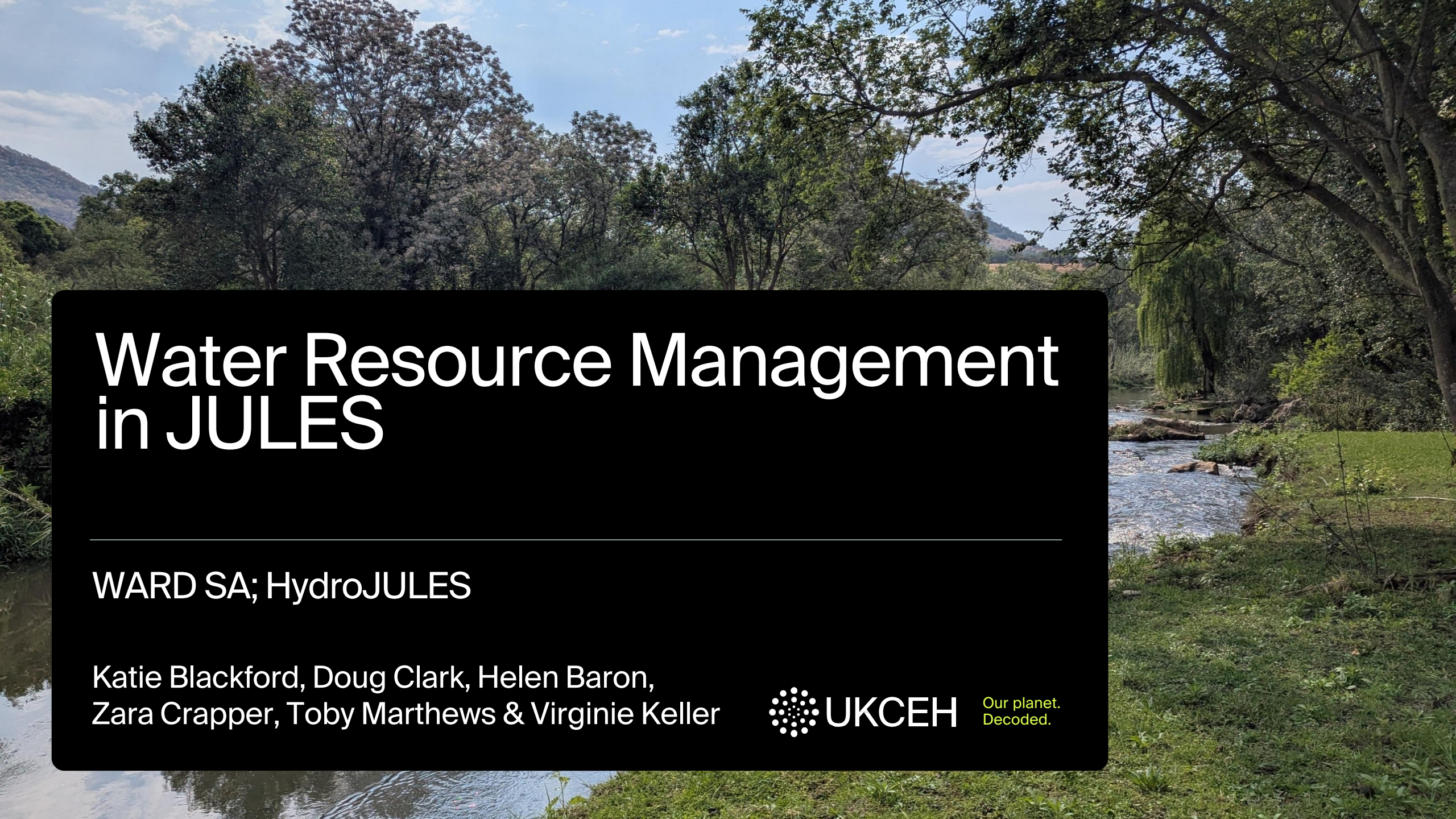


Water Resource Management in JULES

WARD SA; HydroJULES

Katie Blackford, Doug Clark, Helen Baron,
Zara Crapper, Toby Marthews & Virginie Keller

UKCEH
Our planet.
Decoded.

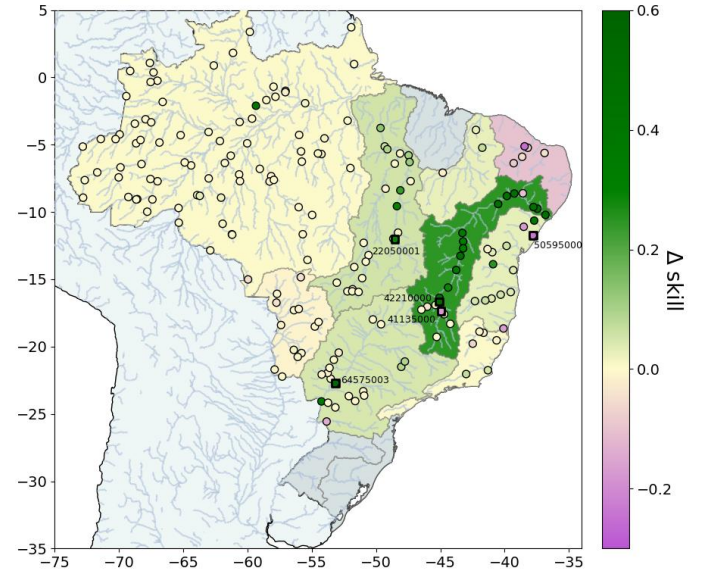
Aims

What: **Water resource management (WRM)** in JULES, at 0.5^0 and km-scale.

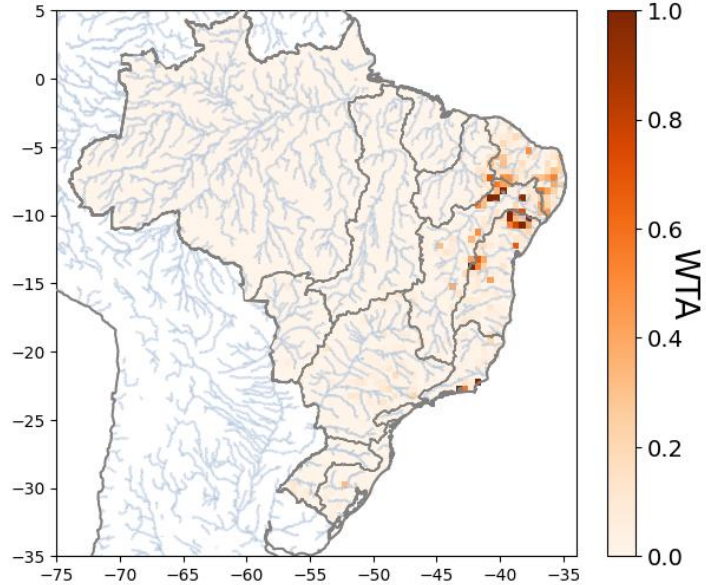
Why: Represent impacts of water on people, & people on water.

Building on CSSP RIVERS Brazil work

Tres Marías reservoir inflow and outflow, observed (orange) & simulated (green)



Change in flow simulation skill, JULES WRM



Simulated water scarcity over Brazil

Model Development: 0.5°

- Local water abstractions, discharges & allocations
- Reservoirs & minor reservoirs
- Non-local abstractions
- Transfers
- Evaporation from open water

Model Development: 0.5°

Water abstractions, discharges & allocations

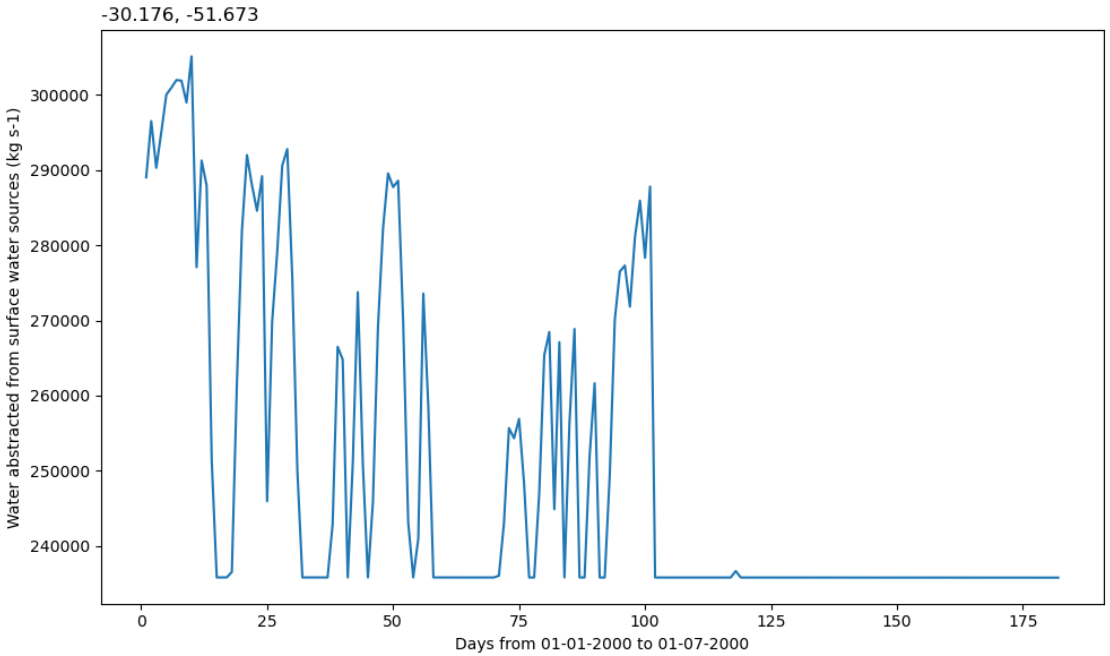
Domestic, industrial, livestock and irrigation demands

Dynamic abstraction from SW (rivers, minor reservoirs, reservoirs) & GW

Resource allocation in water scarcity

Conveyance loss to GW

Return flows to SW and/or GW



Daily surface water abstraction at a location in Southern Brazil

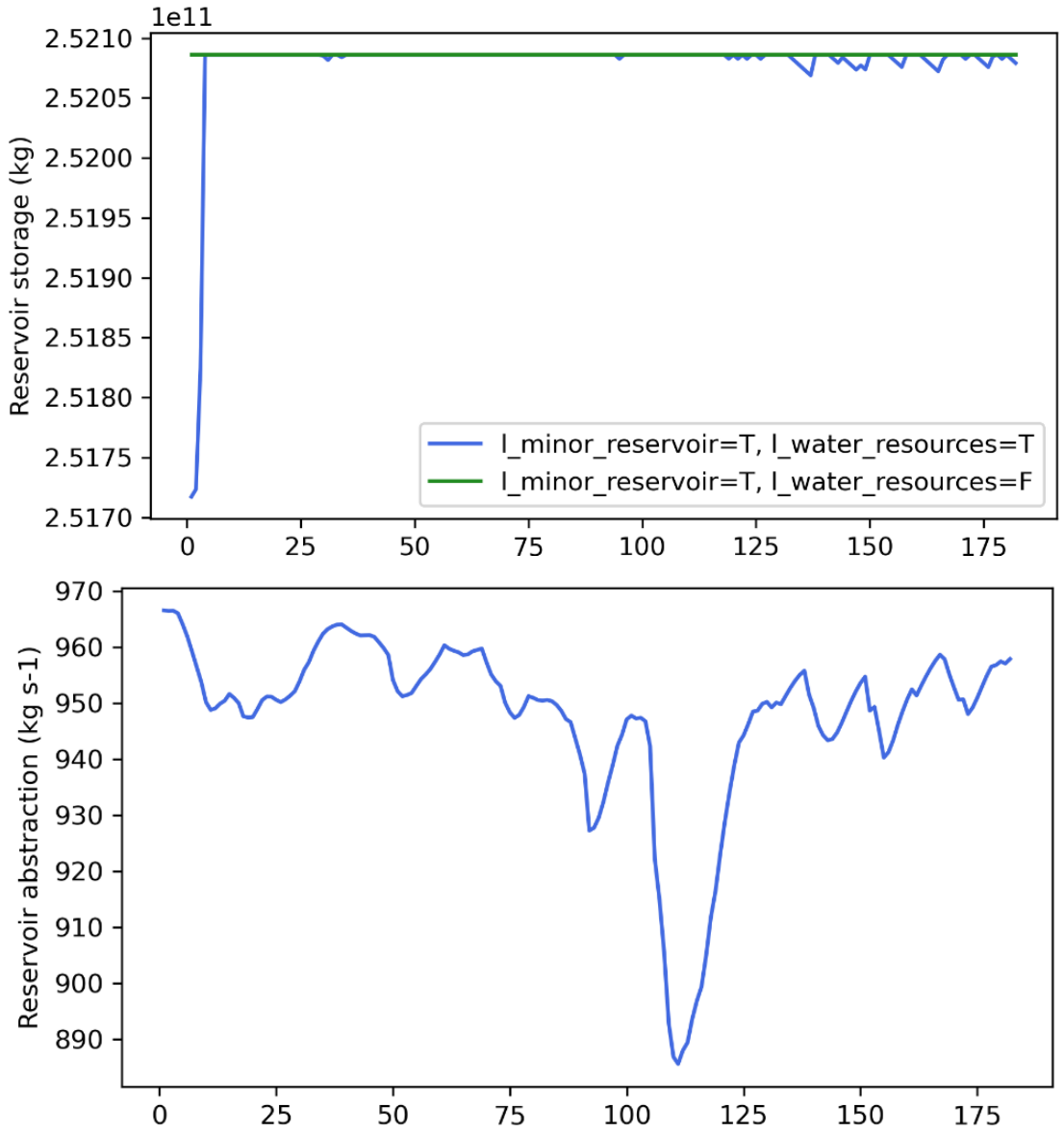
Model Development: 0.5°

Minor reservoirs

Represent small water bodies not on main river stem

Collect and retain local surface runoff

Water is then available for abstractions



Plots of minor res storage, minor res abstraction for location in Northern Brazil

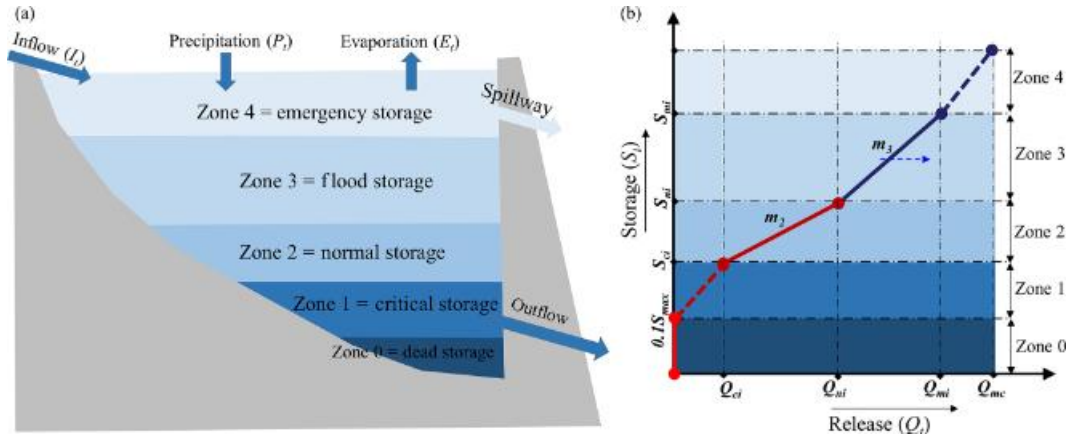
Model Development: 0.5°

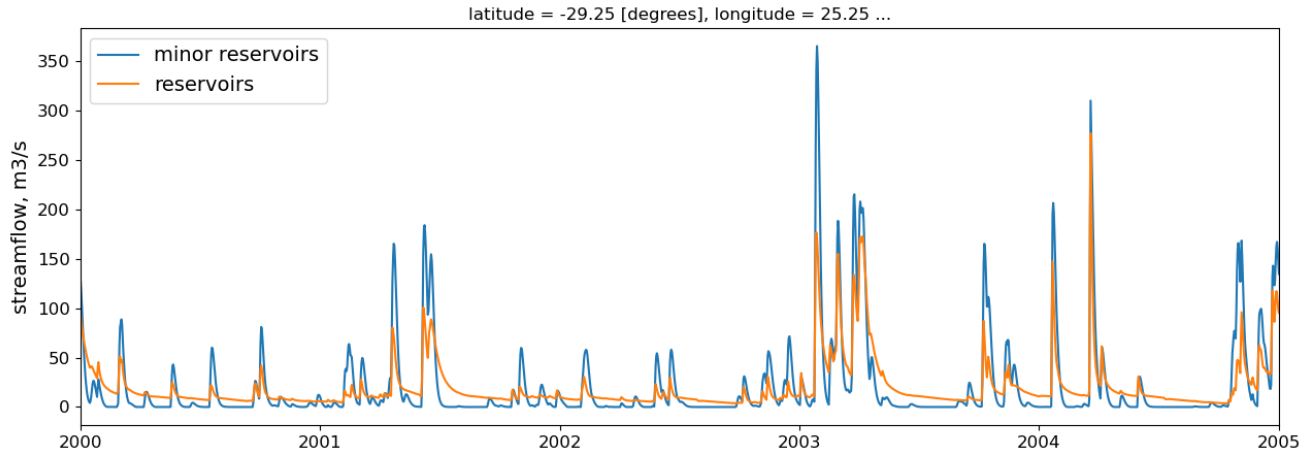
Reservoirs

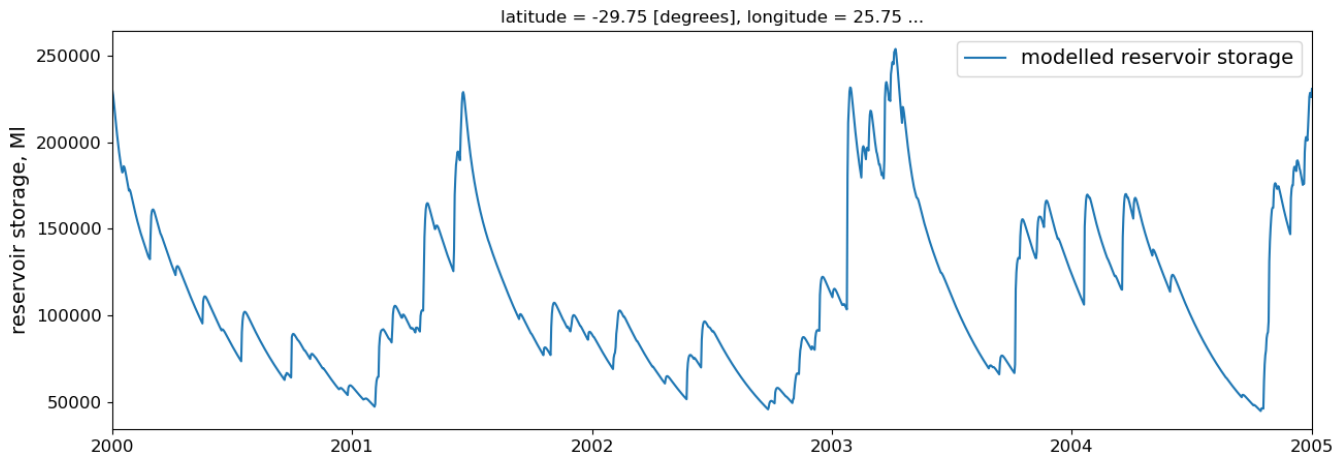
Levels based routine

Requires estimates of zones & associated reservoir release rates

Release rules adapted from Hanazaki et al (2022)







Example of a level-based reservoir routing model from Yassin et al. (2019)

Model Development: 0.5°

Non-local abstractions

Builds network of surrounding grid cells that are at a higher elevation

Water can be abstracted from non-local grid cells to meet demand

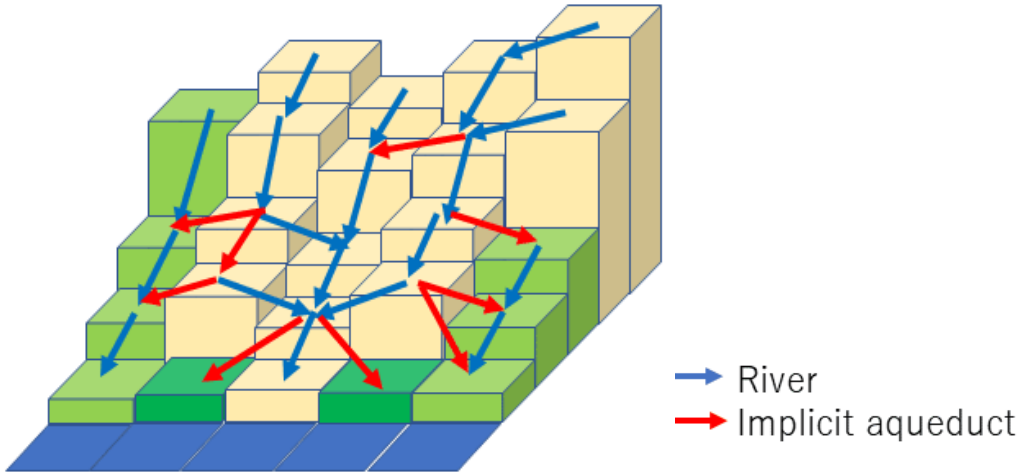
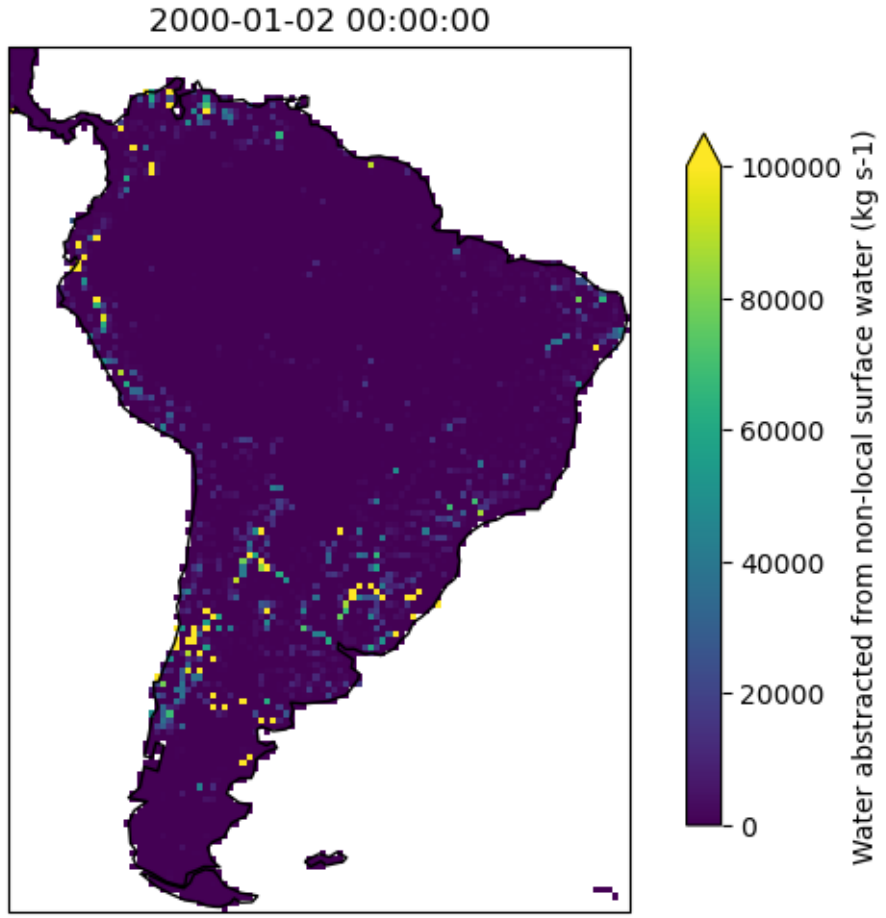


Figure adapted from Hanasaki et al (2022)



Non-local abstractions over South America

Model Development: 0.5°

Transfers

Large scale inter-basin transfers

Prescribed inputs with origin and destination grid box and timeseries of flow

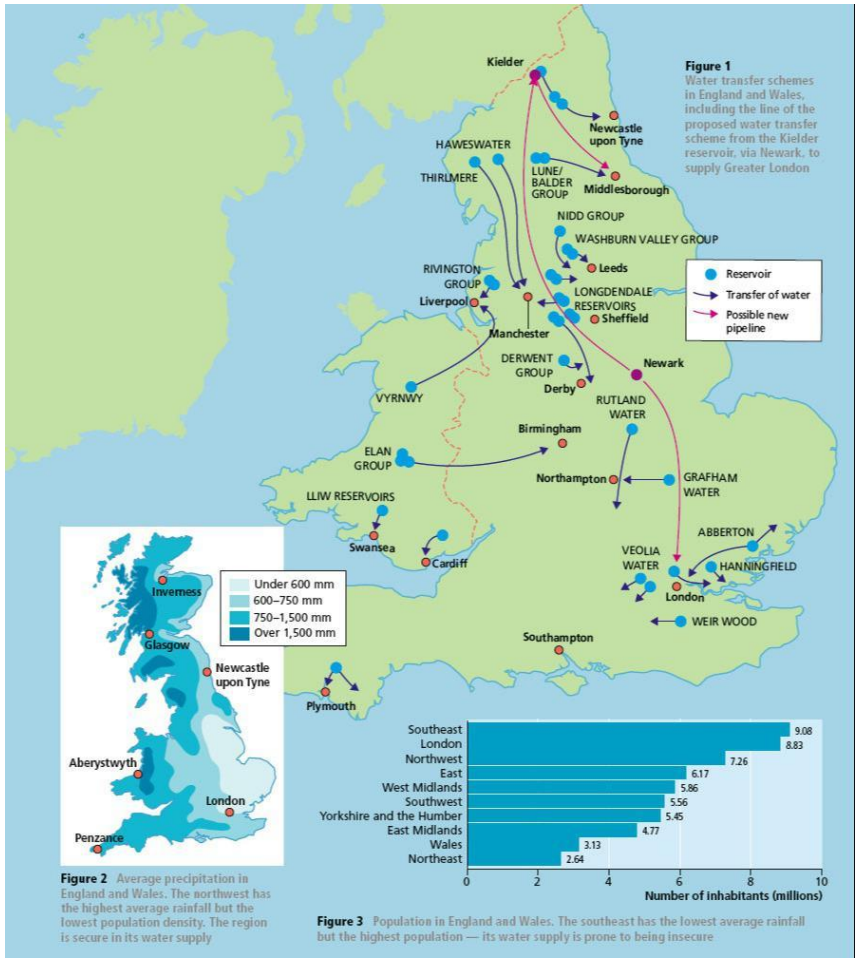
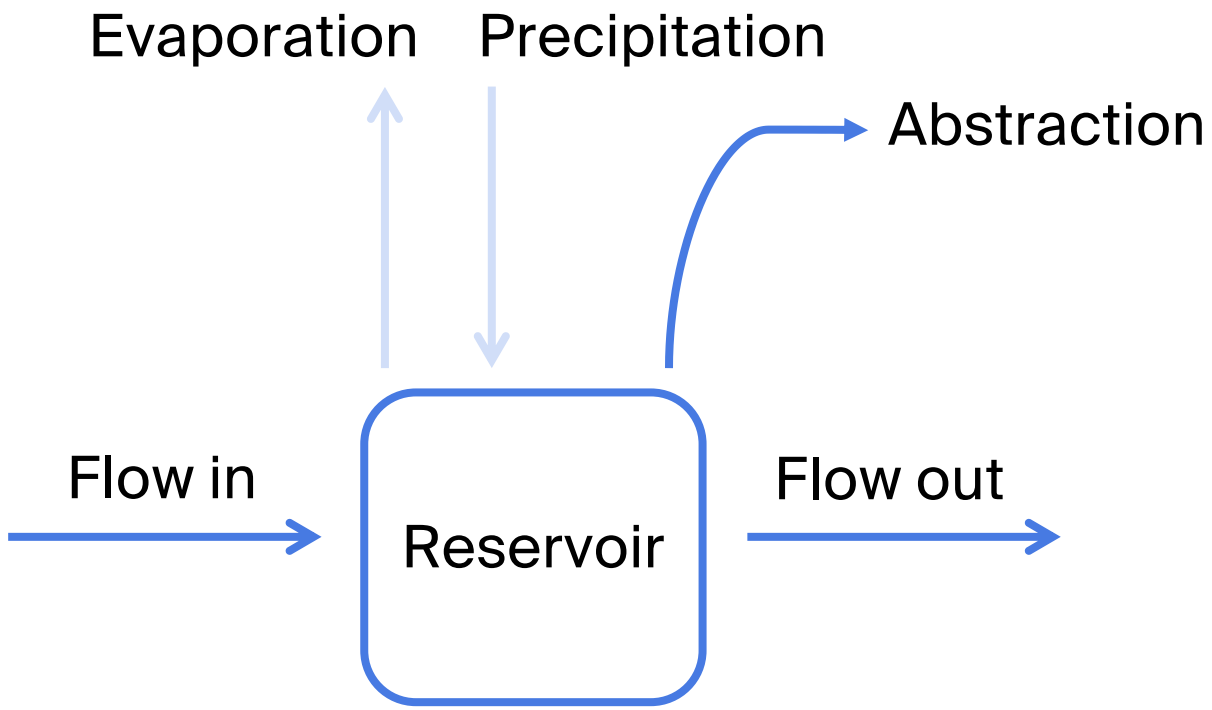


Figure from WideWorld.

Model Development: 0.5°

Evaporation from open water



Model Runs: 0.5°

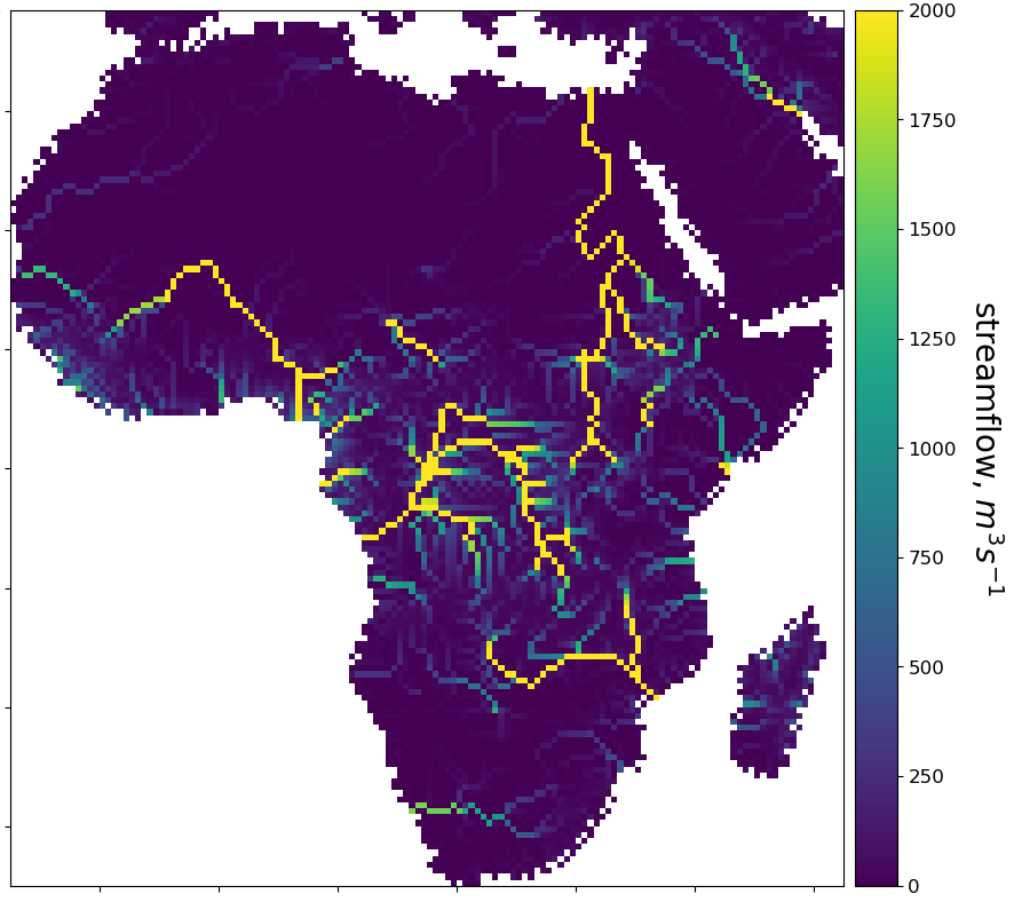
WARD SA: Water Availability duRing Drought, South Africa (WCSSP SA)

Historic & future runs over Africa with WRM

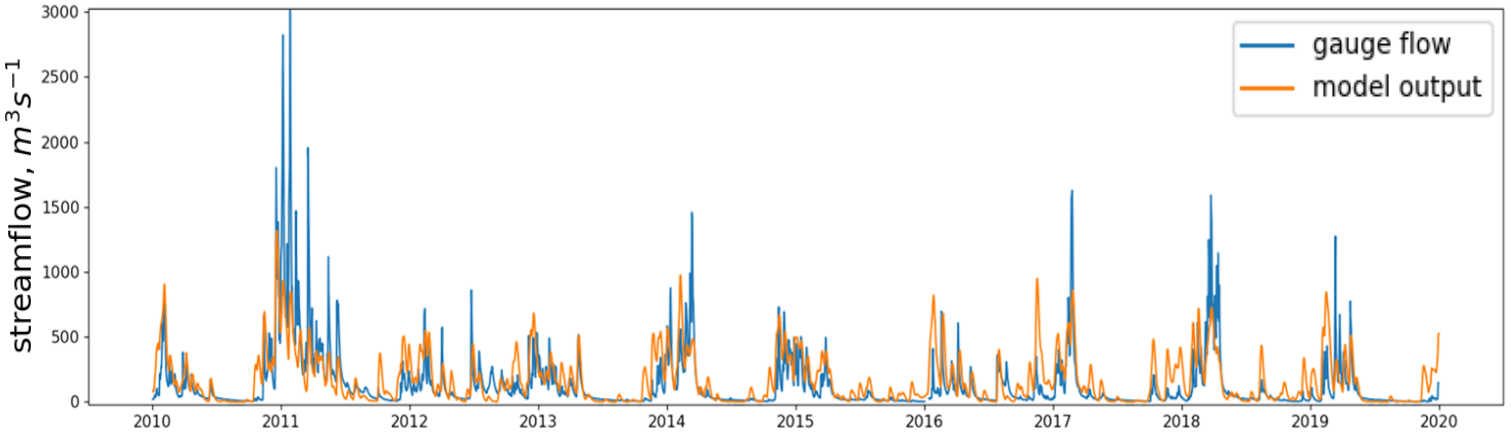
Part of (fixed-vegetation) ISIMIP suite

Paper on food and water security trade-offs in South Africa under future climate

Right: Baseline mean streamflow over Africa, 0.5° JULES (no WRM).



Below: Daily streamflow at Aliwal Noord, in the Orange river basin.



Model Development: km-scale

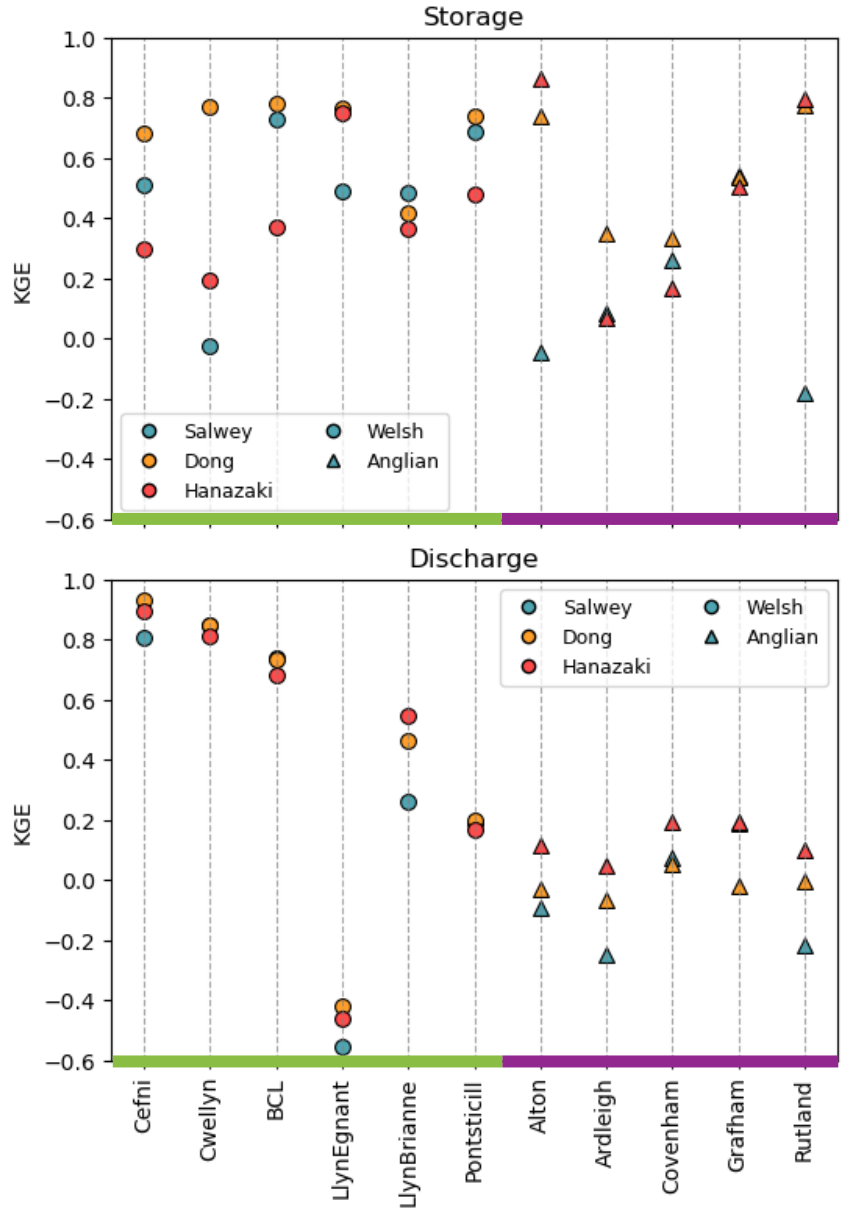
km-scale adaptations scoped

Testing of reservoir routing options

Updated reservoirs

Updated discharge

Updated transfers



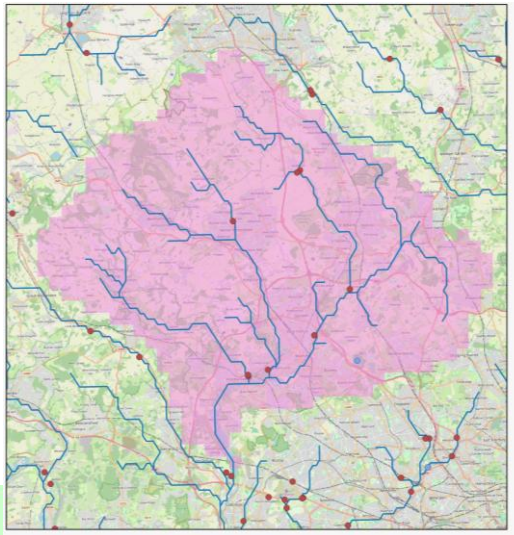
Hydro-JULES

Model Runs: km-scale

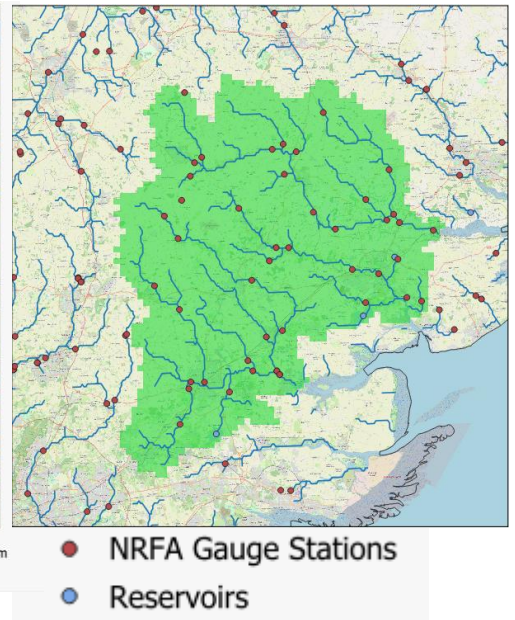
UK catchments (Hydro-JULES)

South Africa catchments (WARD)

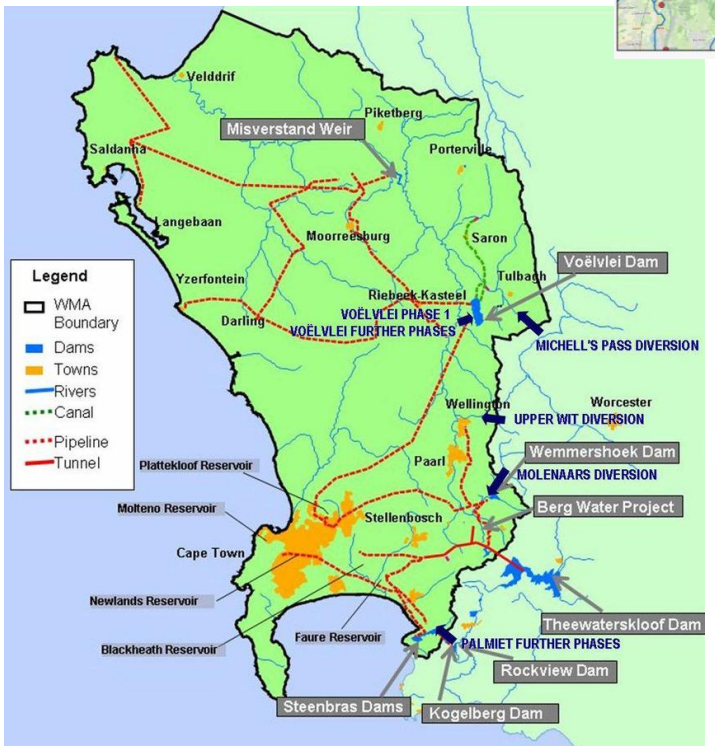
Colne



East Anglia



Above: influenced UK catchments modelled in HJ summer internship project by Ilaria Mocciaro.



Left: Description of the Berg River basin and inter basin transfers from the Breede, from Johnston et al. (2008)

Hydro-JULES

Thank you for your attention

UKCEH

Our planet.
Decoded.