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Evaluating characteristics of dry spell changes in Lake Urmia Basin using an ensemble CMIP5 GCM models

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Drought is a natural phenomenon that can cause significant environmental, ecological, and socio-economic losses in water scarce regions. Studies of drought under climate change are essential for water resources planning and management. Dry spells and number of consecutive days with precipitation below a certain threshold can be used to identify the severity of hydrological drought. In this study, we analyzed the projected changes of number of dry days in two future periods, 2011-2040 and 2071-2100, for both seasonal and annual time scales in the Lake Urmia Basin. The lake and its wetlands, located in northwestern Iran, have invaluable environmental, social, and economic importance for the region. The lake level has been shrinking dramatically since 1995 and now the water volume is less than 30% of its original. Moreover, frequent dry spells have struck the region and effected the region´s water resources and lake ecosystem as in other parts of Iran too. Analyzing future drought and dry spells characteristics in the region is crucial for sustainable water management and lake restoration plans. We used daily projected precipitation from 20 climate models used in the CMIP5 (Coupled Model Inter-comparison Project Phase 5) driven by three representative paths, RCP2.6, RCP4.5, and, RCP8.5. The model outputs were statistically downscaled and validated based on the historical observation period 1980-2010. We defined days with precipitation less than 1 mm as dry days for both observation periods and model projections. The model validation showed that all models underestimated the number of dry days. An ensemble based on the validation results consisting of five models which were in best agreement with observations was used to assess the changes in number of future dry days in Lake Urmia Basin. The entire ensemble showed increase in number of dry days for all seasons. The projected changes in winter and spring were larger than for summer and autumn. All models projected dryer winter and spring periods in the near and far future periods. The ensemble mean for future annual dry days increased by 6.5 % to 7.3% for the different climate change related emission and concentration pathway RCP2.6, RCP4.5, and, RCP8.5.