

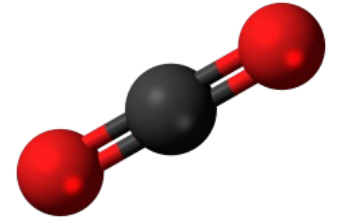
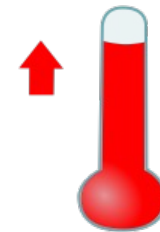
Can past variability help us understand catchment response to future climate change?

C. M. Stephens, L. A. Marshall, F. M. Johnson, L. Lin, L. E. Band and H. Ajami



The research problem

- **Distinct climatic periods (e.g. drought) are often used as proxies for future climate change in hydrologic assessments**
- **However, climate change will also involve:**
 - Long-term persistence of rainfall shifts
 - Simultaneous temperature increases
 - Higher carbon dioxide concentrations
- **None of this exists in the past record – so how much more could catchments ultimately be affected???**



Examples

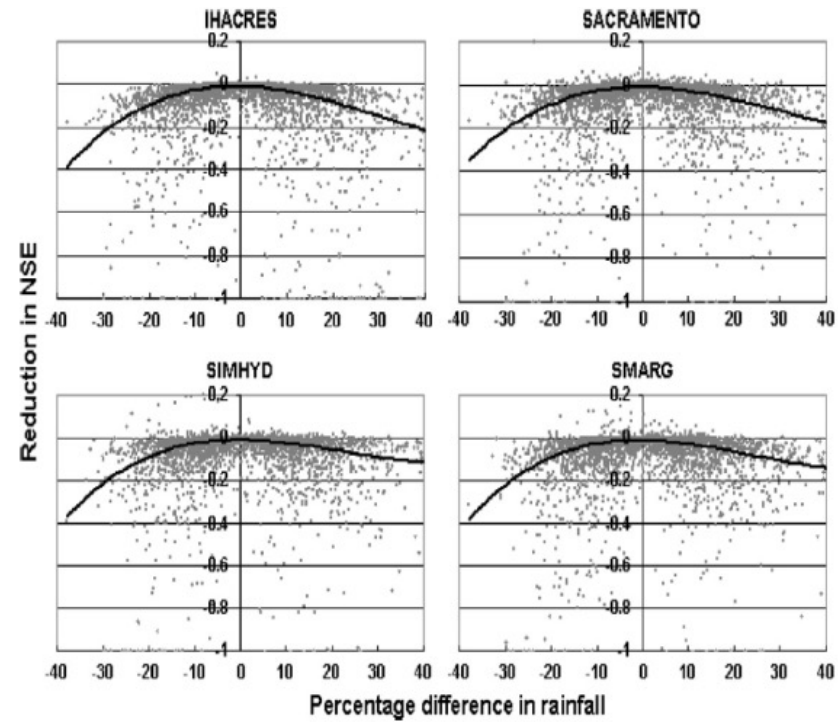


Image from Vaze et al. (2010)

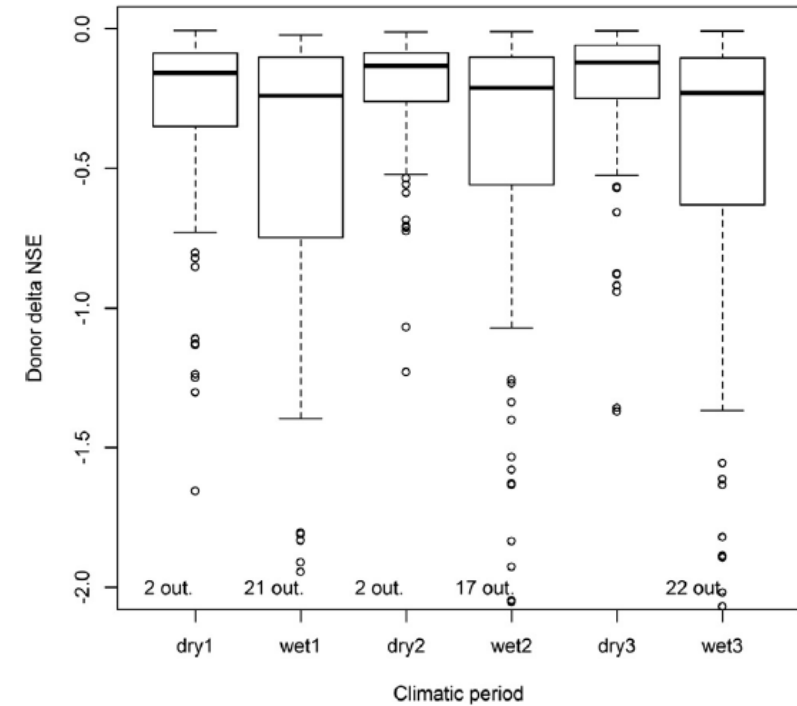
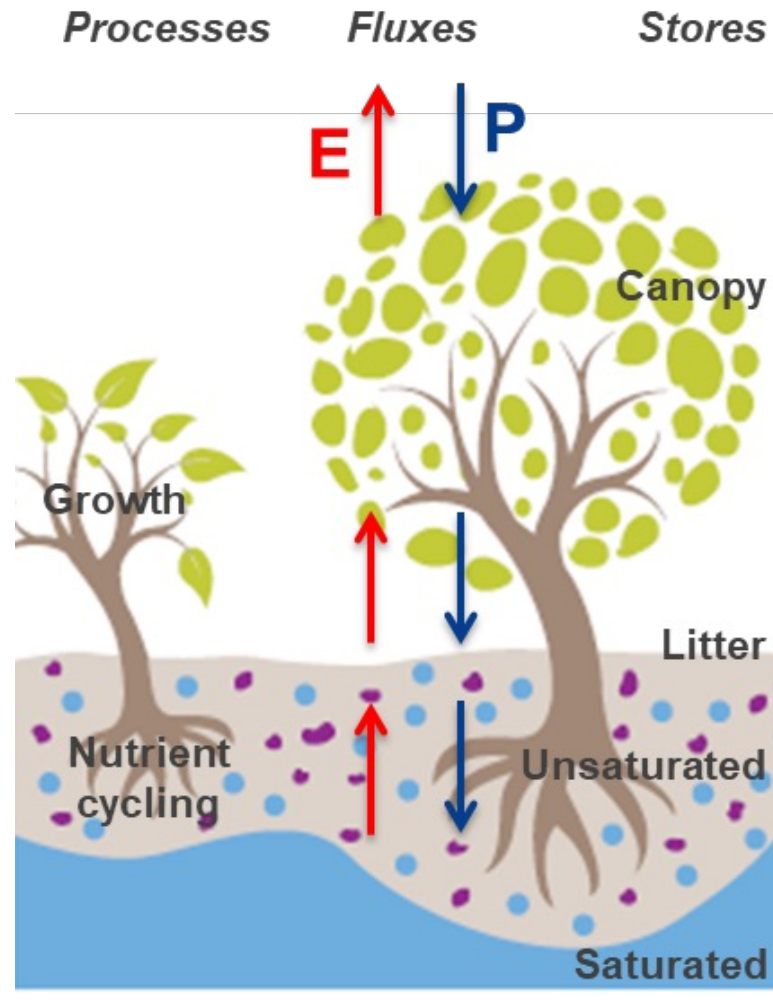


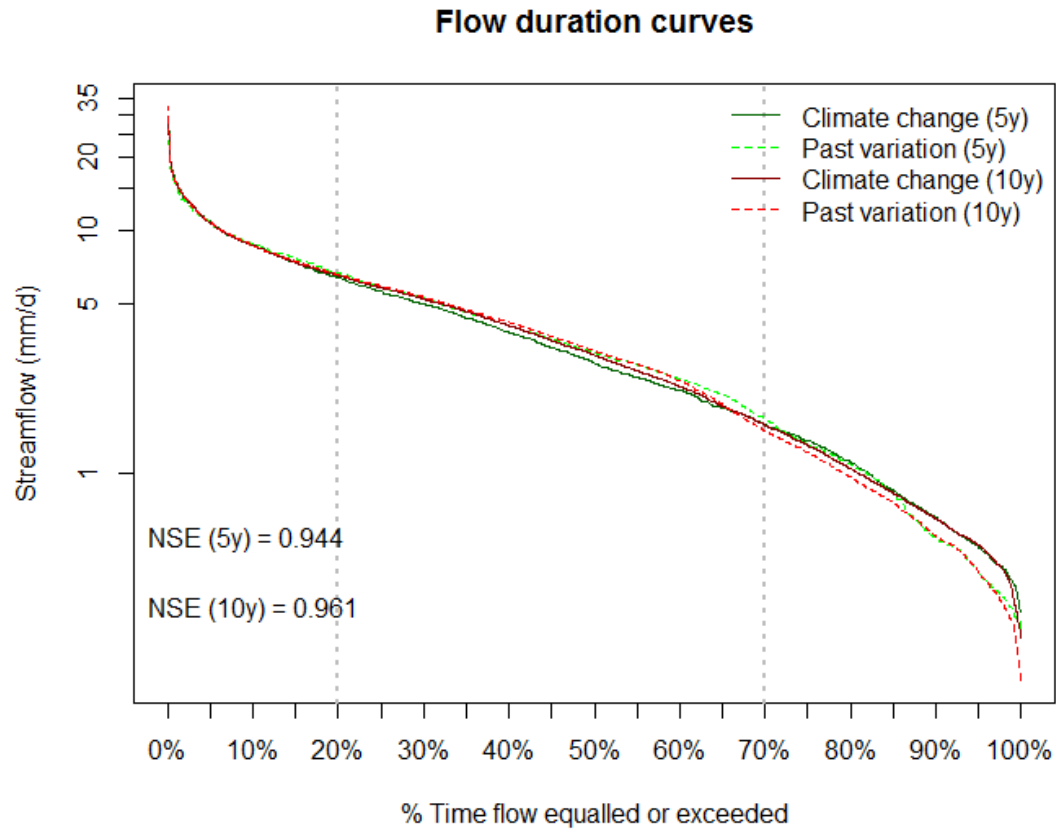
Image from Stephens et al. (2019)

RHESSys as a virtual catchment

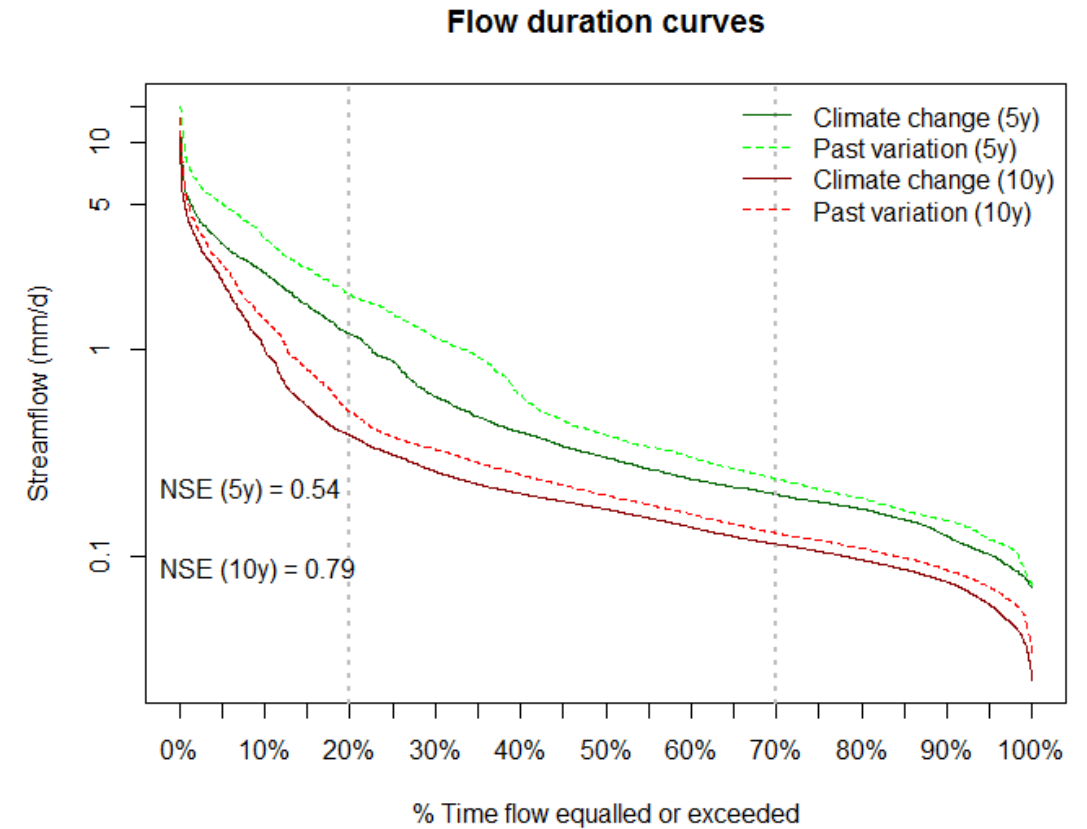


Comparing the overall flow regime

Wetter future climate



Drier future climate



Implications for hydrology

- **Past variability may not indicate climate change response**
- **Models are likely more vulnerable than we think**

Stephens, C. M., et al. (2020). "Is Past Variability a Suitable Proxy for Future Change? A Virtual Catchment Experiment." *Water Resources Research* 56(2): e2019WR026275 <https://doi.org/10.1029/2019WR026275>

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