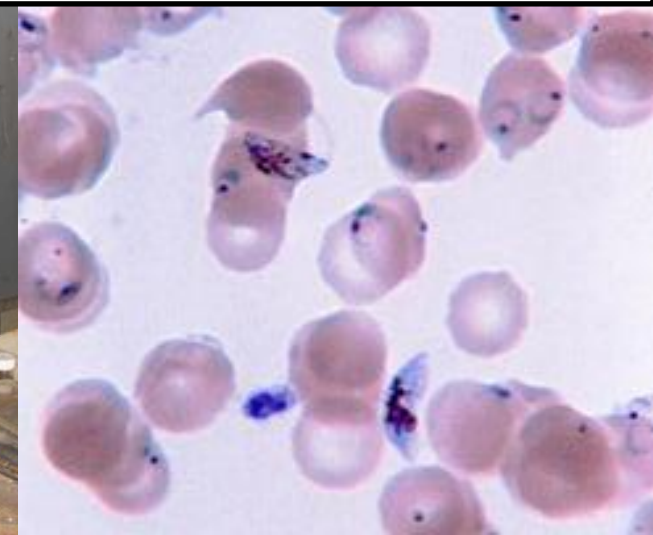


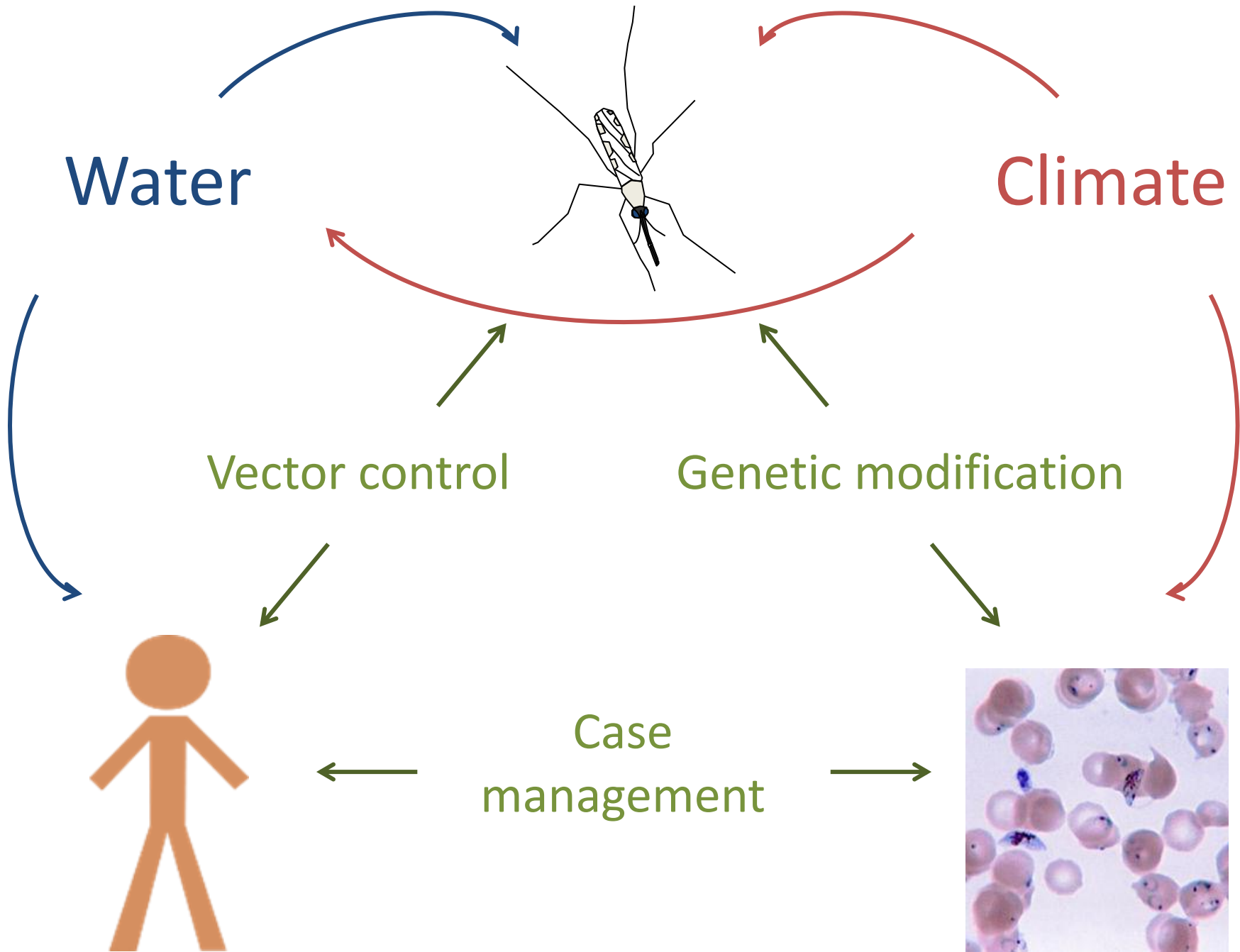
Climate Change Impact on Malaria in Africa

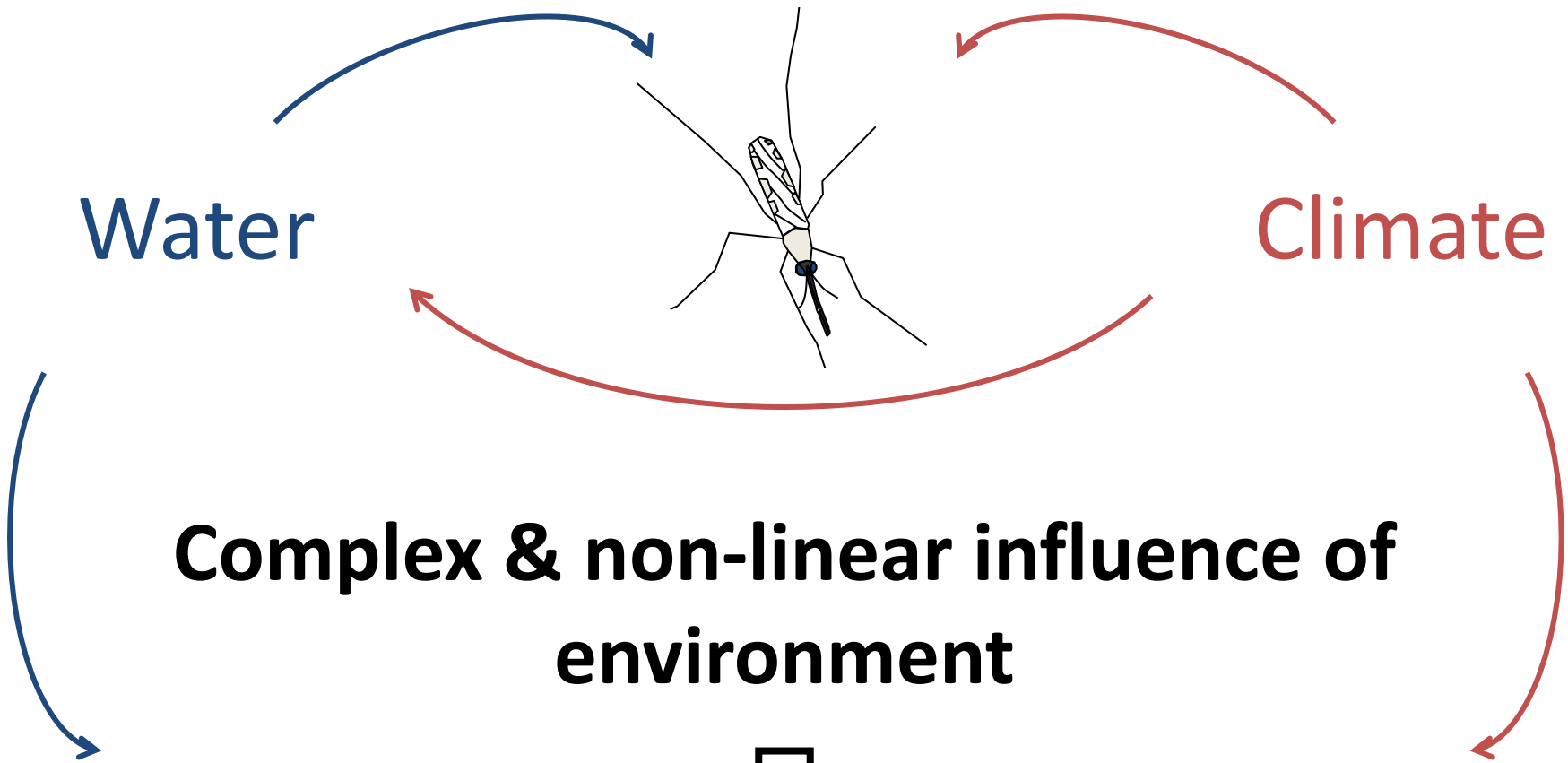
Noriko Endo, Massachusetts Institute of Technology

Teresa K. Yamana, Columbia University

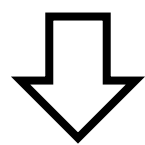
Elfatih A.B. Eltahir, Massachusetts Institute of Technology



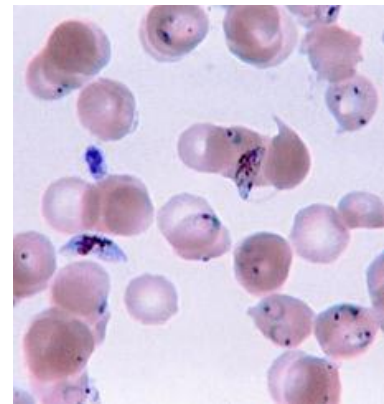




Complex & non-linear influence of environment

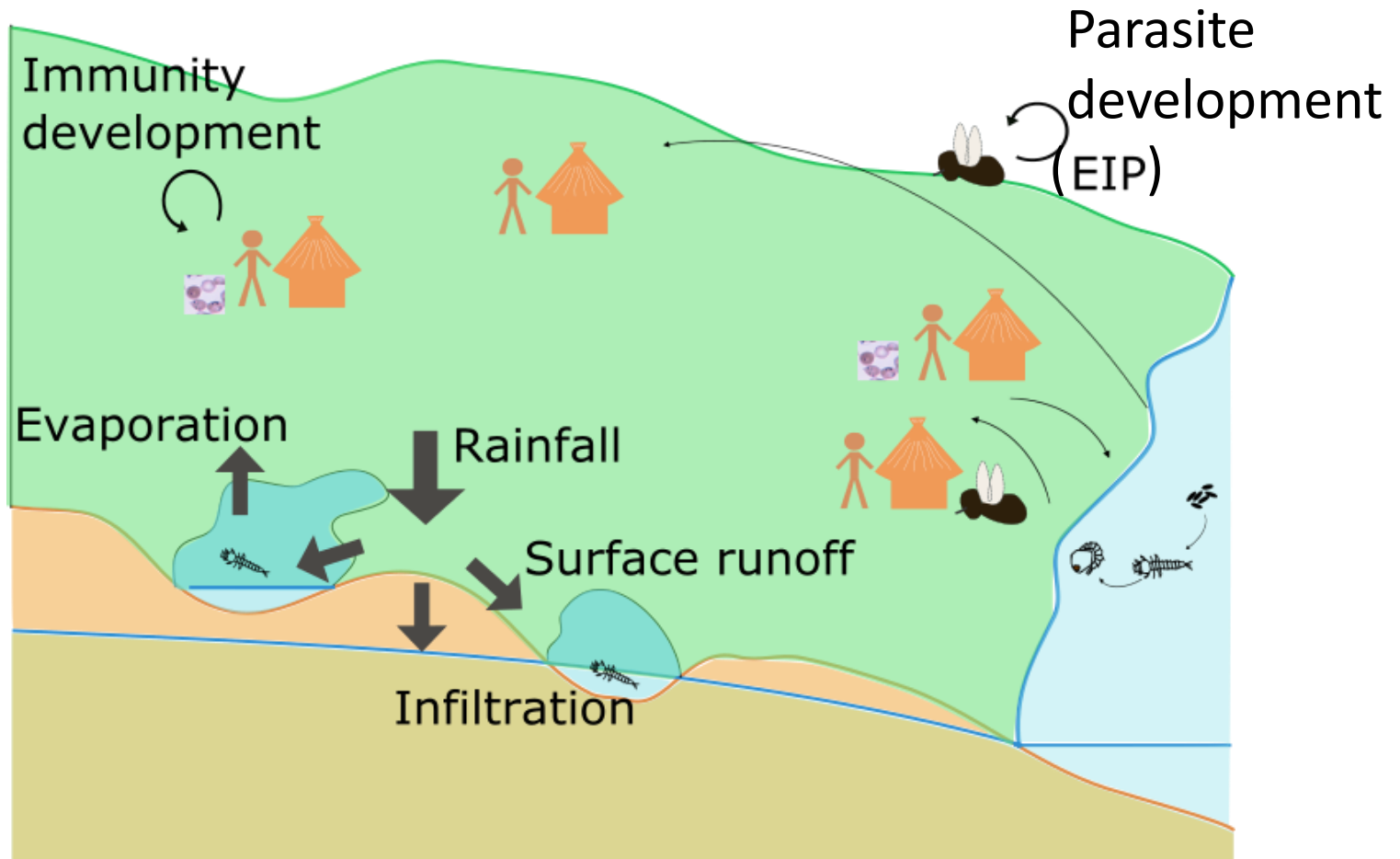


Mechanistic approach

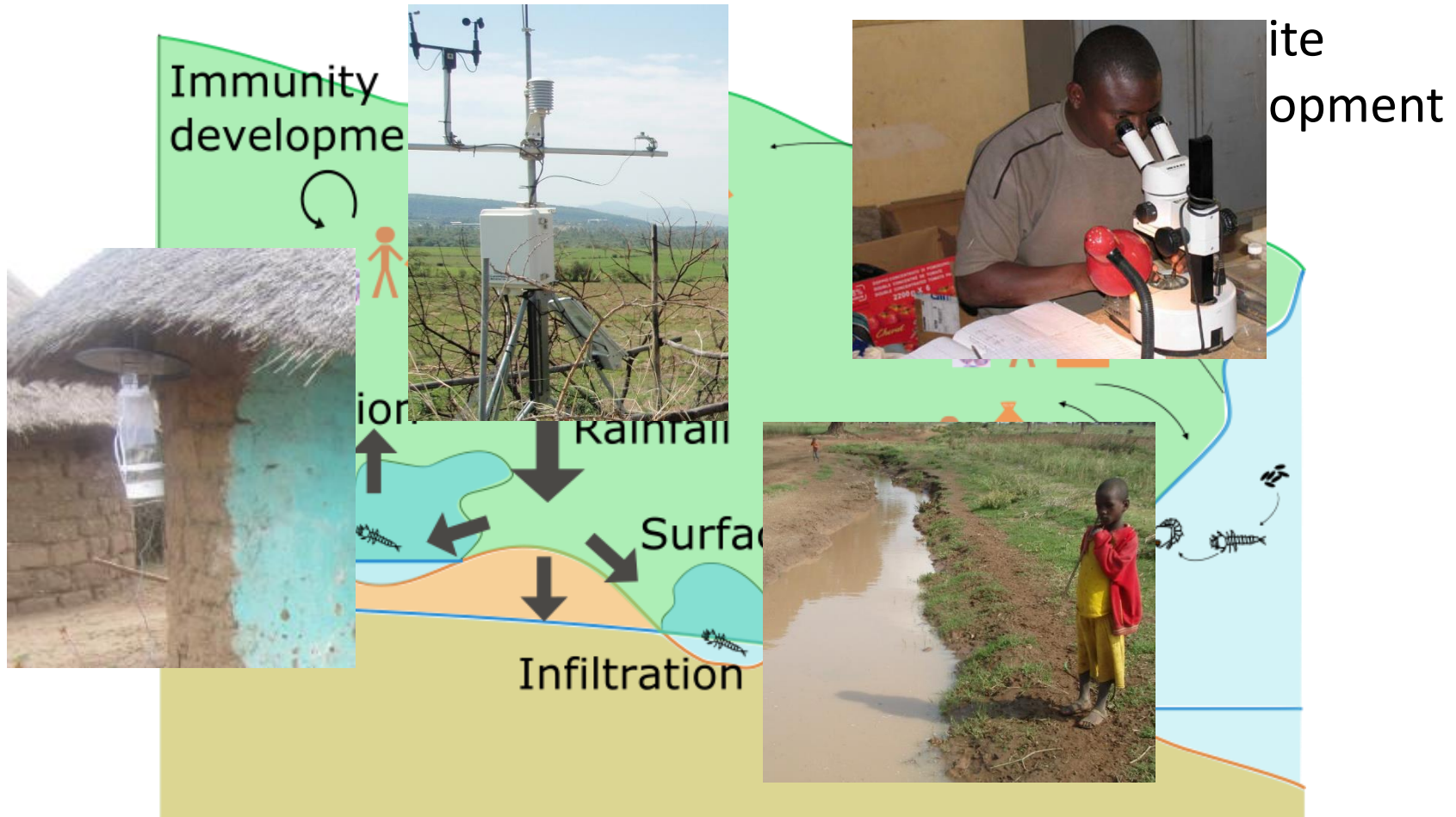


HYDRology, Entomology, and MAlaria Transmission Simulator

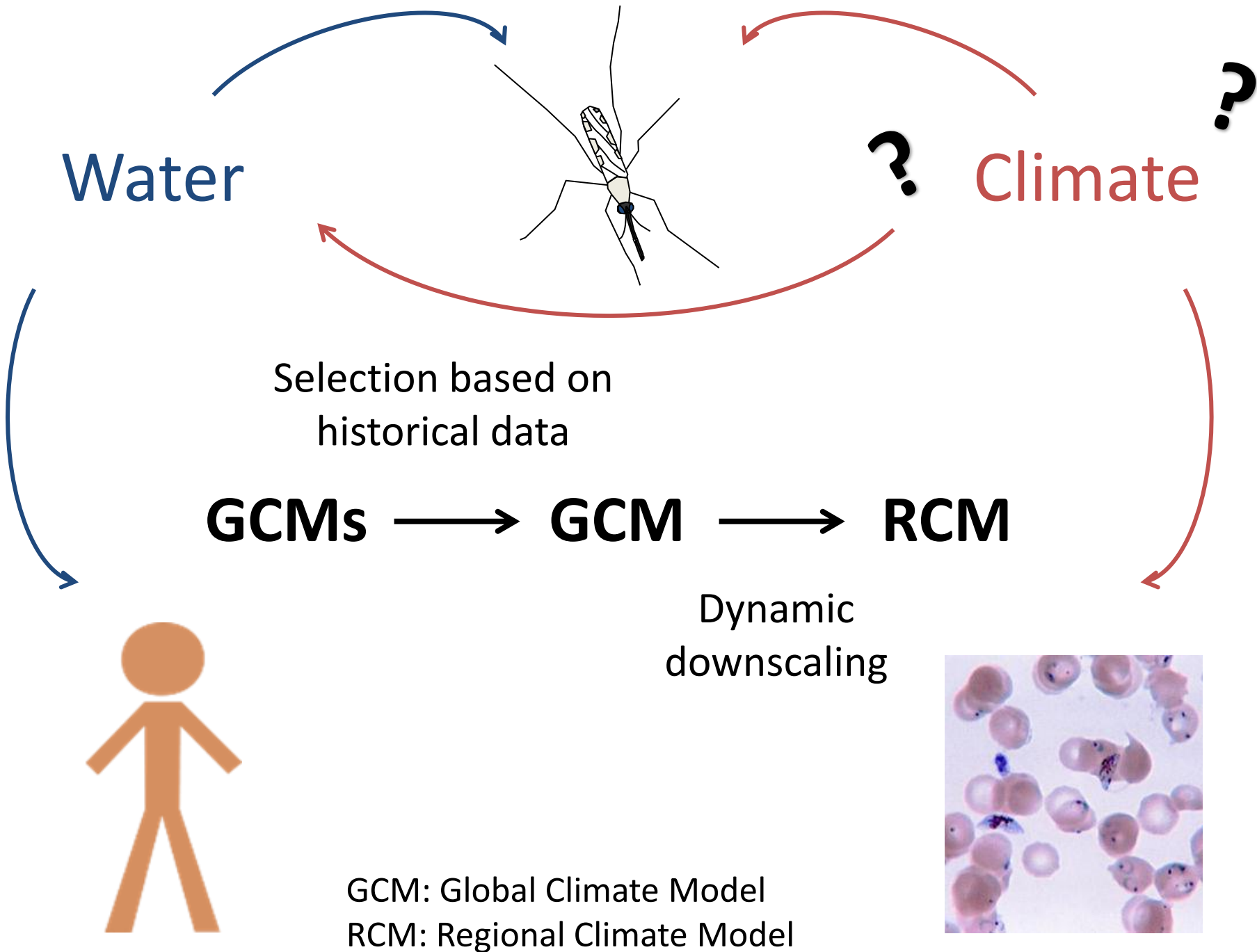
HYDREMATs



HYDRology, Entomology, and MAlaria T Transmission Simulator HYDREMATs



Field surveys in Niger (2005-2007) and Ethiopia (2012-2015)



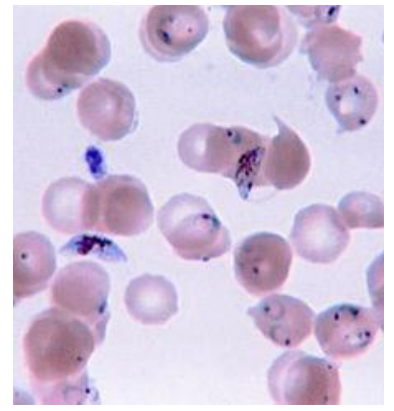
Water

Climate ?

Selection based on historical data

GCMs → **GCM** → **RCM**

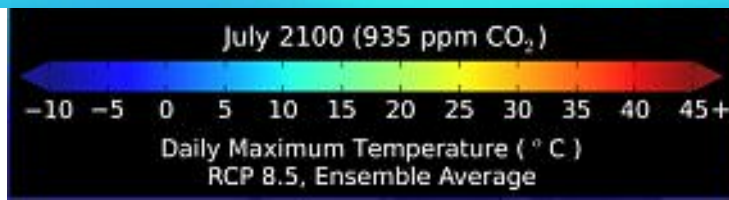
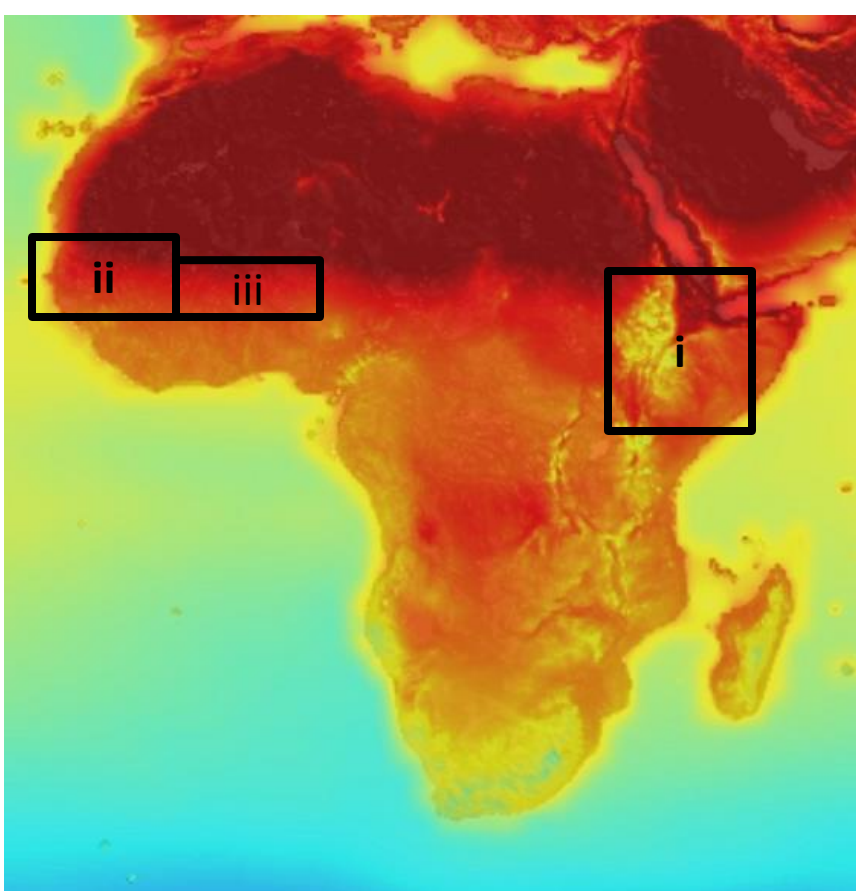
Dynamic downscaling



GCM: Global Climate Model
RCM: Regional Climate Model

Climate change impacts on Malaria in Africa

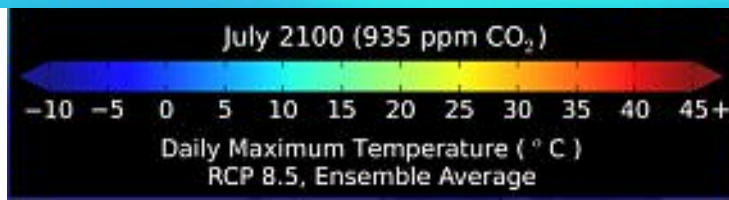
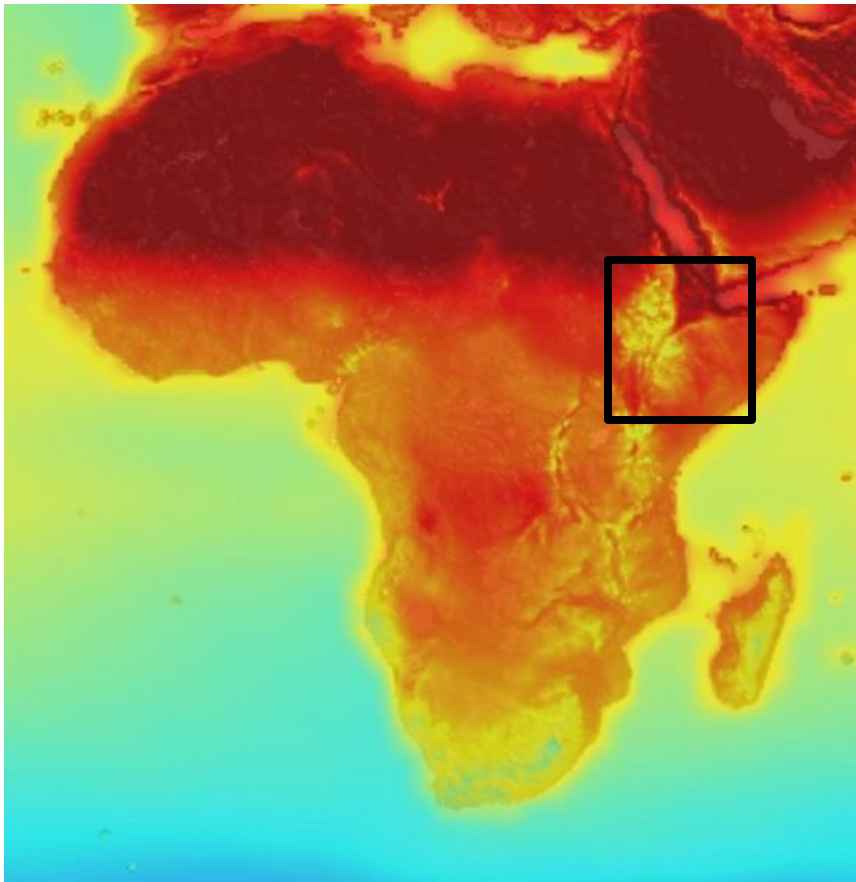
Projected temperature in July 2011



Climate change impacts on Malaria in Africa

▶ Ethiopian Highland

- ▶ Cold to warmer
→ more malaria
- ▶ Wet to slightly wetter
→ more malaria
- ▶ Current low immunity
- ▶ **High risk**



Climate change impacts on Malaria in Africa

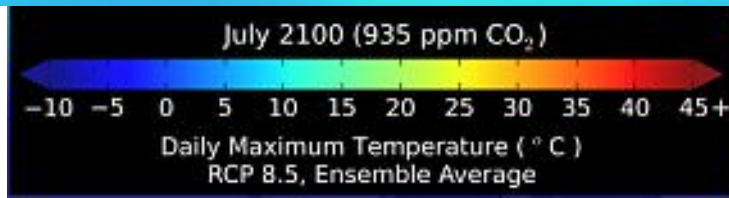
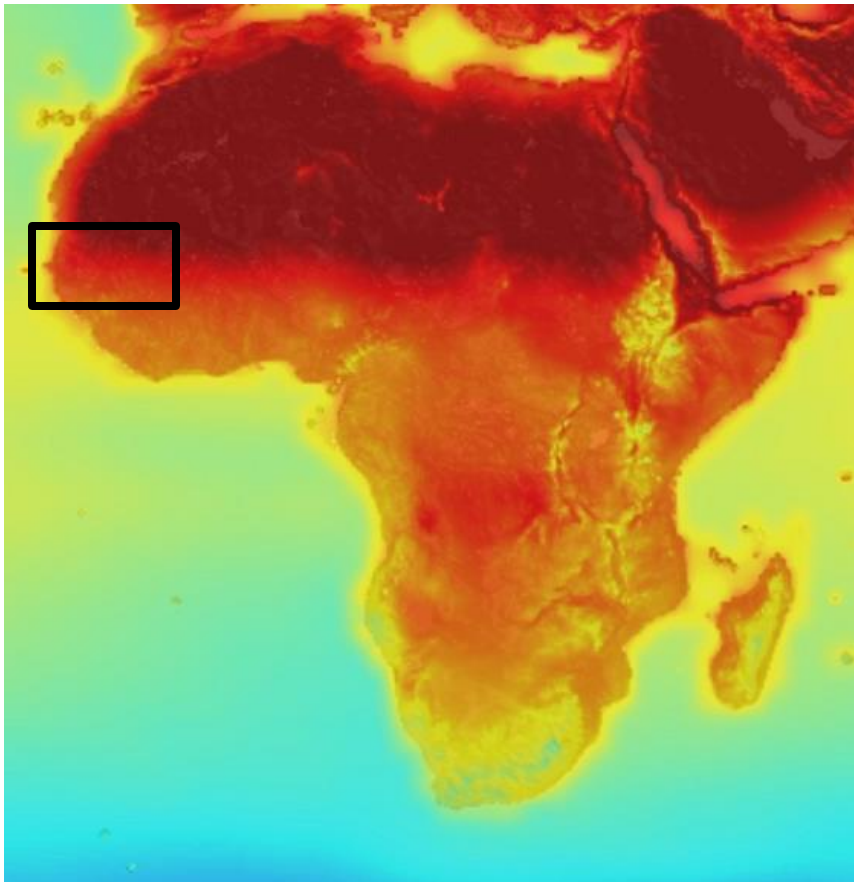
▶ Coastal Sahel fringe

▶ Warm to warmer
→ less malaria

▶ Dry to drier
→ less malaria

▶ Current moderate immunity

▶ **Low risk**



Climate change impacts on Malaria in Africa

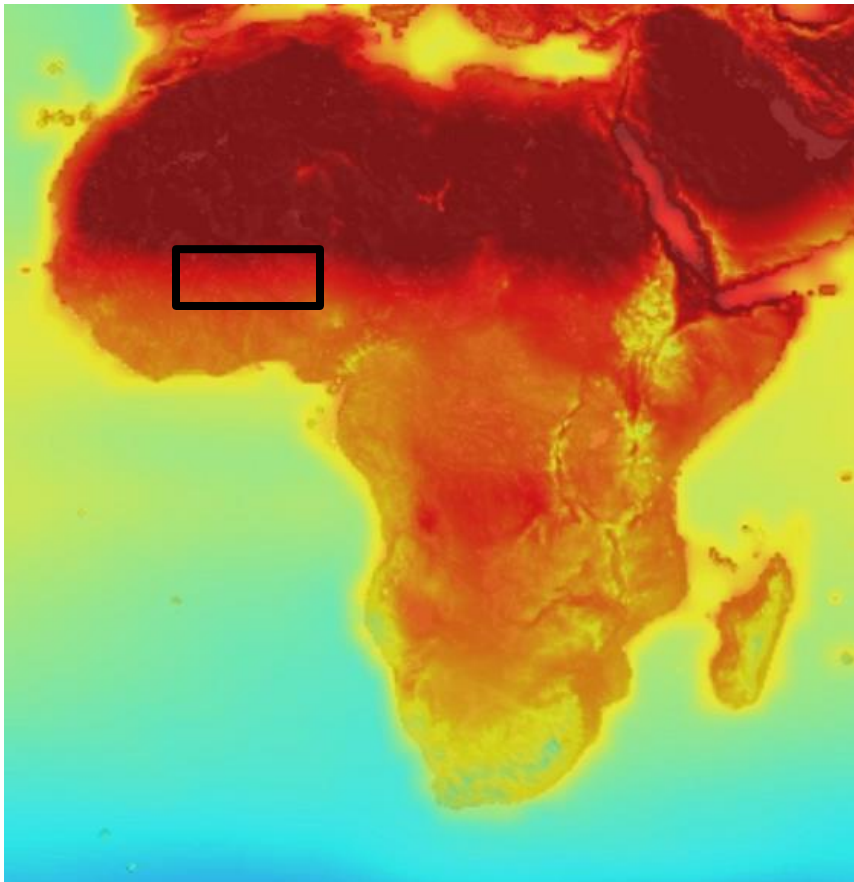
▶ WA Sahel fringe

▶ Warm to warmer
→ less malaria

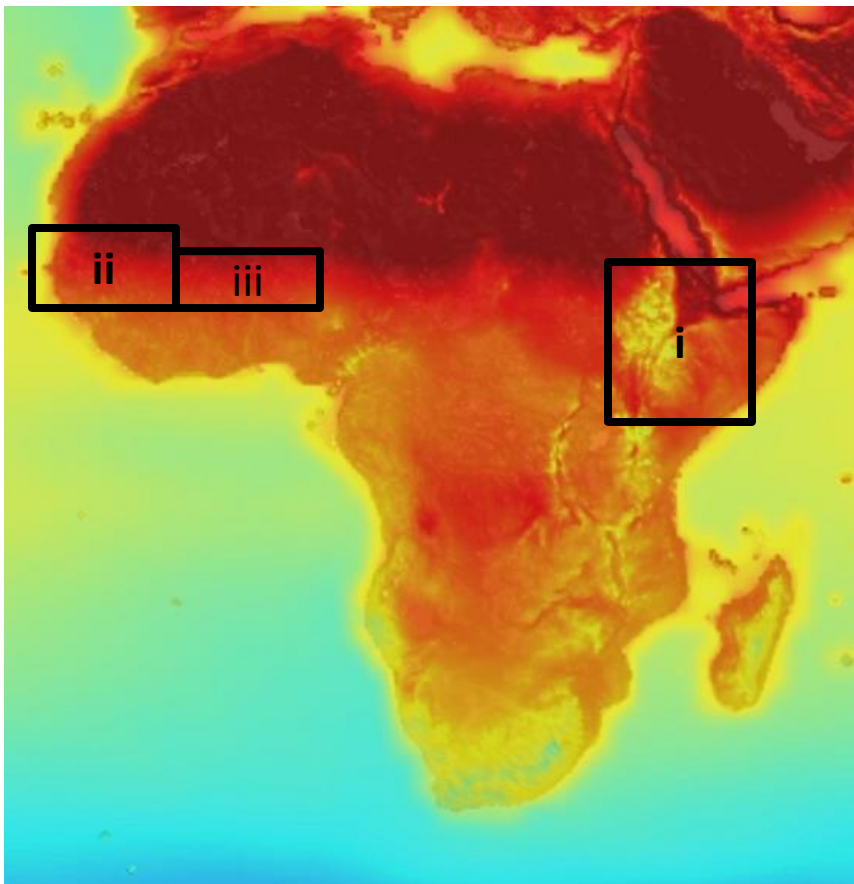
▶ Dry to wetter
→ more malaria

▶ Current moderate immunity

▶ **Moderate risk**



Climate change impacts on Malaria in Africa



- ▶ Ethiopian Highland (i):
 - ▶ Hotter and wetter
 - ▶ Current low immunity
 - ▶ **High risk**
- ▶ Coastal Sahel fringe (ii):
 - ▶ Hotter and drier
 - ▶ Current moderate immunity
 - ▶ **Low risk**
- ▶ WA Sahel fringe (iii):
 - ▶ Hotter and wetter
 - ▶ Current moderate immunity
 - ▶ **Moderate risk**

References: Yamana et al., *Nature Climate Change* (2016)
Endo and Eltahir, *in review*