Hydrology of Malaria

Eltahir Research Group

Weekly malaria cases in Niger, 2001-2003, and Precipitation



GOAL

- Develop credible computational tools that can be used to
 - Test and refine intervention technologies for environmental management of Malaria.
 - Predict the impact of climate variability and change on Malaria transmission.

HYDRology, Entomology and Malaria TRansmission Simulator (HYDREMATS)

- Mechanistic model of malaria transmission
- Village scale
- 10 meter x 10 meter grid cells
- 1 hour timestep



HYDREMATS: Hydrology Component



HYDREMATS: Entomology and Malaria Transmission Components 2nd 1st human intrinsic parasite bloodmeal: bloodmeal: infected by incubation transmit acquire mosquito infection infection extrinsic parasite incubation oviposition adult pupa egg IIIID ¢¢ L4 larva L1 larva IIII Dillinne -L2 larva < L3 larva

Bomblies, 2008

Anopheles mosquito ecology key to understanding transmission



Experimental setting Banizoumbou and Zindarou, Niger







Banizoumbou sensors:

S met. station

X

- soil moisture profile
- pool temp datalogger
- **CDC** light trap

Indoor CDC light trap with temp/RH datalogger



Simulated water pools



Simulated Mosquitoes



CDC light traps







MODEL APPLICATION: EFFECT OF CLIMATE CHANGE ON MALARIA IN WEST AFRICA

Current climate in West Africa





c) Mean parasite rate in children aged 2-10 in 2007

Predicted Climate in West Africa



40°S

0°

20°W

20°E

40°E

60°E

Expected effect of Climate Change



Red: Higher Vectorial Capacity Green: Lower Vectorial Capacity Orange: Unknown

Simulated future vectorial capacity under most extreme conditions



Publications

- Model Development
 - Bomblies et al. 2008 Water Resources Research
 - Bomblies et al. 2009 Malaria Journal
 - Yamana & Eltahir 2011 WRR
- Environmental Management
 - Gianotti et al. 2009 WRR
 - Gianotti et al. 2009 Malaria Journal
- Predicting impacts of climate variability / climate change
 - Bomblies & Eltahir 2009 EcoHealth
 - Yamana & Eltahir 2010 Malaria Journal
 - Yamana & Eltahir in Review