



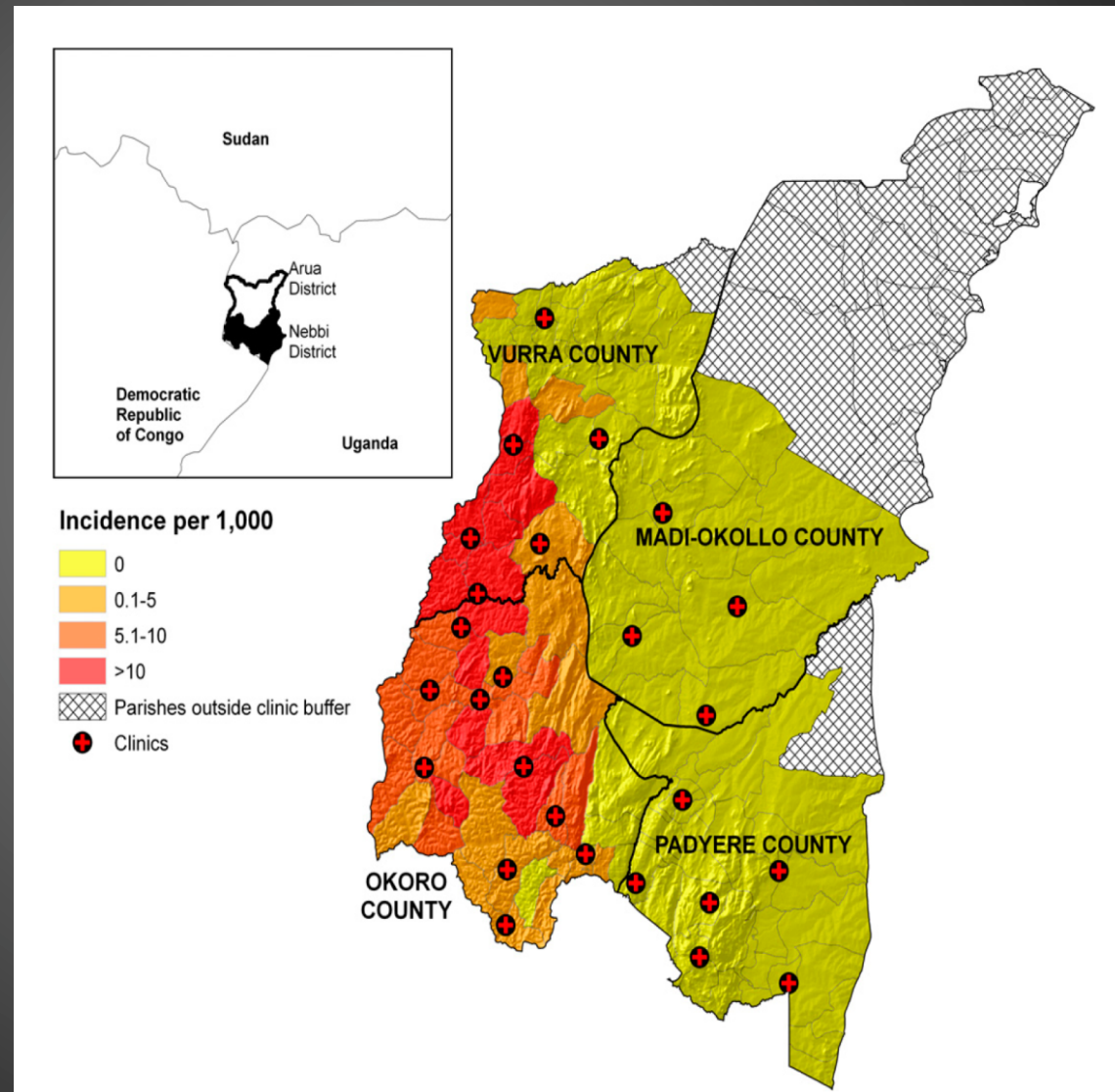
# Climate, Health, Weather and Witch Doctors: Plague in Uganda

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# Plague in Uganda

- Plague is a highly virulent flea-borne disease caused by the bacterium *Yersinia pestis*.
- Infected fleas that travel on rats and intermittently come into contact with humans
- Local rat populations fluctuate in response to climate variability

# West Nile region of Uganda

- Two districts – Arua and Nebbi – in northwestern Uganda consistently report human plague cases.
- From 1999 through 2007, clinics from these districts reported to the Ugandan Ministry of Health a mean of approximately 223 suspect human cases per year.\*



\*Eisen et al. 2008

# Gambian Rat



# Rattus rattus



# NCAR/CDC Collaboration

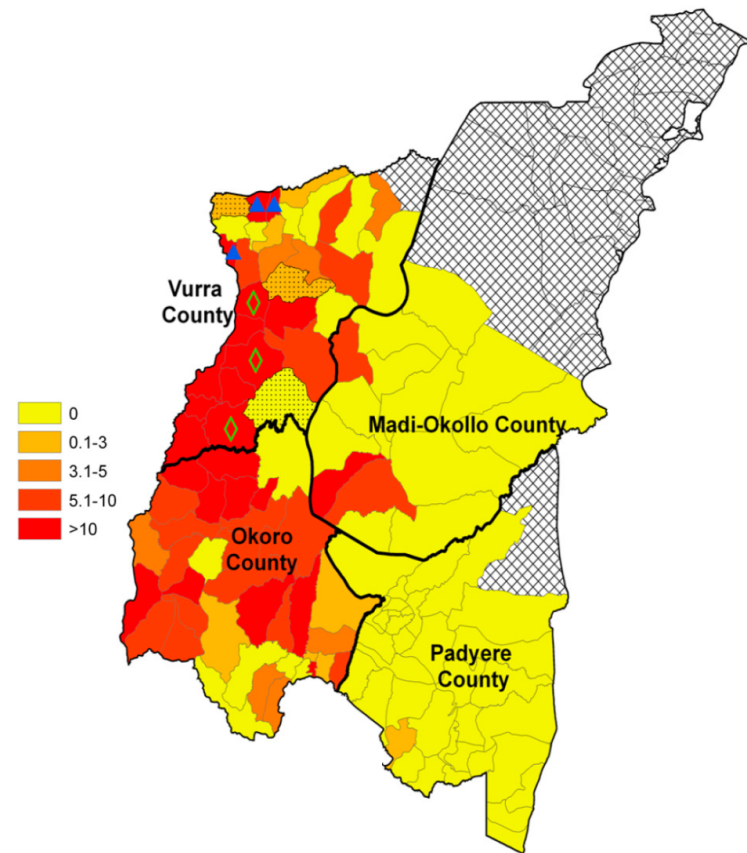
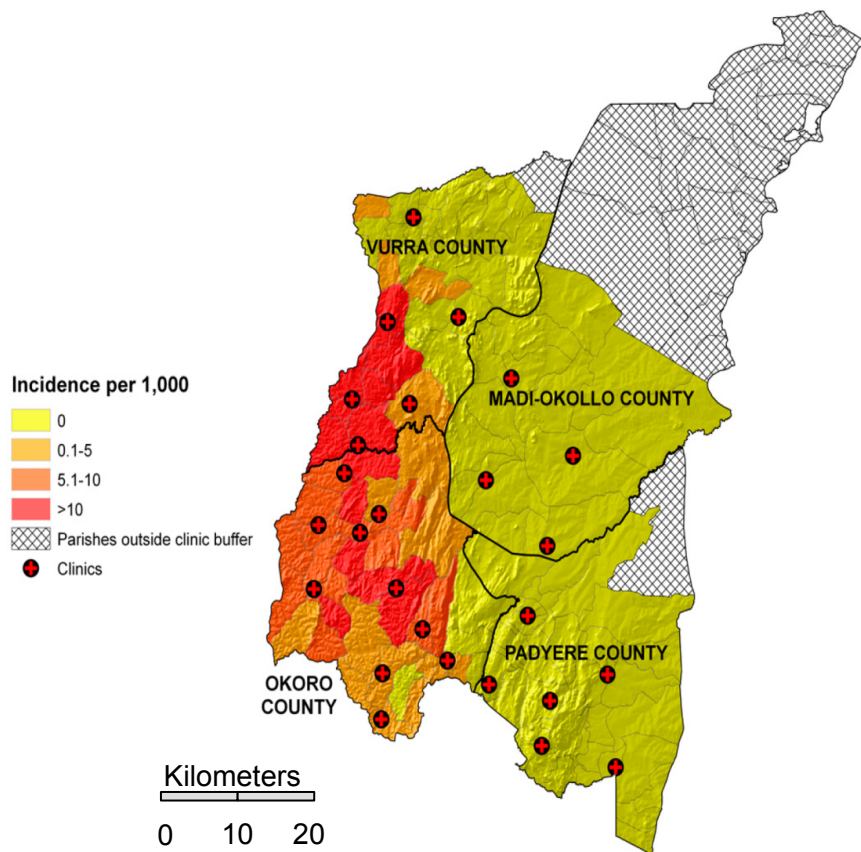
- NCAR is working with CDC to generate a 10 year high resolution climate dataset over Uganda that will be employed in a model to predict plague incidence
- The long-term goal is to incorporate climate models to project potential plague outbreaks several months ahead of time, so that limited resources can be mobilized

# Observed\* versus Modeled Plague Cases, 1999-2007

(\*suspect or probable)

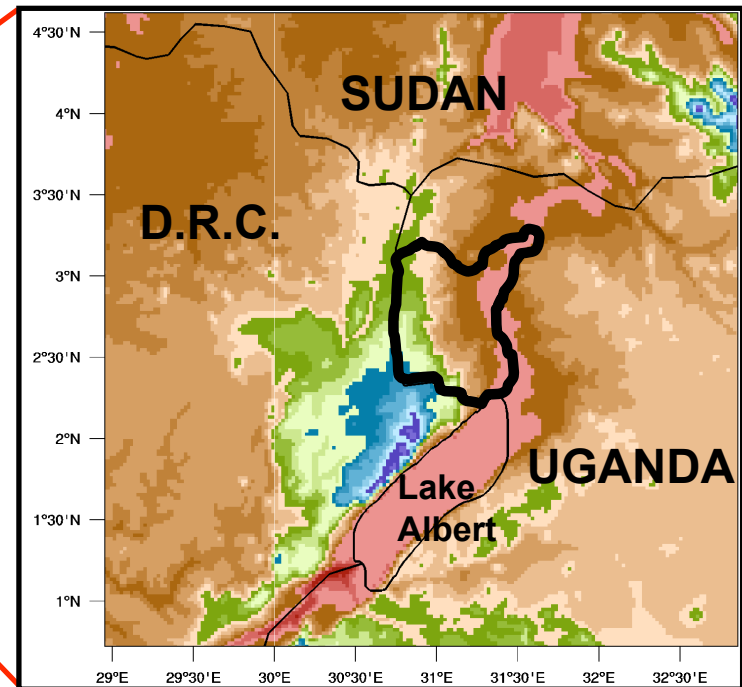
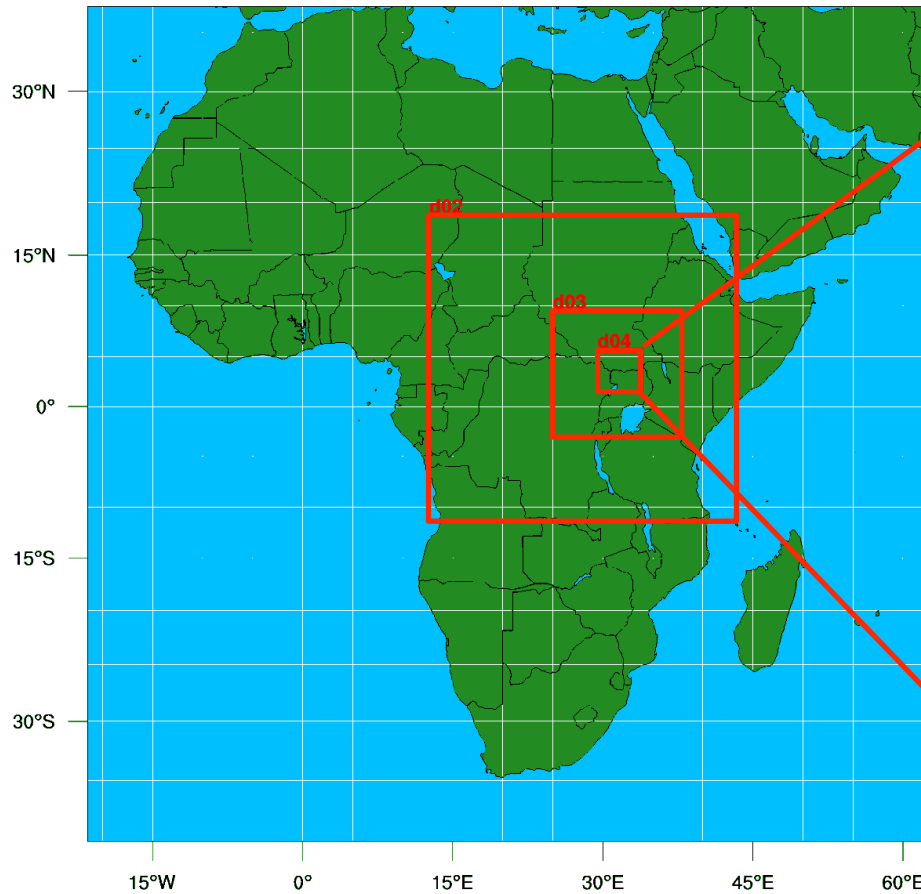
## Observed Plague Cases (1999-2007)

## Modeled Plague Cases (1999-2007)

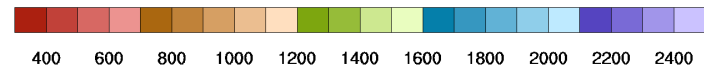


Winters et. al (2009)

# WRF Model Domain and Topography



Terrain Elevation (m)

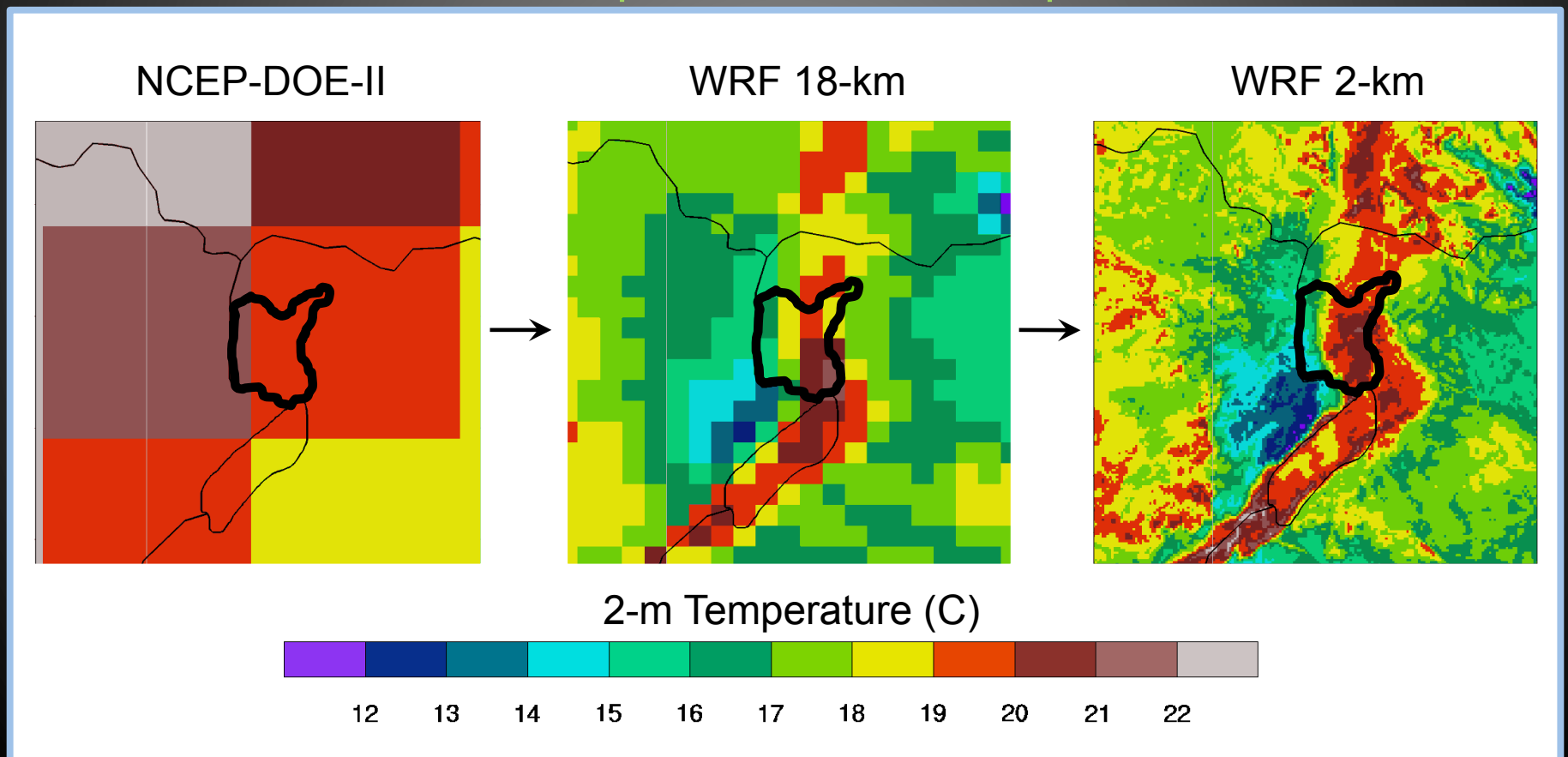




**Problem:** Current climate datasets are too coarse (~200-km resolution) to resolve the complex topography and land use variability in the West Nile region.

**Solution:** Dynamical Downscaling over WN: 200-km to 2-km resolution

Example for 2 meter Temperature:



# Data loggers

Measure local level  
temperature and  
relative humidity



Indoors and  
outdoors along  
a transect



# Societal Impacts

- Plague has a short incubation period (2-6 days), and is often fatal if antibiotic treatment is delayed or insufficient.
- Need to better understand health care seeking behavior and access to health care to reduce fatalities
- Household scale interviews with witch doctors and drug shop employees

# Rural Uganda



Photo courtesy of Brant Foote

# The village



Photo courtesy of Brant Foote



Photo courtesy of Brant Foote

# Interviewing a witch doctor



Photo courtesy of Brant Foote

# The treatment room



Photo courtesy of Brant Foote

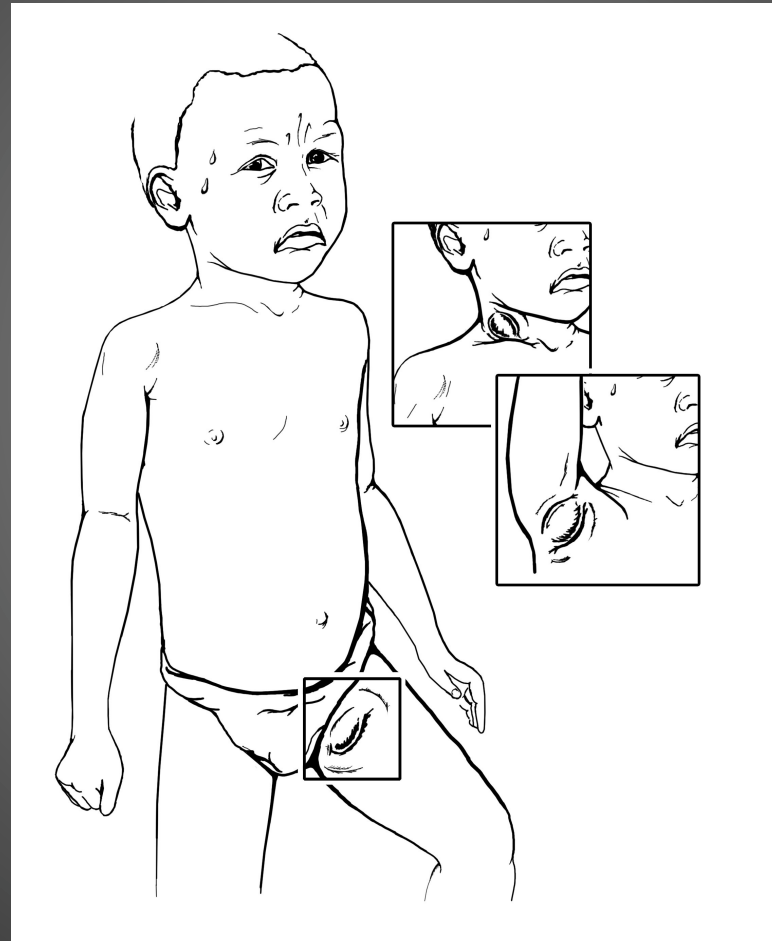


# Interviewing drug shop employees



# Low-literacy educational materials

Develop low-literacy guide to enhance awareness of plague



Work with local collaborators to provide a mechanism for better outreach

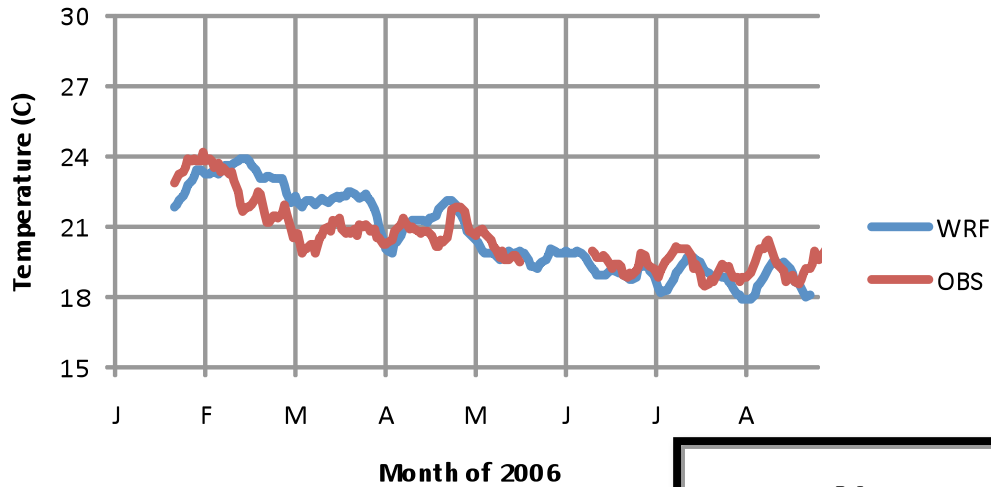
# Summary

- Climate-disease linkages are complex and thus require an approach that accounts for all aspects – social, economic, and environmental.
- The next generation of scientists will be trained to span disciplines in order to address these complex issues.

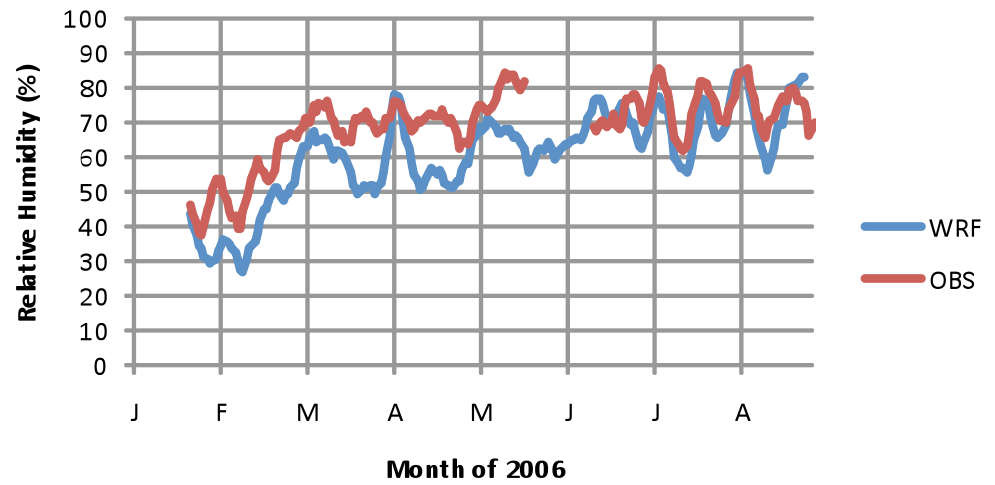
# Extra Slides

# Comparison: Observed vs. WRF Temp. and RH at Nyapea

## Nyapea 7-day mean 2-m Temperature

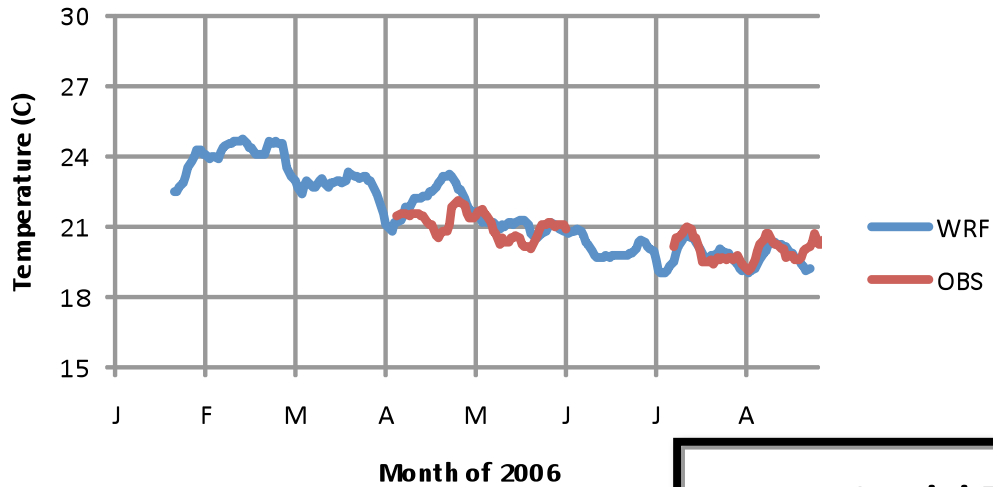


## Nyapea 7-day mean 2-m Rel. Hum.

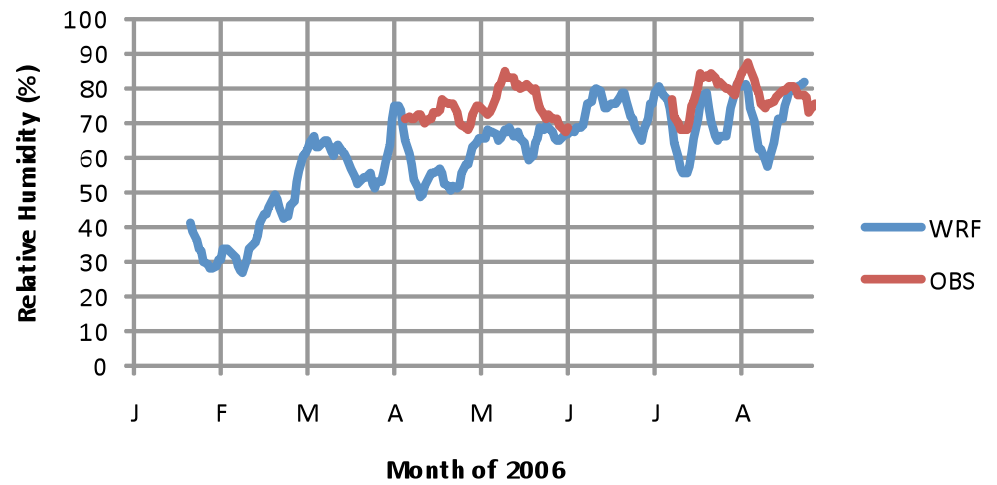


# Comparison: Observed vs. WRF Temp. and RH at Logiri

## Logiri 7-day mean 2-m Temperature



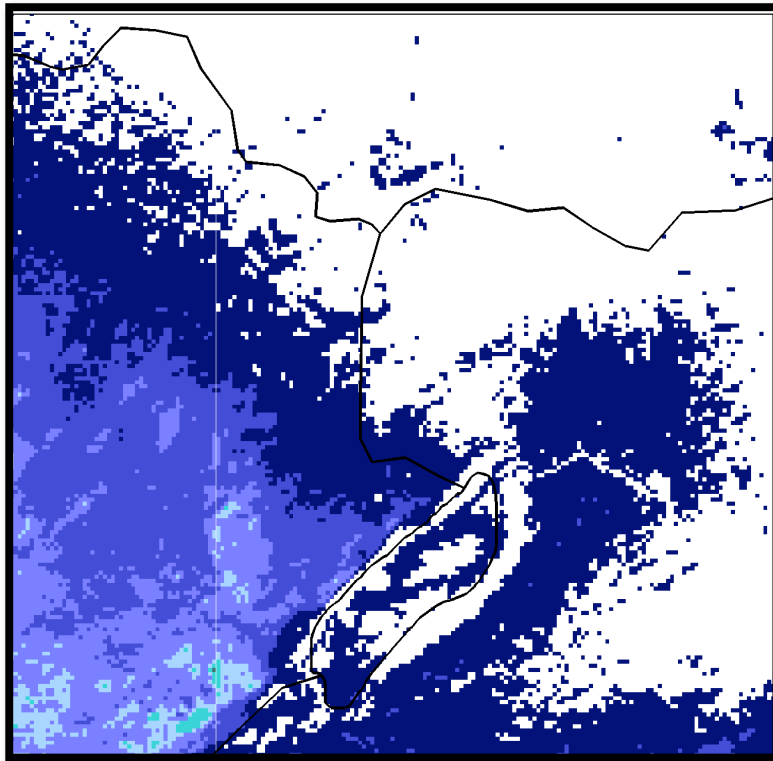
## Logiri 7-day mean 2-m Rel. Hum.



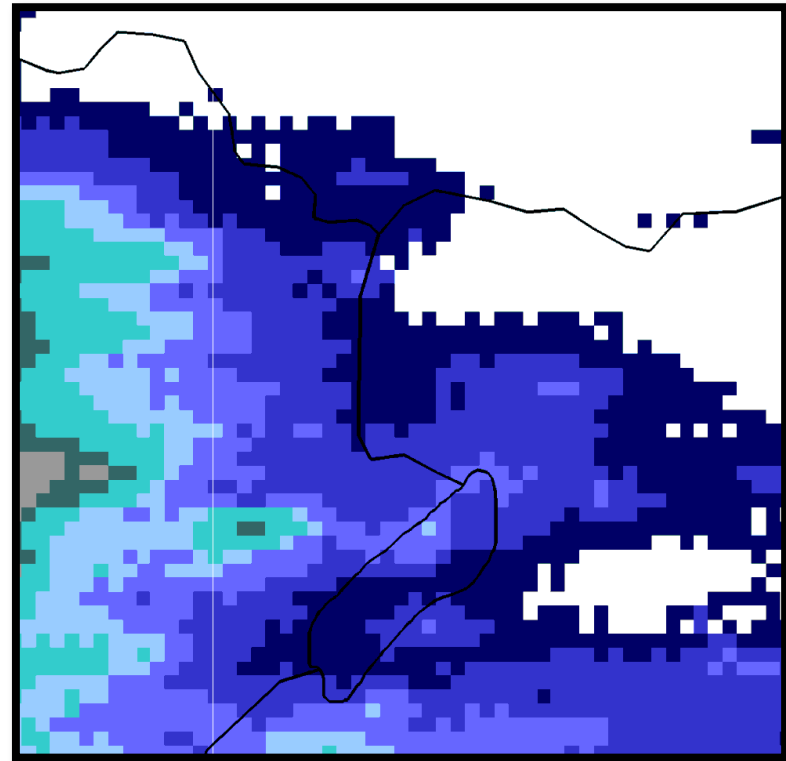
# Comparison: Satellite-derived Rainfall vs. WRF Rainfall

**JAN 2006: DRY SEASON EXAMPLE**

WRF 2-km



CMORPH 8-km



Monthly Total Rainfall (mm)

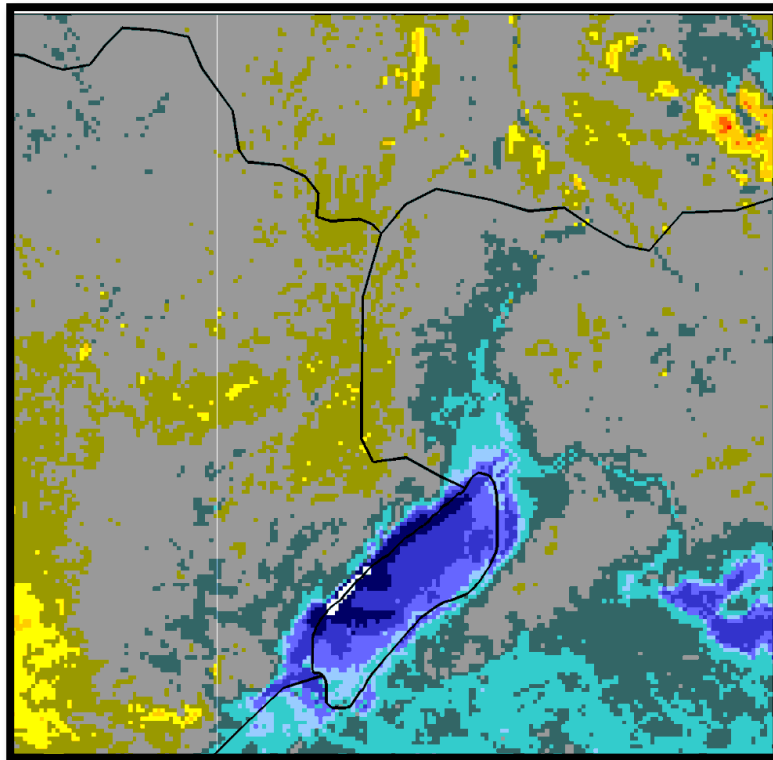


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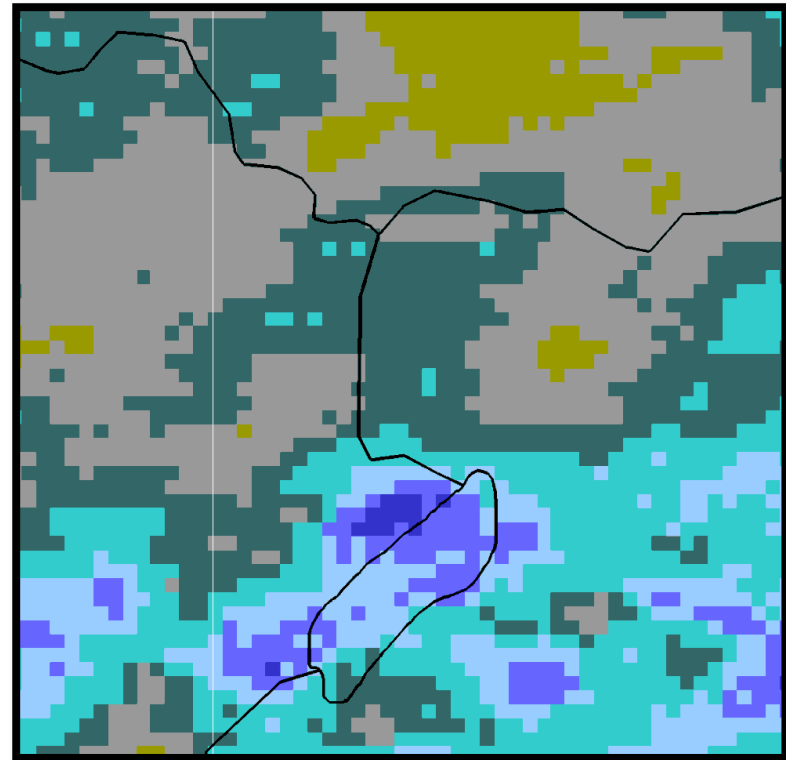
# Comparison: Satellite-derived Rainfall vs. WRF Rainfall

## AUG 2006: RAINY SEASON EXAMPLE

WRF 2-km



CMORPH 8-km



Monthly Total Rainfall (mm)



10 25 50 75 100 150 200 300 400 500 750 1000 1250 1500