Future precipitation change over Latin America and the Caribbean by 20-km and 60-km mesh atmospheric global models

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1. What are we doing?

Meteorological Research Institute (MRI) has been developing 20-km and 60-km mesh atmospheric global models for climate change studies. The horizontal resolution of these models is relatively high as climate models aimed at the projection of future climate change. Using these models, we have conducted sets of time-slice experiments for global warming projection and published many scientific paper on climate change over South America (Kitoh et al. 2011; Blázquez et al. 2012) and the Caribbean (Hall et al. 2012; Nakaegawa et al. 2013; Nakaegawa et al. 2014) in collaboration with scientists in South America and the Caribbean.

This present study shows future precipitation change over South America and the Caribbean by the experiments using the latest version of 20-km mesh global atmospheric model (MRI-AGCM3.2S) and 60-km mesh global atmospheric model (MRI-AGCM3.2H) which were registered as climate models in 5th phase of Coupled Model Intercomparison Project (CMIP5) and Intergovermental Panel on Climate Change 5th assessment report (IPCC AR5; IPCC 2013; Table 9.A.1, page 862).

2. Experimental design

MRI-AGCM3.2S, 20km grid

Target period	SST	Cumulus convection			
		YS	AS	ES	KF
Present-day climate 1979-2003, 25 years	Observation HadISST1	SP_YS			
Future climate, A1B 2075-2099, 25 years	CMIP3 mean	SF_YS			

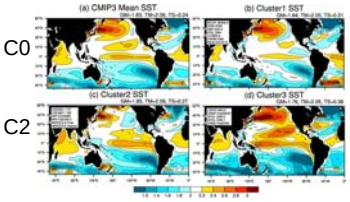
MRI-AGCM3.2H, 60km grid

Target period	SST	Cumulus convection			
		YS	AS	ES	KF
Present-day climate 1979-2003, 25 years	Observation HadISST1	HP_YS	HP_AS	HP_ES	HP_KF
Future climate, A1B 2075-2099, 25 years	CMIP3 mean	HF_YS_C0	HF_AS_C0	HF_ES_C0	HF_KF_C0
	Cluster 1	HF_YS_C1	HF_AS_C1	HF_ES_C1	HF_KF_C1
	Cluster 2	HF_YS_C2	HF_AS_C2	HF_ES_C2	HF_KF_C2
	Cluster 3	HF_YS_C3	HF_AS_C3	HF_ES_C3	HF_KF_C3

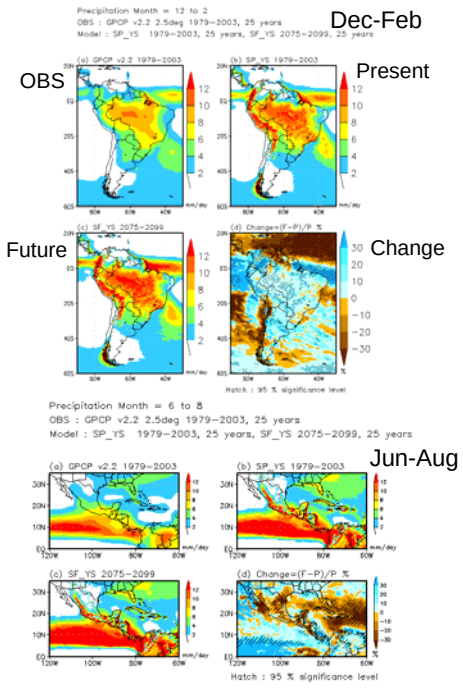
A1B : IPCC SRES emssion scenario
SST: Sea surface temperature
CMIP3 : Couple Model Intercomparison Project 3

YS: Yoshimura scheme
AS: Arakawa-Schubert scheme
ES: MRI-ESM1 scheme
KF: Kein-Fritsch scheme

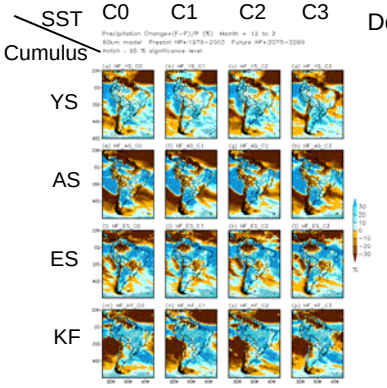
Sea Surface temperature (SST) distribution for 60-km model ensemble runs



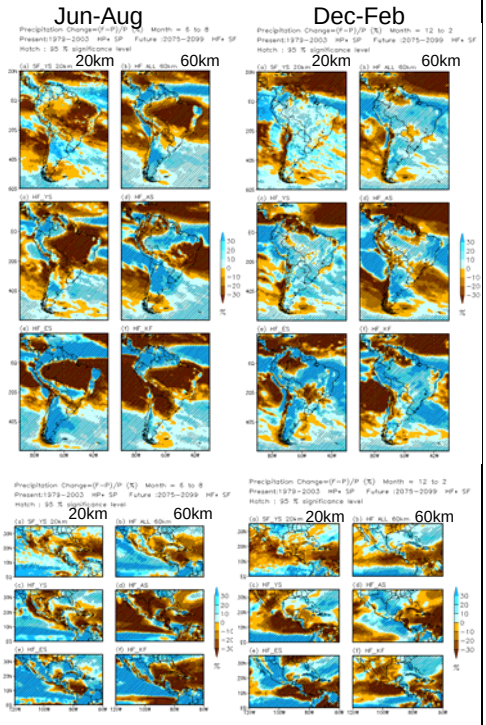
3. 20-km model results



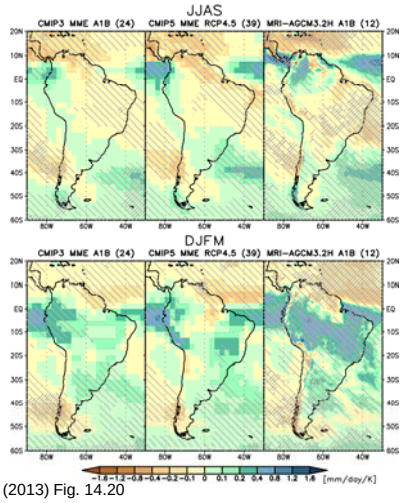
4. 60-km model ensemble runs



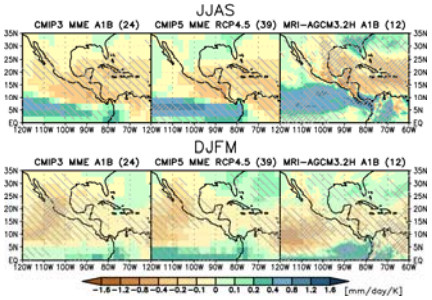
5. Comparison between 20-km and 60-km model



6. Comparison with CMIP3 and CMIP5 models



IPCC (2013) Fig. 14.20



IPCC (2013) Fig. 14.19

7. Summary

1. From June to August, precipitation projected by 20-km and 60-km models decreases over Mexico, Central America, the Caribbean and Eastern Brazil which are consistent with projections by CMIP3 and CMIP5 models.
2. From December to February, precipitation projected by 20-km and 60-km models decreases over Central America, southern Caribbean, Venezuela and Chile, but precipitation increases over Brazil and the La Plata Basin. Decreases of precipitation over Central America, southern Caribbean, Venezuela and southern Chile, and increases of precipitation over Brazil and the La Plata Basin are consistent with projections by CMIP3 and CMIP5 models.
3. Precipitation changes over Central America, southern Caribbean and Northern part of South America can be partly caused by the intensification and southward displacement of Inter-tropical Convergence Zone (ITCZ).

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Acknowledgment

This work was conducted under the framework of the Development of Basic Technology for Risk Information on Climate Change supported by the SOUSEI Program of the Ministry of Education, Culture, Sports, Science, and Technology of Japan.