

# From Climate Model Ensembles to Climate Change Impacts: a case study of water resource management in the South West of England.

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# Outline

1. Large ensemble climate data.
2. Impact models
  - river flows modelling
  - water resources system model
3. Results
  - business as usual supply/demand scenario
  - adaptation options
4. Discussion.



# Large GCM Ensemble: CPDN

- Explore climate model uncertainty by varying settings of poorly constrained model parameters
- HADCM3L model: standard atmosphere and low resolution ocean.
- 26 perturbed parameters (radiation, large scale cloud formation, ocean circulation, sulphate cycle, sea ice formation and energy convection)
- Initial condition ensembles.
- Transient runs:
  - 1920-2000 forced with historical CO<sub>2</sub>, solar and volcanic forcing.
  - 2000-2080 forced with different possible scenarios



# Data Available

- Monthly mean (time series):
  - Global average
  - Large regions (Giorgi)
  - Selected grid-boxes (including UK)
- Variables include
  - Total precipitation rate
  - Convective cloud amount
  - Surface air temperature (1.5m)
  - Relative humidity (1.5m)

We analyse first complete 246 transient model runs,  
identical future forcing.



# Wimbleball Water Resource Zone

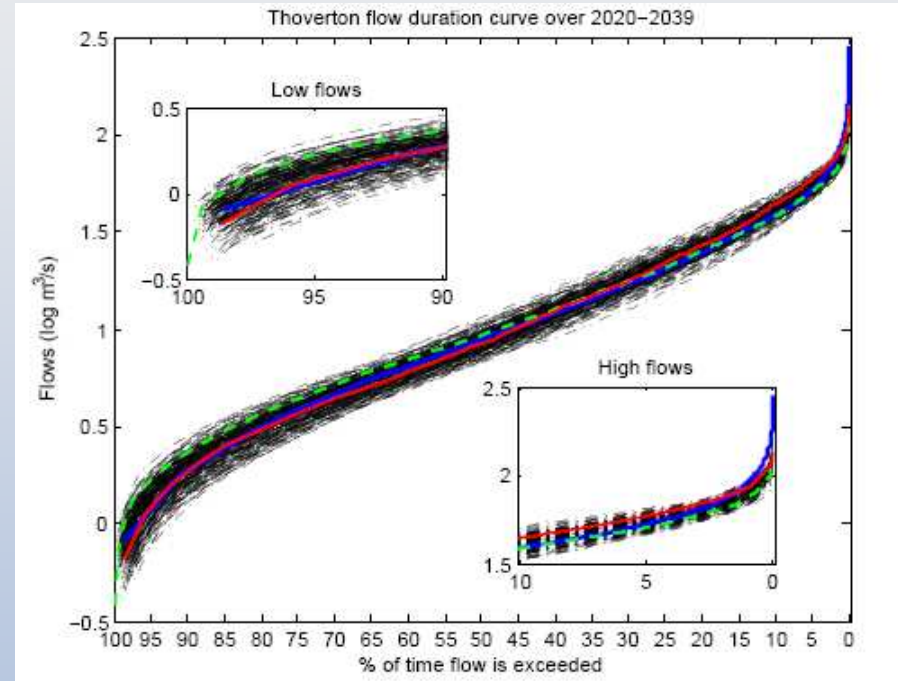
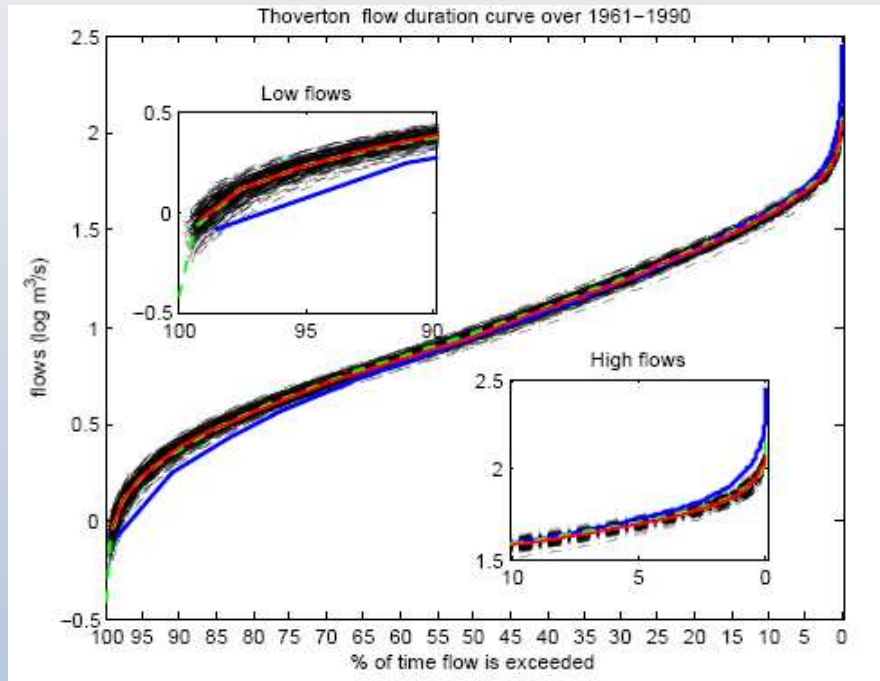


# Modelling Set-up

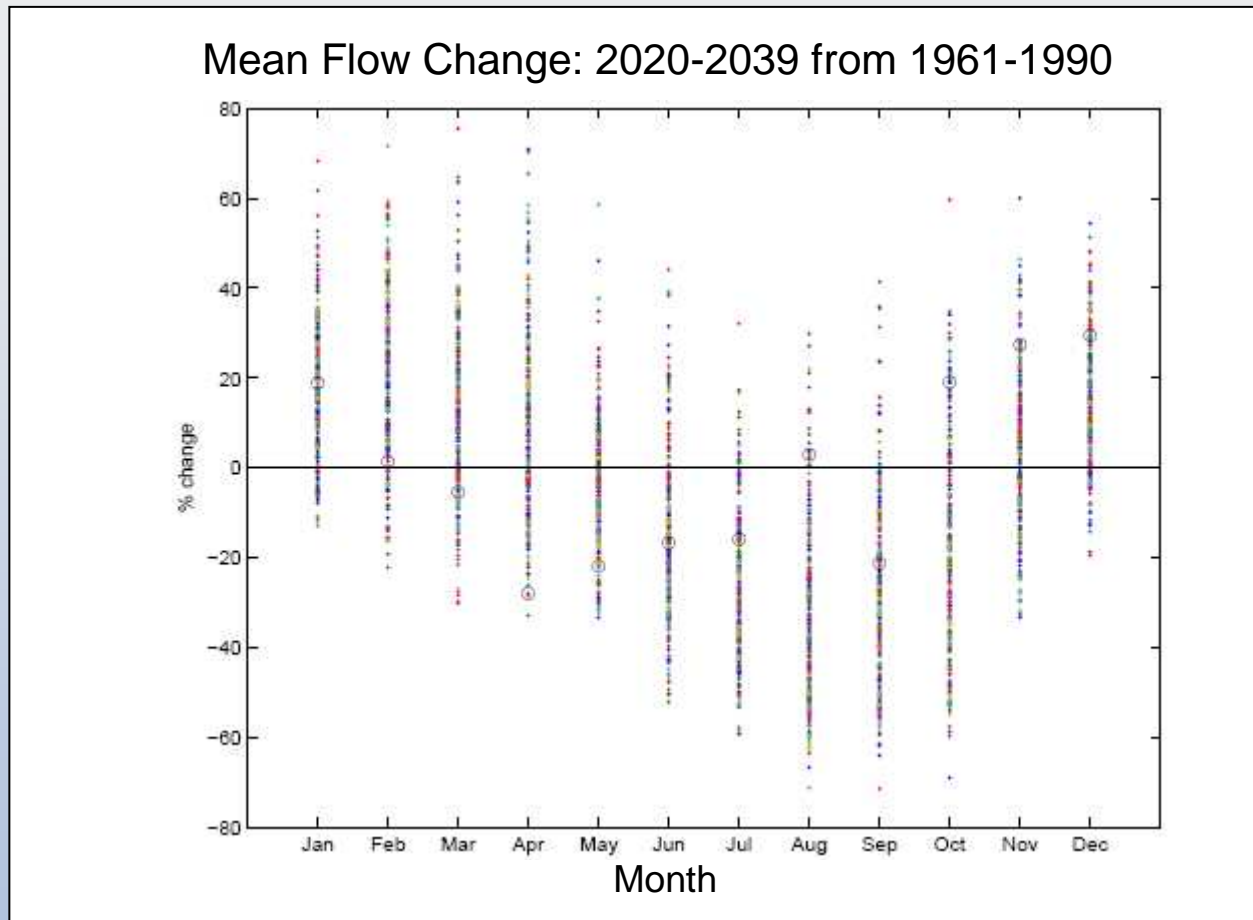
- Downscale climate in space and time
  - SW England -> River Exe
  - Monthly -> Daily
- Generate ensemble of daily river flows
  - CATCHMOD rainfall-runoff model
- Run flow-ensemble through water resource model



# River Flows

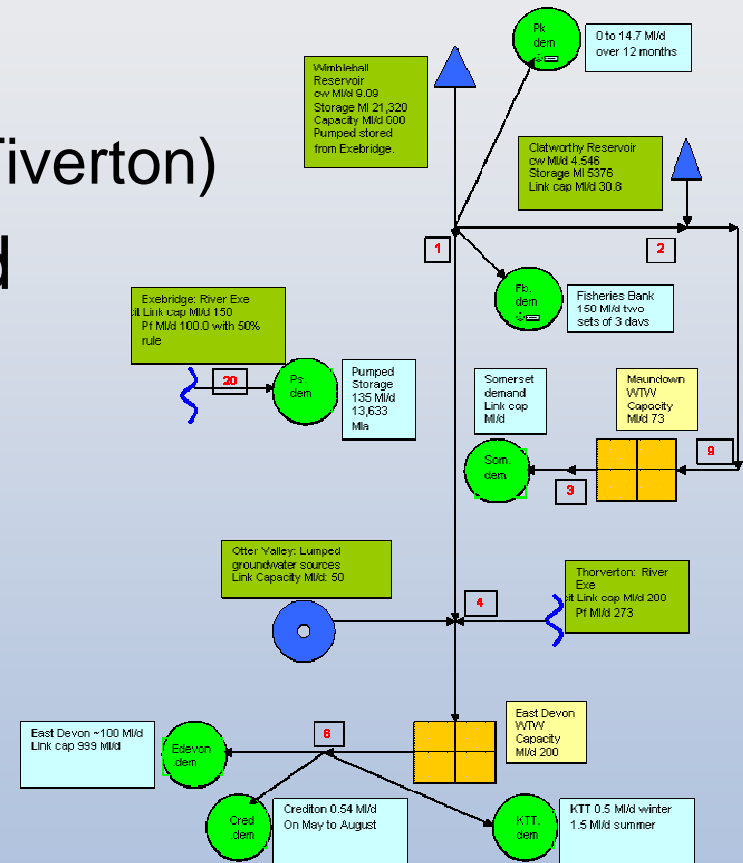
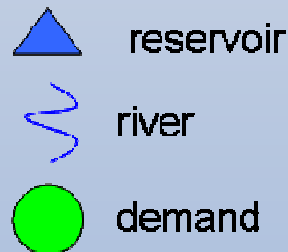


# River Flows

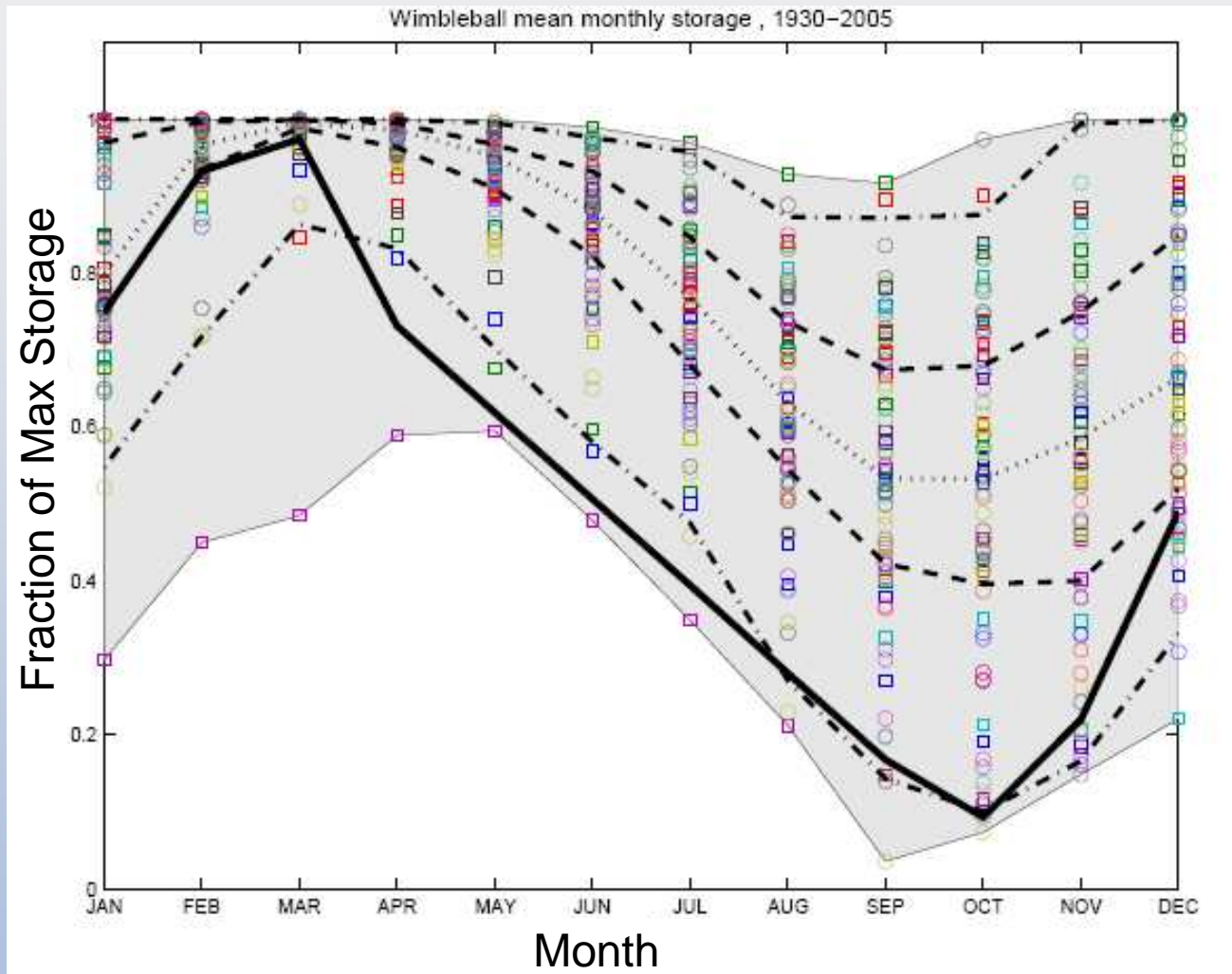


# Wimbleball Water Resource Model

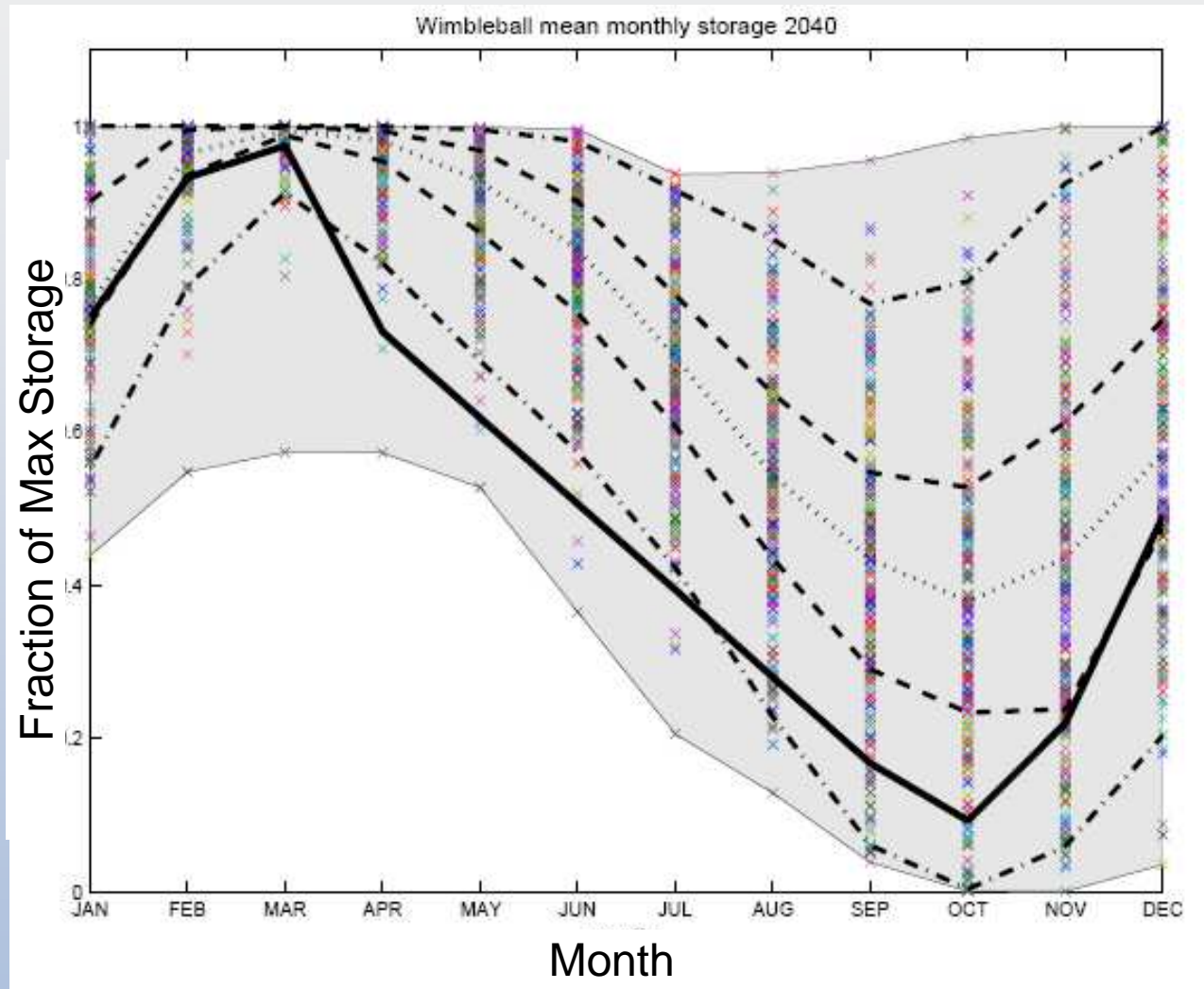
- Supplies:
  - Somerset & Devon (Exeter, Tiverton)
- River & reservoir dominated
- 50 ML/d Groundwater
- Lancmod WR model



# Wimbleball Reservoir: Historic

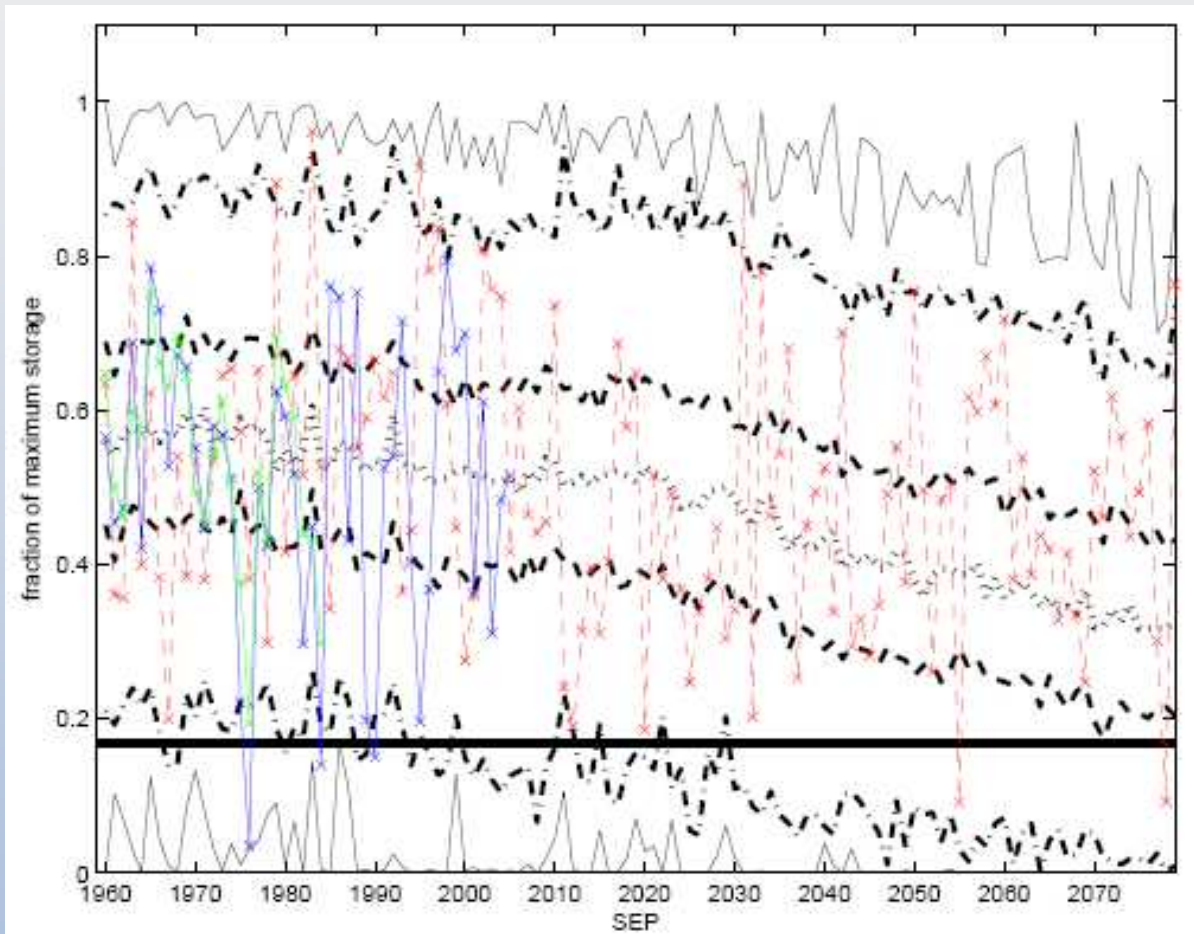


# Wimbleball Reservoir: 2040 Ensemble



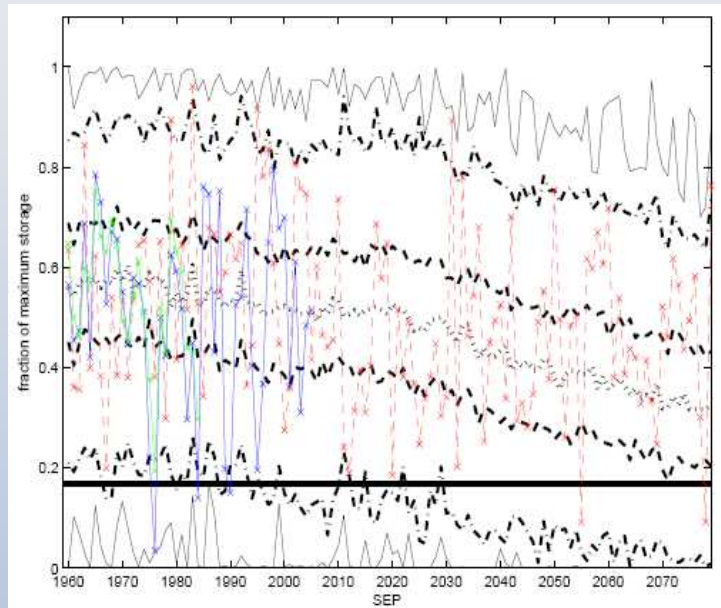
# Wembleball Reservoir: Changing Risk

Mean monthly storage



# Wimbleball Reservoir: adaptation options

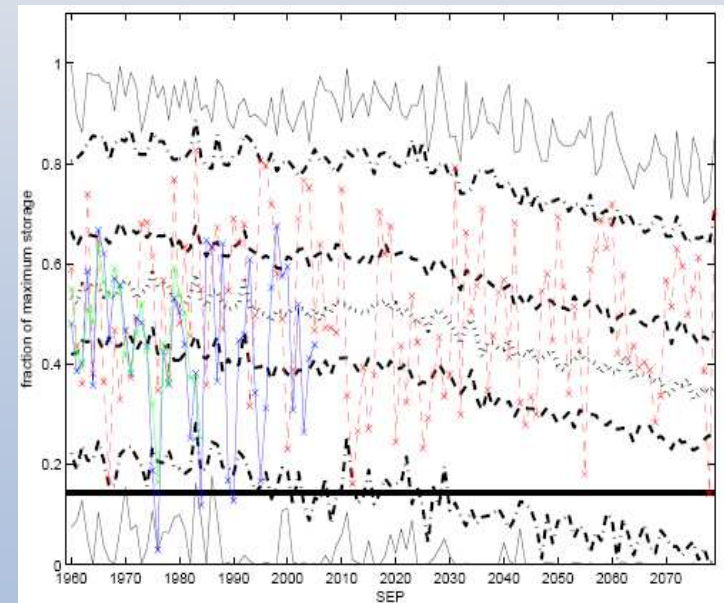
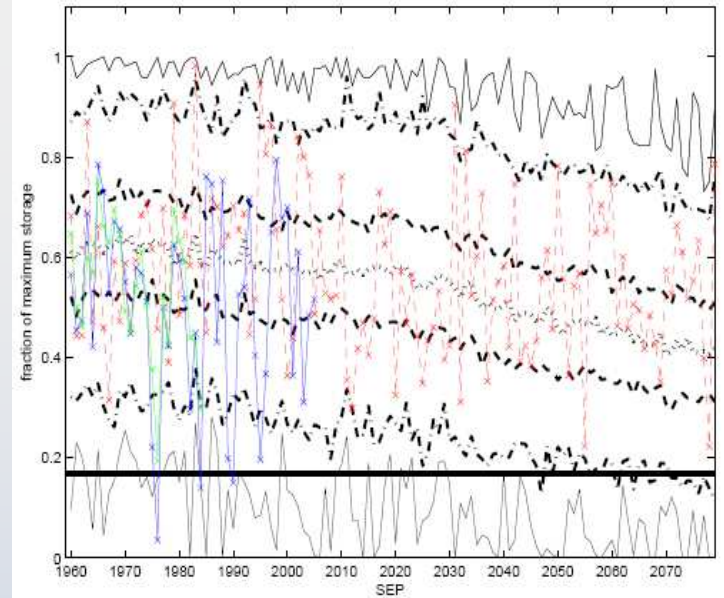
Reduce demands by 15%.

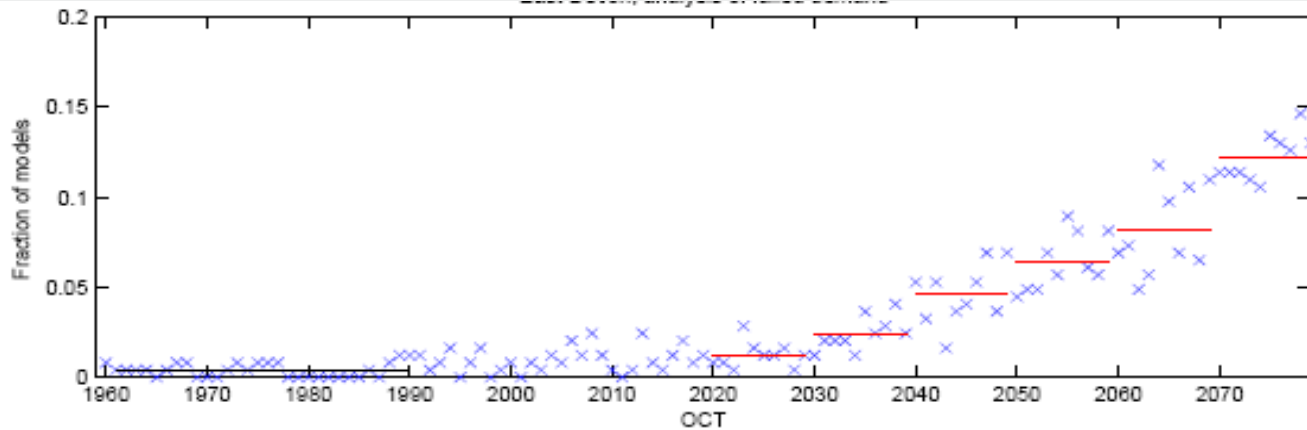


Current demand scenario

OR

Increase Wimbleball capacity by 18%





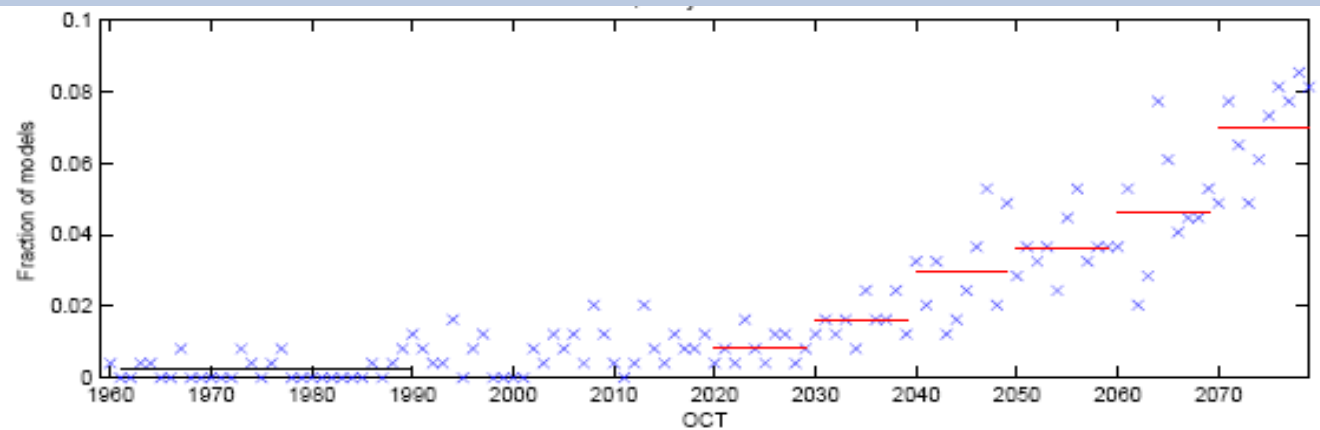
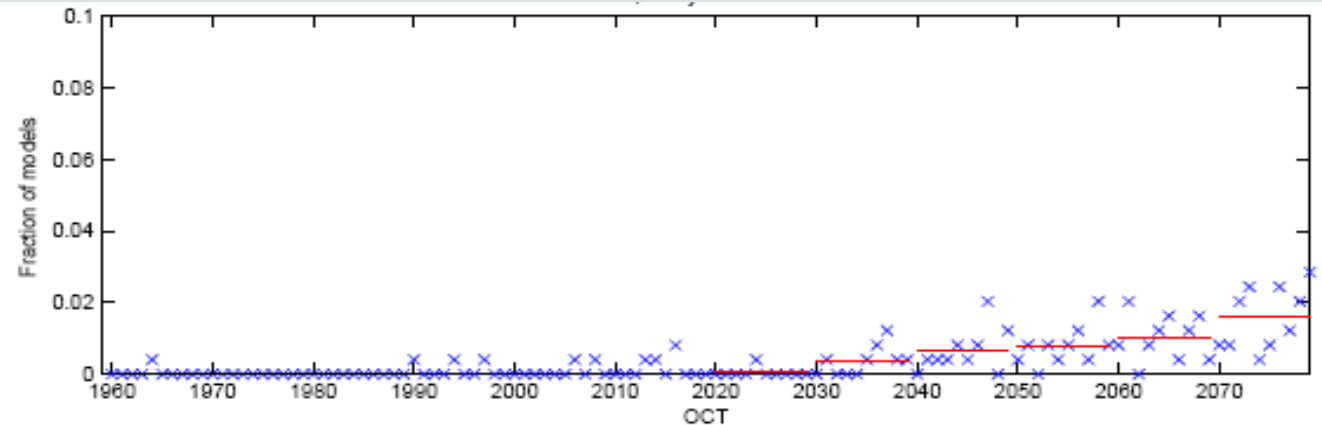
East Devon  
demand:  
adaptation  
measures

Current demand  
scenario

Reduce main  
demands by 15%.

**OR**

Increase  
Wimbledon  
capacity by 18%



# Discussion

Large climate model ensembles → information about full range of climate possibilities → better inform adaptation measures to impacts of climate change.

Just looked at climate information.

Next → integrated assessment of possible adaptation strategies including socio-economic and environmental factors.

Lessons generalizable to other sectors.



Thanks for your attention

**Tyndall**°Centre  
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