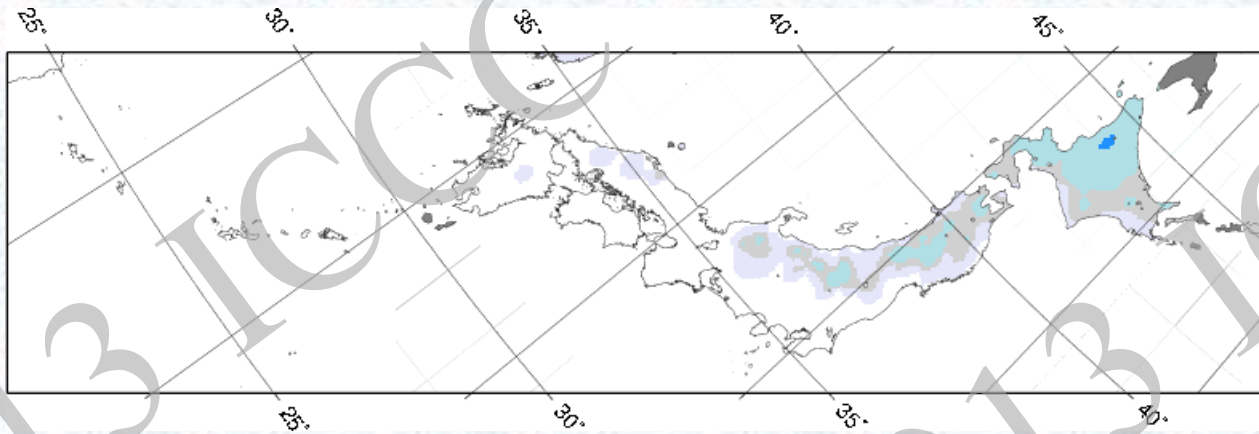


Maximum snow depth in November

NHRCM05

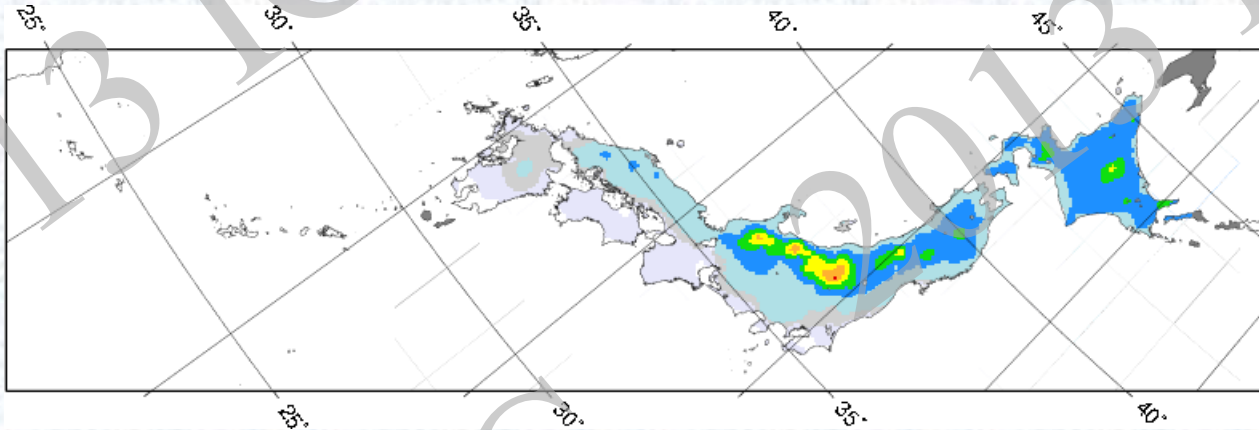


AMeDAS

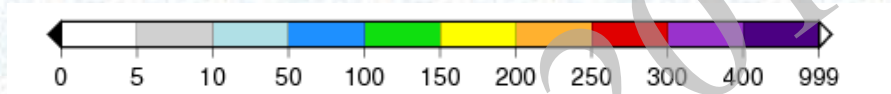
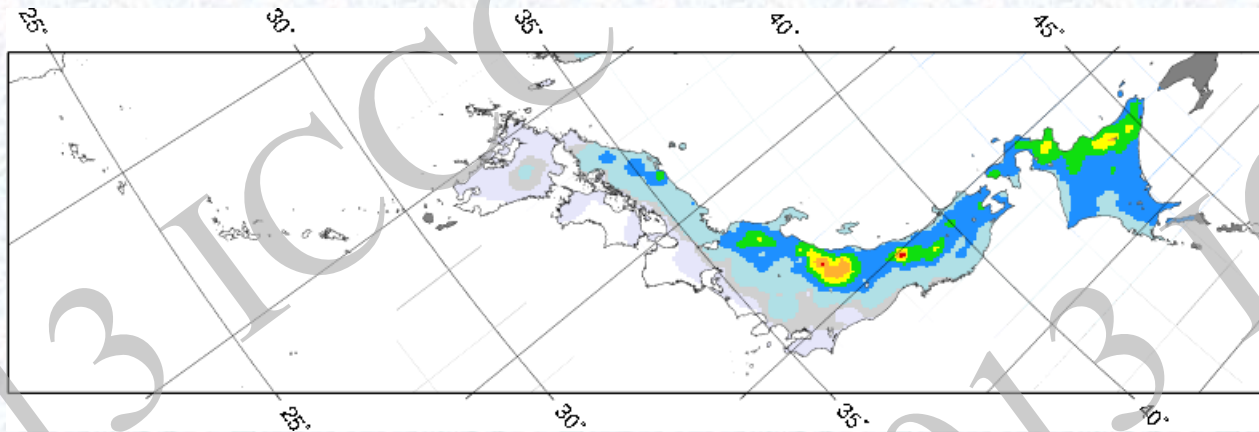


Maximum snow depth in February

NHRCM05

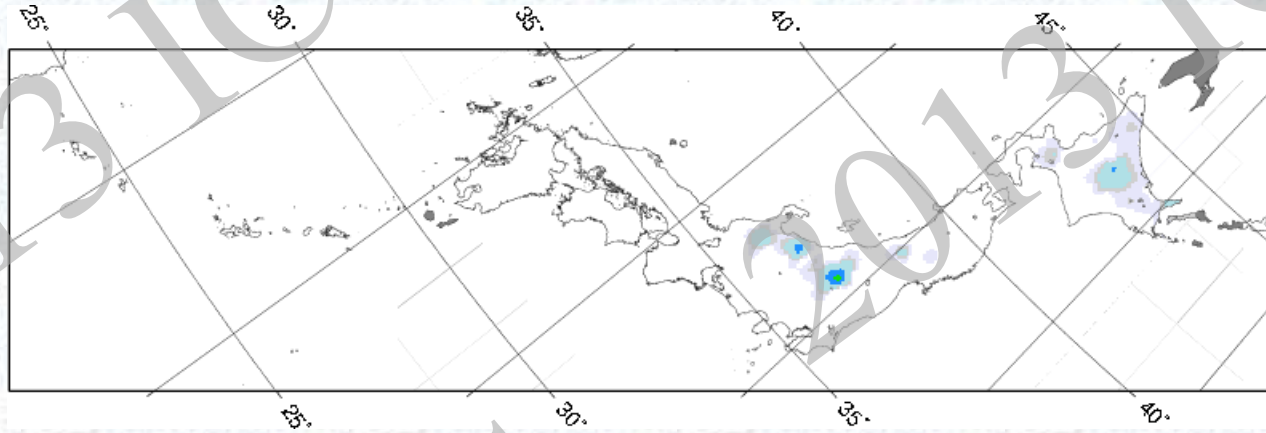


AMeDAS

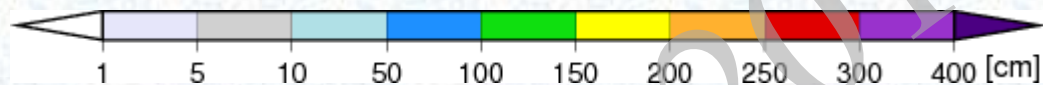
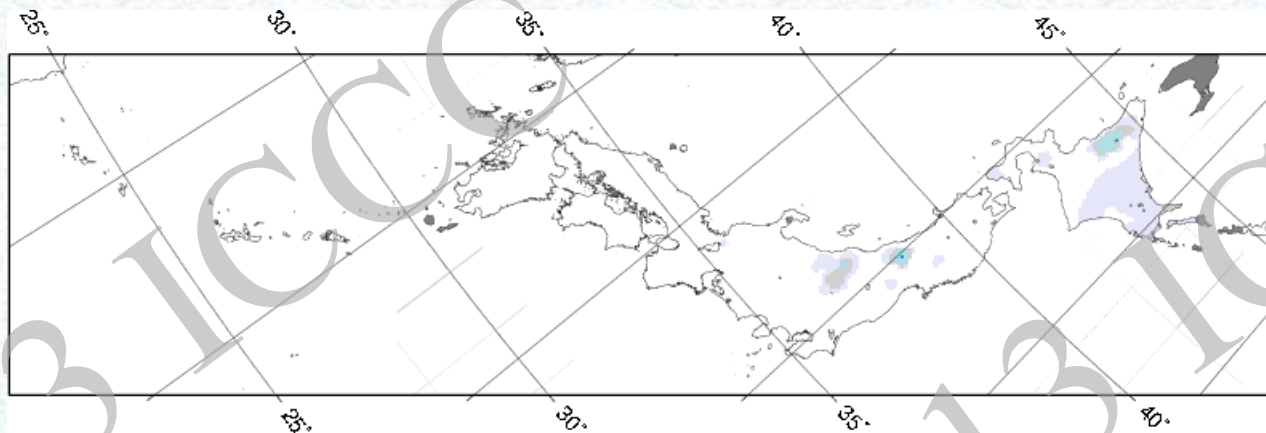


Maximum snow depth in May

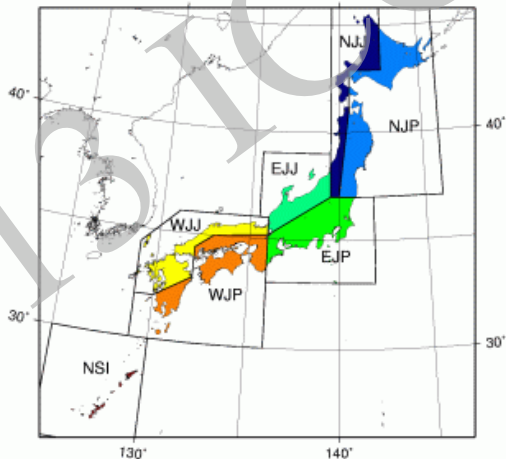
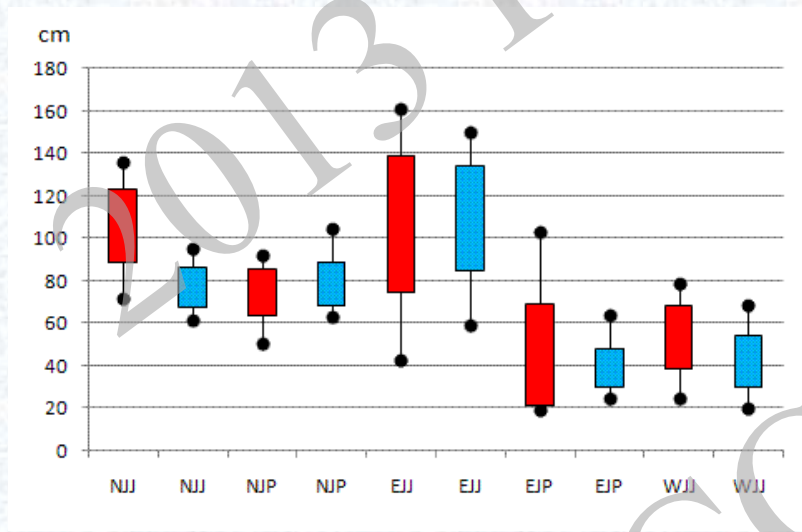
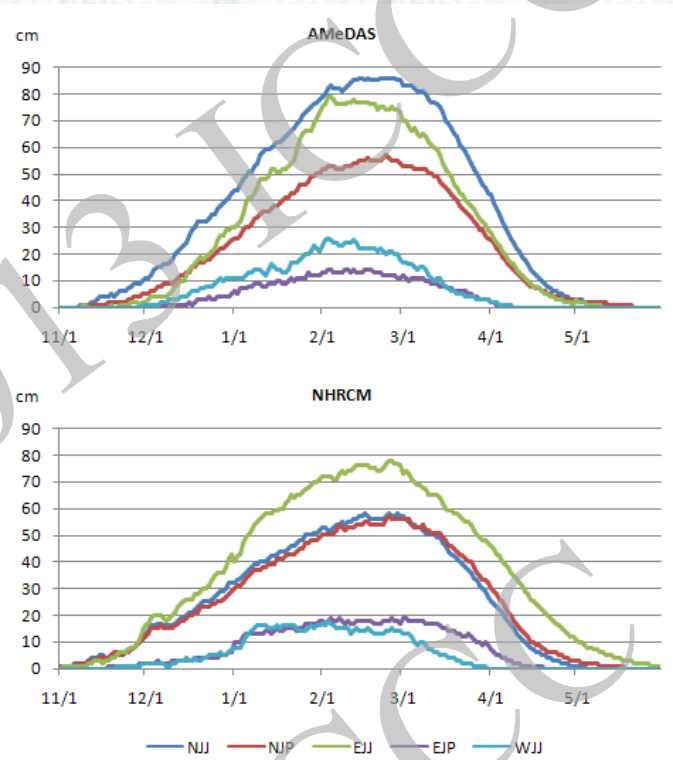
NHRCM05



AMeDAS

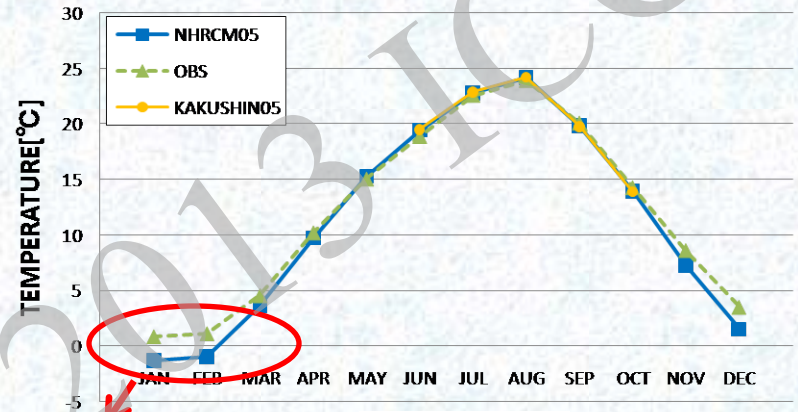
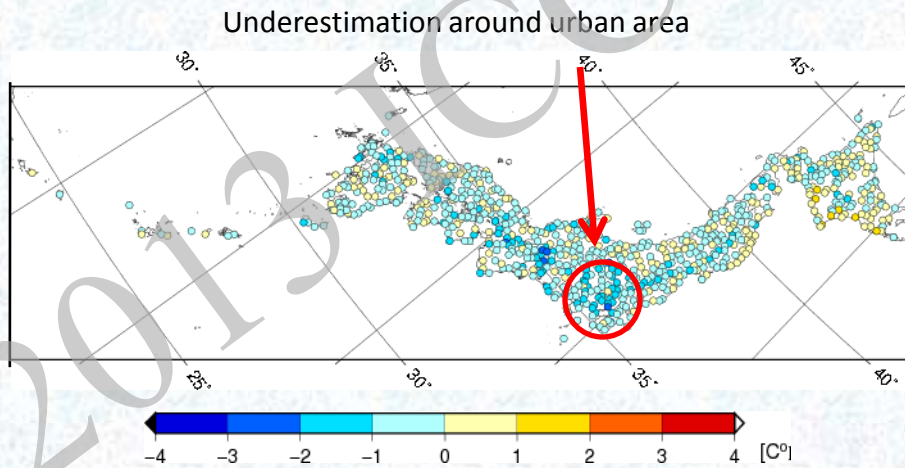


Maximum snow depth



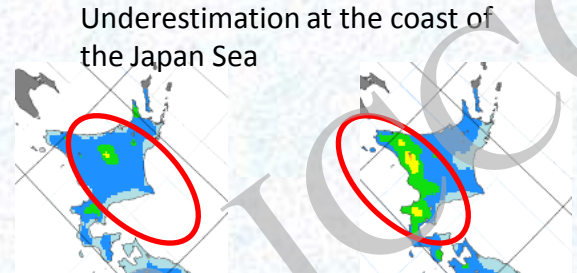
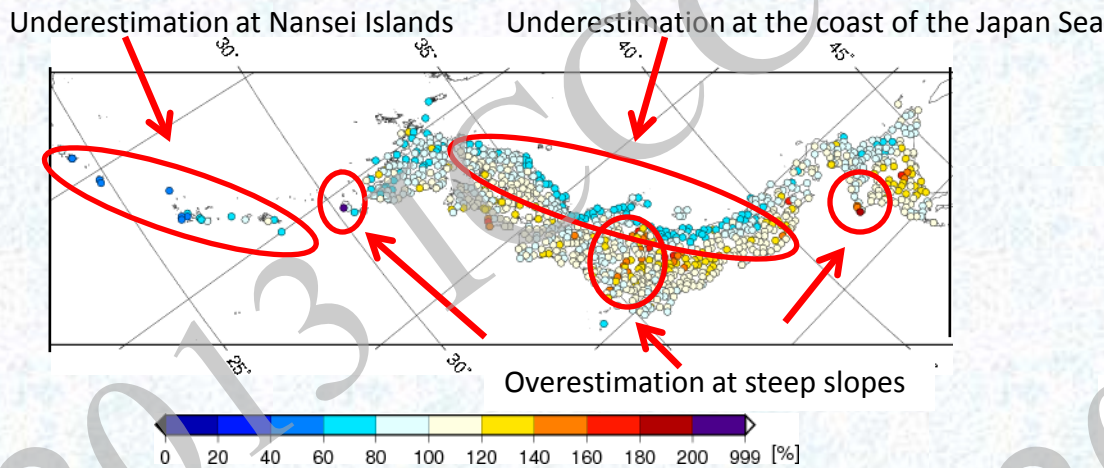
Inter-annual variability of the maximum snow depth. Dots on the bars indicate the maximum and minimum snow depths in each region. Red and blue boxes denote the standard deviation in AMeDAS observations and the NHRCM, respectively.

NHRCM has high performance to reproduce present climate , however



Underestimation during winter

Mean temperature



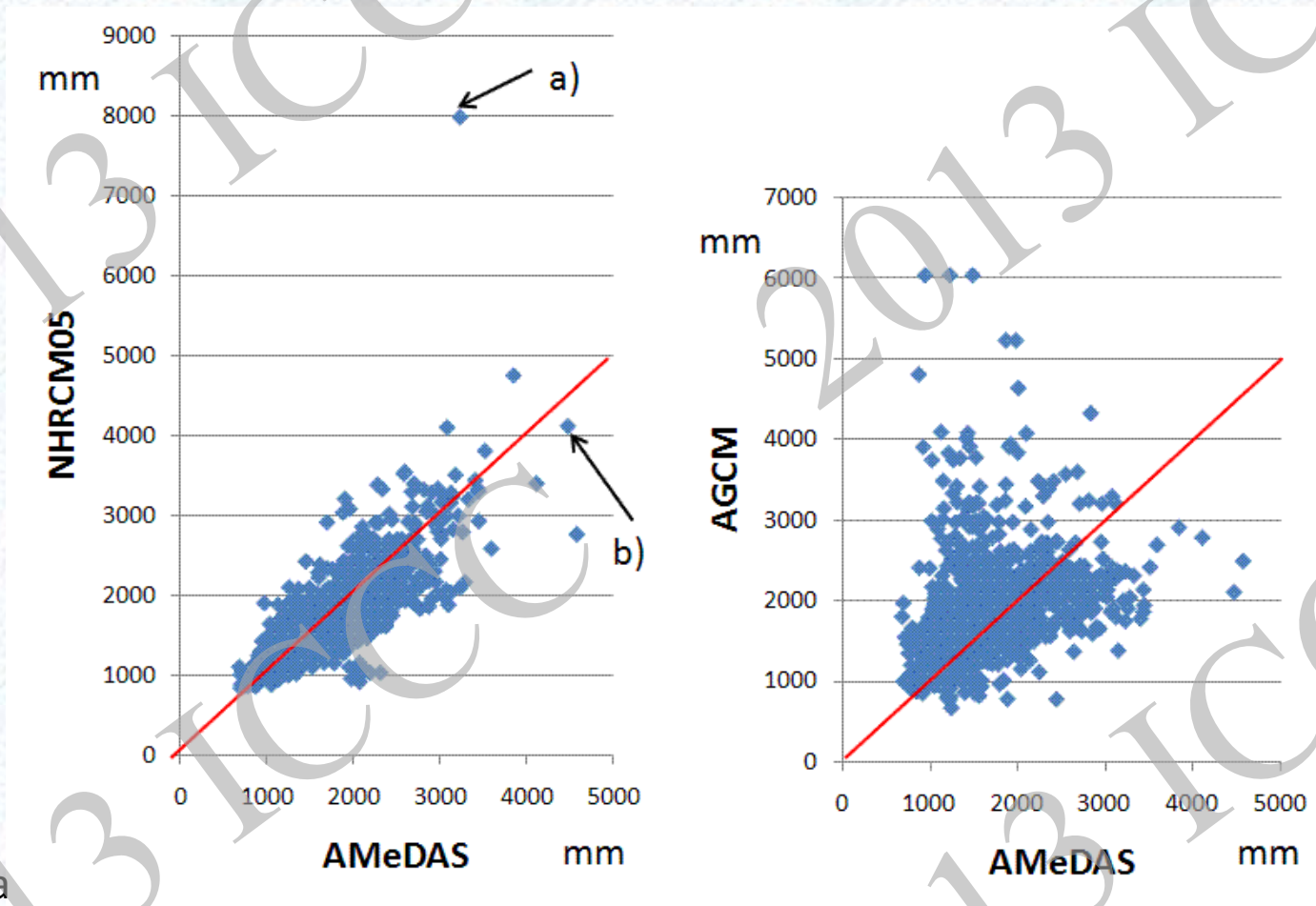
NHRCM

AMeDAS



Maximum snow depth in February

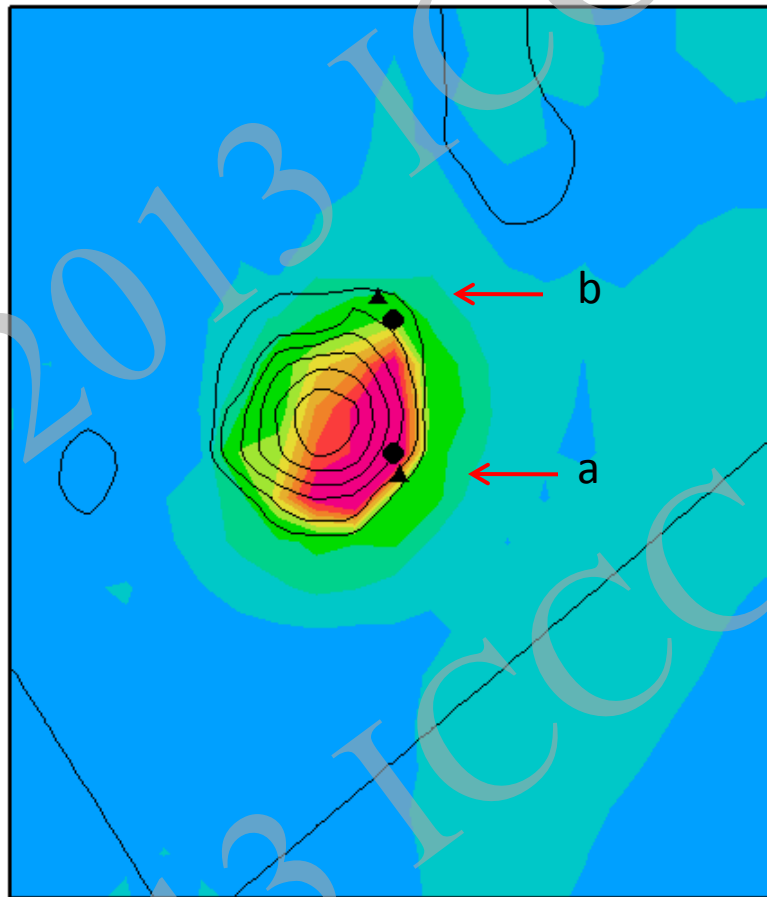
Annual precipitation



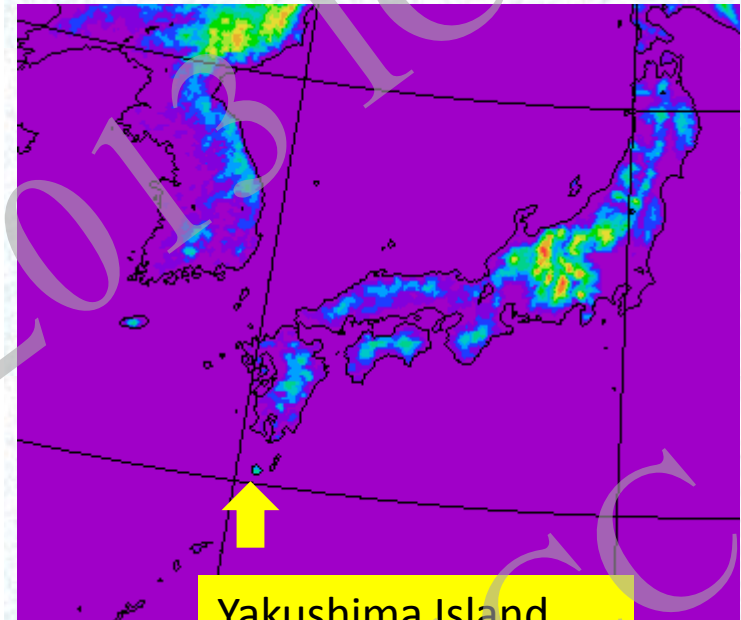
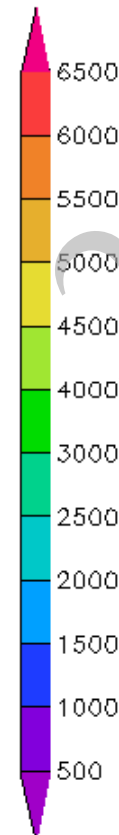
a:Onoaida
b:Yakushima

	COR .	BIAS	RMSE
NHRCM	0.79	-11mm	379mm
AGCM	0.32	138mm	744mm

Distribution of annual precipitation

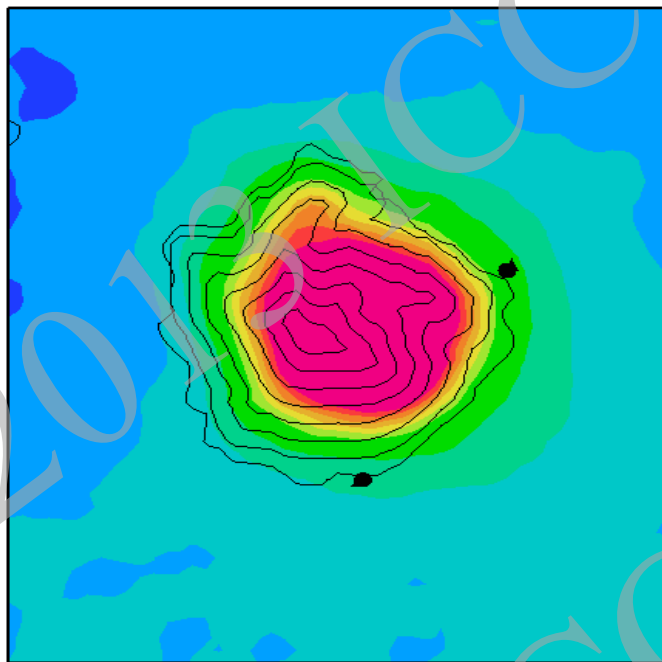


a:Onoaida
b:Yakushima
●:NHRCM
▲:AMeDAS

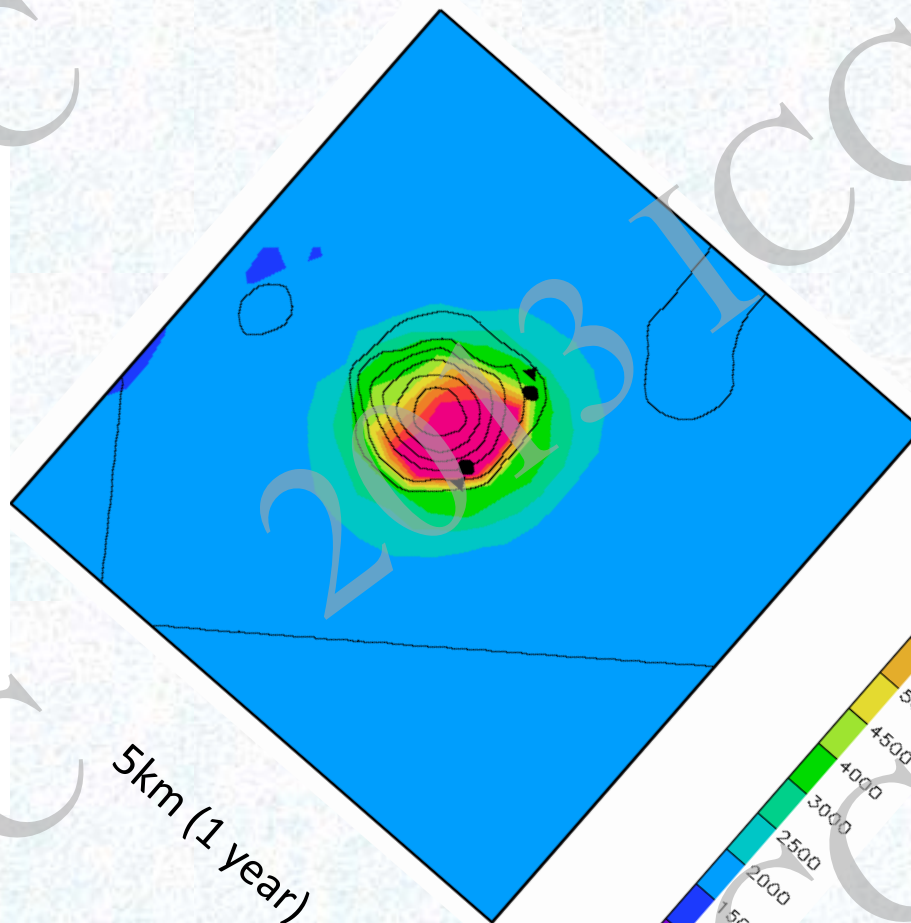


Precipitation in Yakushima Island

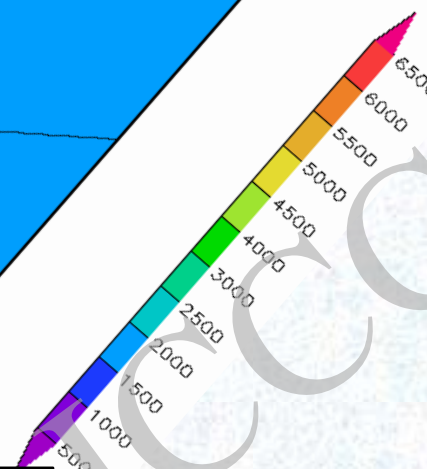
Coastal area: 4,500mm
Inland area: 10,000mm
(Takahara H. and
J. Matsumoto, 2002)



1km (1 year)



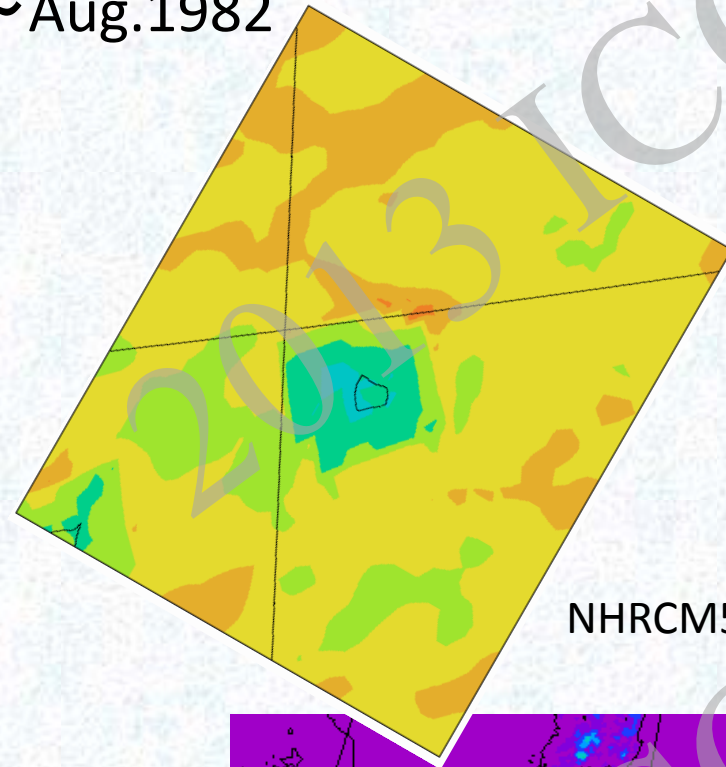
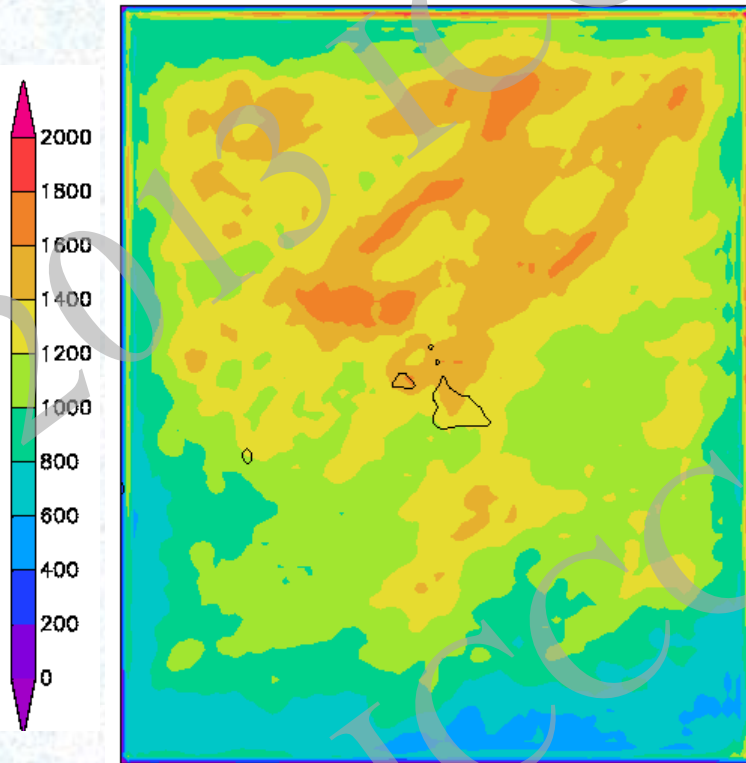
5km (1 year)



	annual precipitation (mm)			
	AMeDAS	5km(20years)	5km(1year)	1km(1year)
ONOAIDA	3,231	7,993	6,265	2,739
YAKSHIMA	4,479	4,122	4,342	3,452

Precipitation around Miyako Island [mm/year] Sep.1981~Aug.1982

NHRCM2km

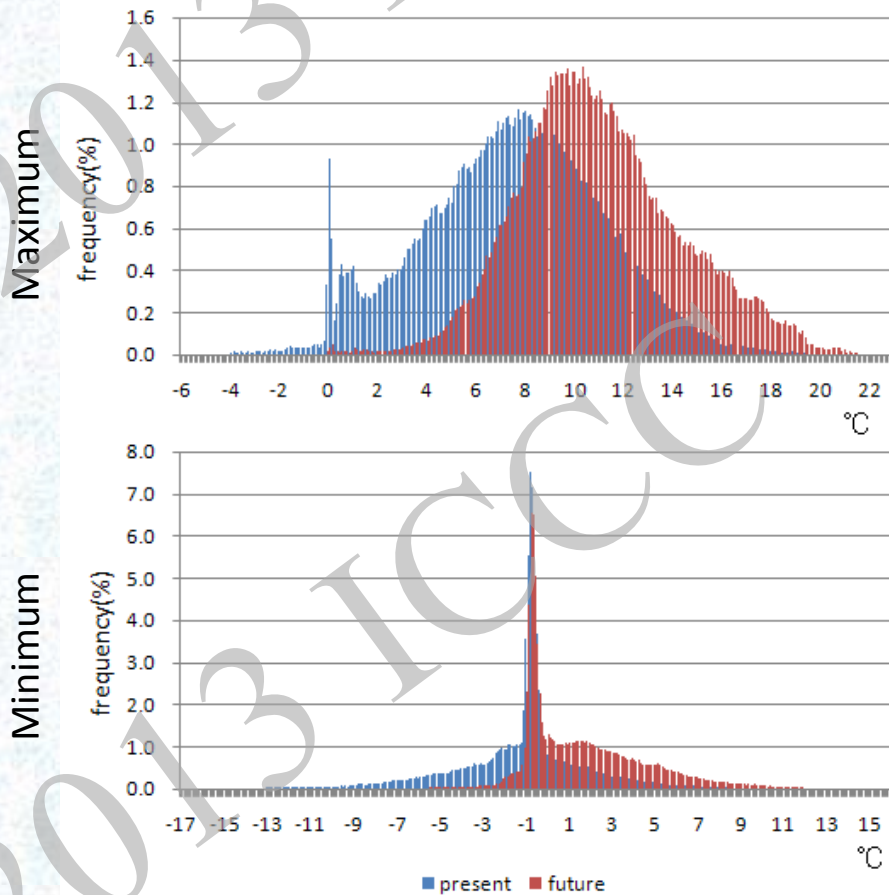


NHRCM5km



	AMeDAS	5km(20)	5km(1)	2km(1)
Miyako	2021.0	923.7	1119.5	1821.1
Gusukube	1973.1	962.6	1324.2	1668.9

Frequencies of maximum and minimum soil temperature 1cm below land surface at the Kanto Plain in Feb.



Improvement of Sib

Introduction of an unfreezing water scheme through super cooling

Summary

- 1.KAKUSHIN program finished in March 2012 and a new program called SOUSEI has been launched since April 2012. In this program, we have been trying to improve the performance of NHRCM considering the results of the previous programs.
- 2.NHRCM has high performance of reproducing present climate, but there are still several weak points.

Improvement plan in SOUSEI

a) Temperature

Underestimation around urban area

- Include urban climate model

Concentration of frequency around 0 degree

- Improvement of Sib model

b)Precipitation

Overestimation at steep slopes

- enhance the grid spacing (We are planning to conduct 2km grid spacing NHRCM in SOUSEI)

Underestimation at Nansei Island

- tuning of KF scheme

Underestimation at the coast of the Japan Sea

- WIP

Thank You.