CMIP5 climate change hydroclimatic projections for Central America

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PRECIPITATION

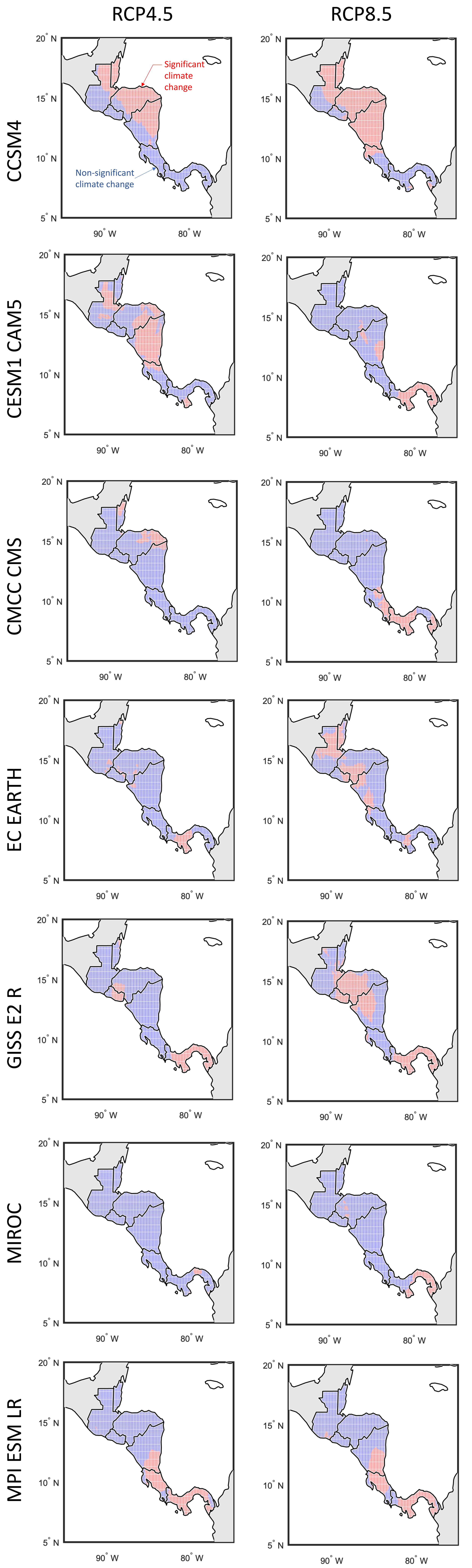

Figure 1. Kolgomorov-Smirnov test of the null hypothesis that the annual precipitation distribution for the baseline scenario (1979-1999) comes from the same distribution as the mid-century projection (2040-2060). Blue (red) colors indicate sites where the null hypothesis can be accepted (rejected). **Similar maps for temperature resulted in all the pixels rejecting the null hypothesis, meaning that by mid century the temperature changes are going to be significant in all the region (not shown).**

METHODOLOGY

All this simulations were produced using the statistical downscaling method of Hidalgo et al. (2017). The final data resolution is 5 km x 5 km. Here, the best seven CMIP5 models for Central America were selected according to Hidalgo and Alfaro (2015). Monthly precipitation and temperature data were converted to daily values using a Weather Generator (WeaGets). The daily meteorological data were used as input in a hydrological model known as the Variable Infiltration Capacity Model (Liang et al. 1994) in 199 station locations in Central America. 1000 simulations of the hydrological model were obtained by varying the parameters values at random.

In Fig. 1 a Kolgomorov-Smirnov test is used to evaluate the changes in precipitation observed under two scenarios RCP4.5 and RCP8.5. A sumary of the results for the mid-century and end-of-century scenarios is shown in Fig. 2

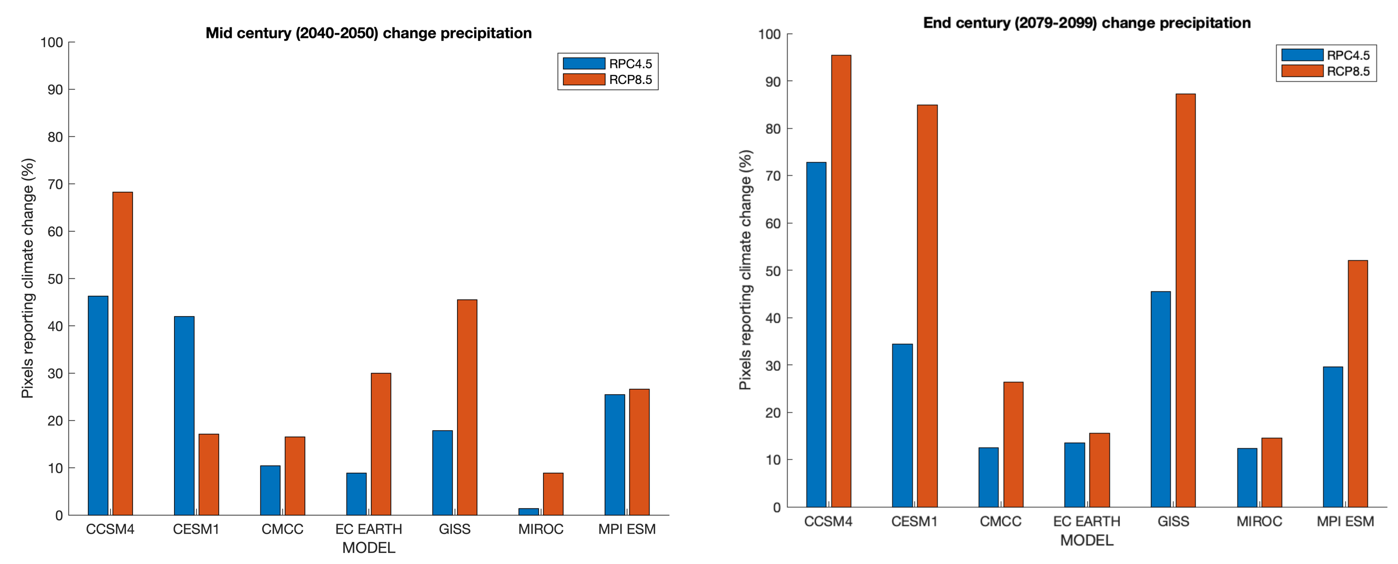

Figure 2. Summary of the percentage of pixels reporting significant change in precipitation distribution according to Kolgomorov-Smirnov test.

In Figs. 3 and 4 are examples of the downscaling procedure results and the runoff calculated by the hydrological model forced by the downscaled data for a wildlife reserve in Costa Rica (Moreno et al. 2019).

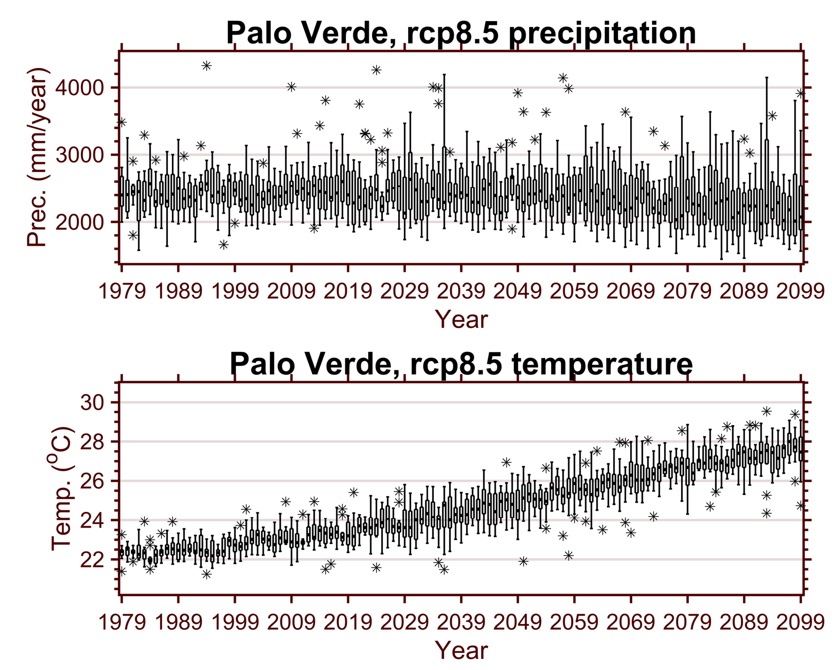

Figure 3. Annual precipitation and temperature projections (RCP8.5) for wildlife reserve Palo Verde in Costa Rica (Moreno et al. 2019)

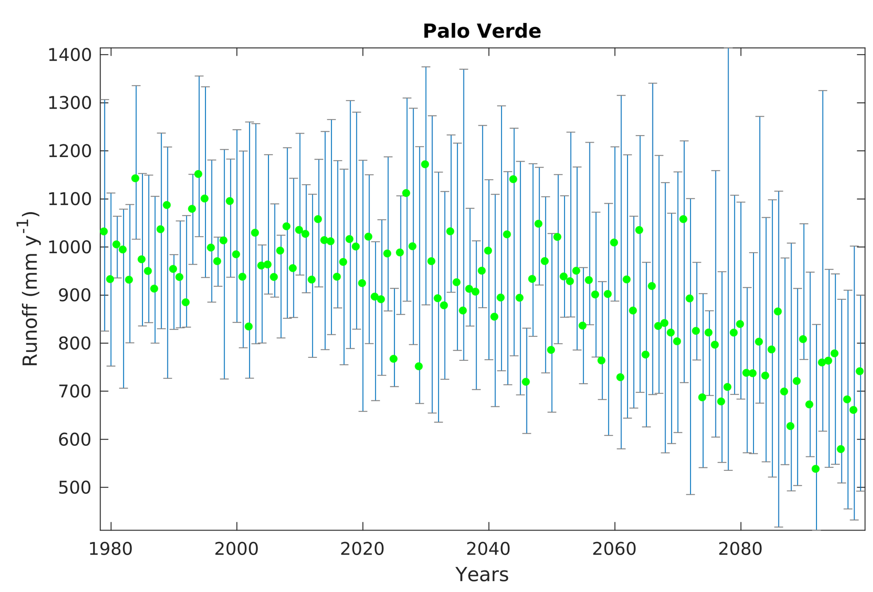

Figure 4. Projected changes in surface runoff in Palo Verde reserve (RPC8.5). (Moreno et al. 2019)

DISCUSSION

From Figures 1 and 2 it can be concluded that for the model CESM1 CAM5 the RCP8.5 scenario at mid century results in a smaller portion of Central America reporting climate changes compared to the RCP4.5. All other models report more changes with the RCP8.5 than the RCP4.5. The pattern of difference in both scenarios is highly dependent of the model selected, with some models having more sensitivity to the selected scenario than others. At the end of the century it is evident that all models report more changes during the RCP8.5 compared to the RCP4.5. Looking at one example of the evolution of the time series of precipitation and temperature (Fig. 3) we can conclude that the larger change in precipitation occurs during the second half of the century and that the mid century does not show clear precipitation changes. It is until the second half of the century that precipitation significantly decreases. The significant warming at the mid and end-of-century and the reduction in precipitation results in significant runoff reductions at the end of the century (Fig. 4).

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