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Quantifying impacts of climate change on water resources in the limestone aquifers of the Caribbean

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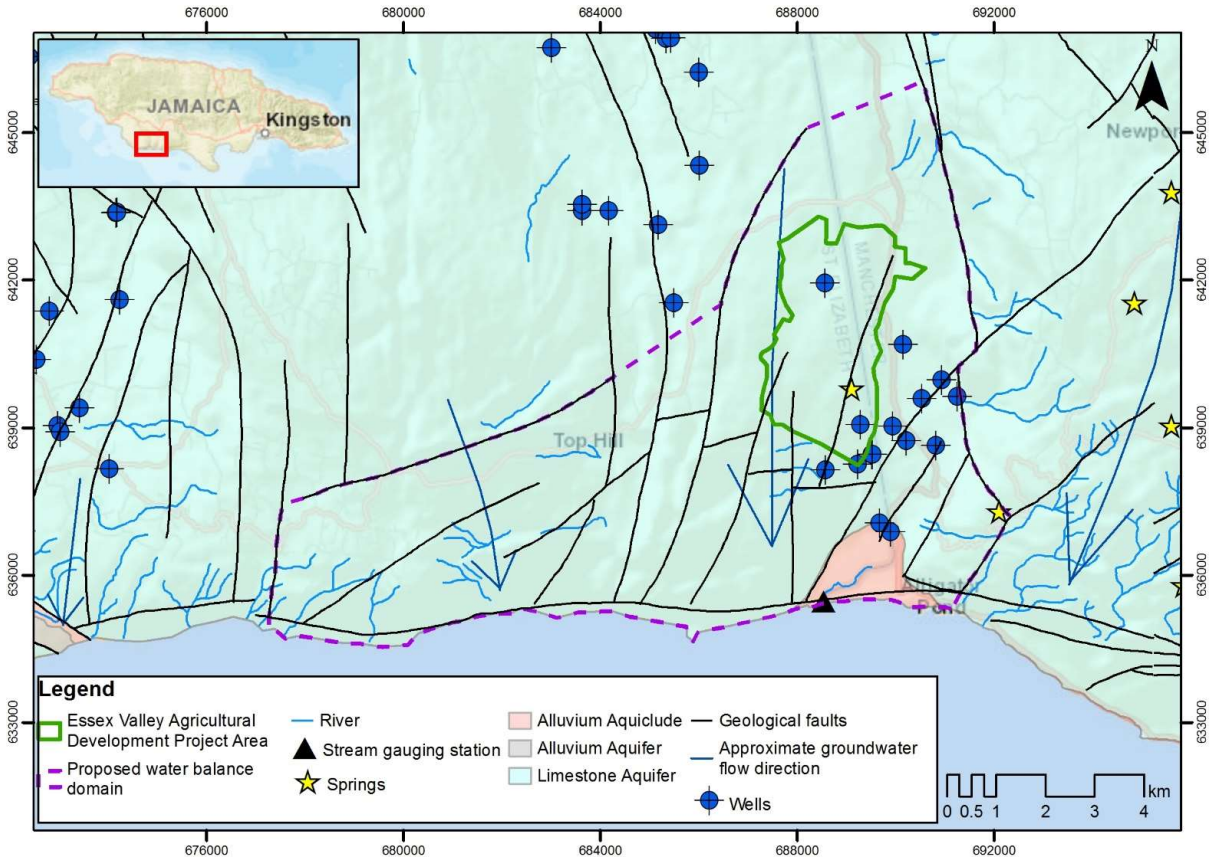
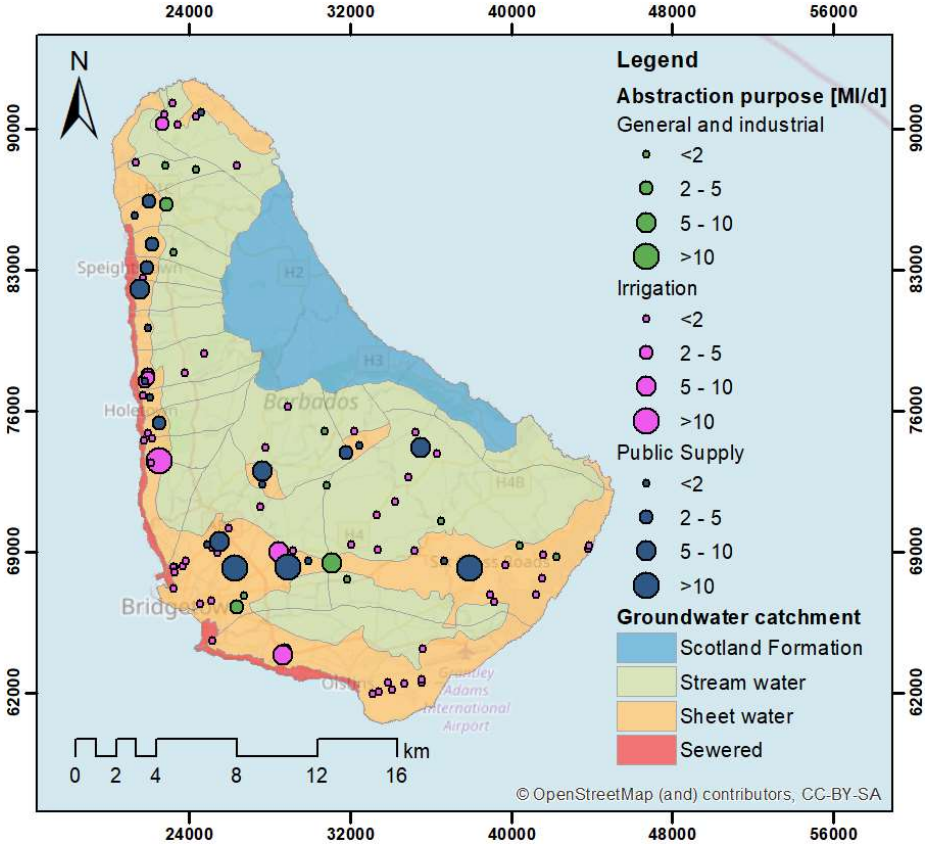
Introduction

Two case studies: irrigation scheme in Jamaica and water supply in Barbados





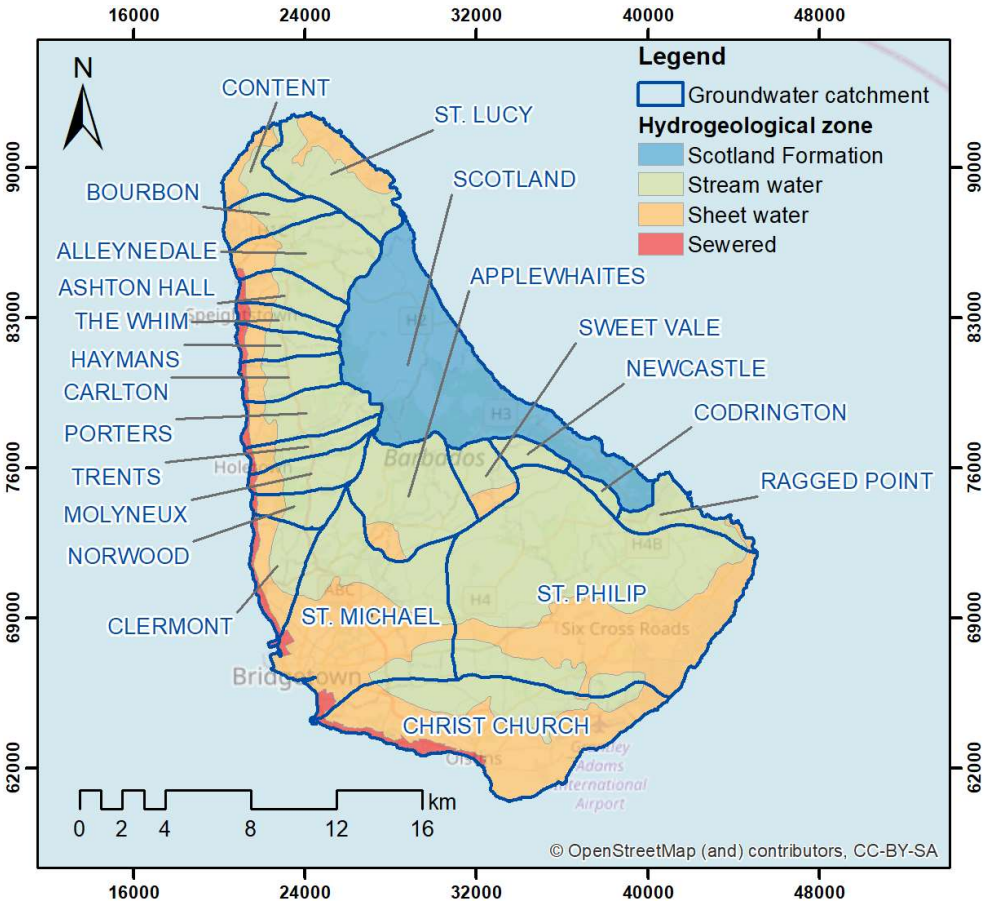
New Forest

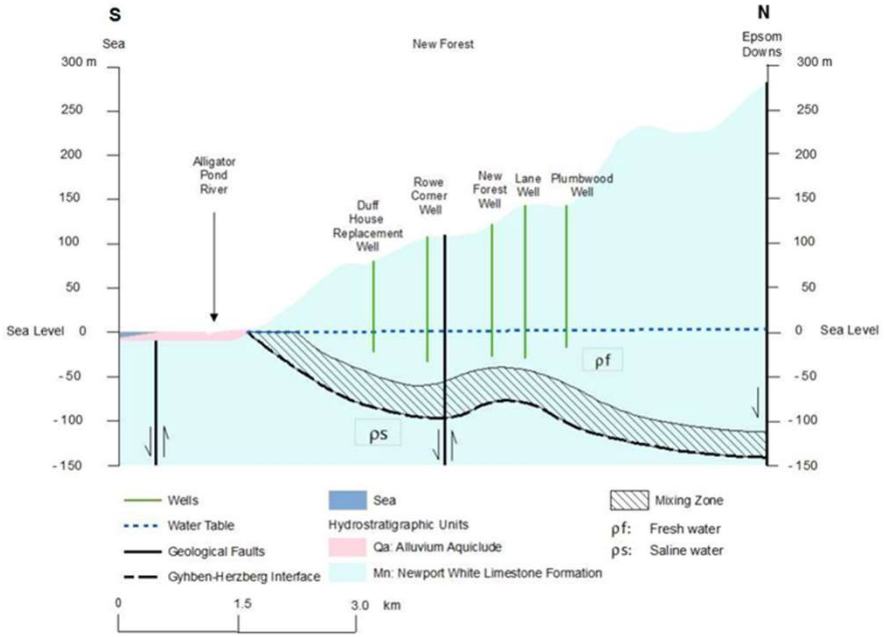
Tomato crop grown in New Forest, fed by irrigation water from the New Forest Well and irrigation system

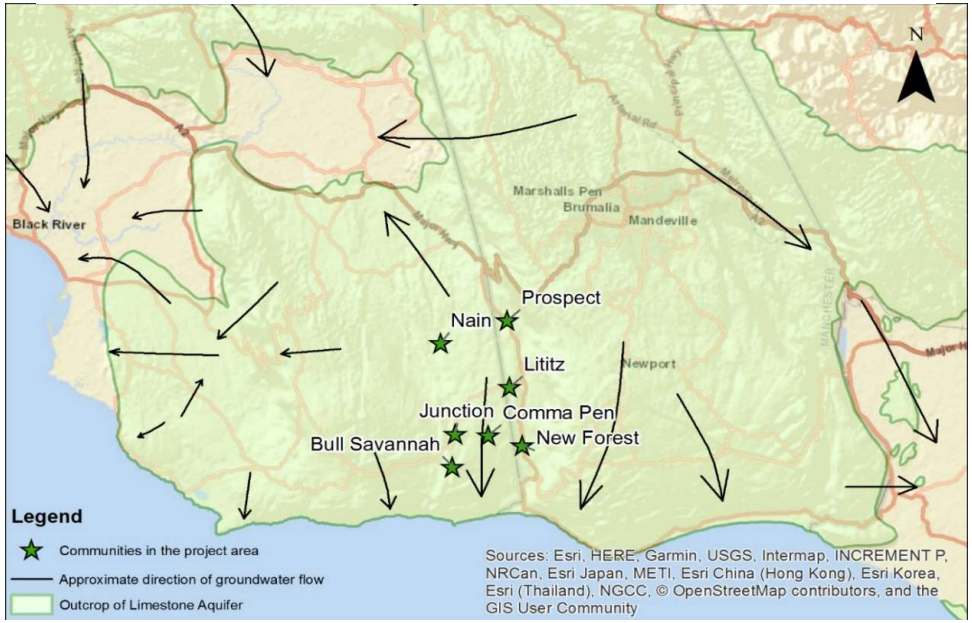
Essex Valley

Limited water supply means much of the Essex Valley study area is under-utilised for agriculture.

Hydrogeological setting







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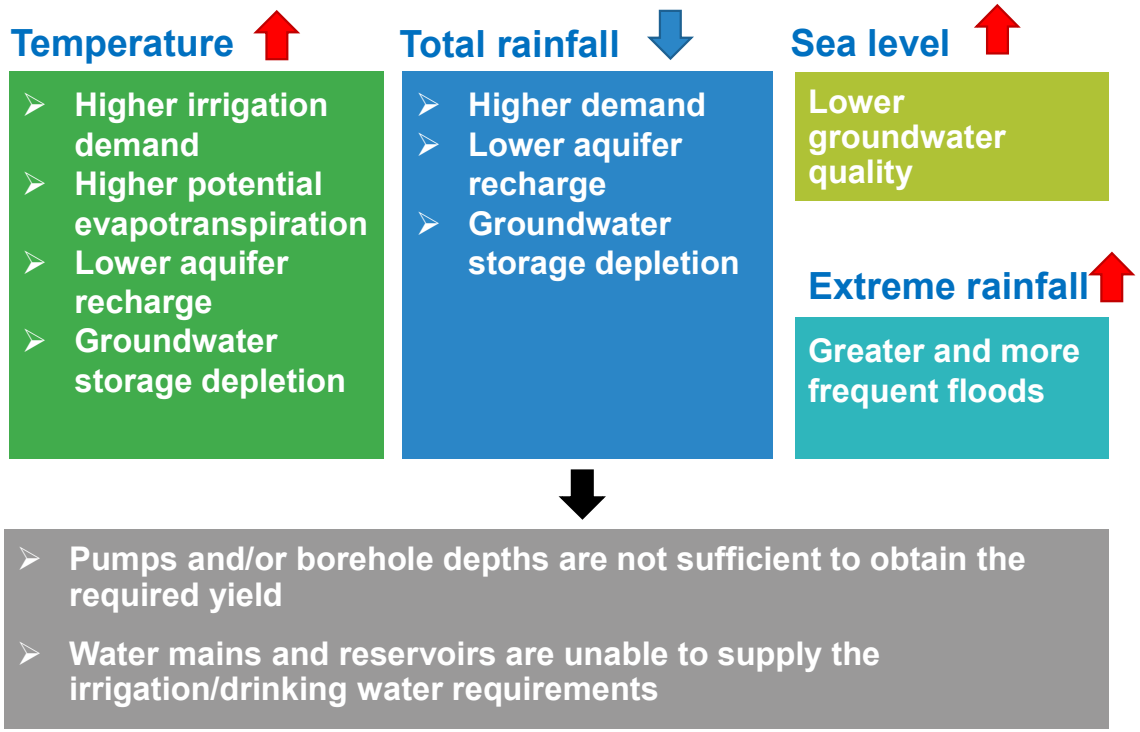
Climate change

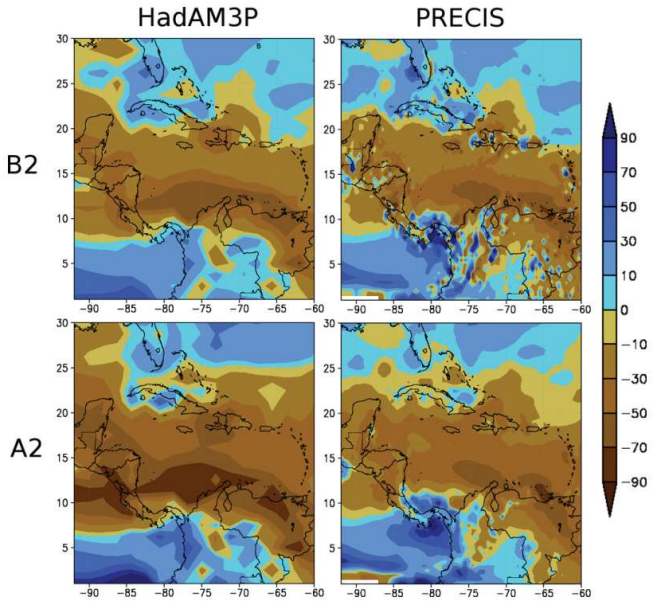
Potential impacts

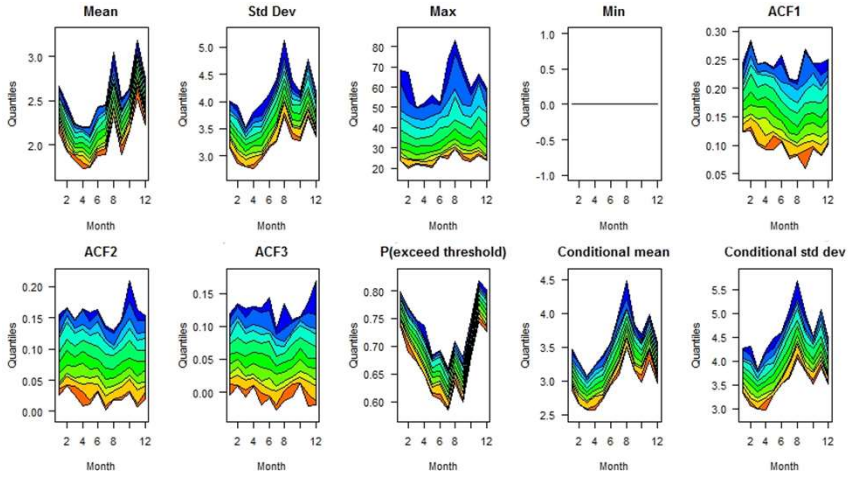


Climate change

Methodology

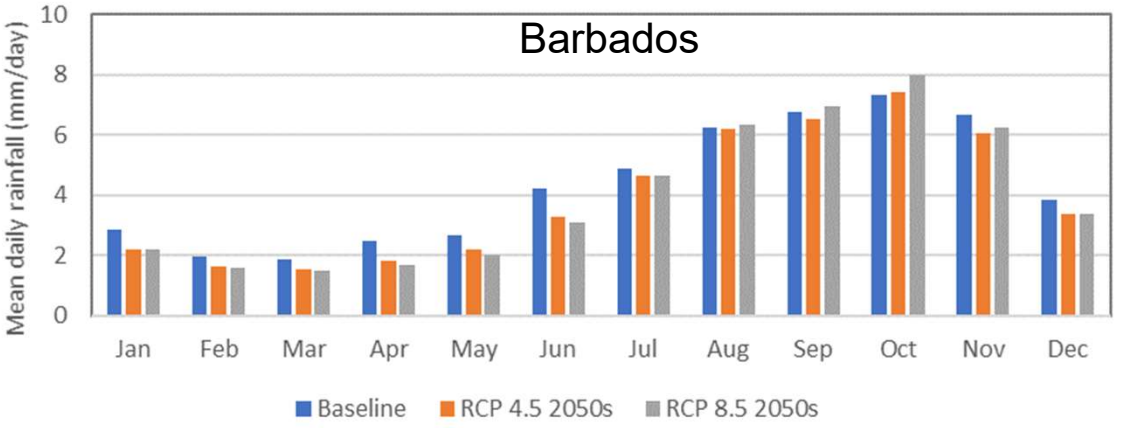
- **Identify the most suitable Global Circulation Models from the CMIP5 pool**
- **Obtain the likely change of selected climatic variables for two time slices (2030s and 2050s) and two emission scenarios (RCP4.5 and 8.5)**
- **Determine Potential Evapotranspiration**
- **Build and fit a Weather Generator (RGLIMCLIM) to observed daily rainfall series**
- **Obtain changes in frequency of droughts and magnitude of annual maxima**





Climate model predictions

- Extension of dry season (and reduction in second wet season in Jamaica)
- Change in rainfall distribution
- More extreme rainfall events
- Increase in PET and irrigation demand

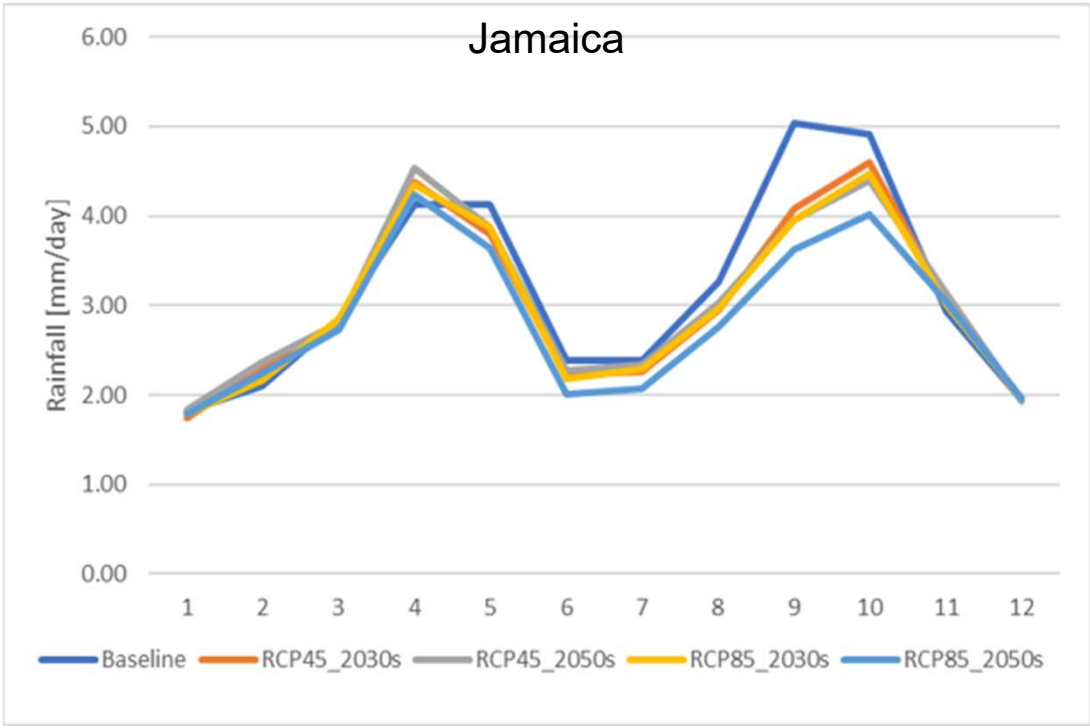


Recharge

Statistic	RCP45_2030s	RCP45_2050s	RCP85_2030s	RCP85_2050s
median	-21%	-18%	-21%	-55%
min	-77%	-76%	-82%	-99%
max	21%	29%	18%	0%
0.05	-53%	-53%	-54%	-89%
0.25	-34%	-32%	-35%	-71%
0.75	-4%	-2%	-9%	-37%
0.95	8%	13%	3%	-17%

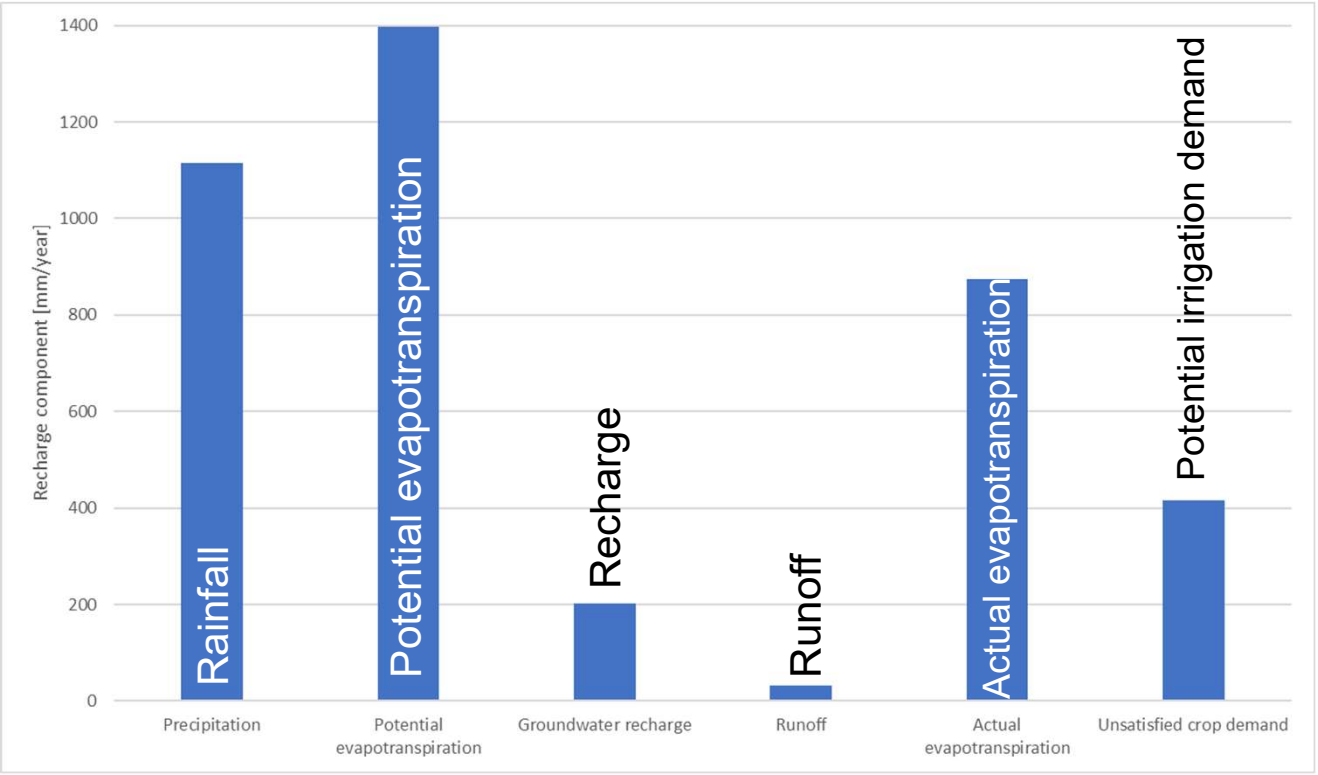
Irrigation demand

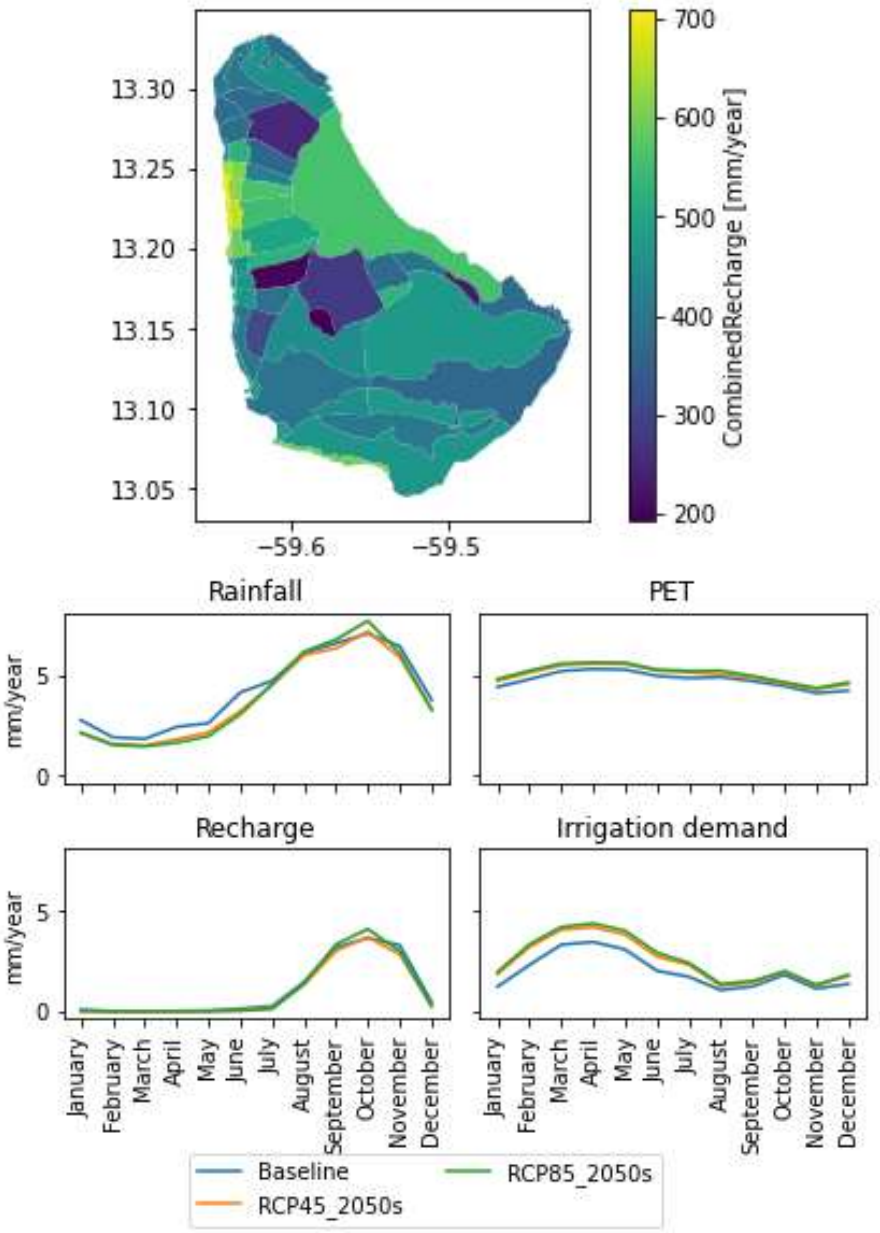
Statistic	RCP45_2030s	RCP45_2050s	RCP85_2030s	RCP85_2050s
median	18%	24%	17%	46%
min	29%	41%	33%	76%
max	12%	14%	8%	39%
0.05	23%	30%	22%	60%
0.25	19%	26%	20%	53%
0.75	17%	23%	15%	44%
0.95	14%	19%	13%	41%



Calculation of recharge

SWAcMod



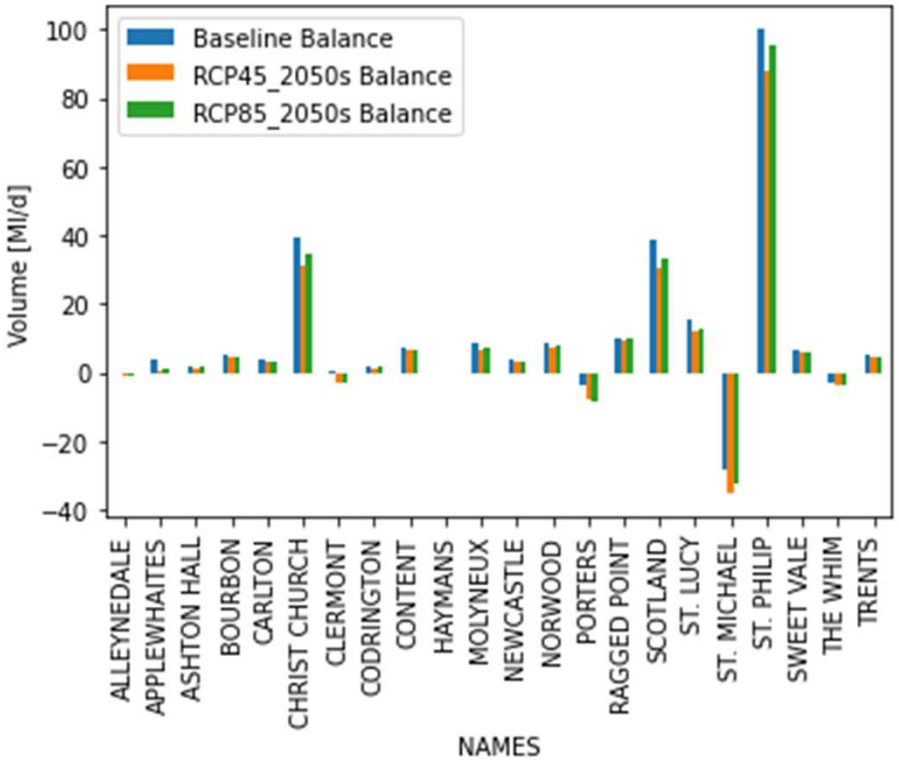


Water balance

Used to assess water availability for irrigation/supply

Jamaica

Barbados



Conclusions

Climate change models predict:

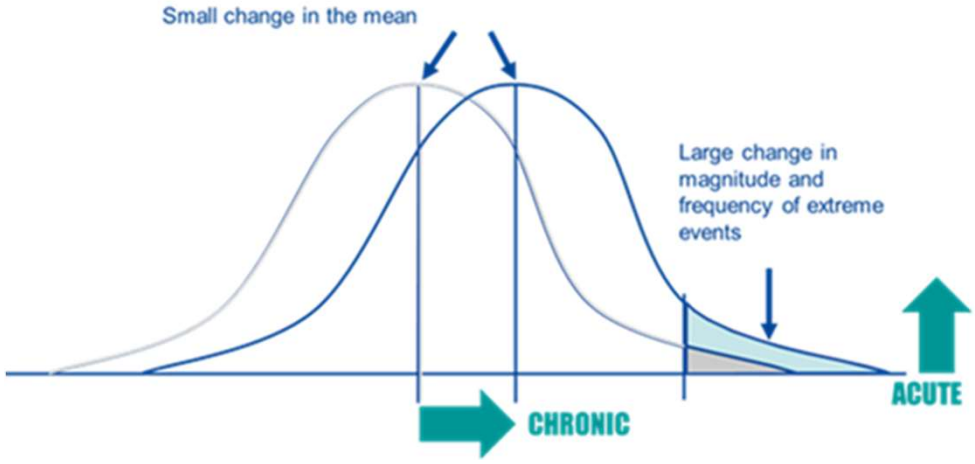
- Reduced recharge due to extension of length of dry season (and reduction in second wet season for Jamaica)
- Increased demand for irrigation

Methodology:

- Recharge modelling with stochastic datasets enables quantification of climate change impacts
- Groundwater balance is used to assess water availability now and in the future

Country focus:

- Impact in Jamaica is higher due to the reduction of the second wet season
- Provision of irrigation water in Jamaica improves livelihoods for those in the study area but there is an increased reliance on groundwater for supply
- Climate change impacts lead to a potential requirement for provision of additional water sources
- Mains leakage contributes to recharge in Barbados
- Regional deficits in supply in Barbados could be met with redistribution of supply



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Thank you