Geophysical Research Abstracts
Vol. 20, EGU2018-2456, 2018
EGU General Assembly 2018

Climate change and disaster risk reduction in the Arab region: linkage of climate extreme events and disaster frequencies using stochastic geospatial models

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Climate change and disaster risk reduction are increasingly being linked to one another and to water resources management at the national, regional and global levels. The negotiations and efforts to implement the 2030 Agenda on Sustainable Development, the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC) and the Sendai Framework on Disaster Risk Reduction demonstrate the importance of linking climate change adaptation (CCA) and disaster risk reduction (DRR) communities together in view of formulating integrated policies with respect to natural disasters. This is particularly so with respect to water-related disasters, such as droughts and floods which are being exacerbated by climate change. Accordingly, this study attempt to secure an innovative way to test whether the Disaster Risk Reduction (DRR) parameters and Key Climate Change (CC) parameters can be correlated.
The Regional Initiative for the Assessment of the Impact of Climate Change on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR) Climate Change indices were used as inputs for the defined methodology and to verify the future projections (RCP's 4.5 & 8.5). The starting point was the hazard susceptibility mapping for floods, torrent, storm, forest fires, heat waves and droughts based on DesInventar historical data, covering the baseline 1986-2005 of the current study. A spatial comparison of the historical DRR data with RICAR CC indices (SU40, SU35, CDD, TR, PR10, and PR20) base period was then completed. The logistic regression model for each hazard was achieved. Then, using a logistic multiple-regression model, the spatial relationships between the hazard susceptibility location and each RICCAR factor were analyzed. The obtained results exhibited a strong correlation between CC scenarios and natural hazards. The projections from 1986 till the end of the century showed a slight decrease in the percentages of high susceptibility levels concerning the water-related hazards, as for flood, torrent and storms. On the opposite side, a remarkable increase in the projected percentages of high susceptibility levels for high temperature-related hazards like forest fires, heat waves and droughts. High drought susceptibility may cover 50% of the study area which is already prone by the end of the century. This should be taken into consideration, especially in the Arab Region, where these hotspots are already vulnerable and suffer from water scarcity with different severity levels. On the other hand, the logistic models explanatory results kept RICCAR indices scientifically justifiable. Remarkably, SU40 and CDD where the most explanatory factors, introduced in 3 models for hazards level prediction. Moreover, SU40 and CDD where the most explanatory factors, introduced in 3 models implying 3 hazards. On the other side, PR10 (introduced only in storms), SU35 and TR (introduced only in heat waves) were the least explanatory factors. This analysis revealed that warming signals will become more threatening in Northern regions of the Arab countries (for instance: Sfax-Tunisia) and extreme rainfalls signals will increase in the southern parts (example: Taizz and Ibb in Yemen).