

Abstract

Projections of Mediterranean Freshwater Vulnerability in a Global Context and Emerging Adaptation Developments at the Local Scale [†]

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The Mediterranean region has experienced substantial changes over the centuries. Persistent hydro-climatic trends have prevailed over the region and have particularly intensified during the recent decades [1]. Extreme events of the recent past have been characterized as exceptionally severe, with their spatial extent and severity placed at the upper bounds of natural long-term variability of the past few centuries. At the same time, climate projections indicate that, given the current emission pathway, the target of limiting global warming to well below 2 °C becomes increasingly difficult to achieve and makes a much more substantial warming increasingly plausible. By examining changes in future freshwater vulnerability, it is foreseen with a high probability that the Mediterranean will be among the regions with the largest increase in freshwater vulnerability considering high-end climate change [2]. This is a combined result of a relatively high sensitivity to water stress, a varying level of adaptation capacity between the Mediterranean surrounding countries and an increased exposure, as simulated by a set of high-resolution global climate models. The increase in exposure is mostly attributed to reduced water availability as a result of decreased precipitation, increased temperature and evaporative demand, and lower levels of runoff and soil water resources. Under the prospect of a dryer future and rising water demand, a prior knowledge of precipitation and temperature anomalies, available a few months ahead could be a key information supporting drought risk assessment and management. The introduction of hydro-meteorological forecasts in local water management can facilitate operational climate service applications at the local scale [3]. Based on precipitation and temperature hindcasts from the European Centre for Medium-Range Weather Forecasts (ECMWF) System 4 and Met Office GloSea5 systems, a prototype drought decision support system (DDSS) has been developed for supporting the sustainable water resources management over the Messara valley in Crete, Greece, by providing forecasts up to seven months ahead [4]. A demonstrator of the DDSS tool is hosted at www.imprex.gr providing tailored probabilistic hydro-meteorological forecasts.

References

1. Cook, B.I.; Anchukaitis, K.J.; Touchan, R.; Meko, D.M.; Cook, E.R. Spatiotemporal drought variability in the Mediterranean over the last 900 years. *J. Geophys. Res. Atmos.* **2016**, *121*, 2060–2074.
2. Koutroulis, A.; Papadimitriou, L.; Grillakis, M.; Tsanis, I.; Warren, R.; Betts, R. Global water availability under high-end climate change: A vulnerability based assessment. *Glob. Planet. Chang.* **2019**, *175*, 52–63.

3. Koutroulis, A.G.; Grillakis, M.G.; Tsanis, I.K.; Jacob, D. Exploring the ability of current climate information to facilitate local climate services for the water sector. *Earth Perspect.* **2015**, *2*, 592.
4. Grillakis, M.; Koutroulis, A.; Tsanis, I. Improving Seasonal Forecasts for Basin Scale Hydrological Applications. *Water* **2018**, *10*, 1593.



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