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Projections of rainfall intensity in central America, Panama

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1. Introduction

The Republic of Panama, located in Central America, separates the Atlantic and Pacific Oceans by about 100 to a few hundred kms. Due to varying distance from these oceans, Panama has a variety of meteorological conditions, which is advantageous for analyzing the influence of climate change on the subtropical environment. Moreover, Panama plays an important role in the international maritime trades due to Panama Canal which depends on the water level in artificial lakes. It is thus important to evaluate future rainfall and develop sustainable operation policies. To assist this, the present study aimed to project rainfall in Panama using MRI-GCM20.

2. Methods and Results

Daily rainfall was analyzed at 8 field observation stations: 3 on the Atlantic Ocean coast, 3 on the Pacific Ocean coast and 2 inland (Figure 1). To investigate the applicability of MRI-GCM20 to this system, seasonal changes in rainfall were compared with field observations. Single grid-point data corresponding to the field observation stations, 5 grid-point mean data including the nearest 4 stations and 9 grid-point mean data surrounding the field observation stations were computed as GCM output. On the Atlantic Ocean side, 9 grid-point mean data had the highest correlation with the field observations, but the single grid-point data had the highest on the Pacific Ocean side. Since the inland single grid-point data had the highest correlation, this data was used through the following analyses.

Fig. 1 Meteorological stations in Panama. Red circles indicate 8 target stations.

Twenty year mean monthly rainfall showed good agreement with field observation, though the MRI-GCM20 total rainfall was a slight underestimate (Figure 2). However, it appears that the GCM produces smaller rainfall intensity relative to field observations, except when rainfall intensity was less than 1 mm day^{-1} (Figure 3). The incidence of rainfall of less than 1 mm day^{-1} were 65 and 300 days in the field observations and GCM, respectively, which suggests the necessity for careful selection of downscaling techniques.

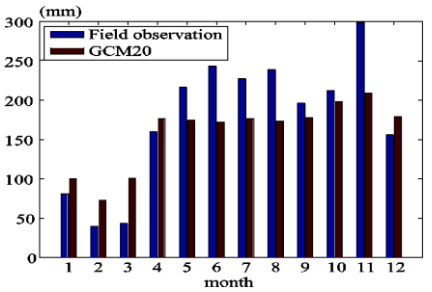

Fig.2 20 years-mean monthly rainfall at Nargana.

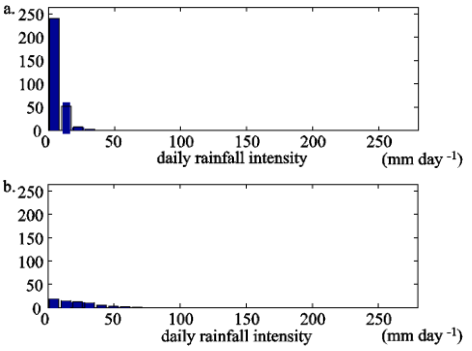

Fig. 3 Histogram of daily rainfall at Nargana. (a) MRI-AGCM3.1S. (b) Field observation.