

Groundwater shifts and critical thresholds in the changing hydroclimate

Georgia Destouni

Dept. of Physical Geography, Bolin Centre for Climate Research



Conundrum of

- What is drying wetting for water in the landscape at the surface and in groundwater?
- What drying wetting is driven by atmospheric climate change and/or by human drivers in the landscape?
- What drying wetting crosses critical thresholds?

Focus:

Hydro-climatically vulnerable Southern Europe – Middle East region Climate-Food-Water Nexus





Regional example: **Greece** – catchments draining into **Aegean** & Ionian Seas



Regional example: **Greece** – catchments draining into Aegean & Ionian Seas



Destouni & Prieto (Water, 2018)





Regional example: Iran – 30 main catchments



(i)

Climate changes 1986-2000 → 2001-2016

Regional example: Iran – 30 main catchments





Mostly **even drier** than ΔP

Both wetter & drier for vegetation/crops seen across country



Moshir Panahari et al. (Sci. Rep., 2020)



Large-scale biospheric drought response over the world



Large-scale biospheric drought response over the world



Intensively exploited aquifers largely **for agriculture/food** East Mediterranean example of **East** and **Middle Nile Delta**

Normalized proximity to







Conclusion

Consideration & disentanglement needed for **multifaceted** – **coupled** and sometimes **contrasting** - aspects of **drying** & **wetting** in the landscape, including:

- Water at the surface vs groundwater
- Water for vegetation/crops (food) vs water for other uses
- Atmospheric climate change vs other human drivers in the landscape including agricultural intensification/expansion for food production
- Goal conflicts & tradeoffs involved in avoidance of various critical thresholds for long-term sustainability in the Climate-Food-Water Nexus

