Evaluating the effects of drought mitigation measures during floods

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BACKGROUND

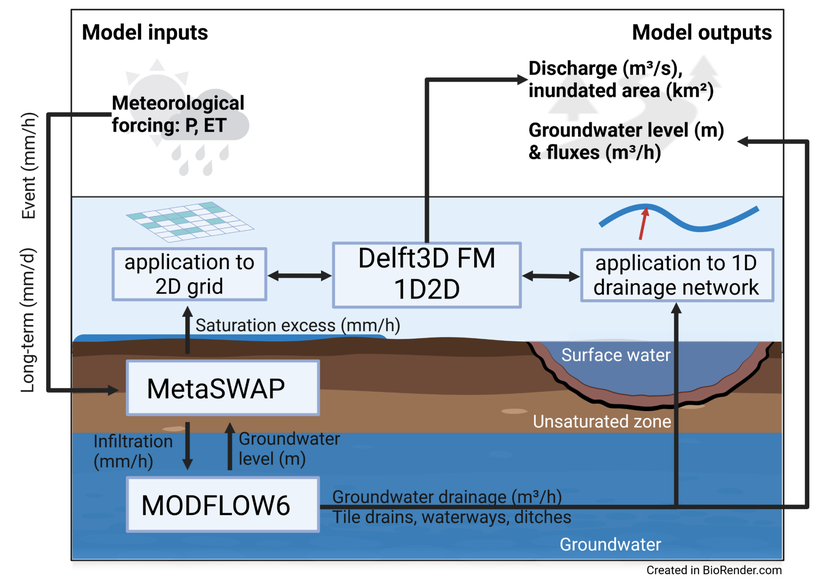
- **Climate change** increases intensification and variability of floods and droughts
- Recent **droughts** in Netherlands have sparked interest in nature-based water retention

Aim: to quantify the **effects of drought mitigation measures** (DMM) on long-term groundwater levels and surface water response during **heavy rainfall events**

Study area: Chaamse beken catchment, Dutch sandy soils region in southern Netherlands

METHODS

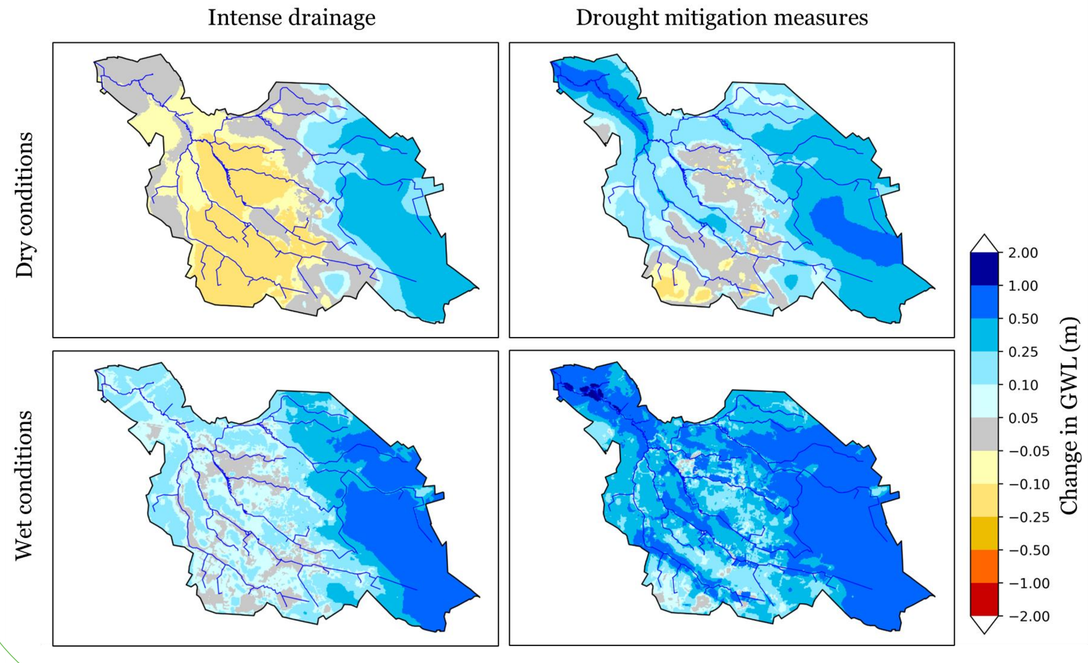
- Coupled **groundwater-surface water model**
- Implementation of substantial, catchment wide **drought mitigation measures** (DMM):
  - → Blocking drainage ditches
  - → Raising stream beds
- Simulations under **future climate scenario**:
  - → Initial multi-year simulation of groundwater levels
  - → Simulation of groundwater levels and streamflow during heavy rainfall events



RESULTS

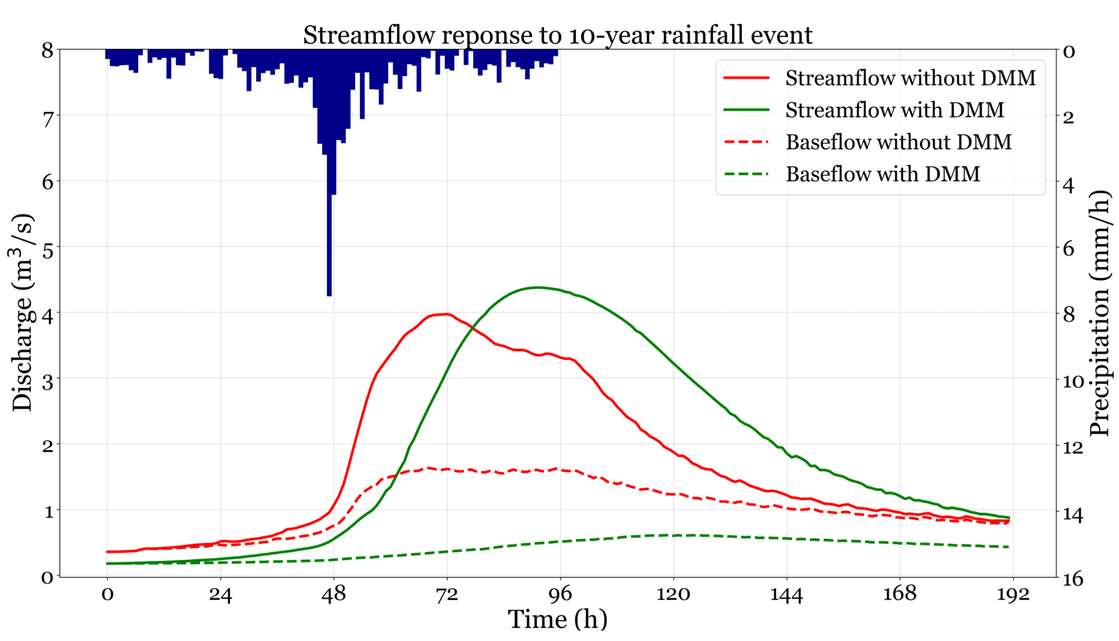
Long-term effects of DMM

- DMM **raised average groundwater levels** (GWL) in both dry (summer) and wet conditions (winter)
- Climate change induced summer groundwater deficit is compensated
- Additional increase in climate change induced winter groundwater surplus



Effects of DMM during heavy winter rainfall event

- Increased formation of saturation excess, leading to **groundwater flooding**
- Reduced channel discharge capacity leading to **overbank flooding**
- Increased overland flow leading **higher but delayed streamflow peak**
- **Reduced baseflow** contribution to streamflow

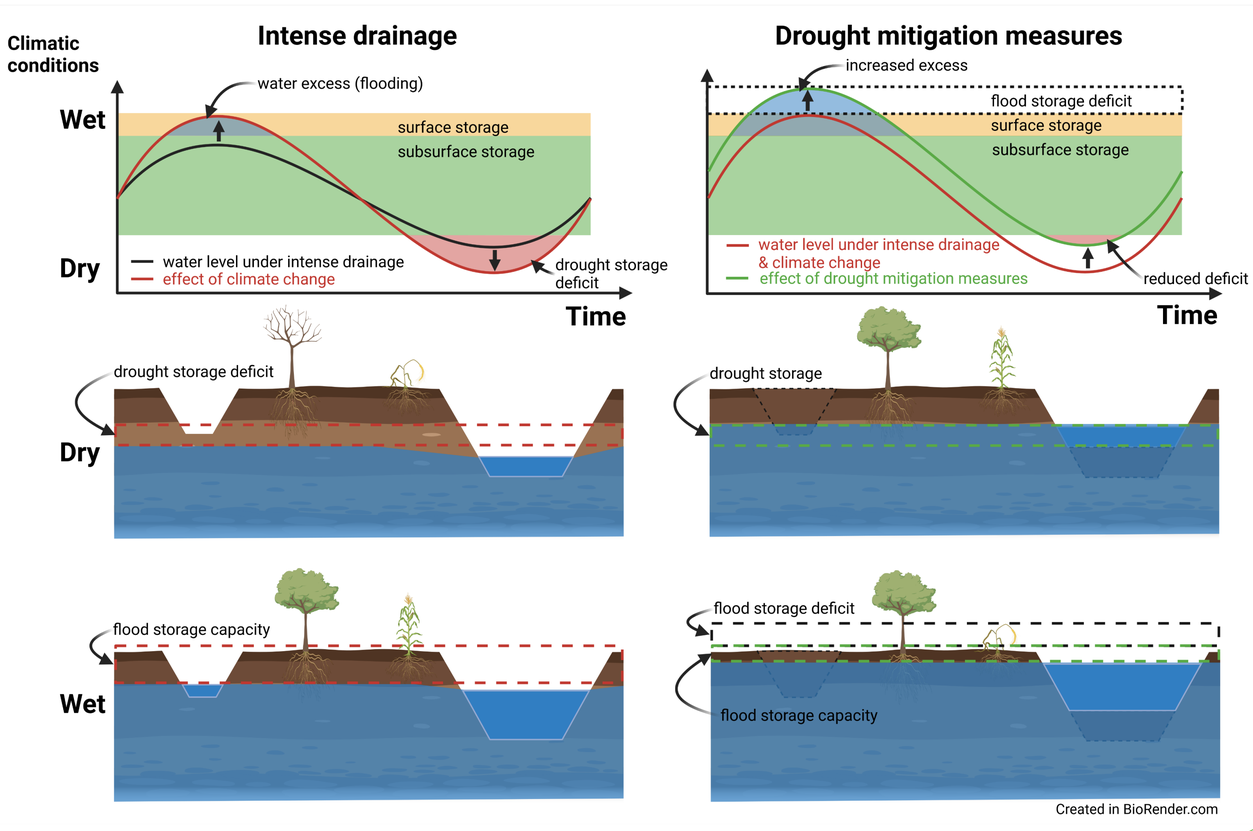


CONCLUSIONS

- Higher groundwater levels reduce summer deficits, but also reduce flood storage capacity
- Surface storage can partially compensate flood excess, but not sufficiently to avoid downstream peak increase
- **Joint design and planning** of drought and flood mitigation measures is crucial
- Achieving resilient landscapes requires a **paradigm shift** toward management based on environmental conditions
- **Integrated modeling approaches** are necessary to inform the formulation of mitigation strategies

Further research

- → Continue **testing and developing modeling approaches** to quantify hydrological effects
- → **Quantify the consequences of a wetter landscape** for crop production and ecosystem integrity



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