

The GCAM ecosystem: Xanthos and Tethys

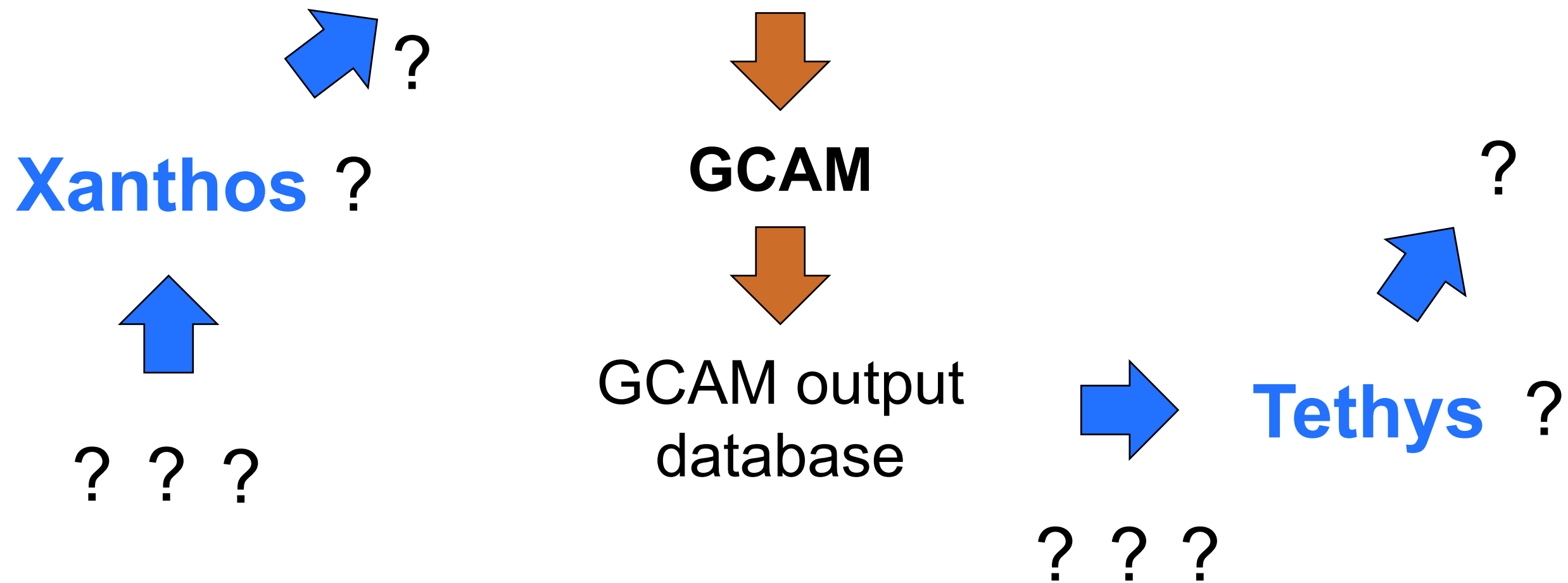
October 15, 2018

Sean Turner

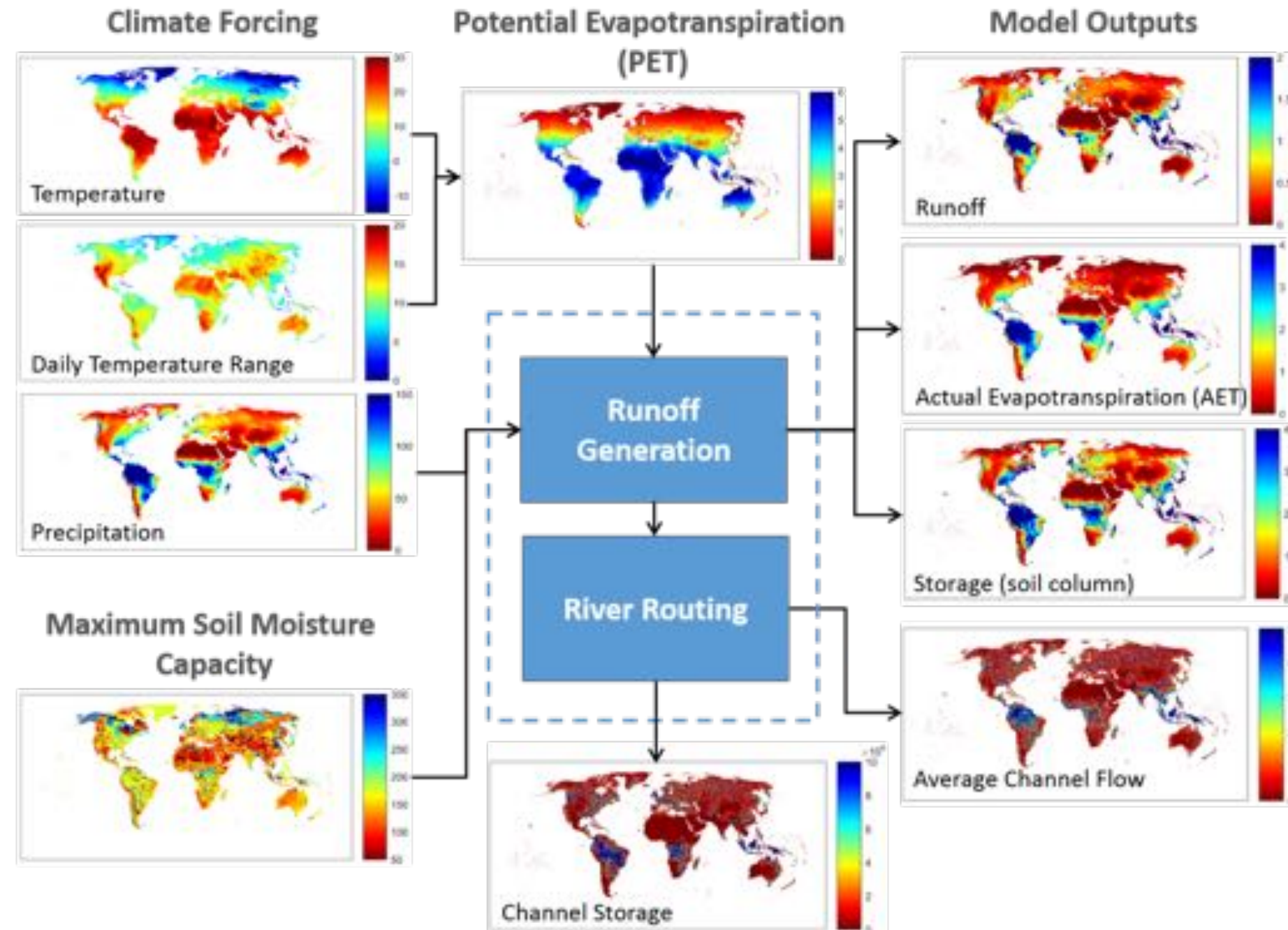
Hydrology Group
PNNL

GCAM data system

energy water aglu socioecon ...



Xanthos is a **Global Hydrology Model**

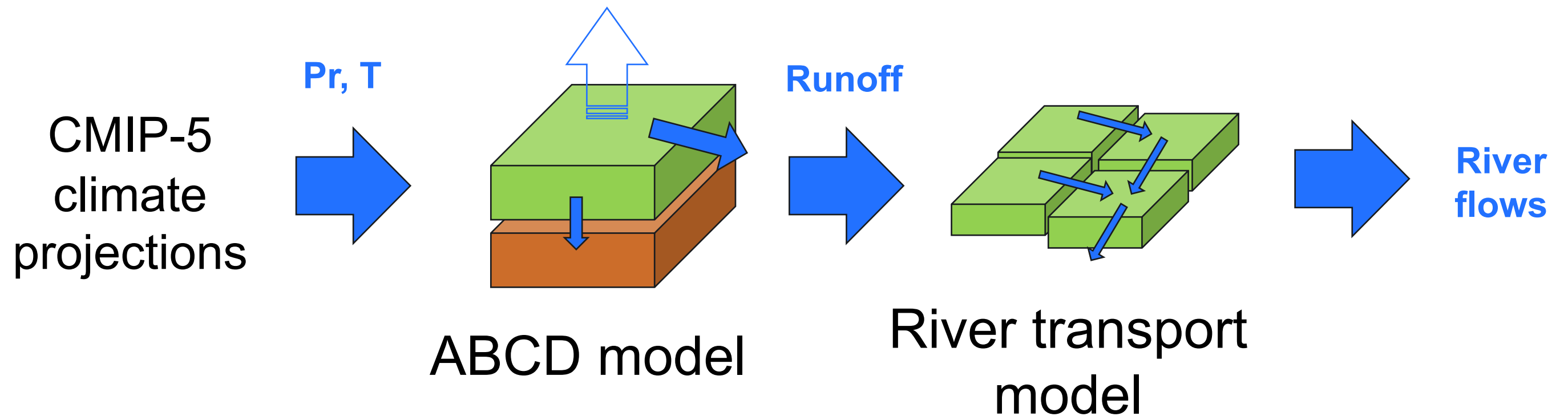


Li, Vernon,
Hejazi, Link, et al.
JORS, 2017

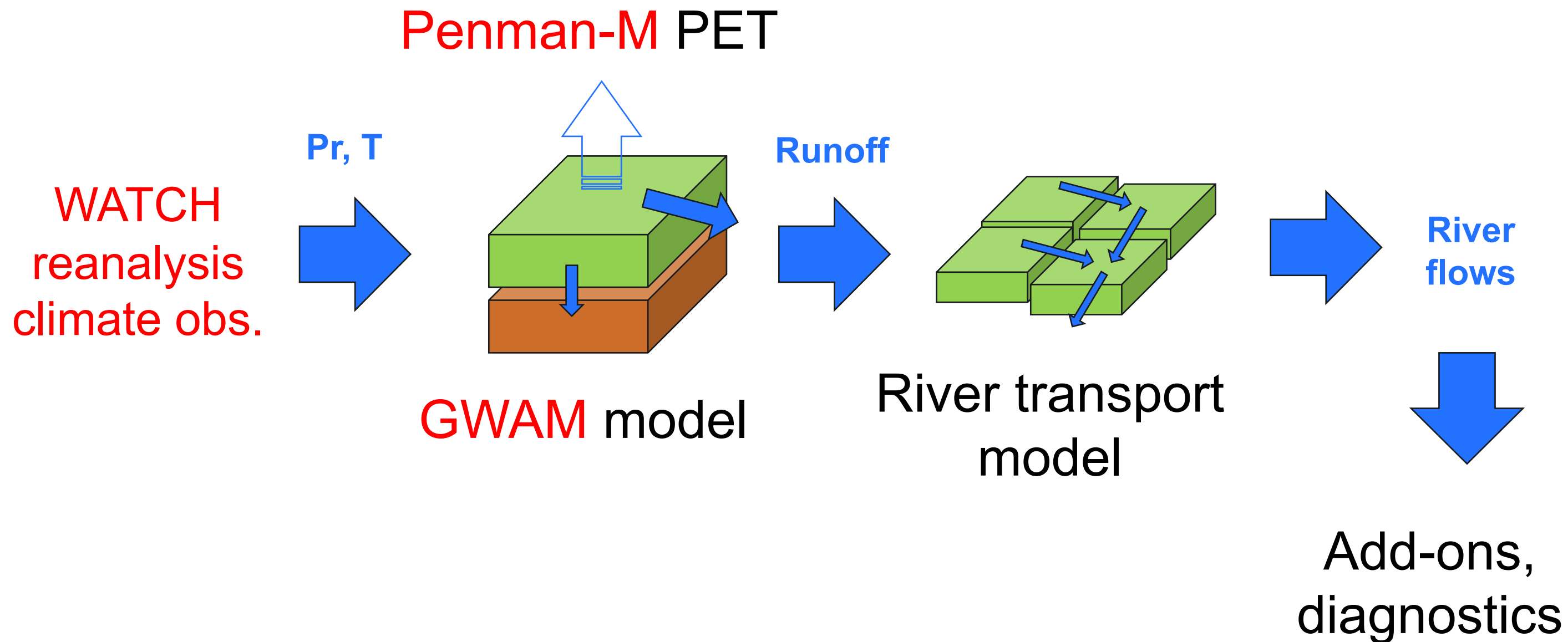
Vernon, Hejazi, et
al. **JORS**, 2018
(in review)

Xanthos features an **extensible, modular** structure

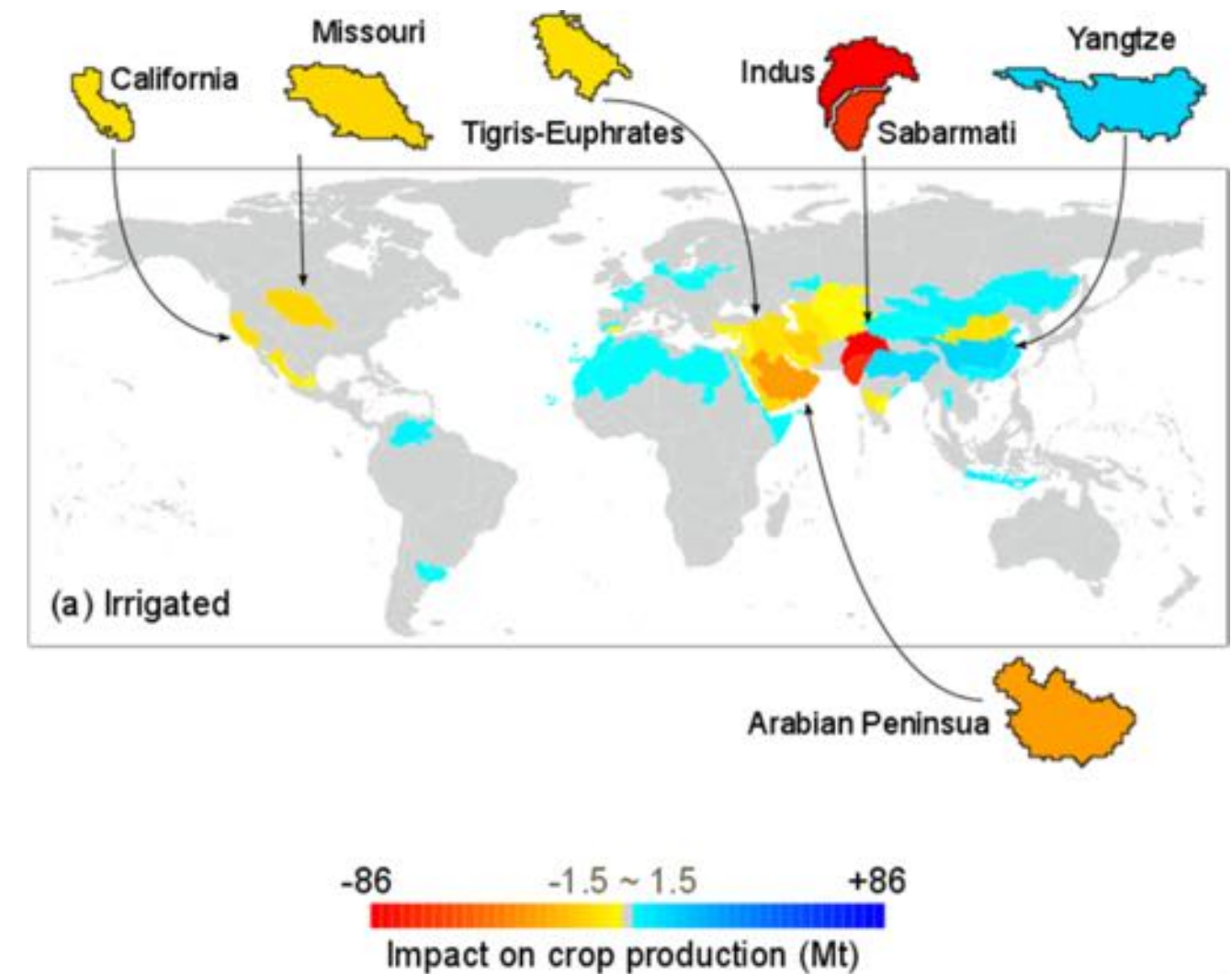
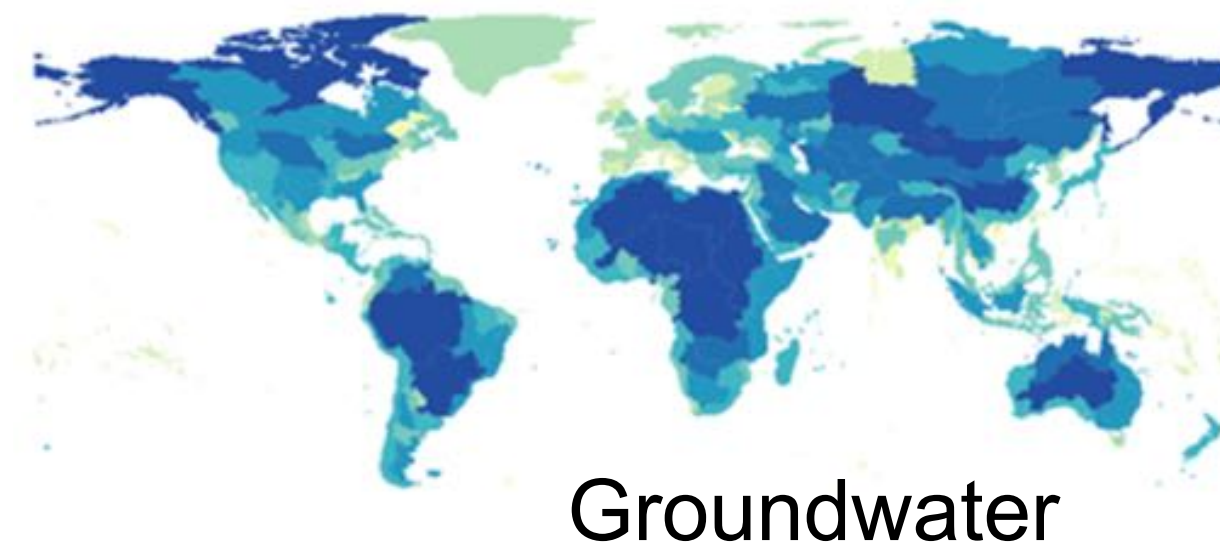
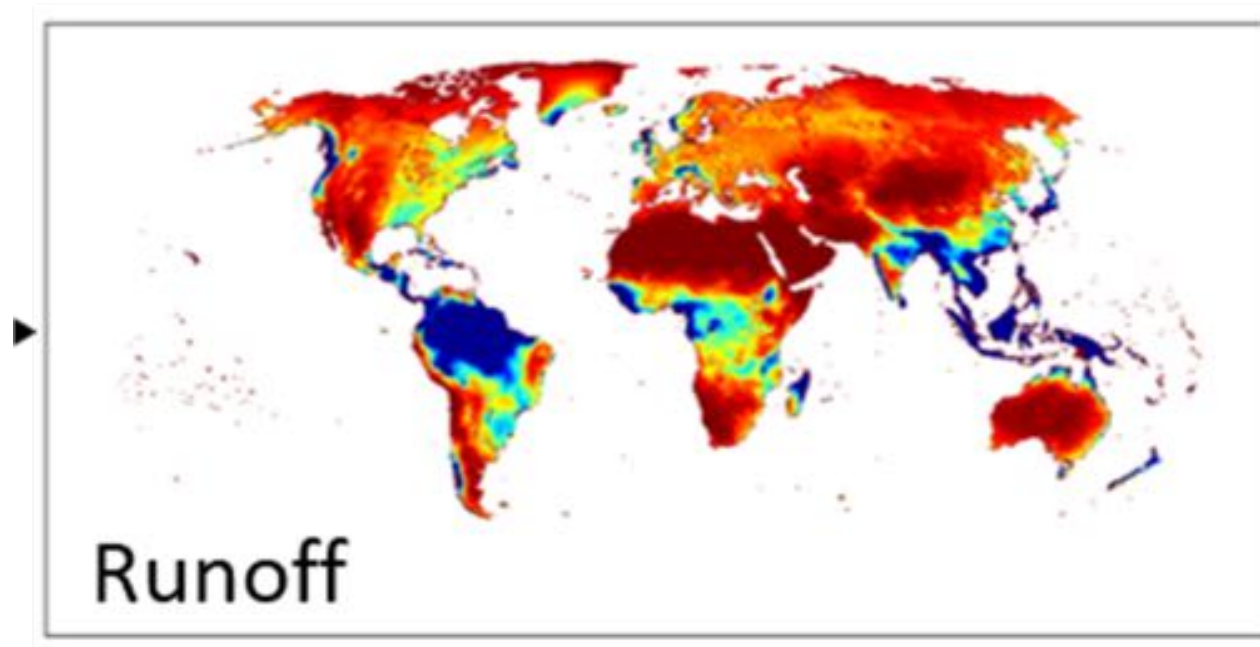
Hargreaves PET



Xanthos features an **extensible, modular** structure



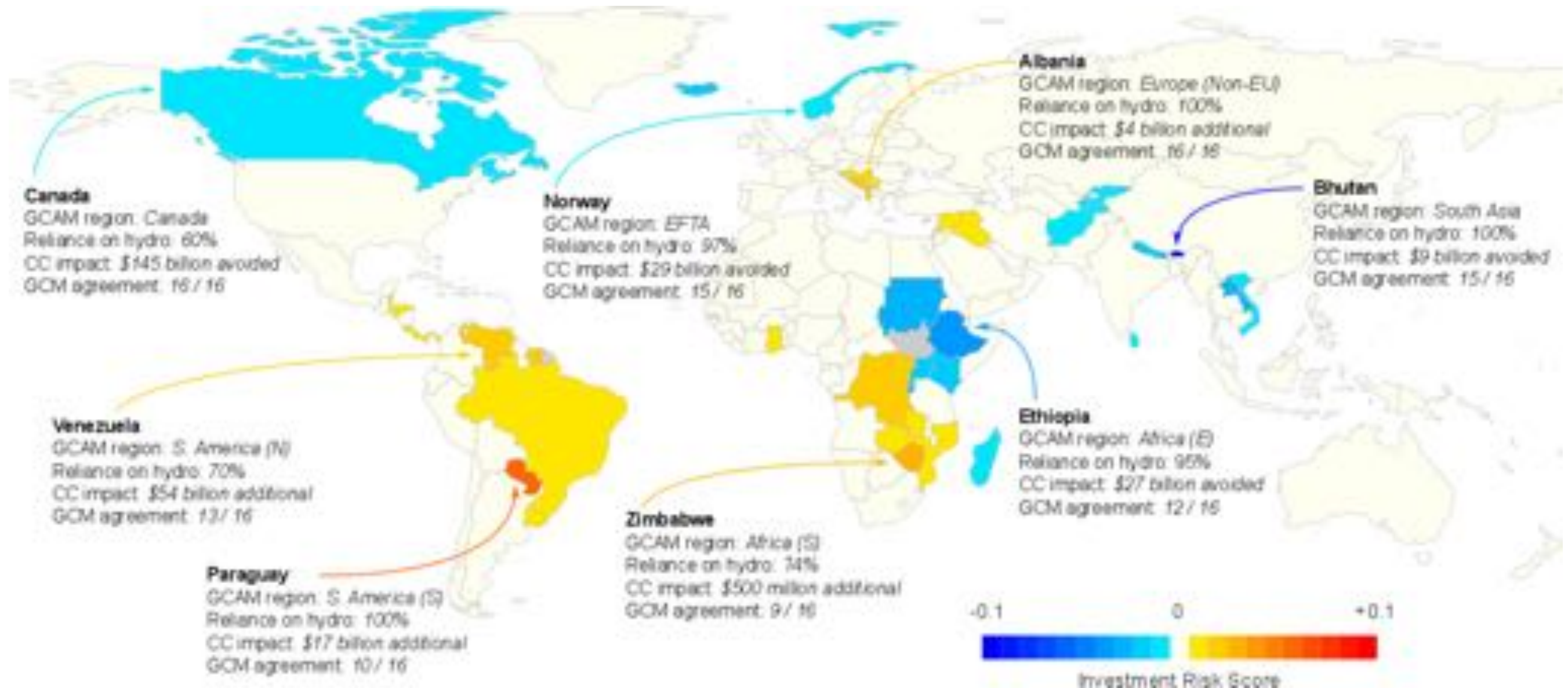
Xanthos can populate **water availability** in GCAM



Xanthos can compute **hydropower generation**



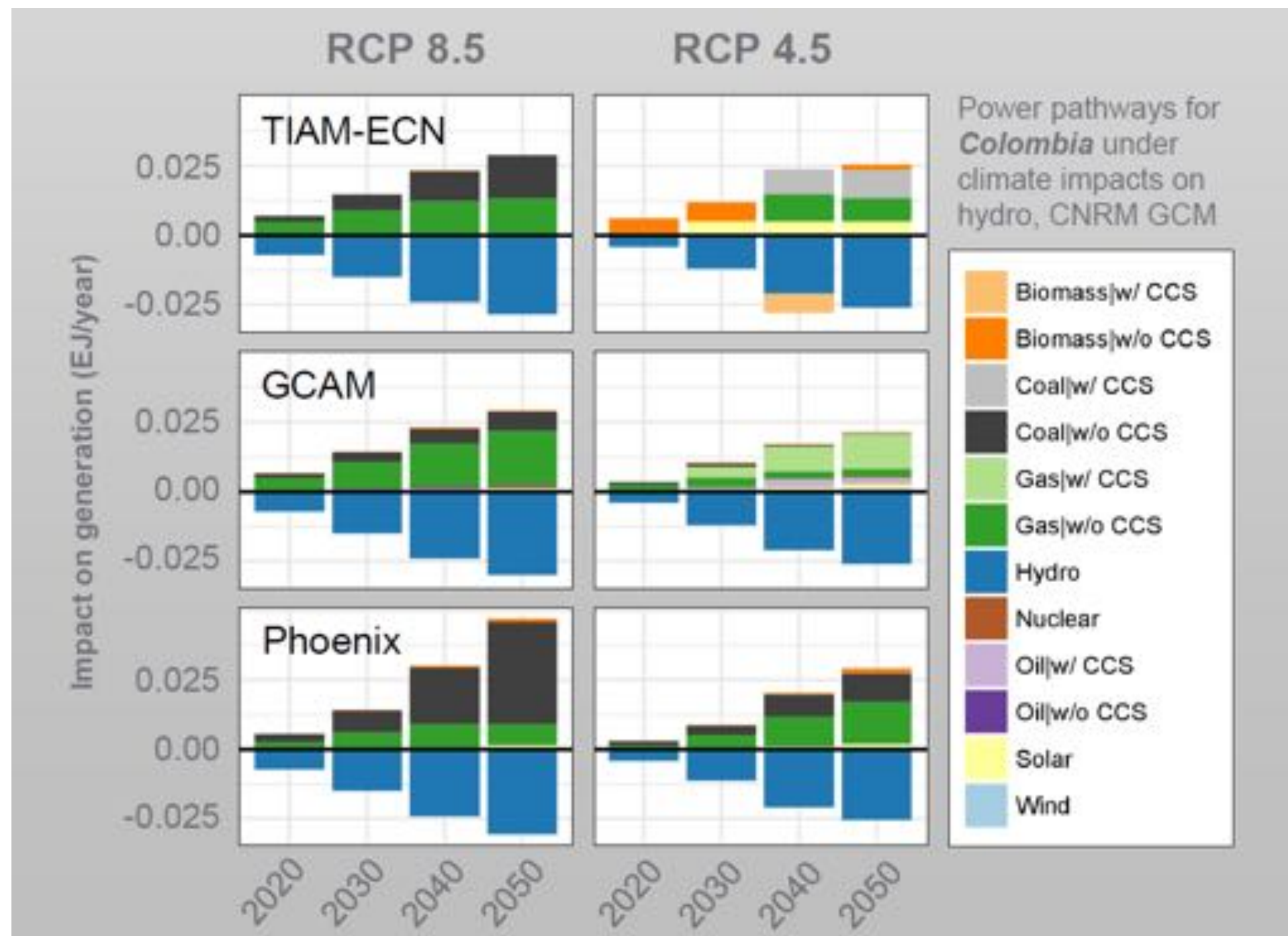
Xanthos can compute **hydropower generation**

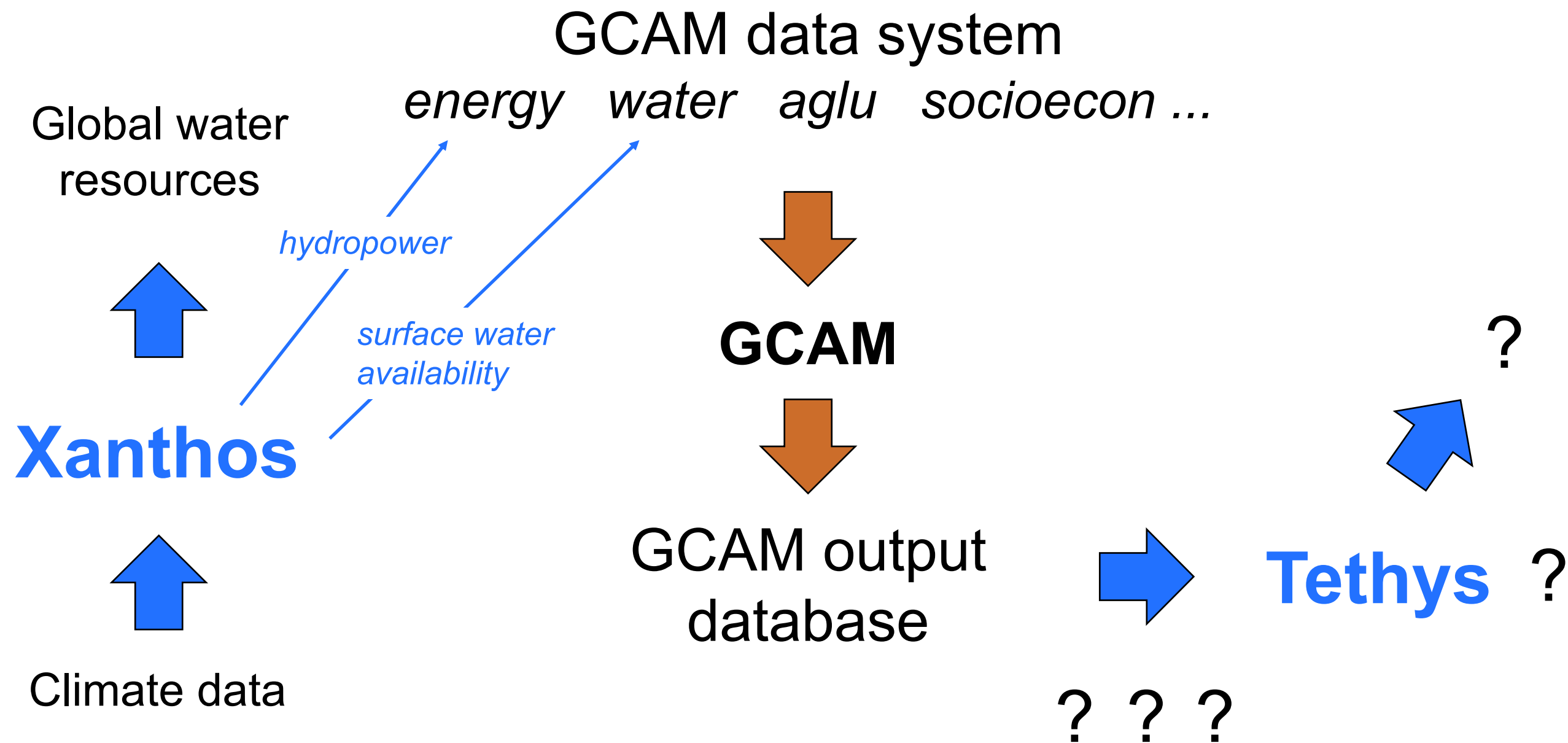


Turner et al. (2017) Climate impacts on hydropower and implications for global electricity supply investment needs. *Energy*, 141, 2081-2090.

Xanthos outputs can supply other models

Arango-Arumburo et al. (in review) Climate impacts on hydropower in Colombia: a multi-model assessment of power sector adaptation pathways. *Energy Policy*





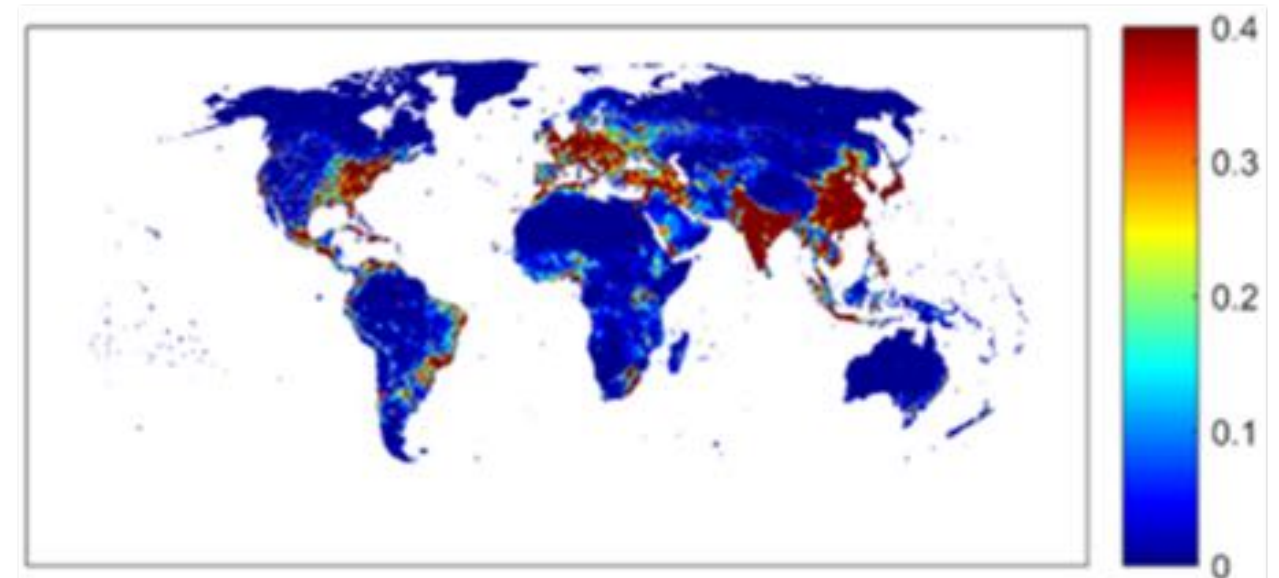
Tethys is a **water demand downscaling** tool

Annual domestic water demands by basin

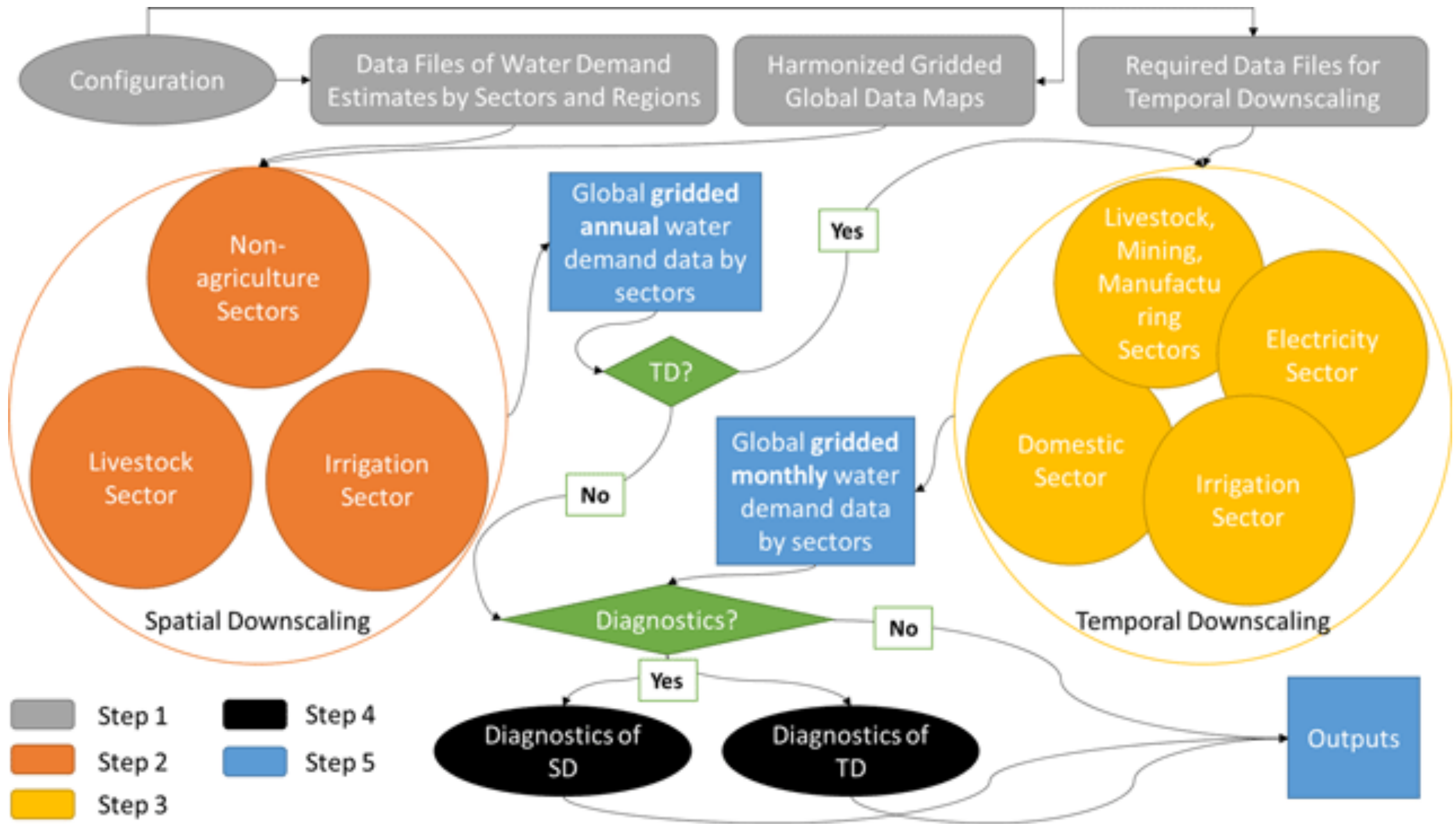


km³ / basin / year

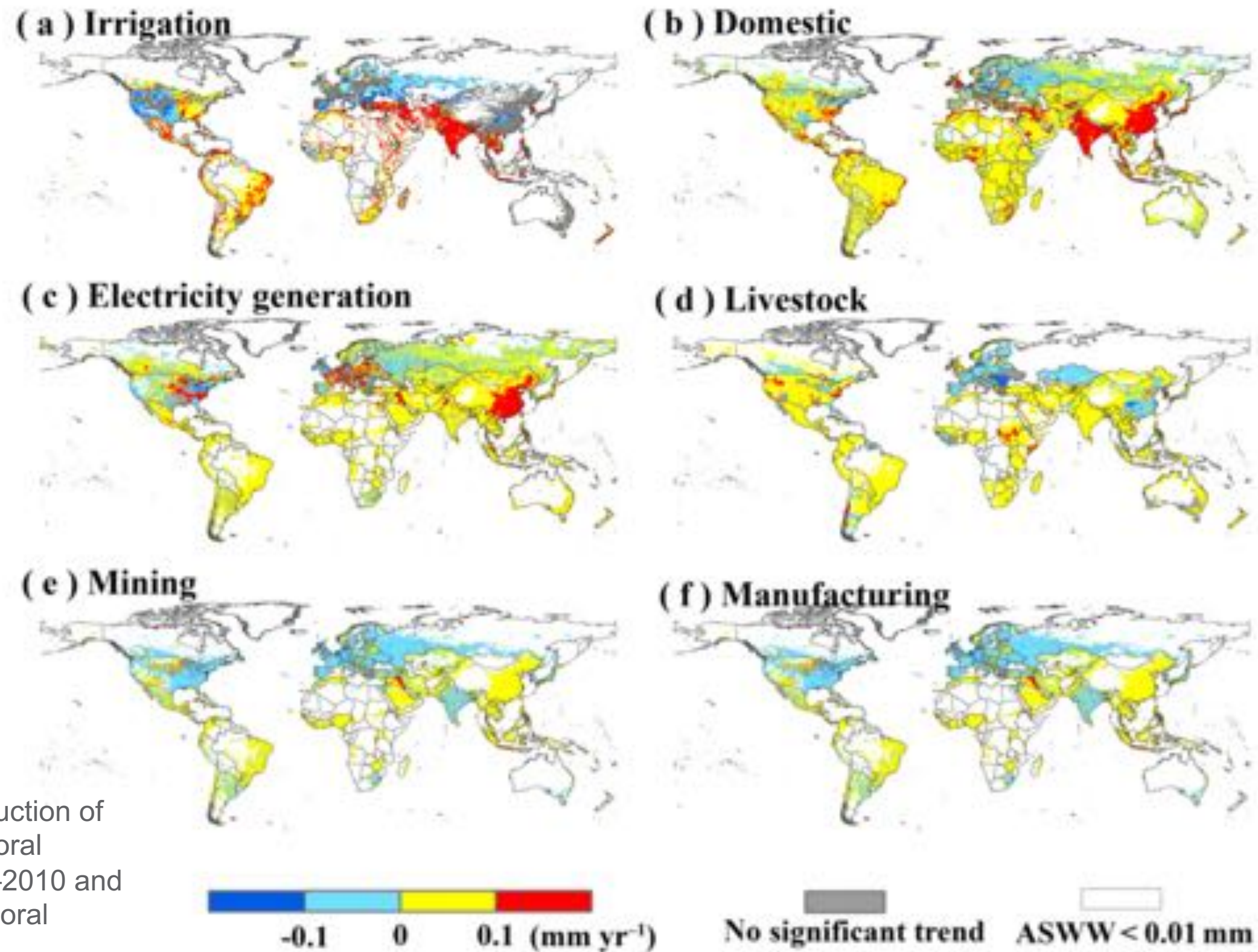
Monthly domestic water demands by grid



km³ / grid sq / month

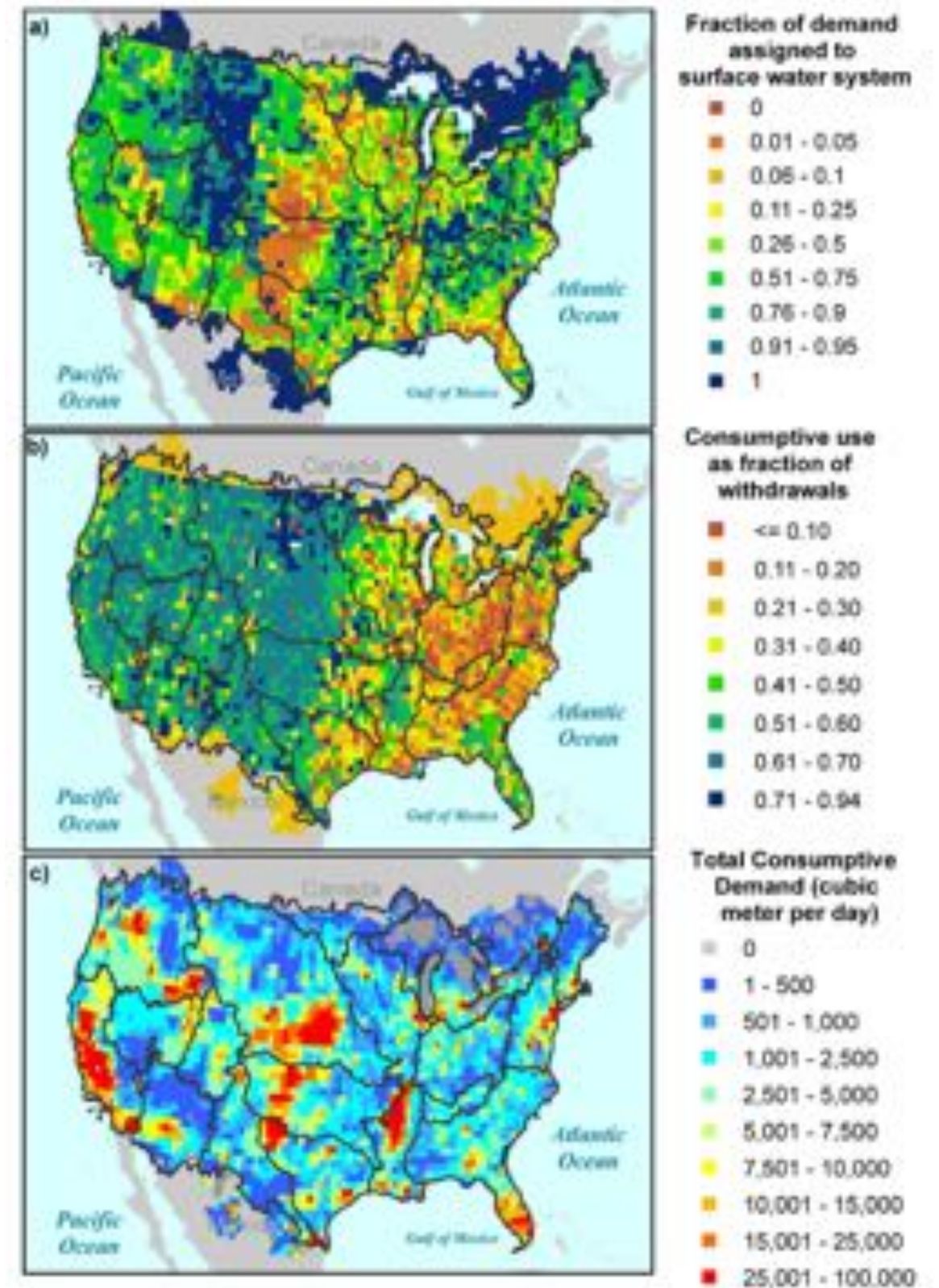
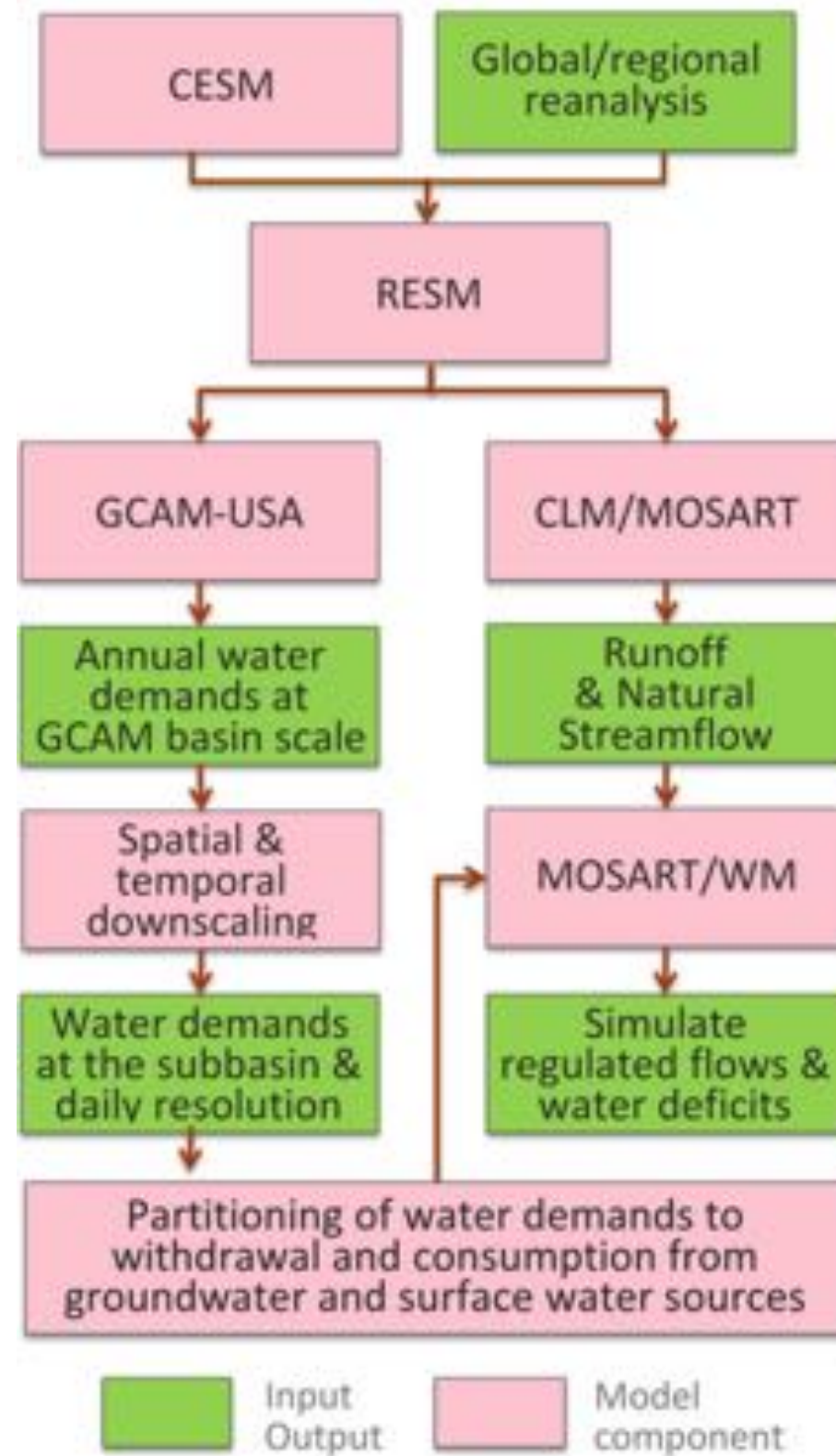


Trends in water demands 1971 - 2010



Huang et al. 2017 Reconstruction of global gridded monthly sectoral water withdrawals for 1971–2010 and analysis of their spatiotemporal patterns. *HESS*, 3(5).

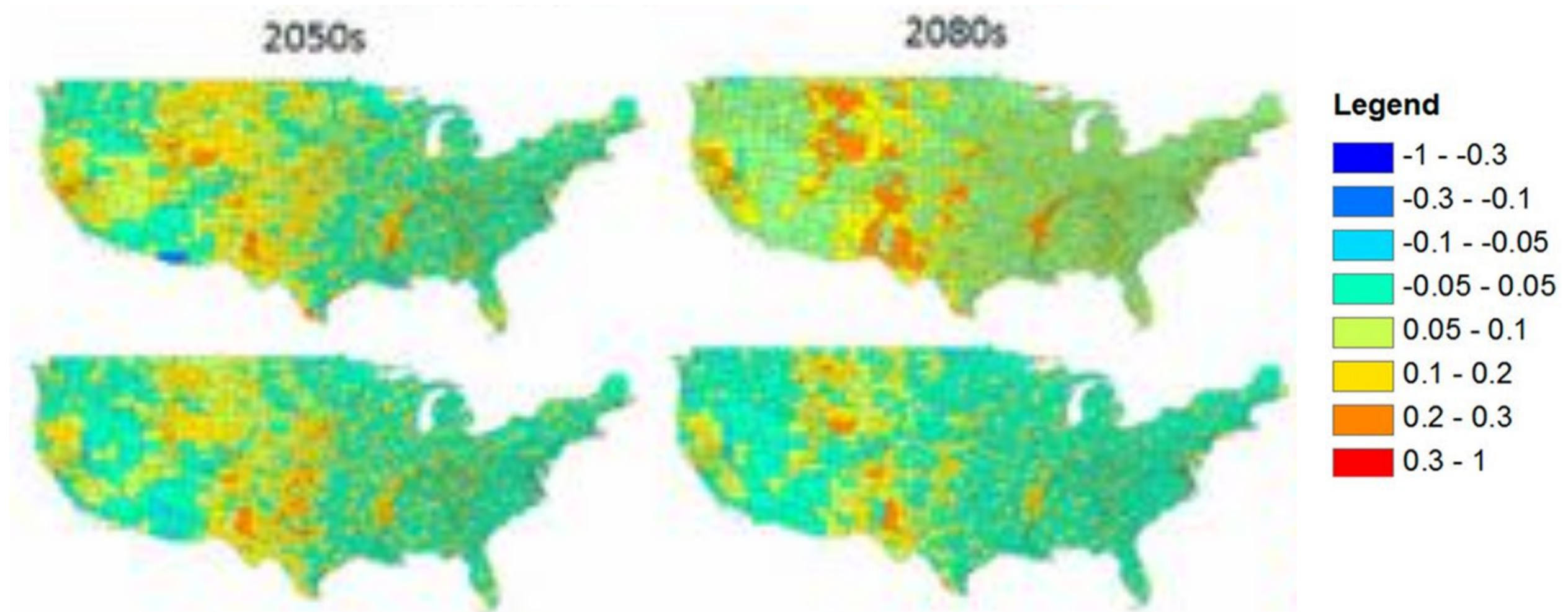
Voisin et al. (2018)
Effects of spatially distributed sectoral water management on the redistribution of water resources in an integrated water model,
Water Res. Res., 53(5).



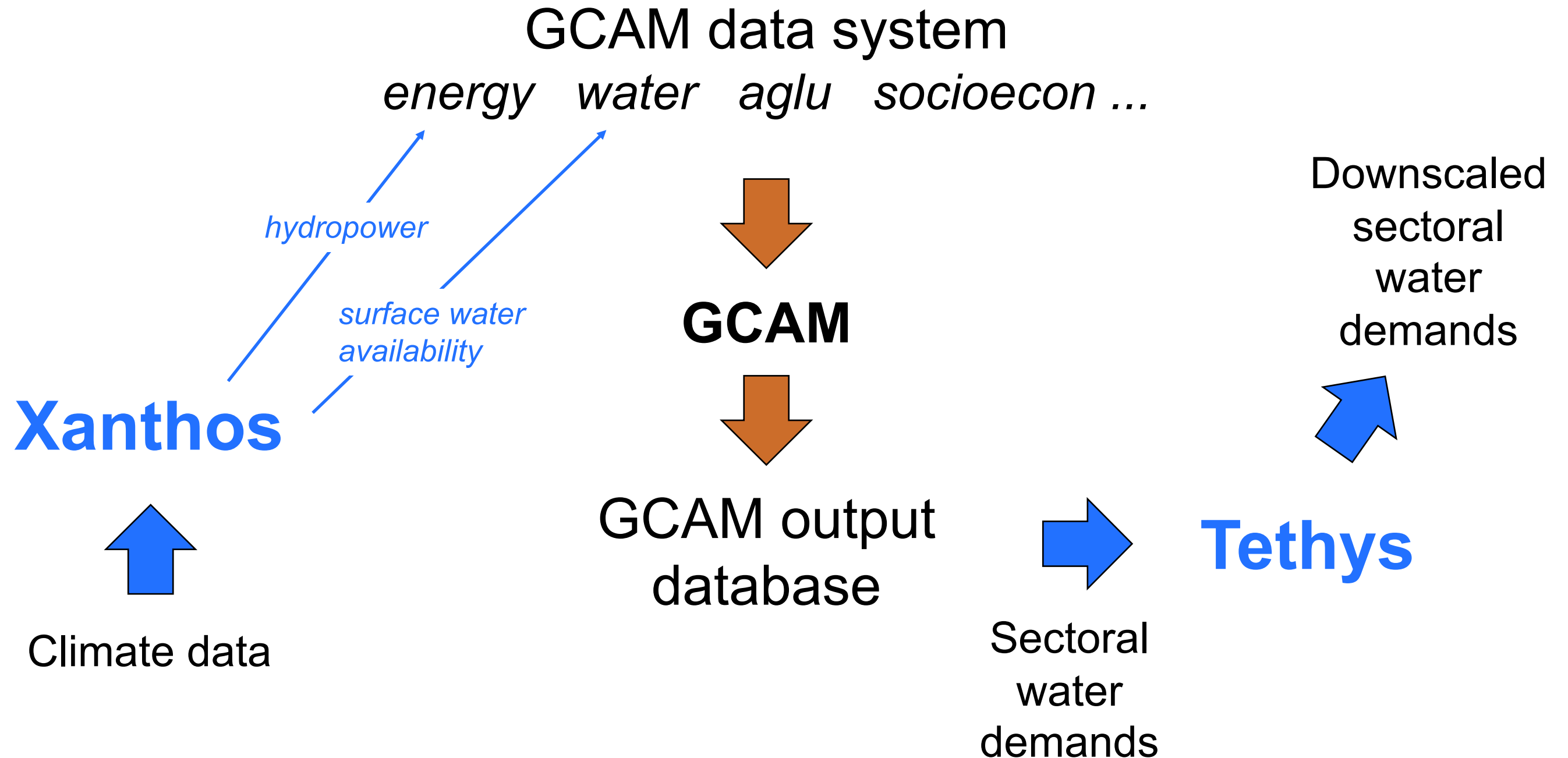
GCAM provides **consistent boundary conditions**

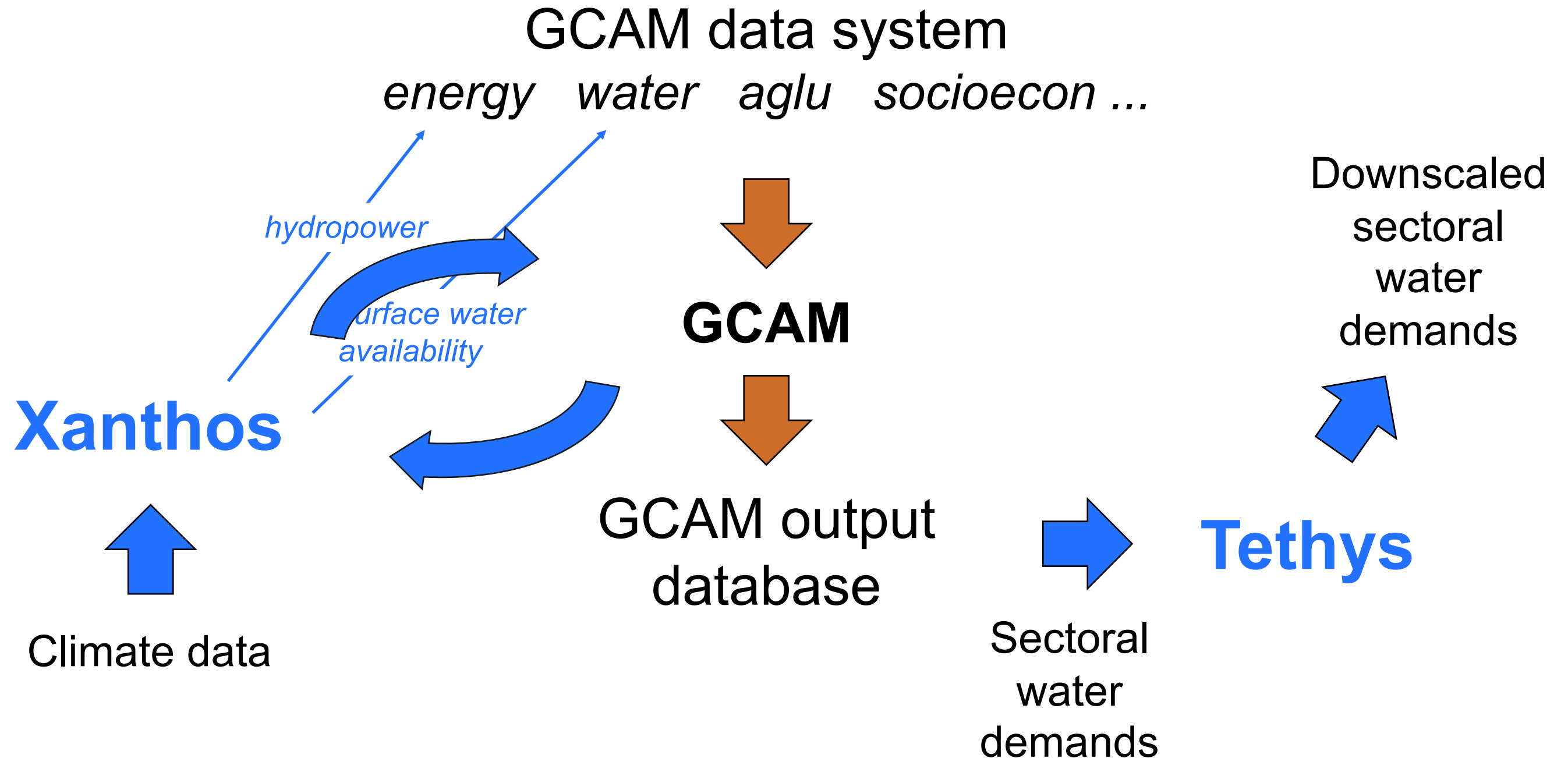
RCP4.5

RCP8.5



Water deficit as fraction of historical





Thank you

sean.turner@pnnl.gov

