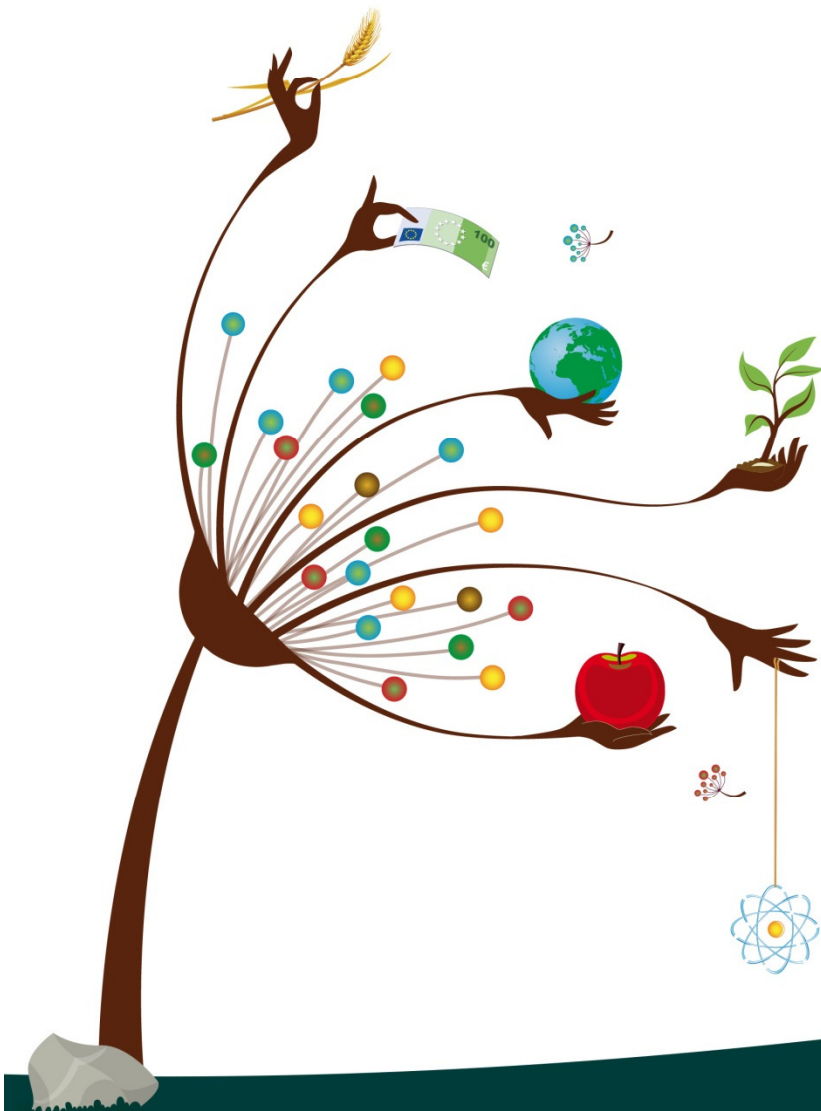


The European Commission's science and knowledge service

Joint Research Centre

Water Nexus and Climate Change

Prof.Dr. Ad de Roo

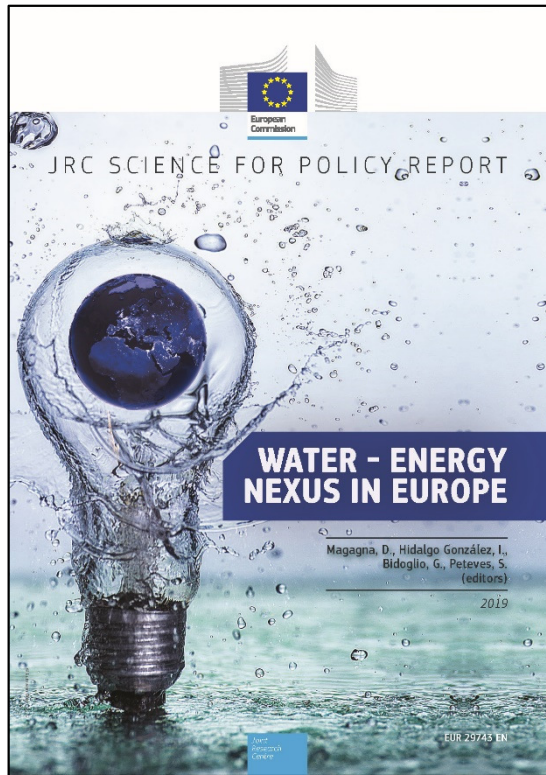


JRC WEFE-Nexus: Managing sectoral interdependencies in a cross-border context

- *Securing resilience of global food and energy systems builds on fairness of water allocation strategies*
- *Overcome stakeholders' view of resources as individual assets*



4 JRC reports as a basis

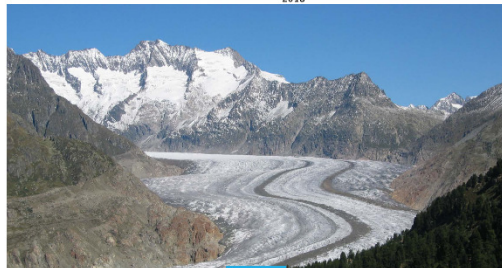


JRC TECHNICAL REPORTS

Impact of a changing climate, land use, and water usage on Europe's water resources

A model simulation study

Bernard Bisselink, Jeroen Bernhard, Emiliano Gelati, Marko Adamovic, Susann Guenther, Lorenzo Mentaschi, Ad de Roo
2018



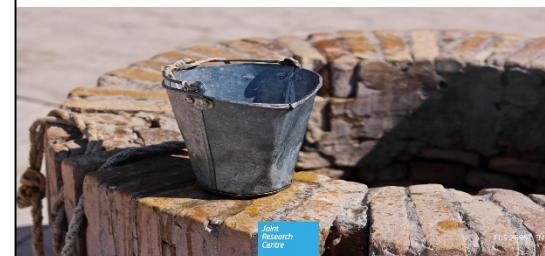
EUR 29130 EN

JRC TECHNICAL REPORT

Climate change and Europe's water resources

JRC PESETA IV project – Task 10

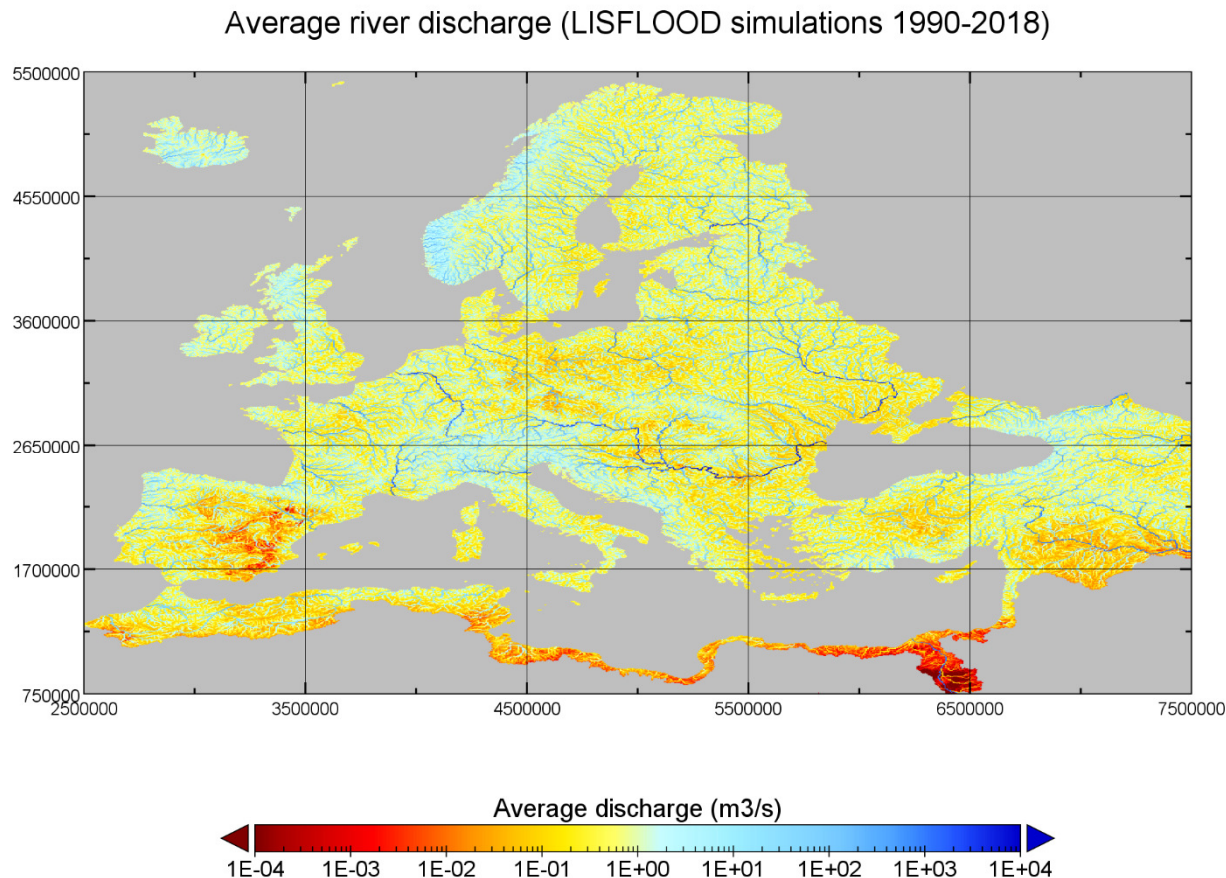
Bisselink B., Bernhard J., Gelati E., Adamovic M., Guenther S., Mentaschi L., Feyen L., and de Roo, A.
2020



JRC Research Centre

European
Commission

LISFLOOD: water resources, floods, droughts and nexus simulation model



5km Europe

- **EFAS - floods**
- **EDO - droughts**
- **EU: Nexus, BLUE2, PESETA**

0.1° Global

- **GloFAS – floods**
- **E2O Tier1&2**

0.083° Africa

- **JRC nexus studies**

0.5° Global

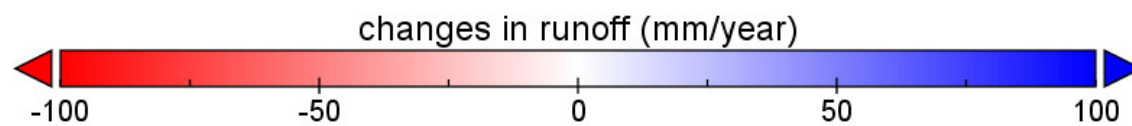
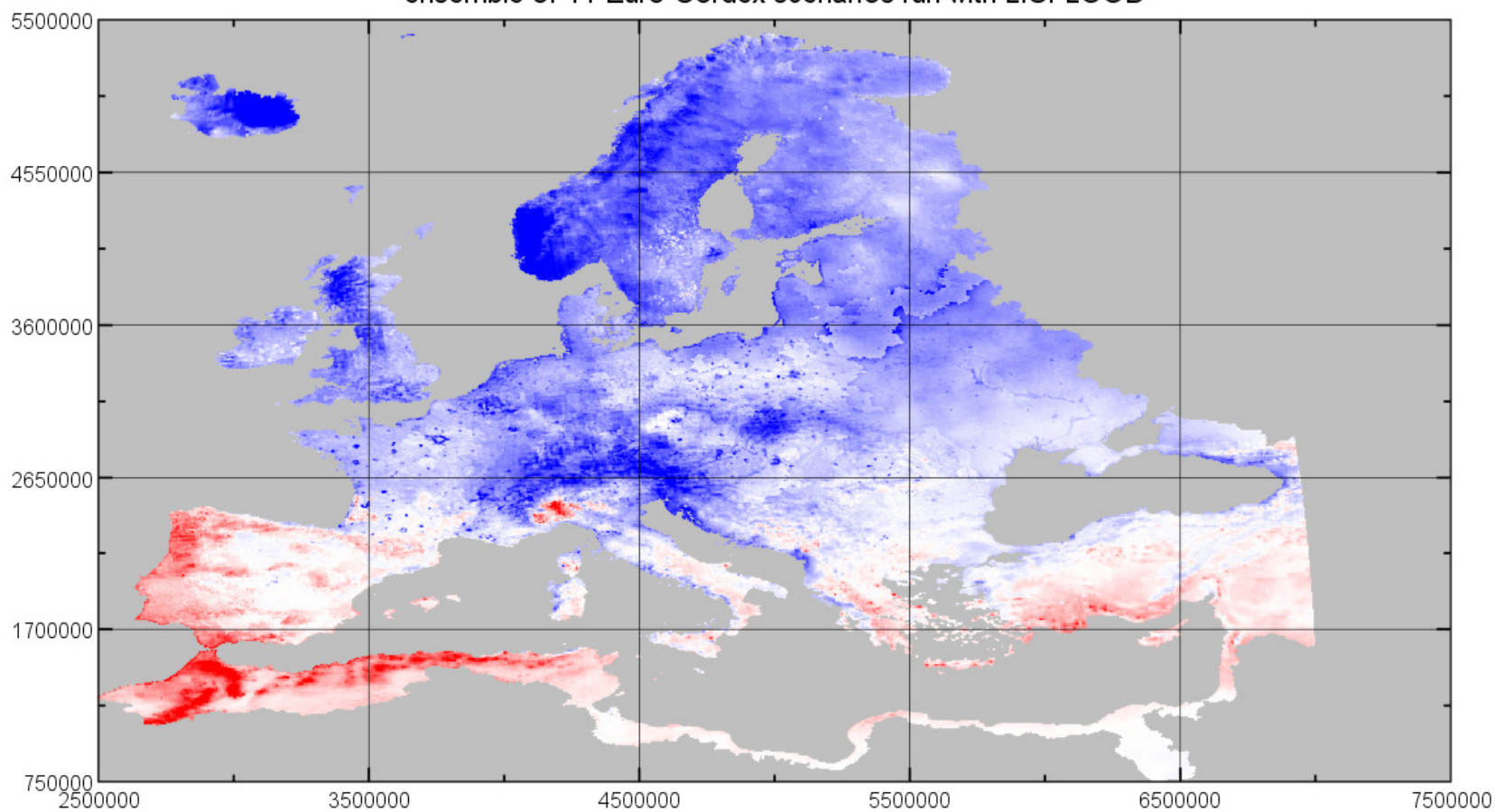
- **HELIX**

Conclusions

- A **North-South pattern** emerges across Europe for water availability under a 2°C warming scenario. Overall, Southern European countries are projected to face increased water shortages, particularly Spain, Greece, Cyprus, Italy and Turkey.
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5 renewables, all seem viable options.

Changes in local runoff: 2deg vs hist

ensemble of 11 Euro-Cordex scenarios run with LISFLOOD

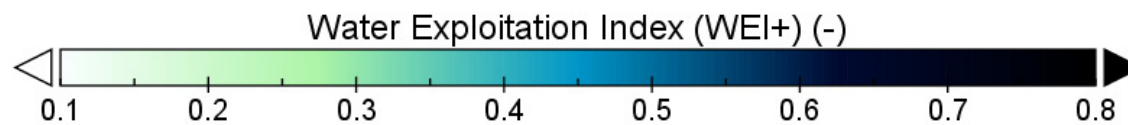
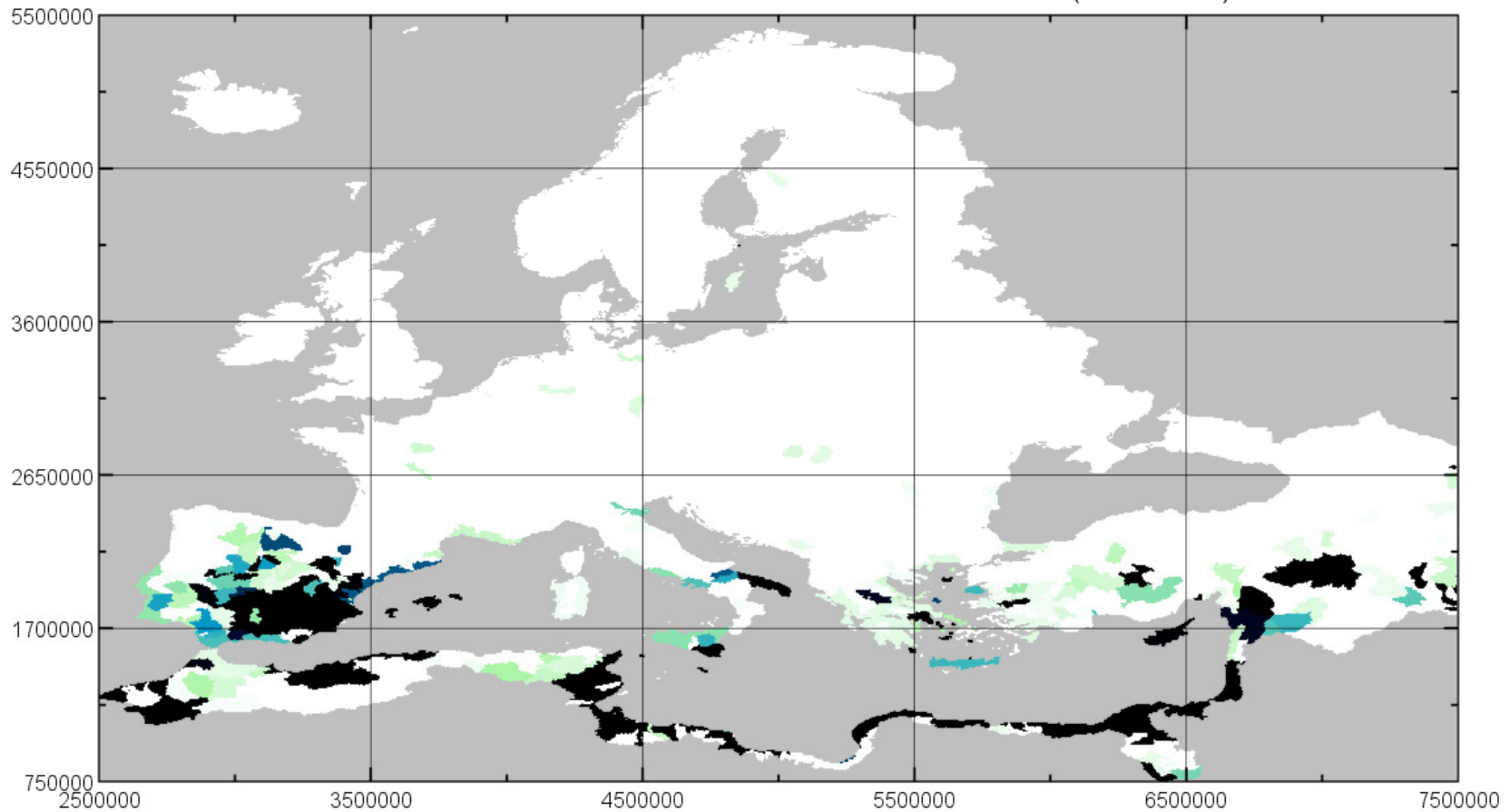


Conclusions

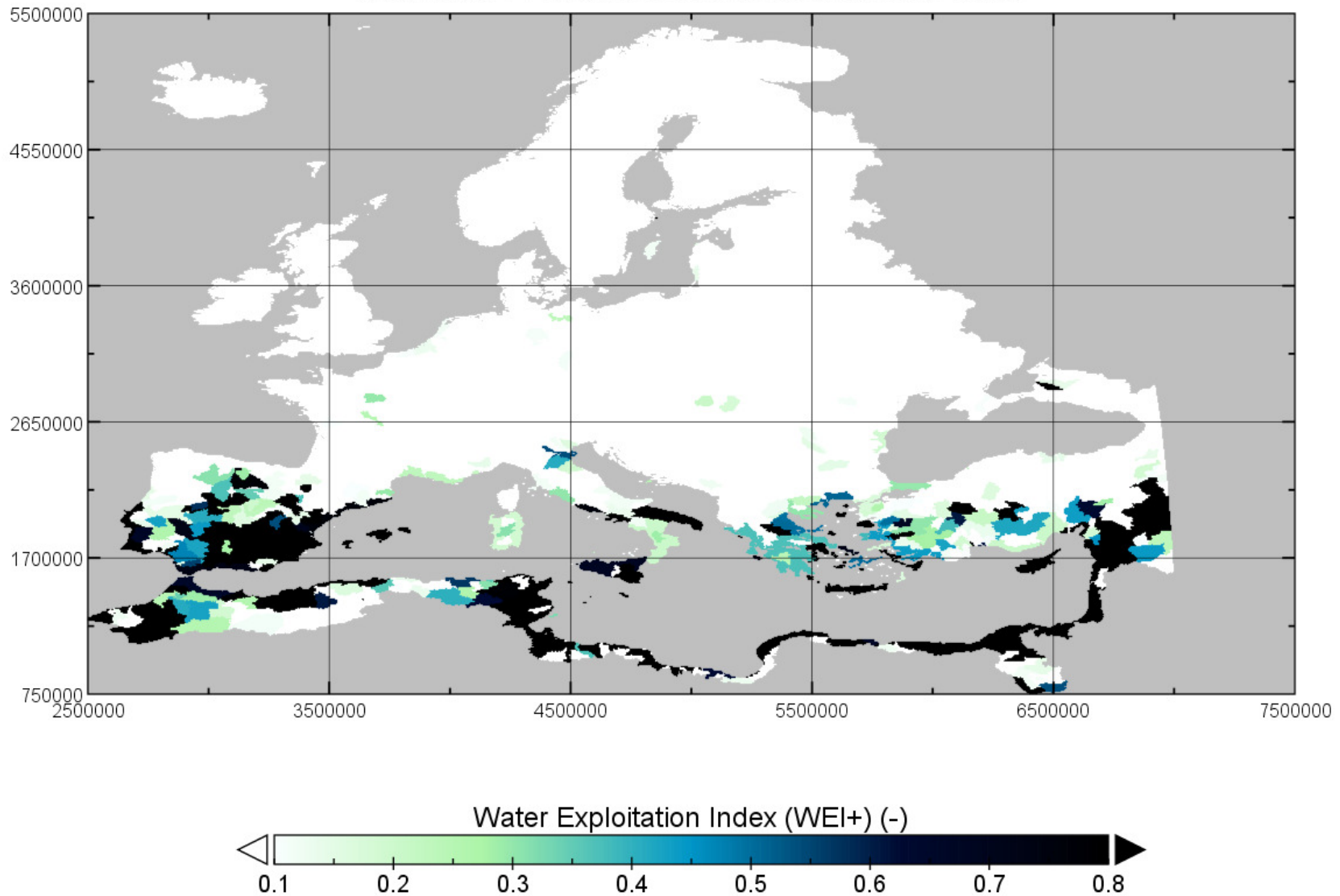
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Water Exploitation Index (WEI+) (consumption): 1990-2016

LISFLOOD reference run forced with observed meteo data (JRC-EFAS)



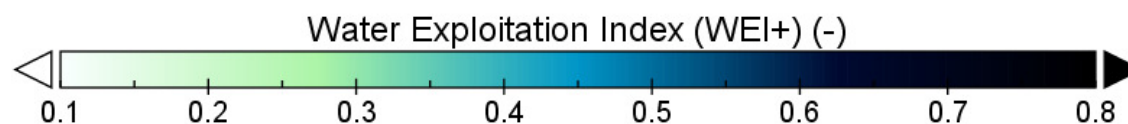
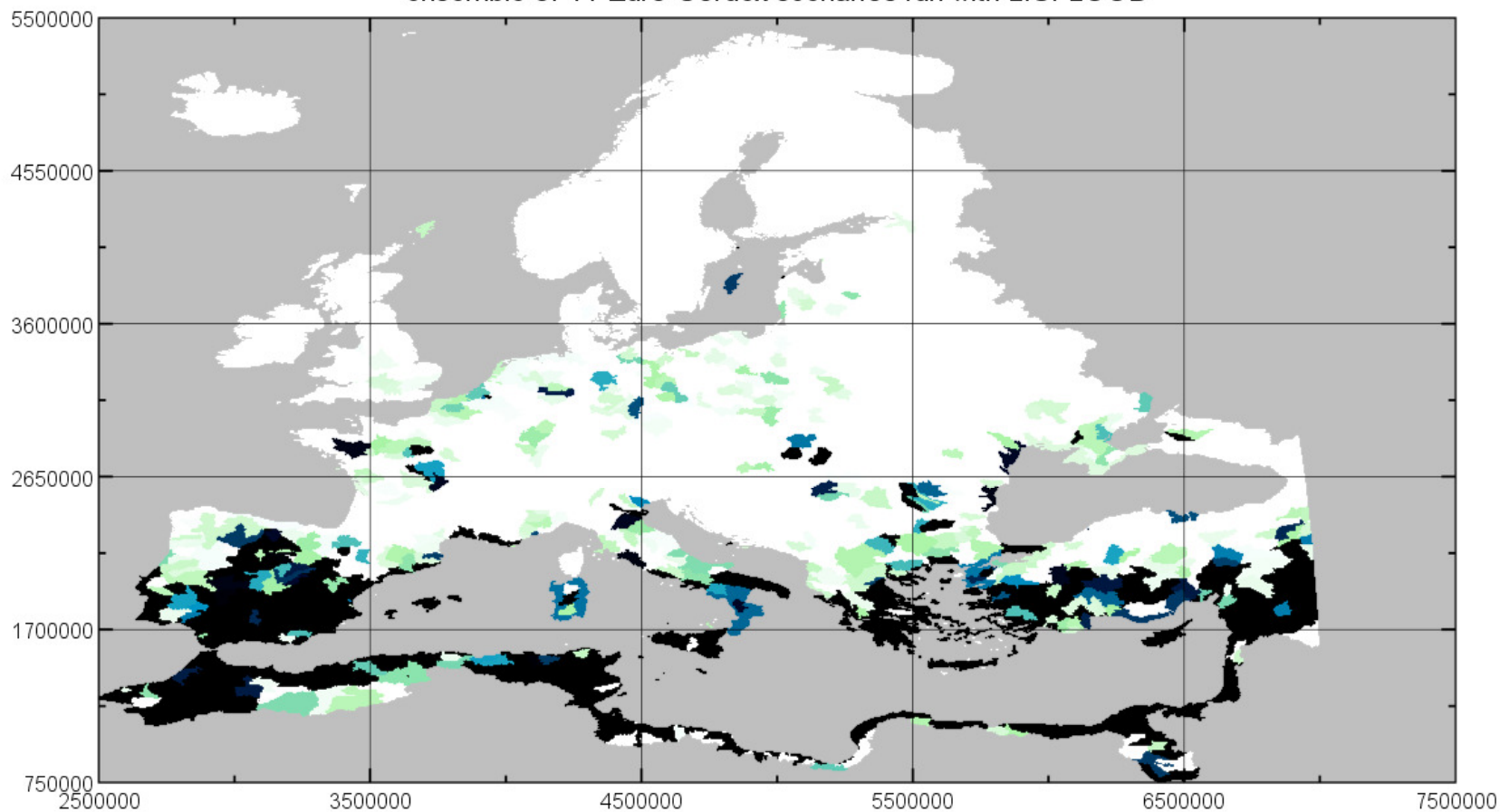
Water Exploitation Index (WEI+) (consumption): 2degree climate
ensemble of 11 Euro-Cordex scenarios run with LISFLOOD



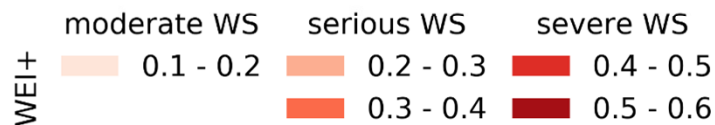
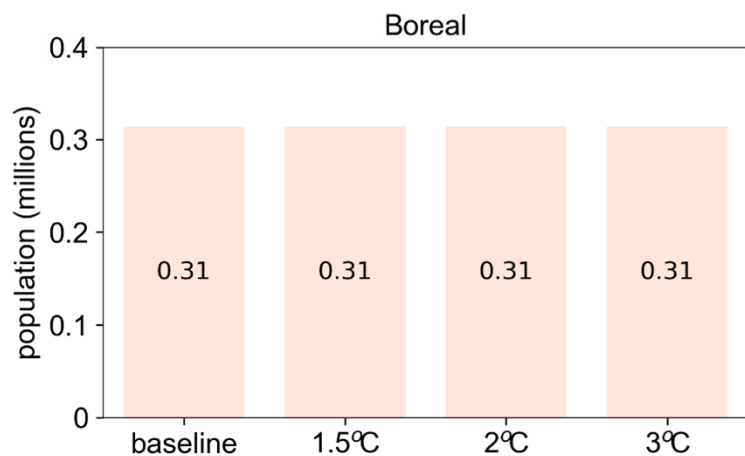
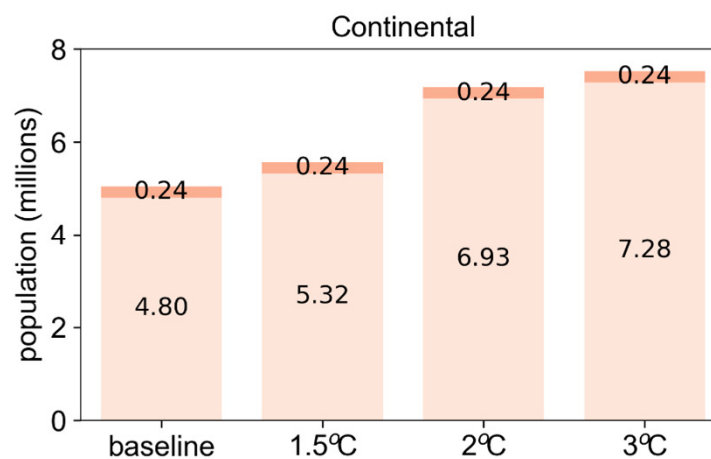
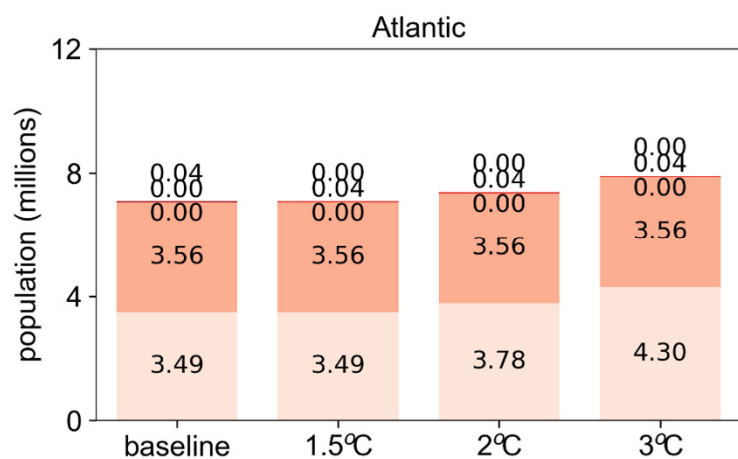
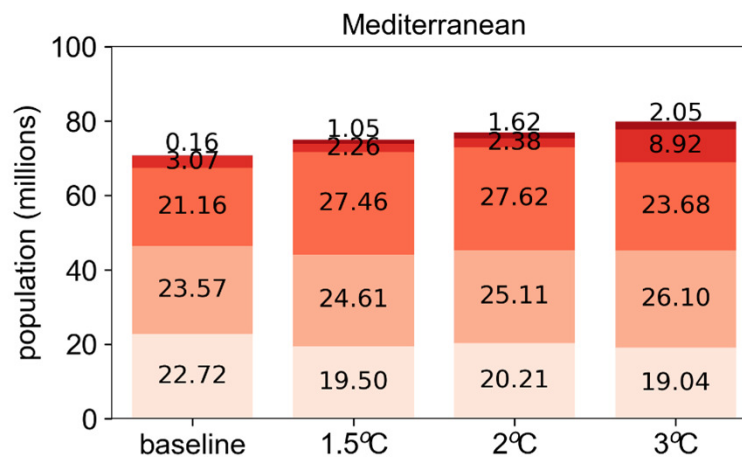
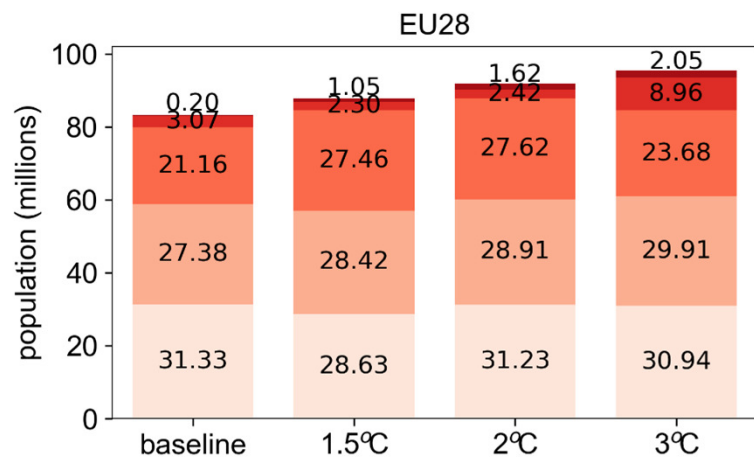
Same regions affected, but WEI+ gets worse

Water Exploitation Index (WEI+) (consumption): rcp85 climate 2070-2099

ensemble of 11 Euro-Cordex scenarios run with LISFLOOD



More regions affected, WEI+ gets >> worse

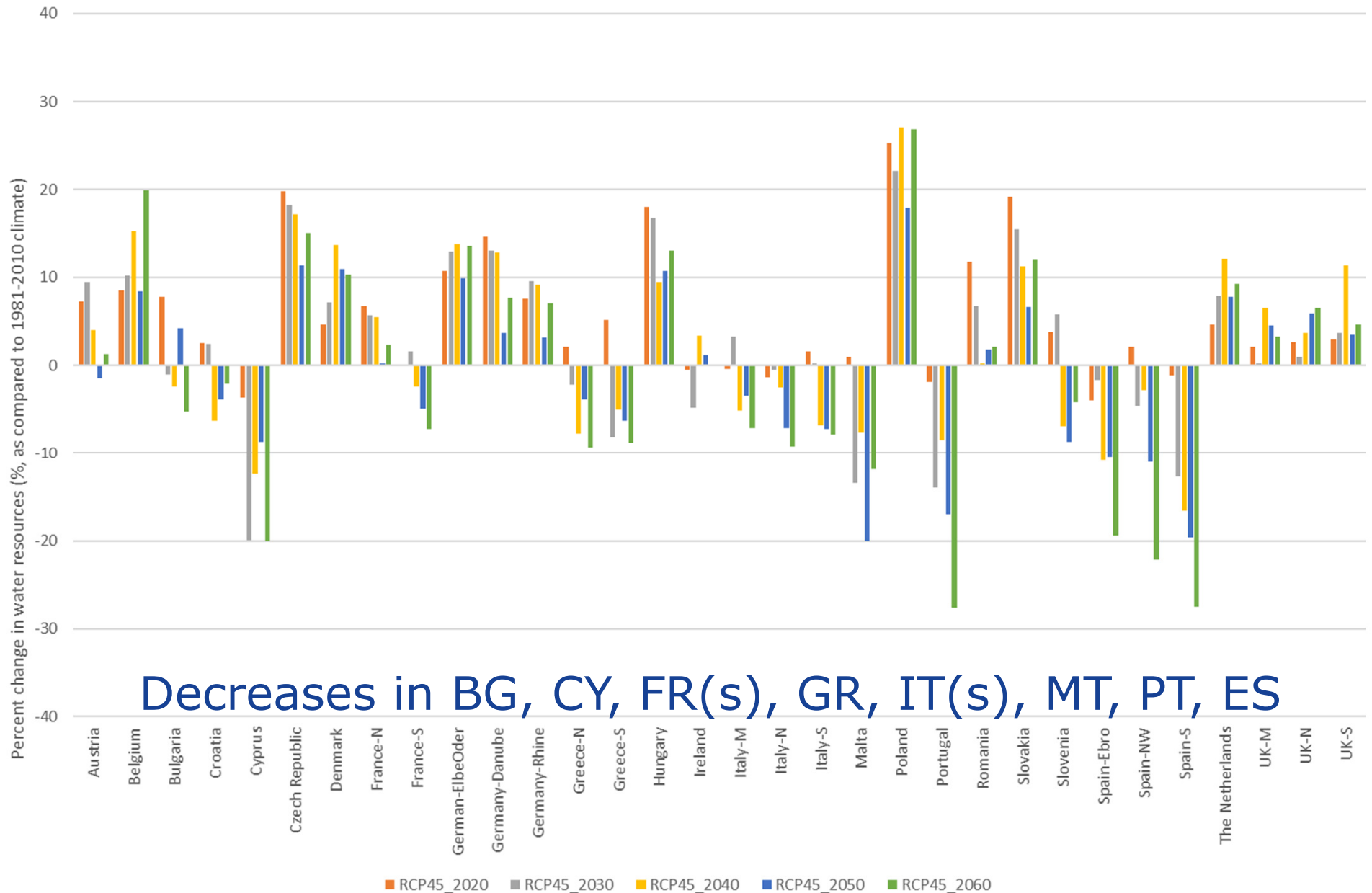


Population affected

Conclusions

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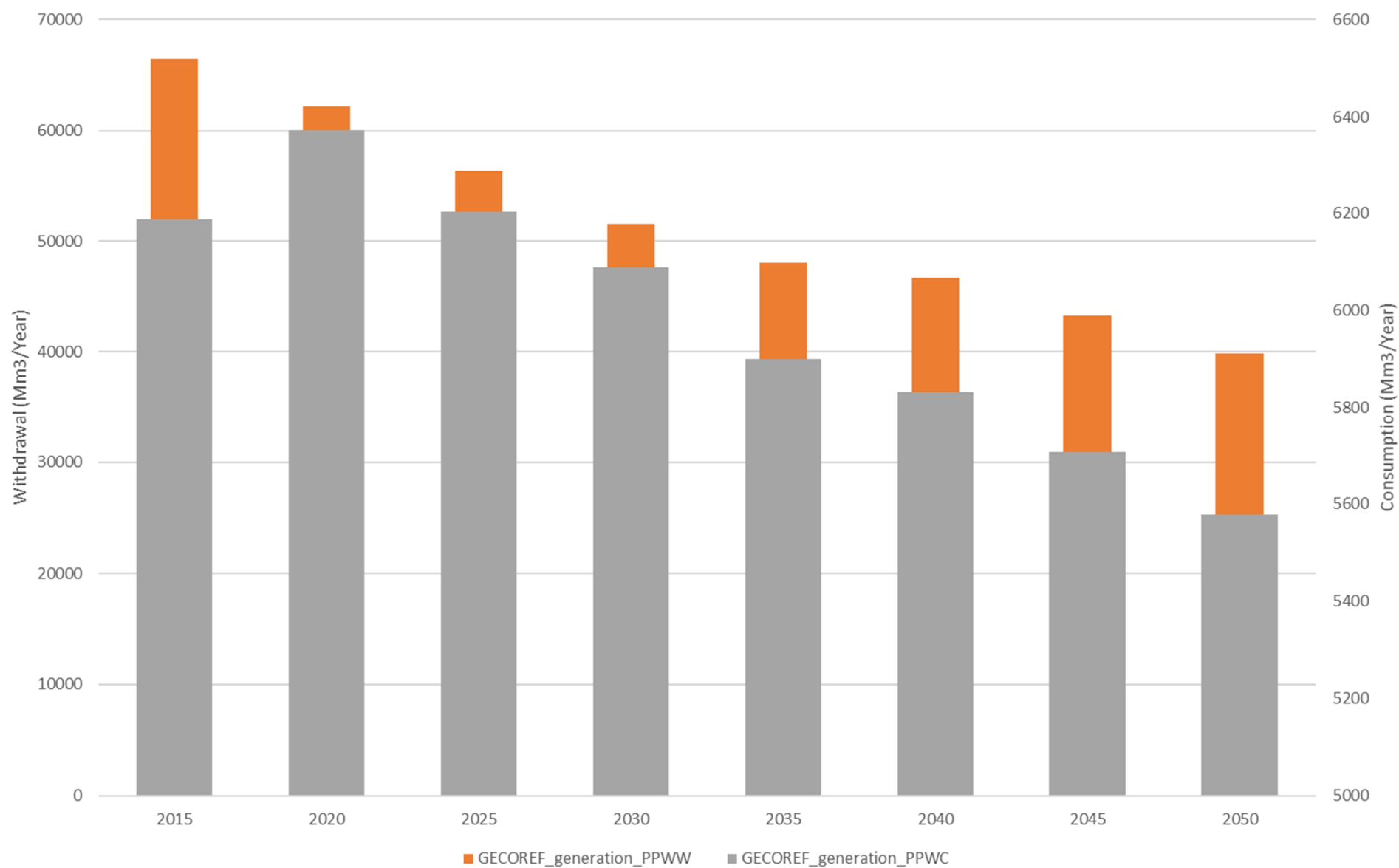
Change of water resources (RCP4.5), months 5-8



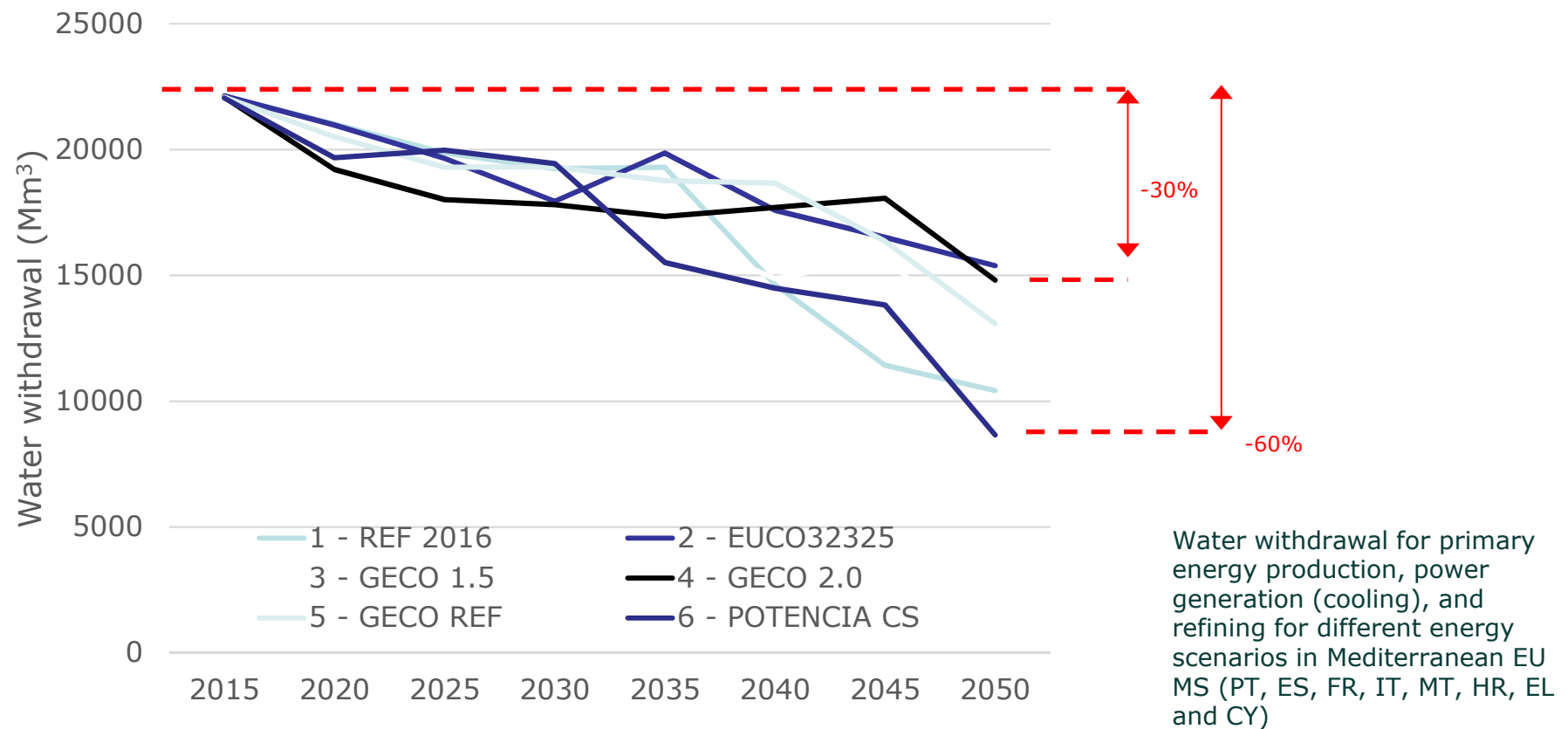
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Water Withdrawal and Consumption for Electricity Generation (GECO-REF EU28)



Due to the decarbonisation of the energy system, freshwater needs in Mediterranean EU MS are expected to decrease significantly in all scenarios but will remain high nevertheless in 2050

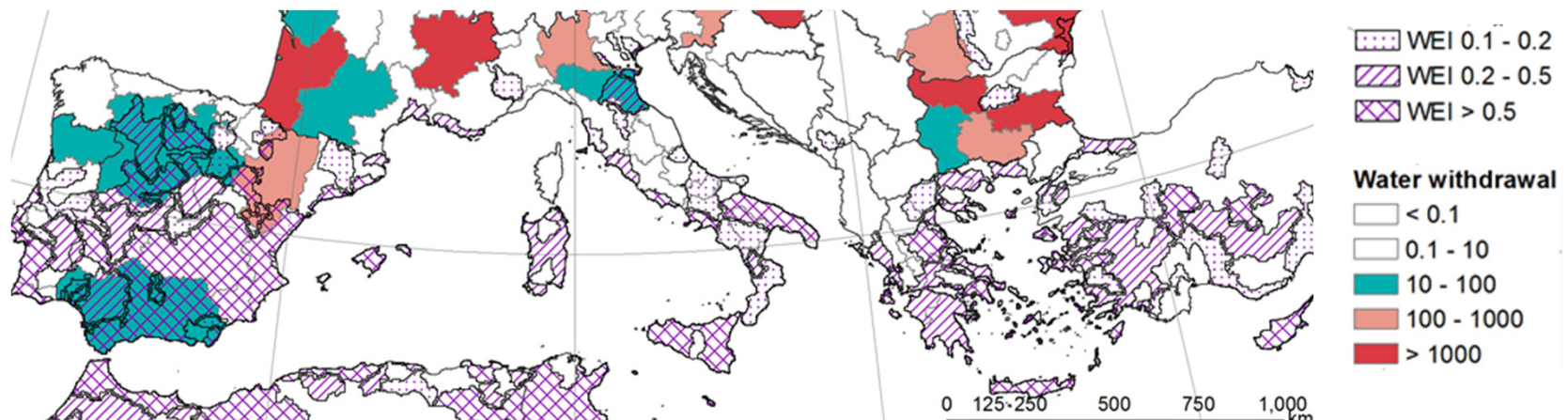


Source: JRC 2019, provisional results

Expected long-term impacts

Cooling of thermal power plants and hydropower generation are already vulnerable to droughts, high water temperatures, and changes in seasonal patterns

By 2050 climate change is expected to increase the frequency, the intensity, and the costs of these events across the EU, especially in already water-stressed areas around the Mediterranean



Overall water stress index vs. power system water withdrawals

Source: JRC115853, 2019

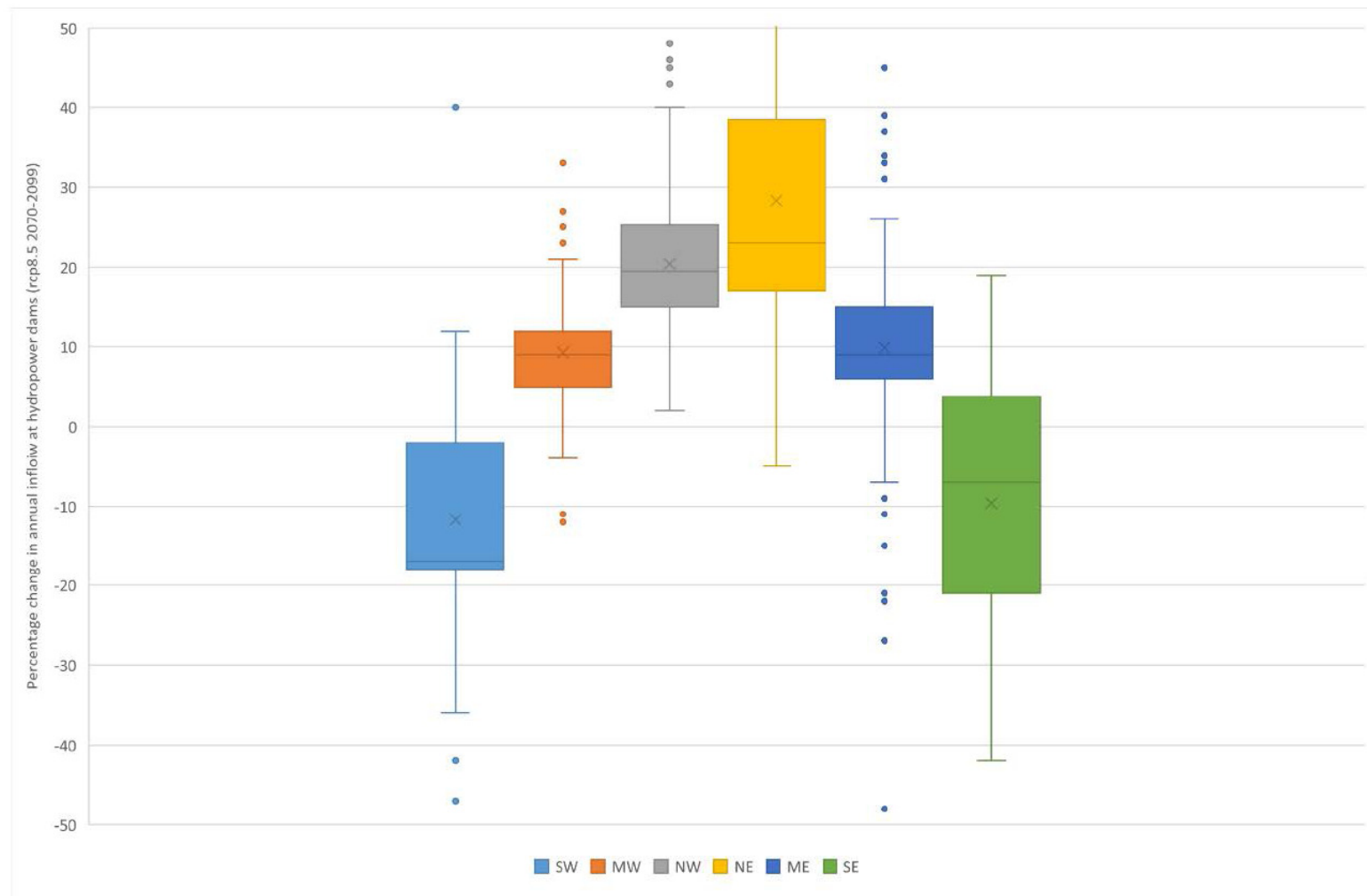


Figure 46 Changes of average annual inflow (Q_{avg}) at hydropower stations in 6 European regions for the RCP8.5 2070-2099 climate change as compared to current climate 1981-2010: ensemble of 11 Euro-Cordex models run with the LISFLOOD model.

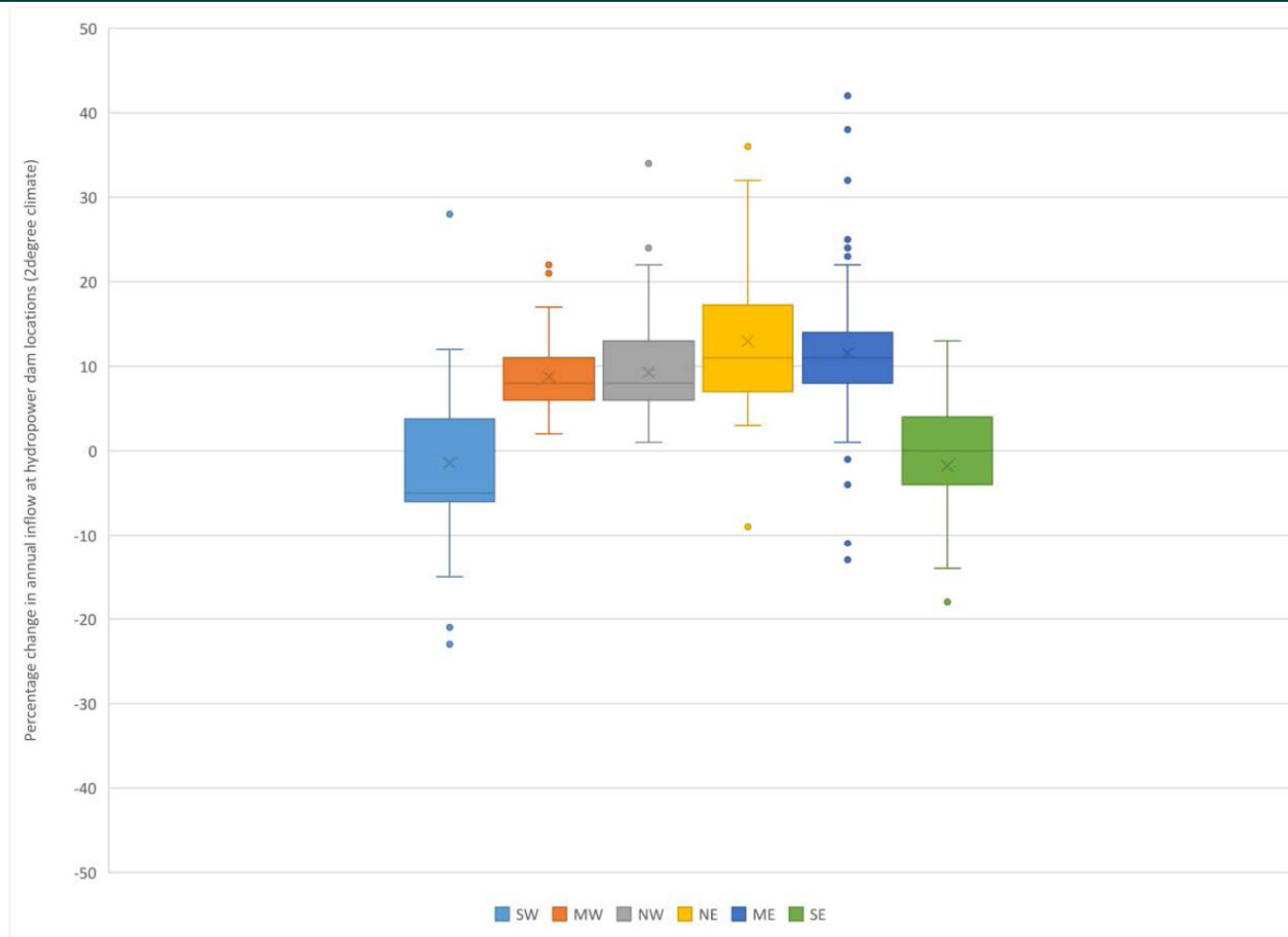
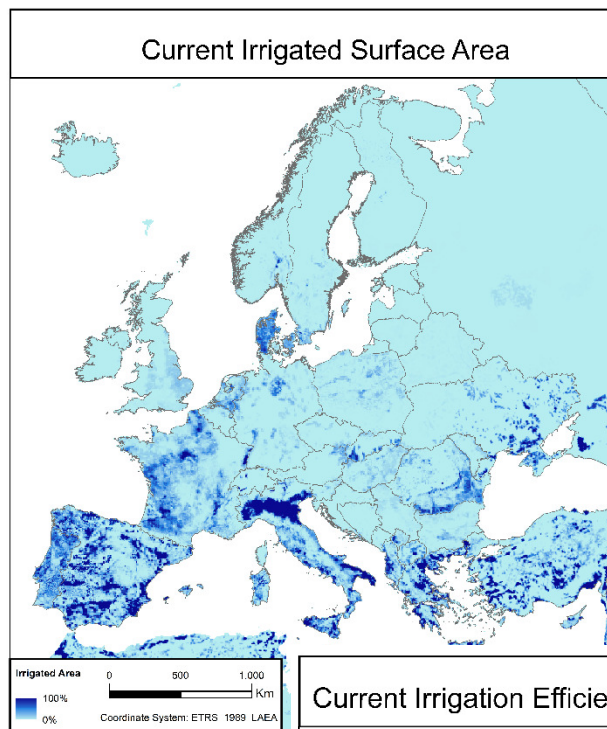


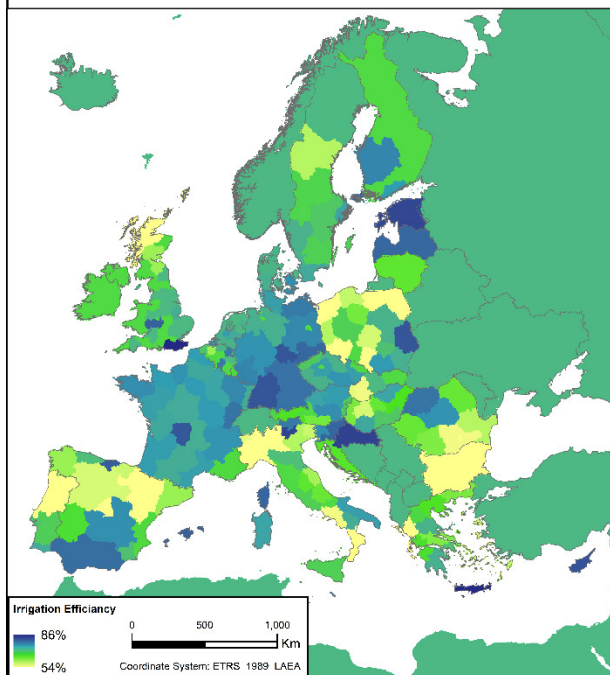
Figure 45 Changes of average annual inflow (Q_{avg}) at hydropower stations in 6 European regions for the 2 degree climate change as compared to current climate 1981-2010: ensemble of 11 Euro-Cordex models run with the LISFLOOD model.

Conclusions

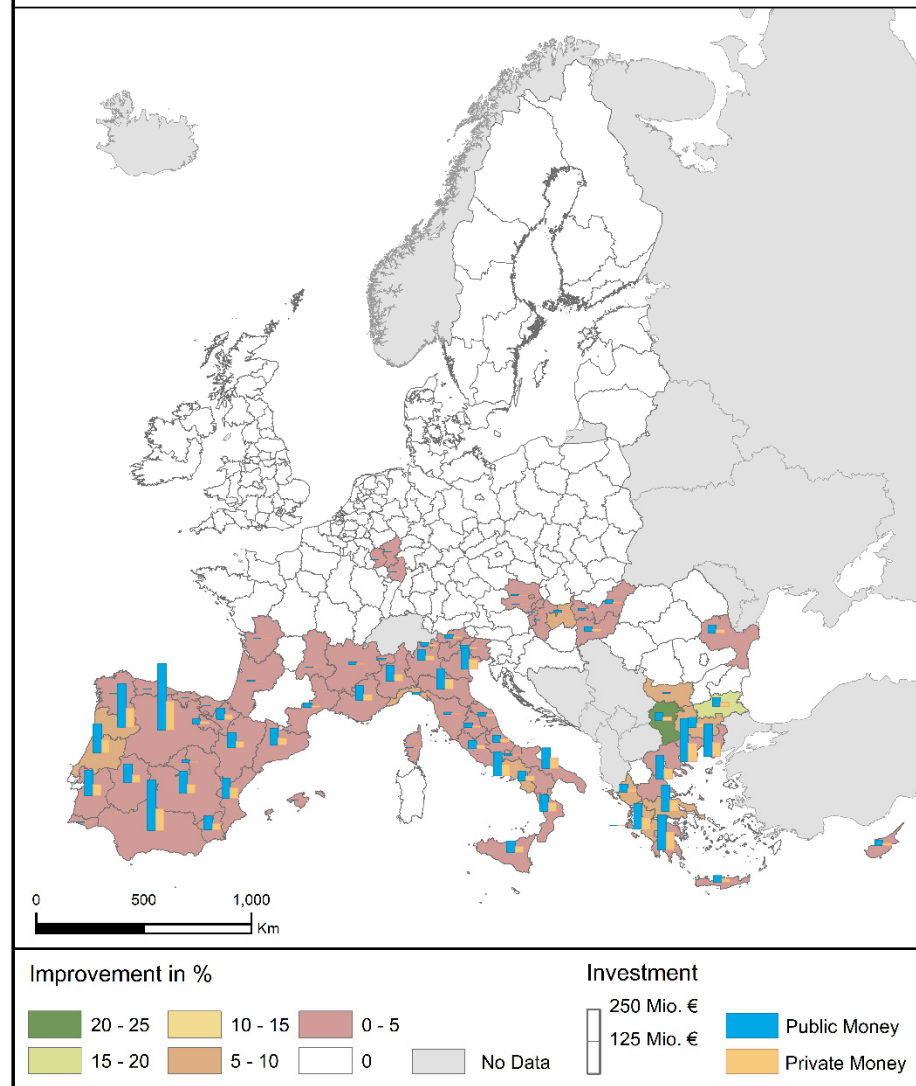
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Current Irrigation Efficiency in NUTS 2 Regions

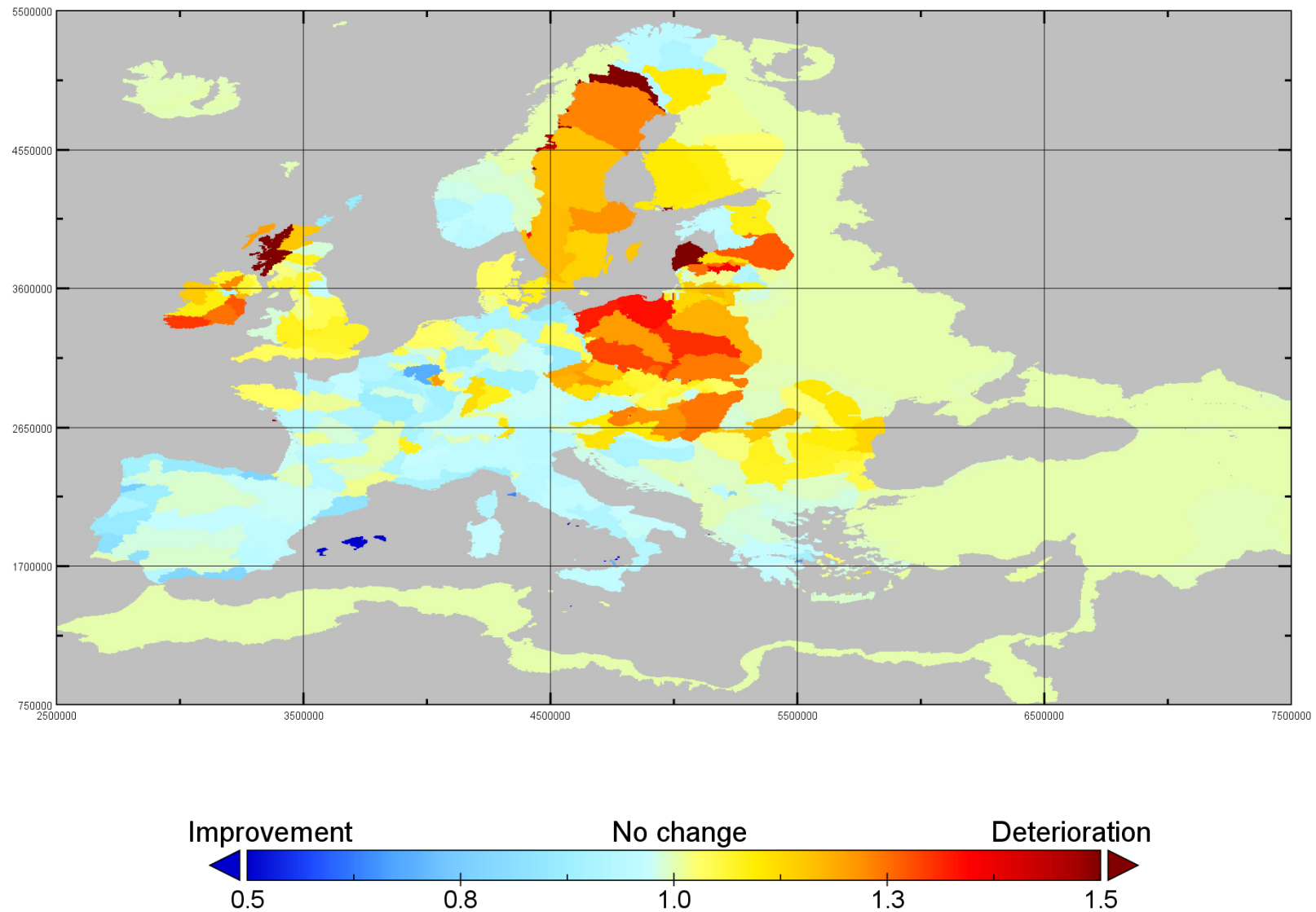


Irrigation Efficiency increase in BAU2027

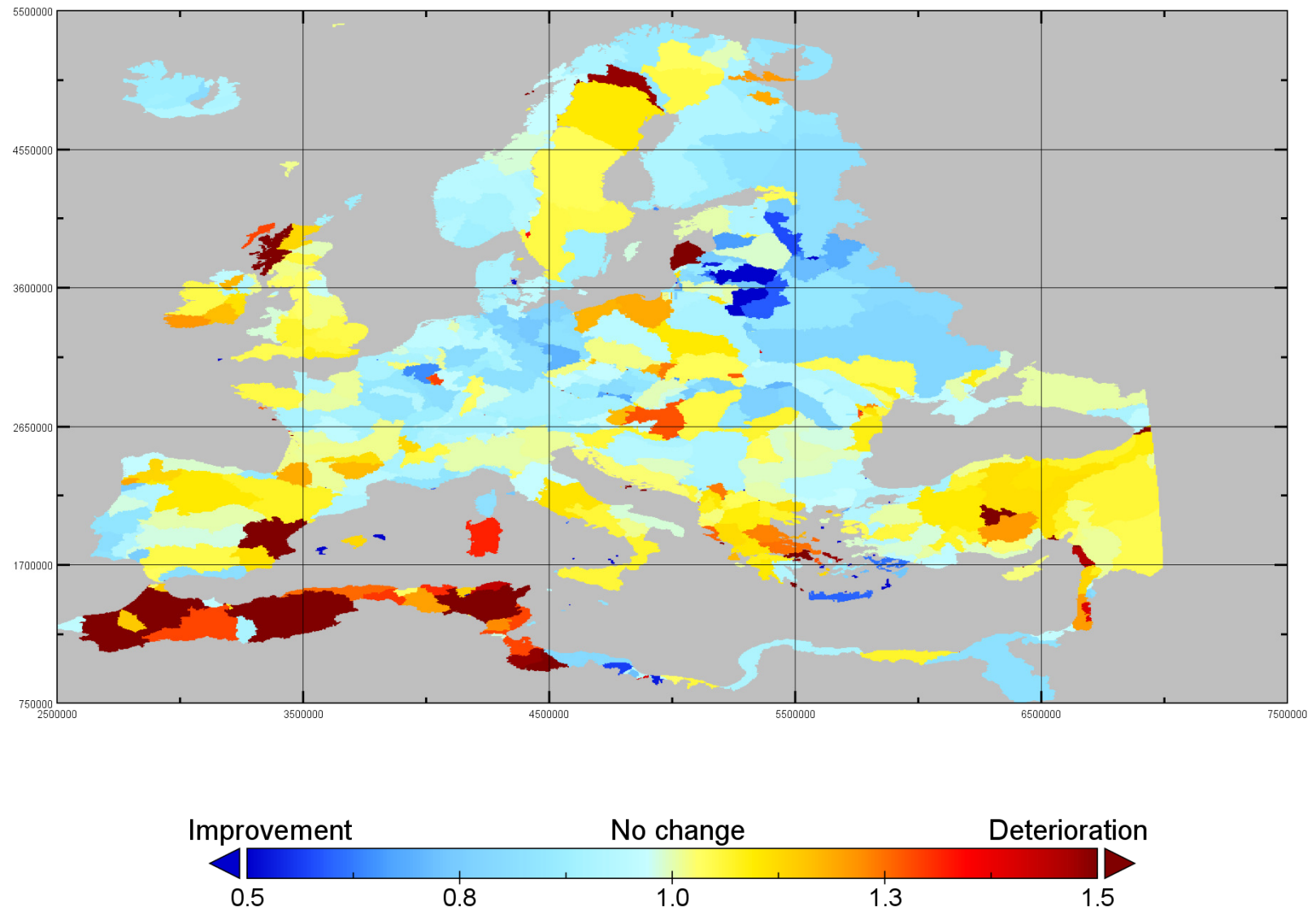


Projected impacts of combined measures on water resources

Change of Water Exploitation Index (WEI+) under 4 planned measures, under current climate



Change of Water Exploitation Index (WEI+) under 4 planned measures, under 2 degree climate



Conclusions

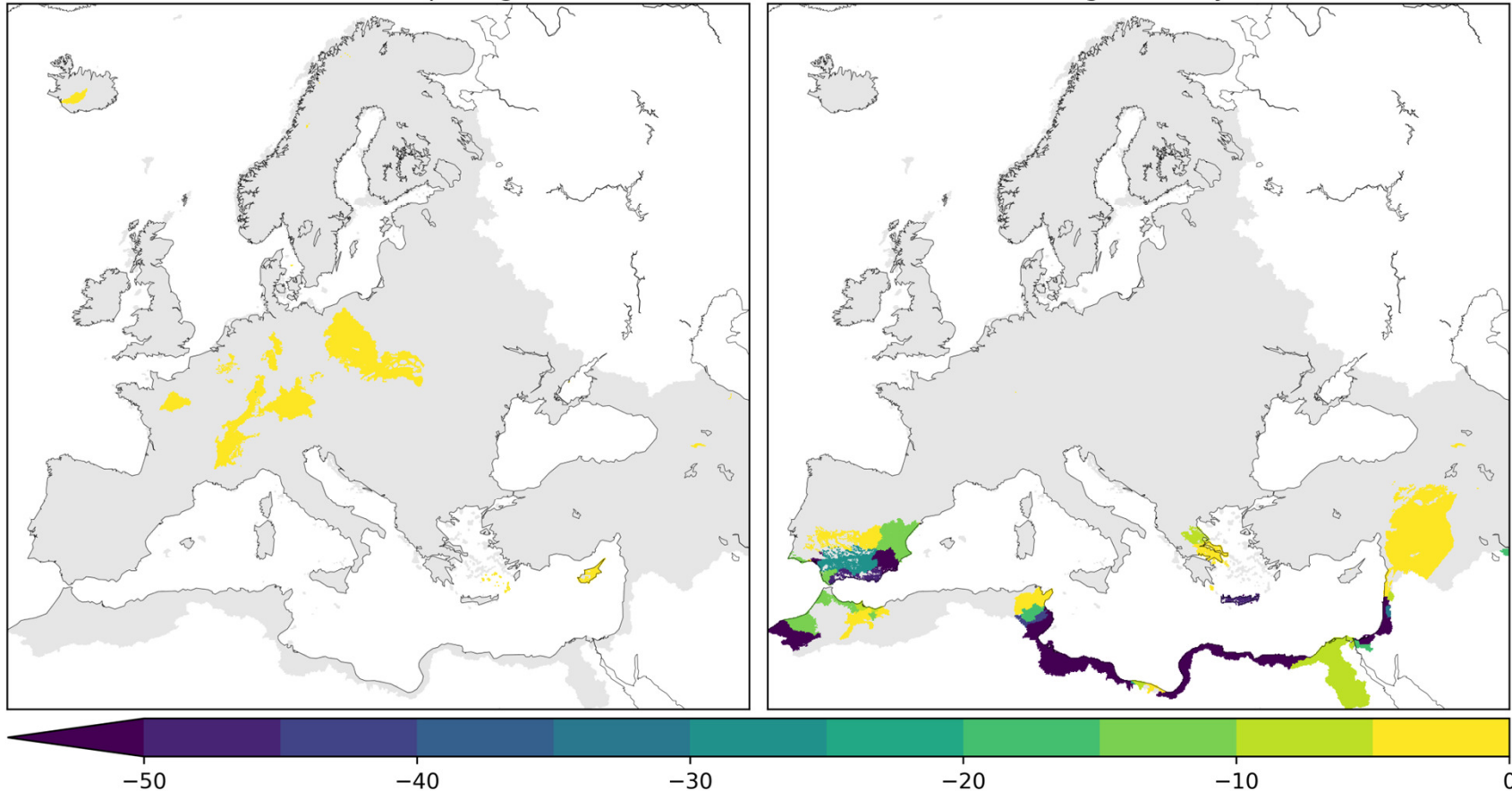
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Groundwater depletion (simulated)

Groundwater depletion (% of recharge)

All water uses except irrigation

Irrigation only



(grey = no depletion)

Severe depletion (>50% of recharge) due to irrigation abstractions across the Mediterranean

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