Global-scale assessment of GW stress in TBAs under climate and water use change using the global hydrological model WaterGAP

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COMPARISON OF CURRENT-STATE INDICATORS TAKING INTO ACCOUNT DIFFERENT CONCEPTS OF SUSTAINABLE GROUNDWATER USE

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The assumption "GWR = renewable GW resource" is subject to critique:

"*withdrawals are balanced by capture, as well as by storage depletion, and not by average annual recharge*"
(ALLEY & KONIKOW, 2015, p. 828) (Ground Water)

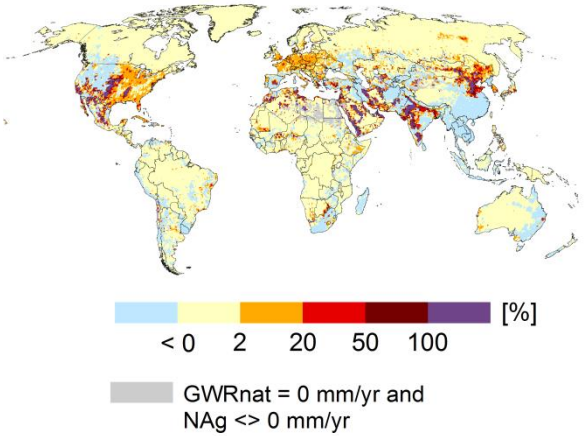
- Sustainable groundwater use, if $\Delta R_0 + \Delta D_0 = P$ (BREDEHOEFT, 2002) (Ground Water)

  ΔR_0 , ΔD_0: Change in virgin GWR and GW discharge caused by pumping
  P: Pumping rate

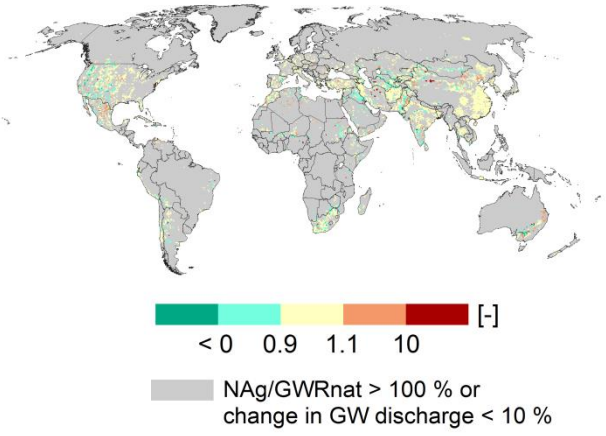
- Water requirements of ecosystems and downstream users not taken into account

- New indicator: Human-induced change in GW discharge $GWSI = \frac{Dant - Dnat}{Dnat}$

NAg/GWRnat (2001-2010, transient water use)



-(Dant-Dnat)/Dnat divided by NAg/GWRnat



NAg: Net abstractions from GW
GWRnat: GWR without return flows from irrigation
Dant: GW discharge, model run with water use
Dnat: Virgin GW discharge

IMPACT OF CLIMATE AND WATER USE CHANGE IN TRANSBOUNDARY AQUIFERS

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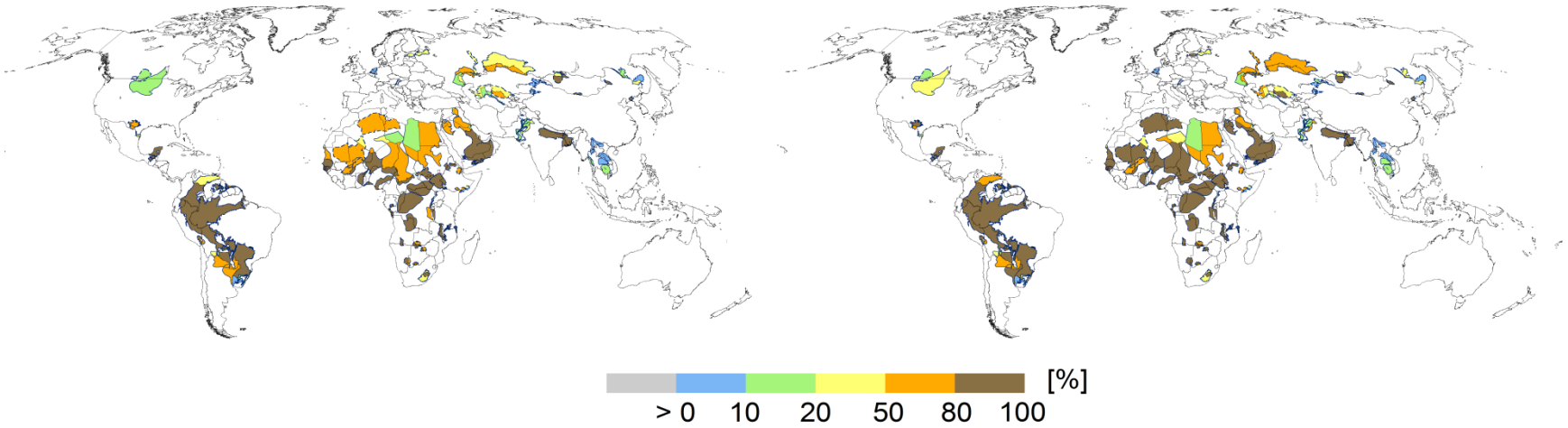
Ensemble Mean over 10 scenarios in 2050

Maximum value among 10 scenarios in 2050

Areal fraction of TBA country segments with an increase in NAg/GWRnat ≥ 20 %



- Areal fractions of TBA country segments exceeding a selected indicator level to capture GW stress at the regional (grid-cell) scale
- GW stress = projected changes in GW stress AND absolute levels of future GW stress
- Assessment of ensemble means (robust indicators balancing the errors of individual models) and maximum values (worst-case assessment to support a precautionary approach to adaptation to climate change)