

**3<sup>RD</sup> AFRIWATSAN CONSORTIUM  
WORKSHOP**

**PROJECTED IMPACT OF CLIMATE  
CHANGE ON RAINFALL IN KISUMU:  
EVIDENCE FROM CMIP5**

**ASHA SITATI  
MSc. Climate Change, UCL**

# INTRODUCTION

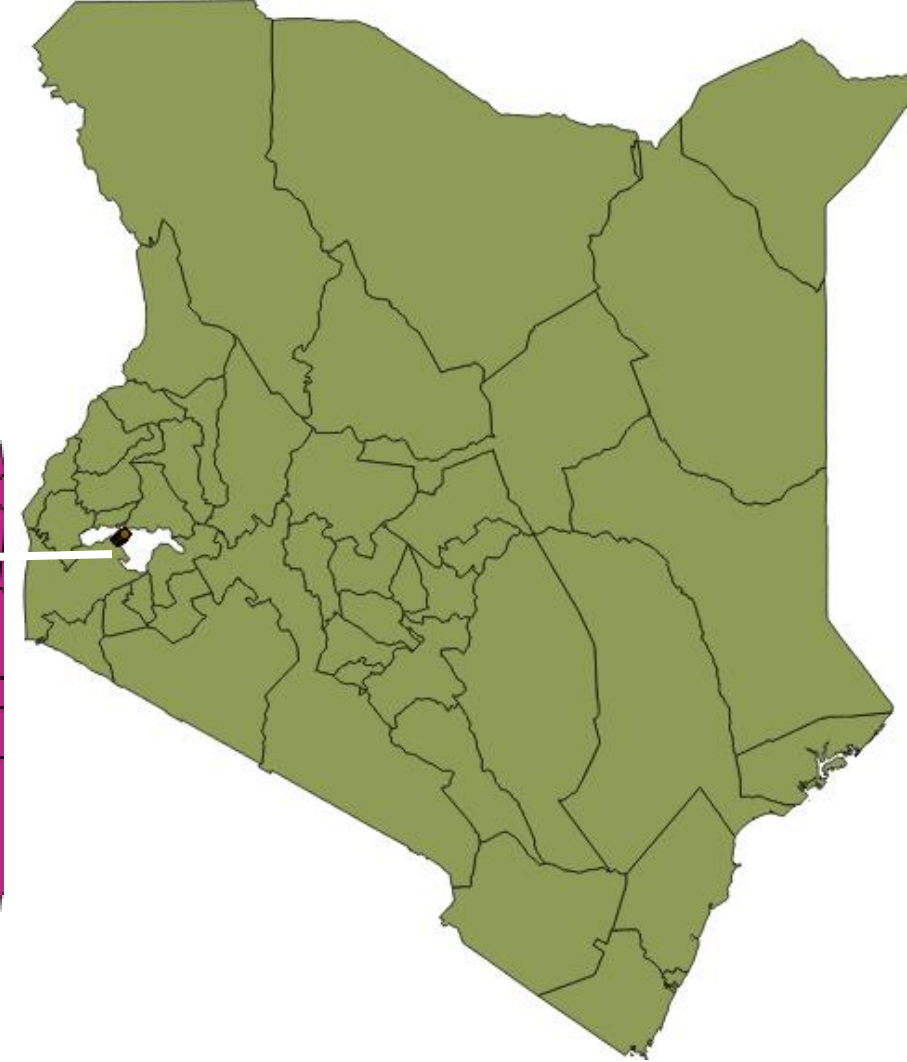
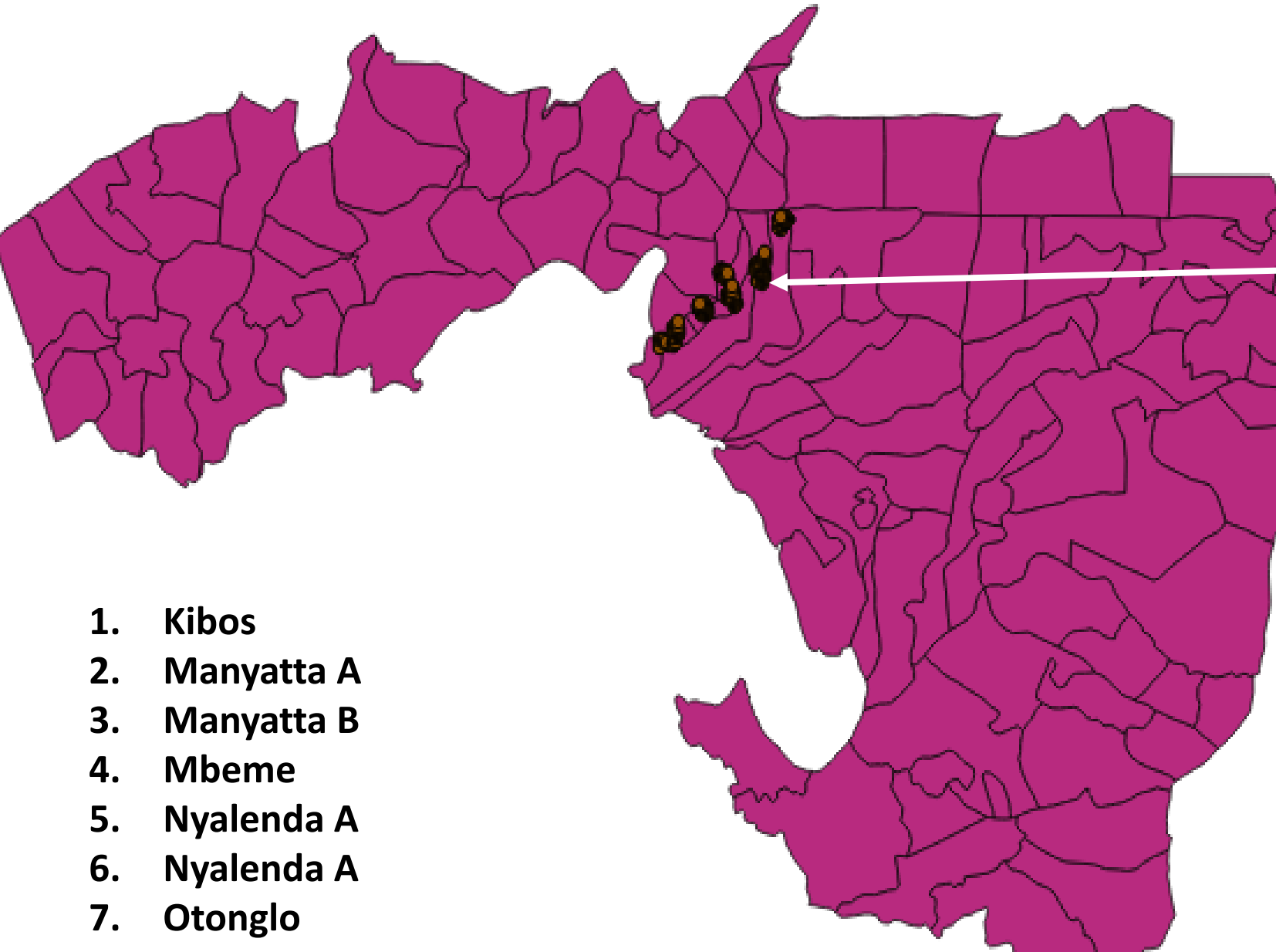
- Climate change alters the frequency & magnitude of extreme hydrological events – potentially impairing water quality
- Compromise water quality - likelihood of emergence and re-emergence of waterborne diseases



# OBJECTIVES

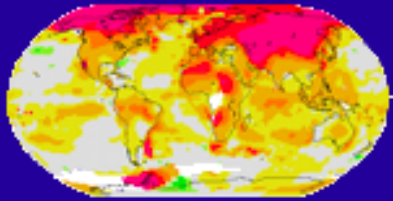
1. To assess the impact of climate dynamics on the quality of on-site domestic water
- 2. To evaluate how projections of climate change may impact on-site domestic water**
3. To assess the policy implications for urban planning and management based on the projected impacts of climate change

# STUDY AREA



1. Kibos
2. Manyatta A
3. Manyatta B
4. Mbeme
5. Nyalenda A
6. Nyalenda A
7. Otonglo

# METHODOLOGY



## KNMI Climate Explorer

Climate Explorer European Climate Assessment & Data KNMI

search in the Climate Explorer

Help News About Contact World weather Effects of El Niño Seasonal forecasts Climate Change Atlas

### KNMI Climate Change Atlas

<b>Select a region</b>	
Type:	<input checked="" type="radio"/> IPCC WG1 <input type="radio"/> IPBES <input type="radio"/> countries <input type="radio"/> place <input type="radio"/> box <span style="float: right;">[i]</span>
IPCC WG1:	World <span style="float: right;">[v]</span>
<b>Select a season</b>	
Season:	First month <input type="text" value="Jan"/> <span style="float: right;">[v]</span> , length <input type="text" value="12"/> <span style="float: right;">[v]</span> months <span style="float: right;">[i]</span>
<b>Select a dataset and variable</b>	

Users are strongly advised to study the short introduction. Specific help is available under the [i] icons.

#### Further information

- > Short introduction
- > IPCC WG1 AR5 report, notably Annex I "Atlas"
- > CMIP5 co-ordinated climate model experiments
- > RCP scenario's

#### Funding

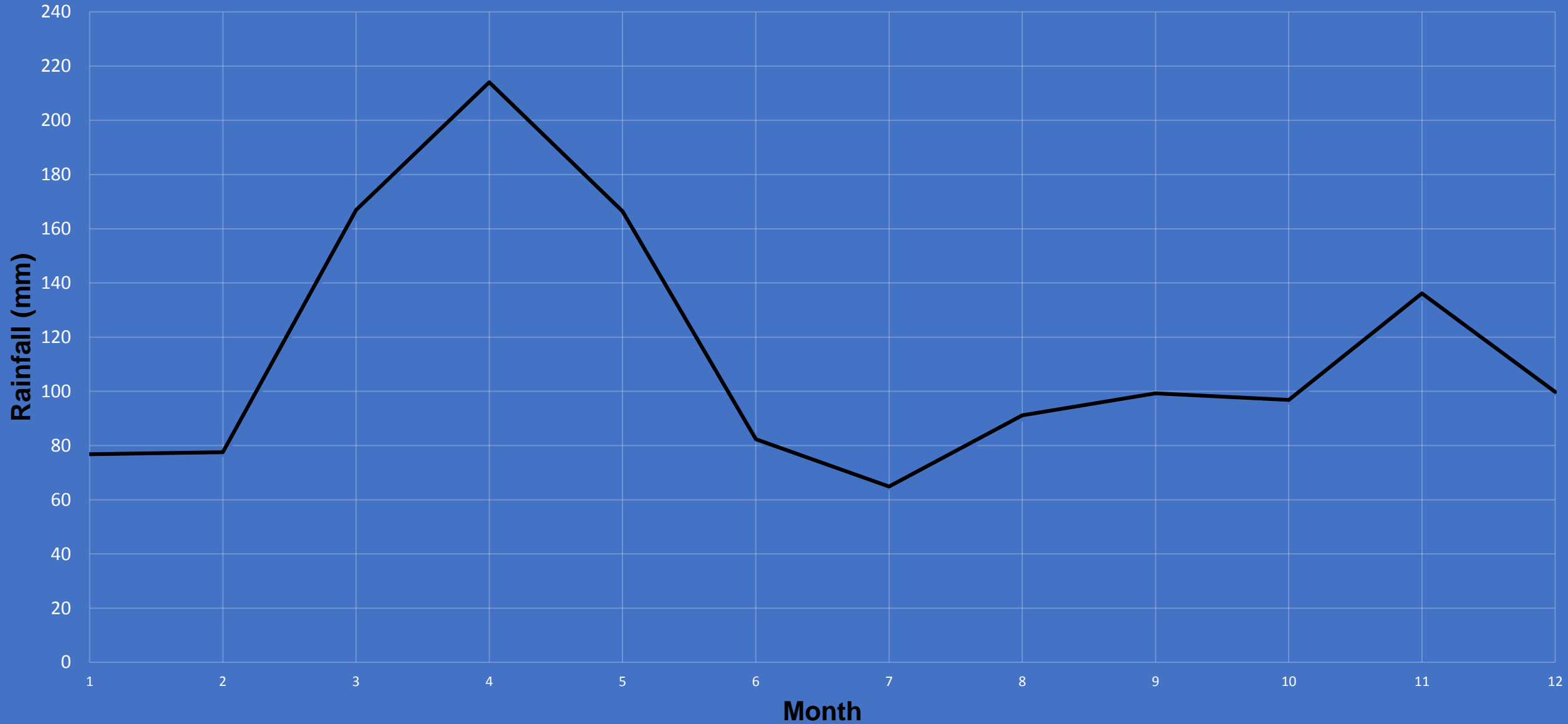
> KNMI



- CMIP5
- Climate data – KMD
- Household surveys - 6 sites – urban and peri-urban ; 30 HHs + Vendo
- Literature review

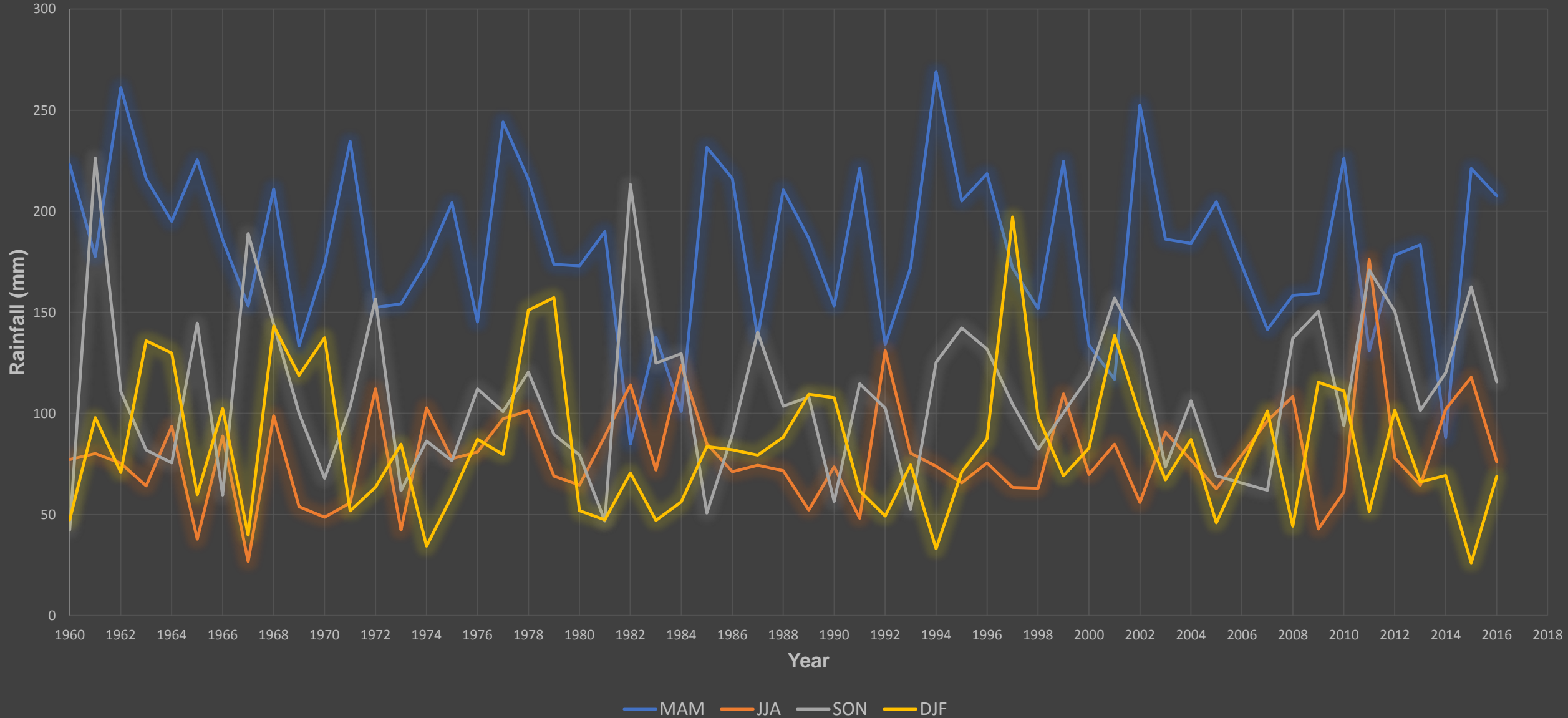
# OBSERVED PRECIPITATION IN KISUMU

MONTHLY AVERAGE PRECIPITATION\_1960-2016



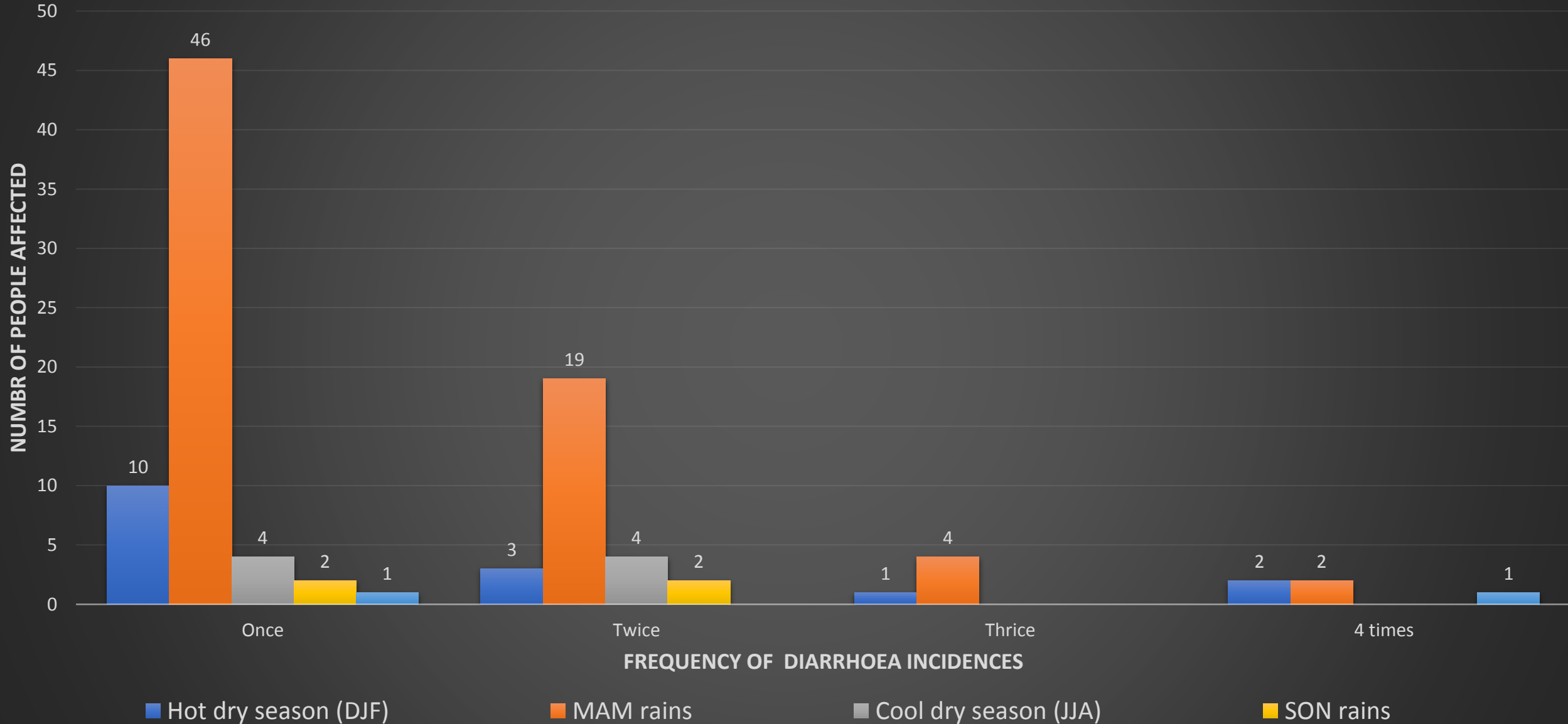
# OBSERVED SEASONAL PRECIPITATION

Seasonal Average precipitation\_1960-2016

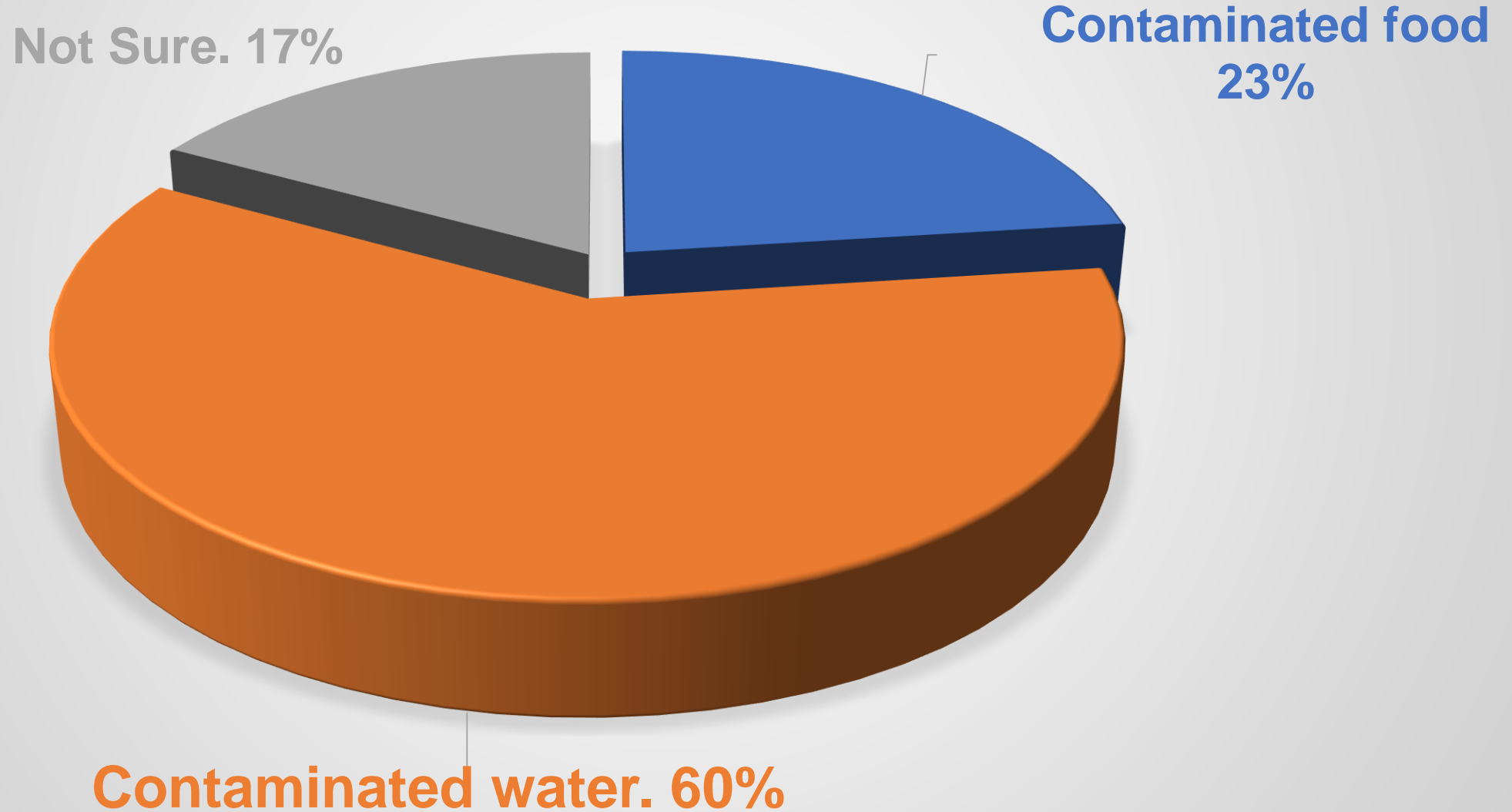


# DIARRHOEA IN KISUMU

Seasonal frequency of diarrhoea-related diseases (past year)



# CAUSES OF DIARRHOEA



# DIARRHOEA RISK FACTORS



# DIARRHOEA RISK FACTORS



# CLIMATE PROJECTIONS

## Representative Concentration Pathways (RCPs):

*scenarios used for the CMIP5 experiments in the IPCC AR5 report - involved around 21 GCMs/ESMs*

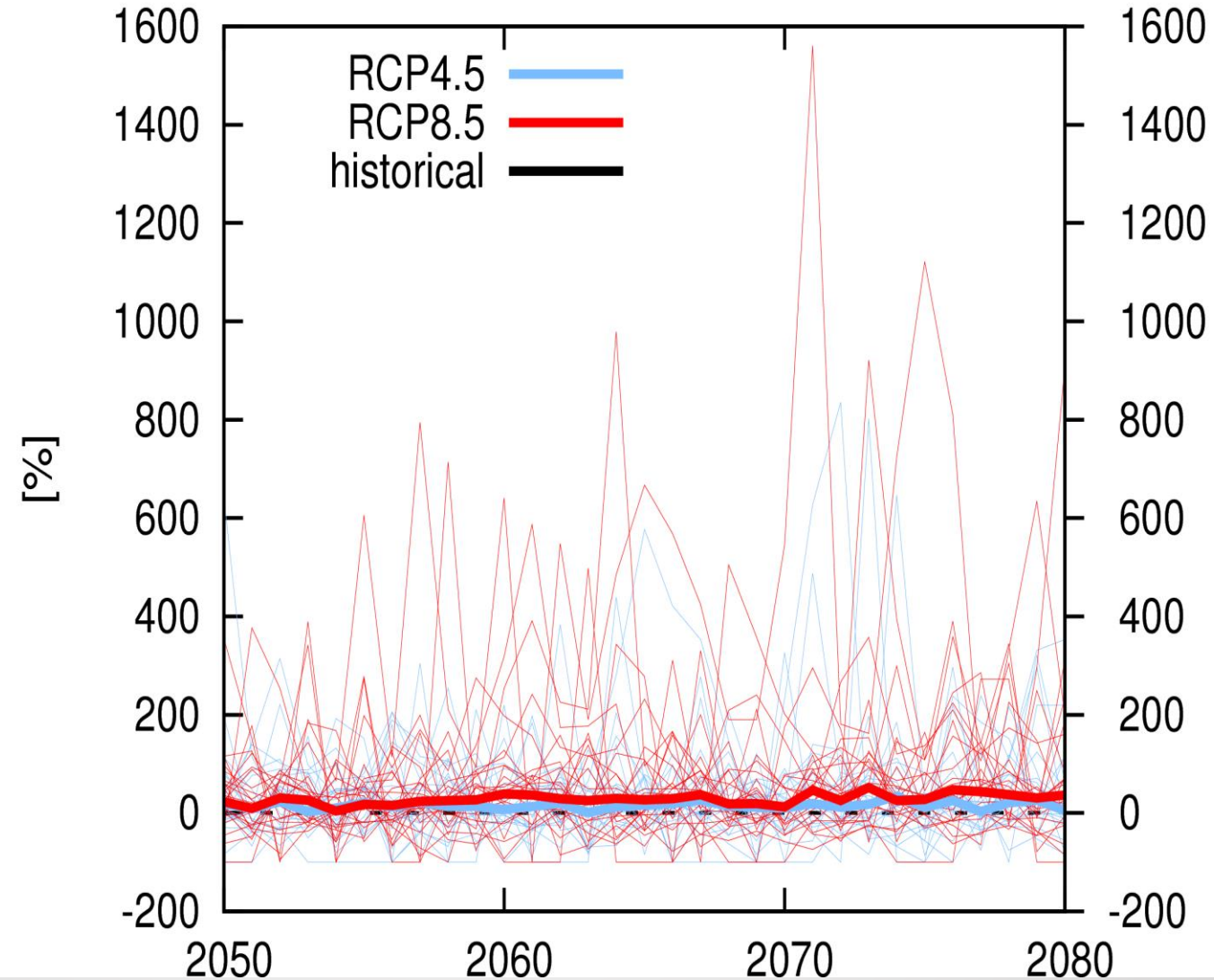
4 scenarios of which I focus on two:

- i. RCP8.5 - business-as-usual scenario with increasing GHG
- ii. RCP4.5 - assumes quicker action to limit GHG emissions with emissions peaking in 2040 and declining strongly until 2080

# Annual count of days when precipitation $\geq 20\text{mm}$

Relative R20MM change 0.0917N, 34.7680E wrt 1981-2010 CMIP5 one member

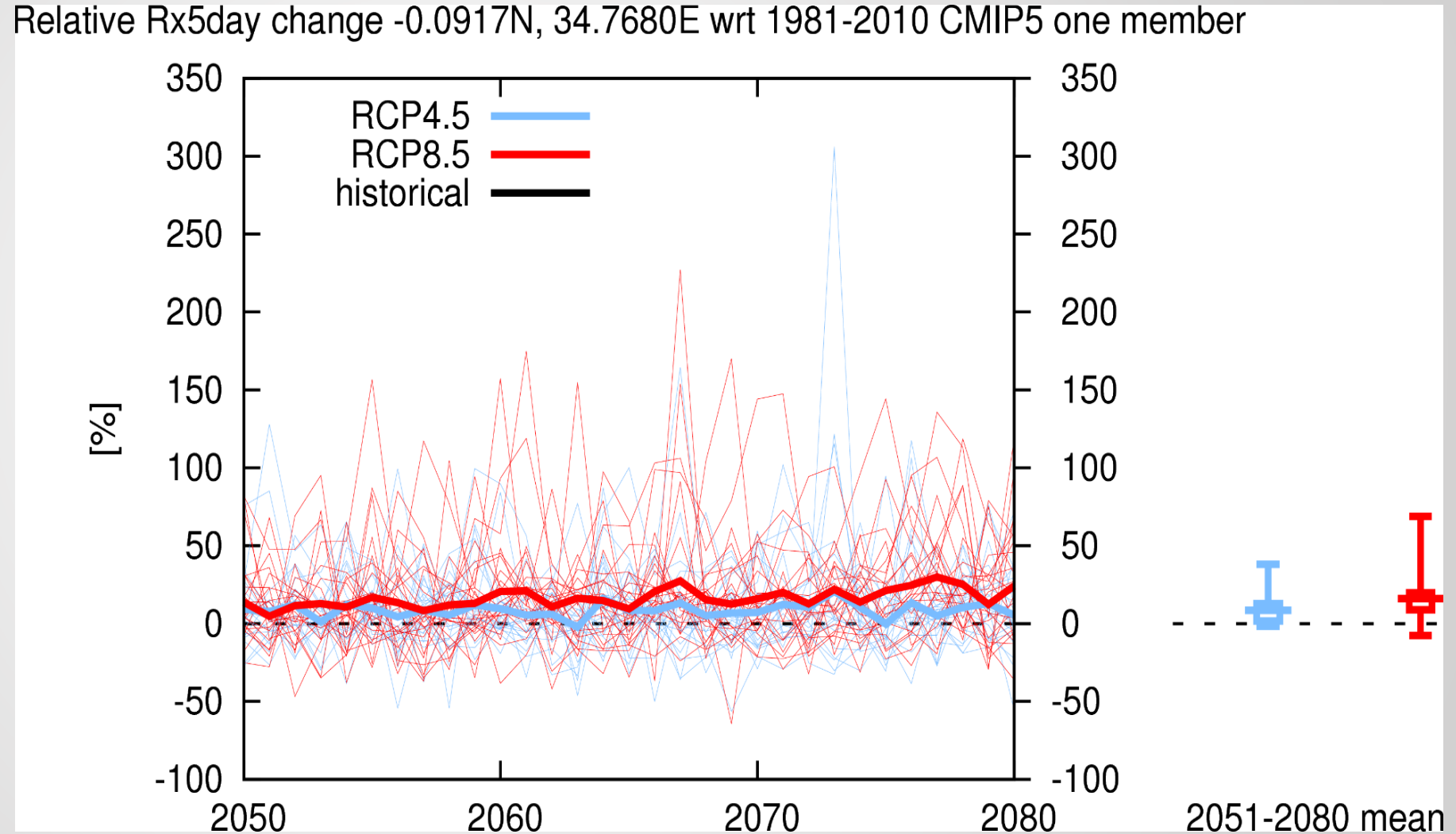
Increased runoff =  
increased pathogen  
transmission



2051-2080 mean

# Annual maximum consecutive 5-day precipitation

Increased runoff =  
Increased diarrhoea  
incidences



# DIARRHOEA AND CLIMATE CHANGE DYNAMICS

- Rainfall has impacts on the transmission and survival of pathogens as it influences their movement from environmental reservoirs
- The frequency and intensity of rainfall events can lead to overflow of storm drains that may be combined with the sewage system resulting in a substantial amount of faecally polluted water entering directly and exposing people to bacteria from the contaminated water supply systems
- Projected changes in climate are highly uncertain but ensemble means consistently indicate more intensive rainfall for Kisumu that increases with increased radiative forcing (*i.e.* RCP8 versus RCP4.5)
- Climate variables may not always affect the number of diarrhoea cases directly but through various pathways like the changes in other non-climatic factors and extreme seasonal weather

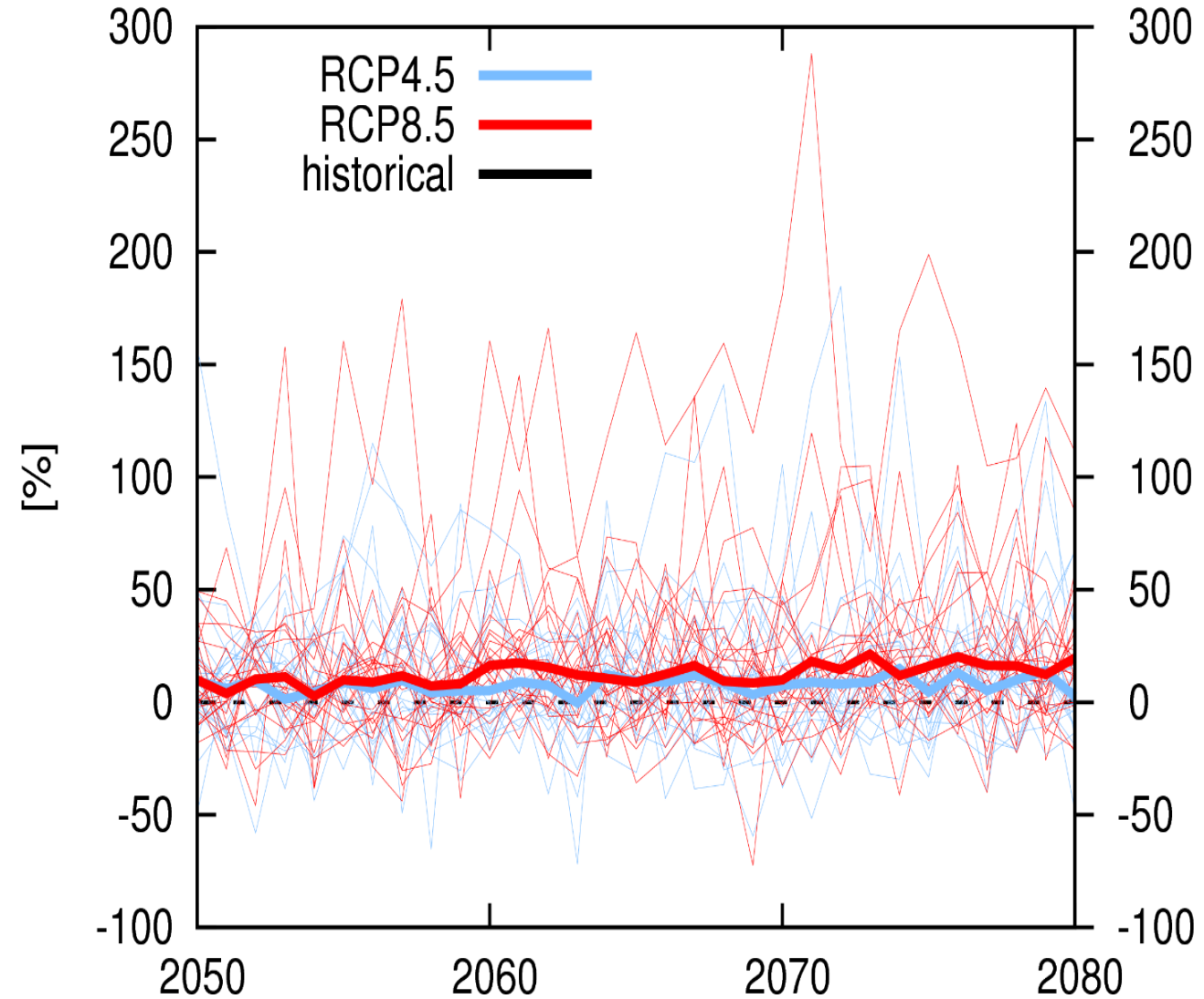
# THANK YOU!



# Annual total precipitation in wet days

Relative PRCPTOT change 0.0917N, 34.7680E wrt 1981-2010 CMIP5 one member

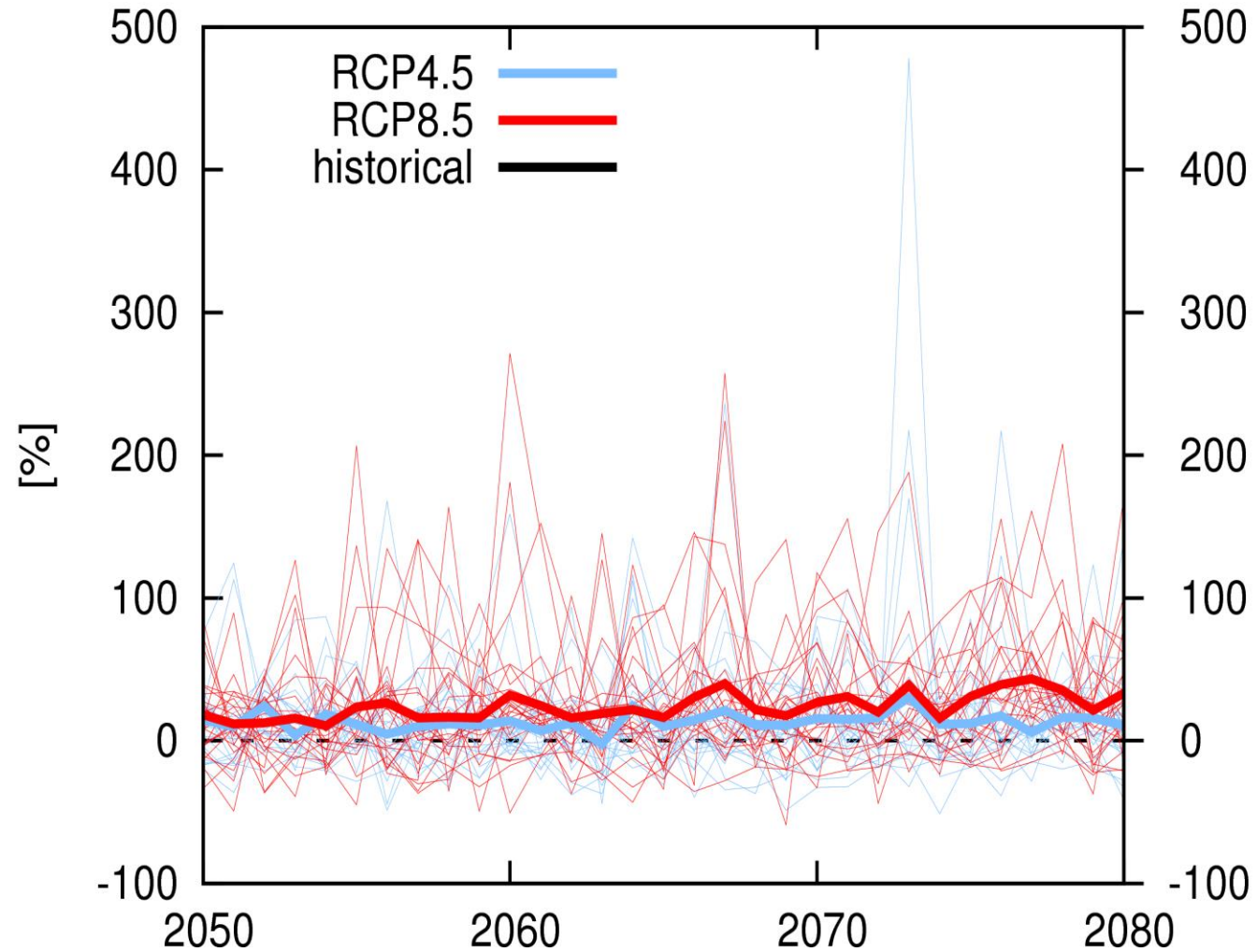
Heavy rainfall  
following wet  
periods=dilute the  
concentration of  
pathogens=decrease  
chances for pathogen  
transmission  
(Carlton et al., 2013)



2051-2080 mean

# Annual maximum 1-day precipitation

Relative Rx1day change 0.0917N, 34.7680E wrt 1981-2010 CMIP5 one member



Increased diarrhoea incidences

