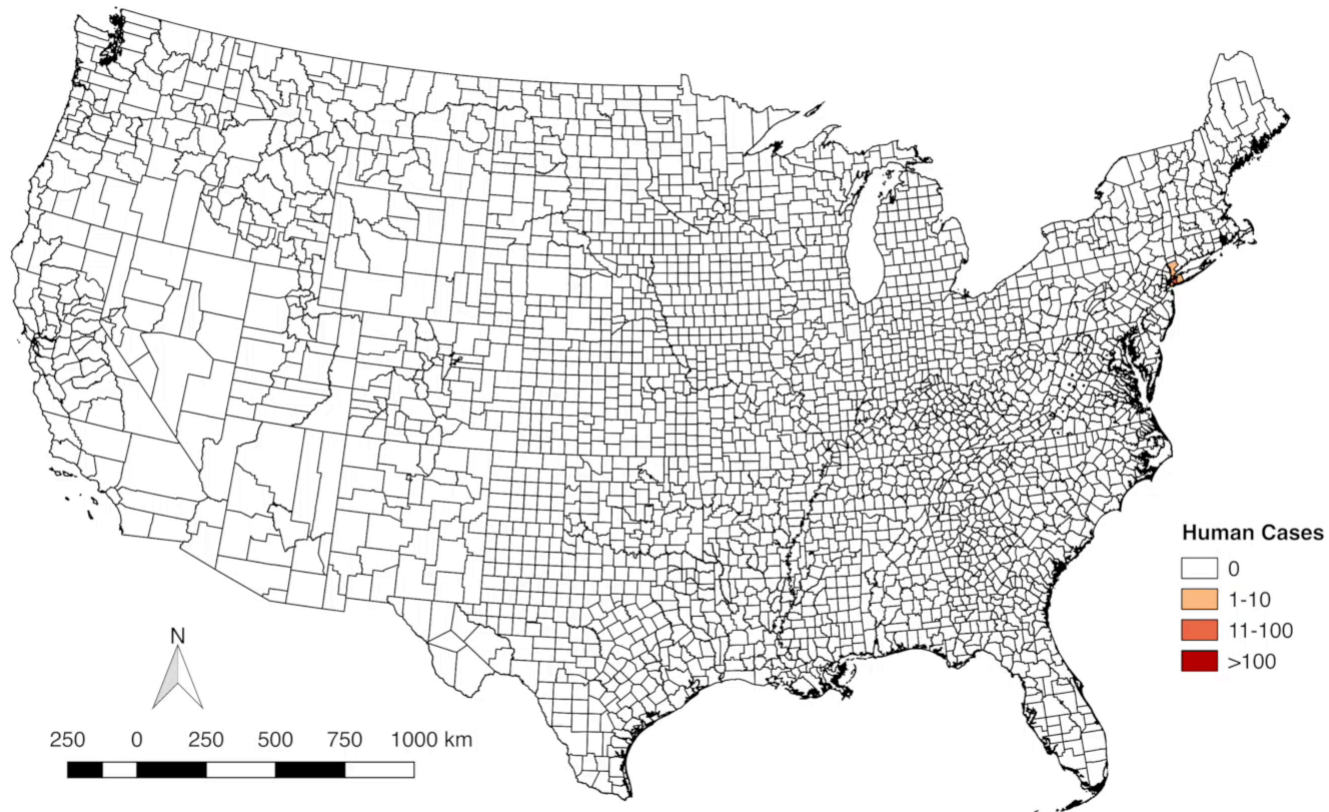# Developing Spatial Real-Time Forecasts of Mosquito-Borne Diseases

Nicholas DeFelice (PI)
Meytar Sorek-Hamer
Scott Campbell
Krishna Vemuri
2/13/20

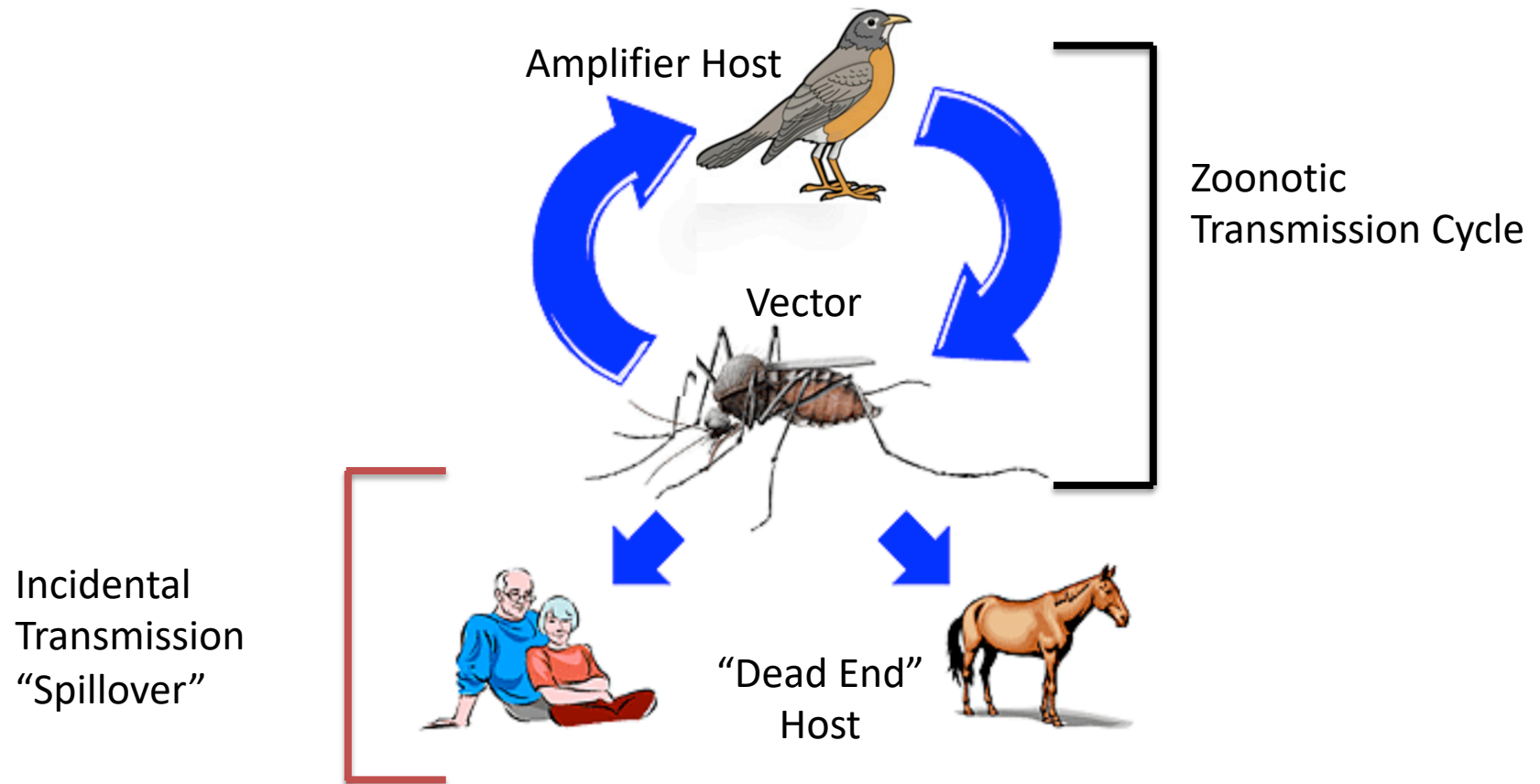# Impact of WNV in the US

Human Cases
- 0
- 1-10
- 11-100
- >100

CDC

West Nile Virus Transmission Cycle

Environmental Components Influence the Transmission Cycle

**Humidity**   **Temperature**   **Hydrology/Precipitation**

Prevention

o No human vaccine or specific treatment

o Personal protection

    o Mosquito repellent

    o Long sleeve shirts and pants

o Community based mosquito control programs

Forecasting Framework

- Model-EAKF system relies on three components:

  1. WNV surveillance data

  2. Mathematical model that can freely simulate the spread of WNV in mosquitoes, birds, and humans

  3. Data assimilation method
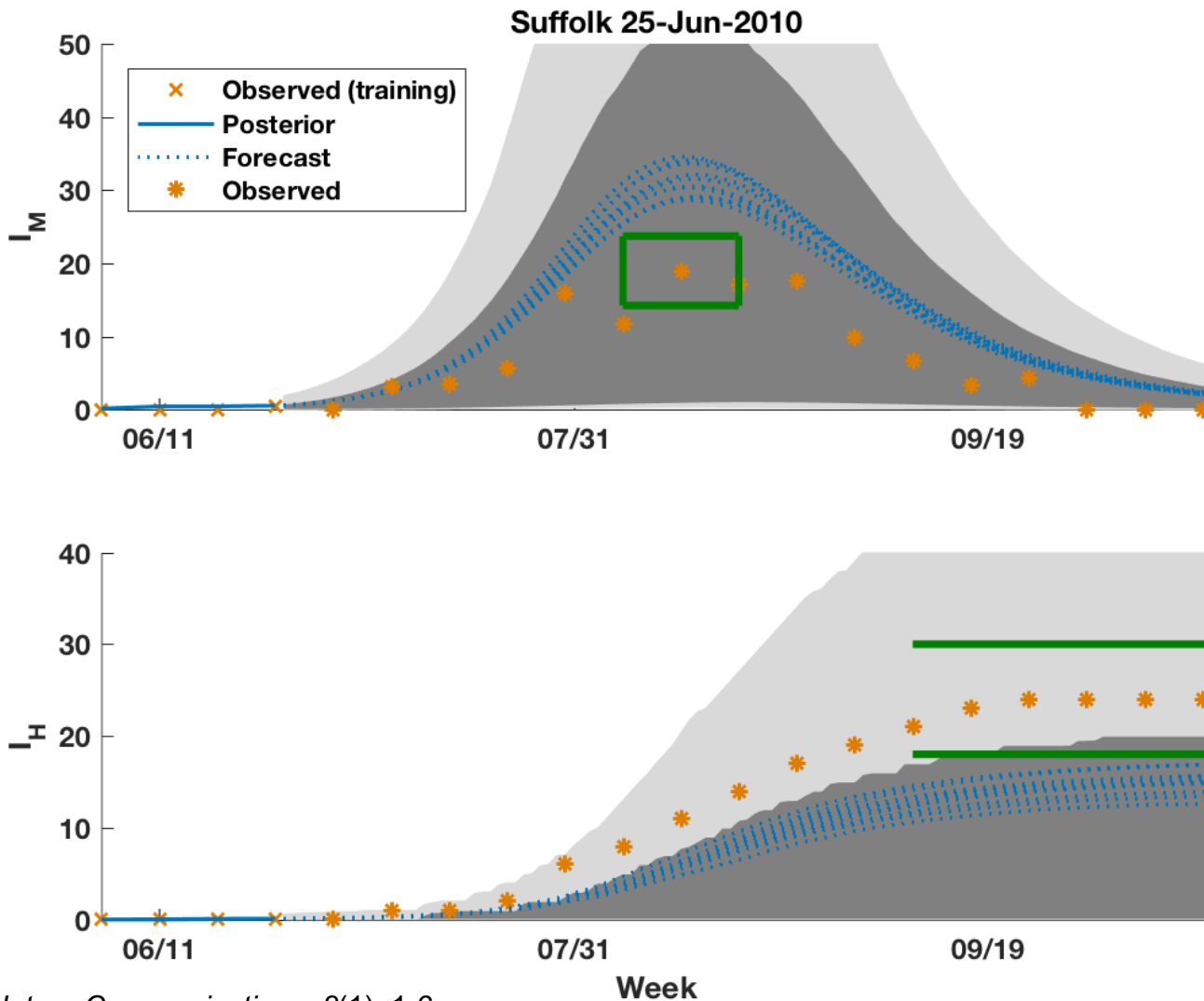   - Ensemble adjustment Kalman filter (EAKF)
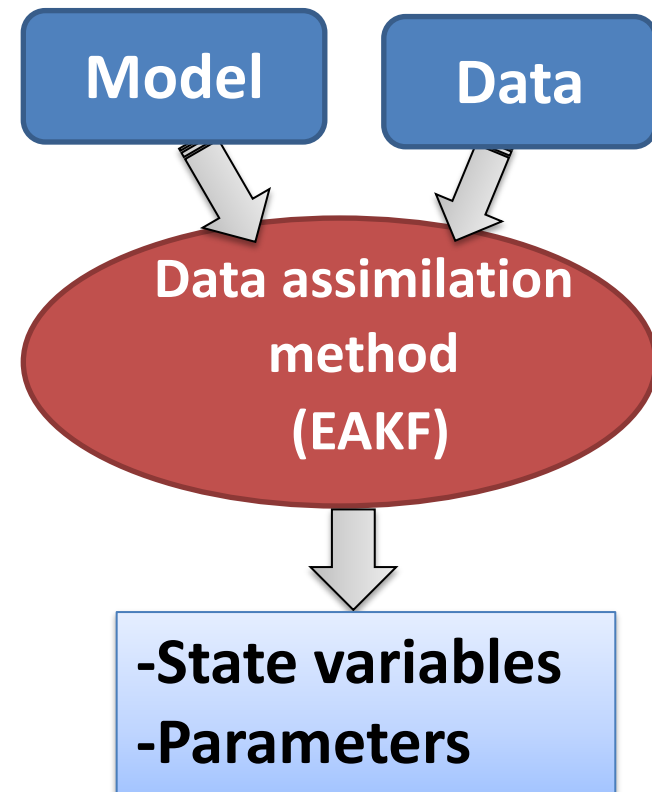
Model **Data**

Data assimilation method (EAKF)

-State variables
-Parameters

N DeFelice et al. *Nature Communications*, *8*(1), 1-6.

Retrospective Forecast

N DeFelice et al. *Nature Communications*, *8*(1), 1-6.

Forecast Accuracy

Suffolk 25-Jun-2010

A forecast was deemed accurate if:
- ±25% total number of human cases
- Peak timing within ±1 week of the observed peak of infectious mosquitoes
- Maximum mosquito infection rate was within ±25% of the observed peak infection rate
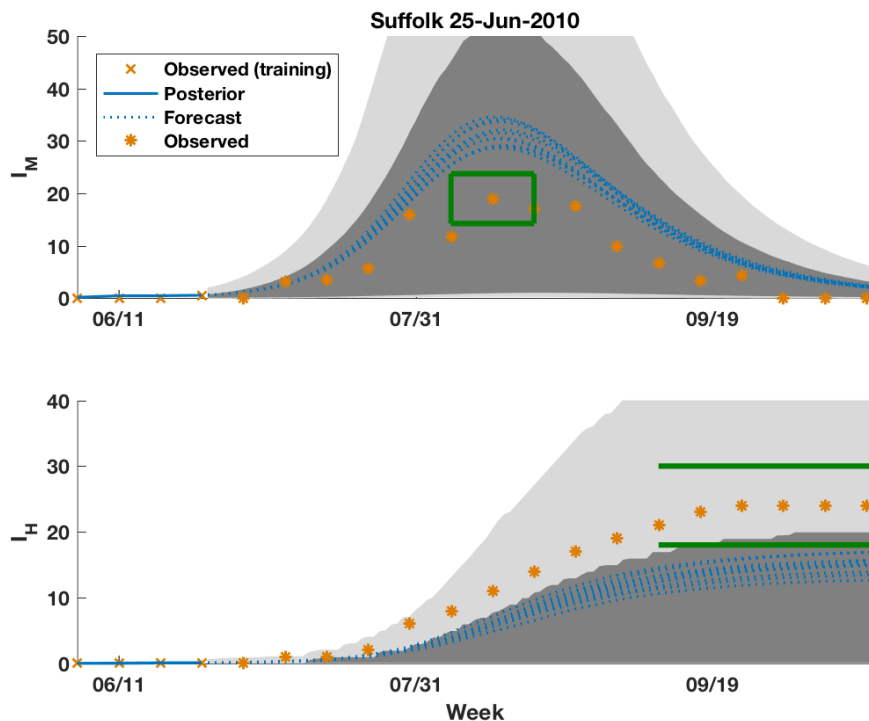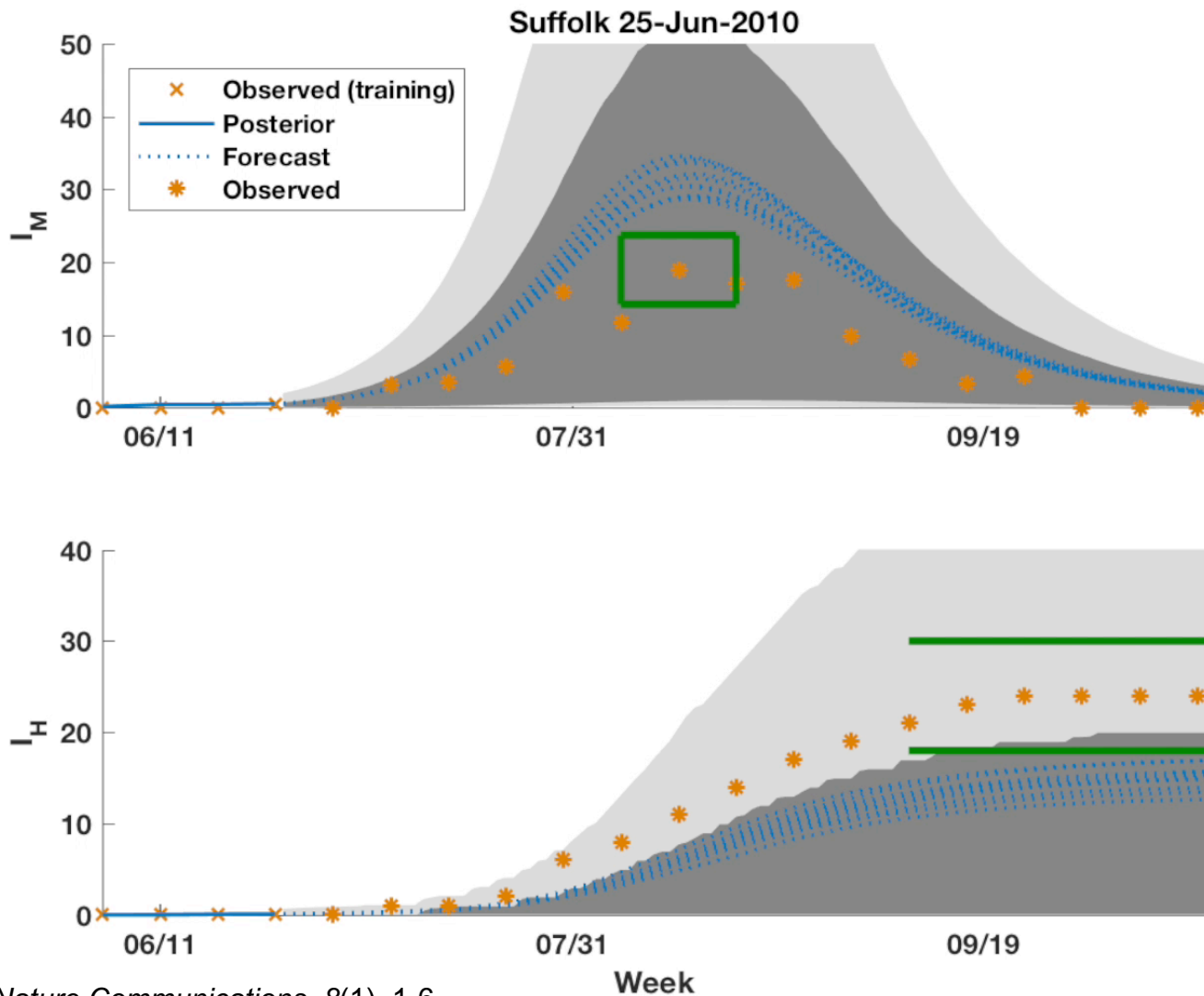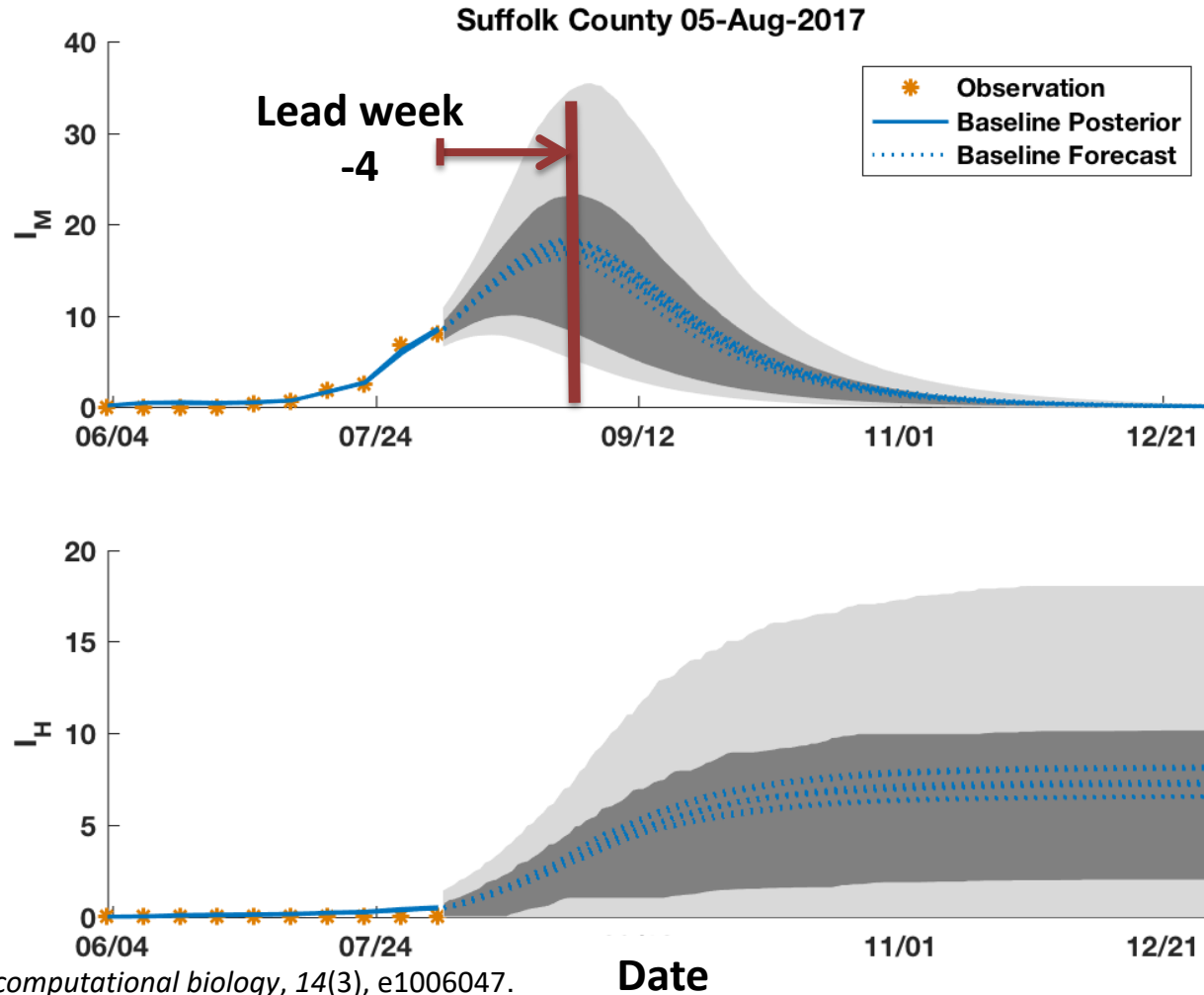
N DeFelice et al. *Nature Communications*, *8*(1), 1-6.

Retrospective Forecast

N DeFelice et al. *Nature Communications*, *8*(1), 1-6.
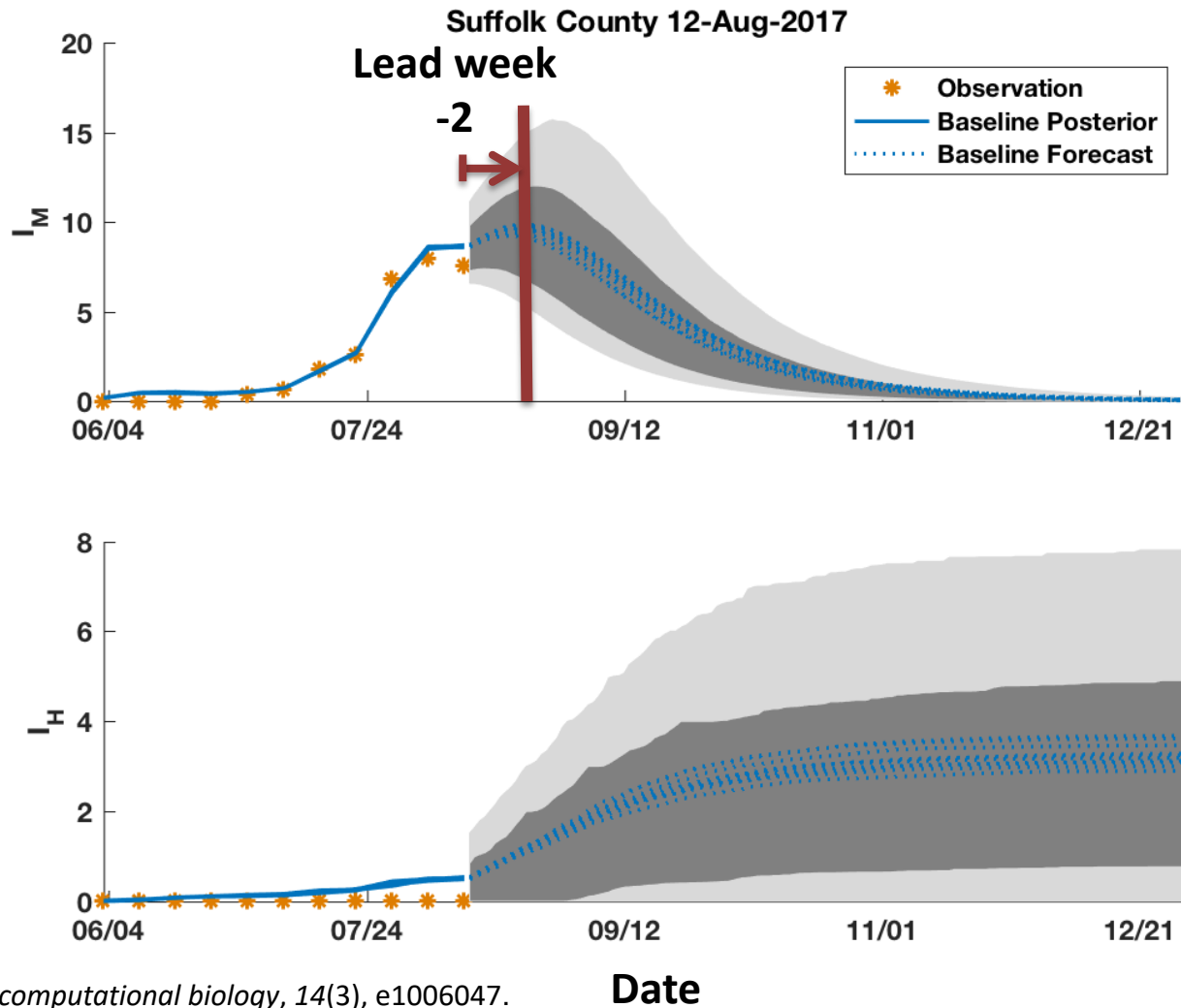
Lead Week Explanation

Suffolk County 05-Aug-2017

Lead week -4

N DeFelice et al. *PLoS computational biology*, *14*(3), e1006047.

Lead Week Explanation
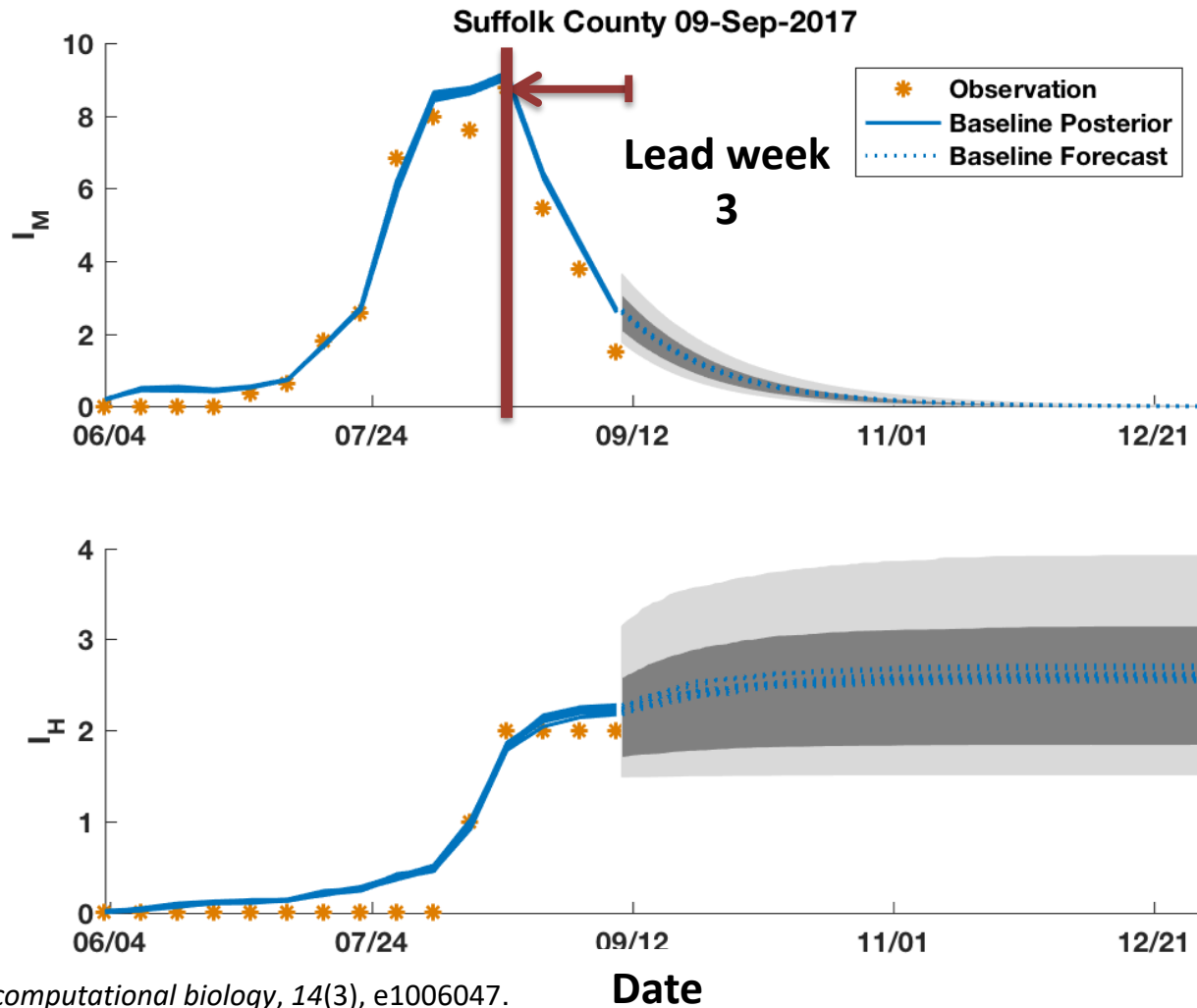

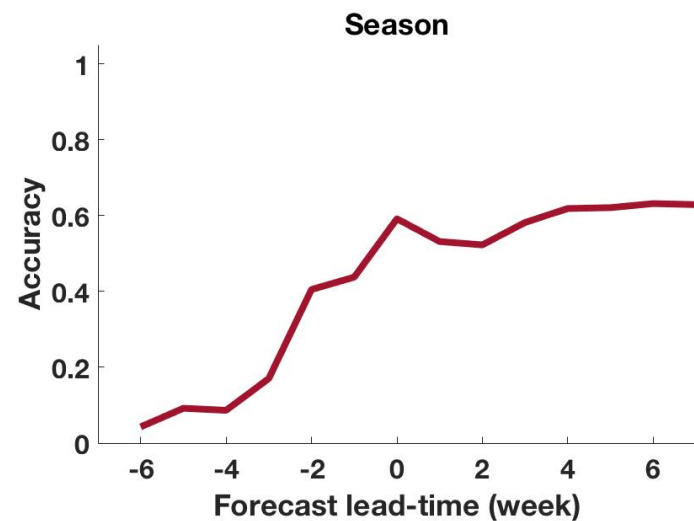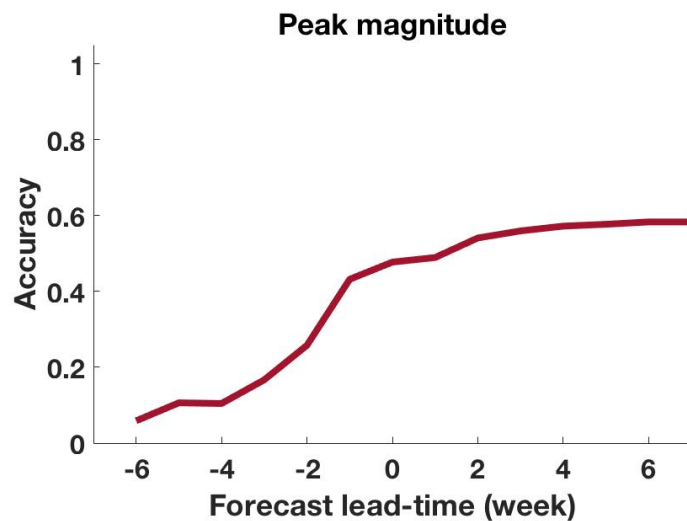Suffolk County 12-Aug-2017
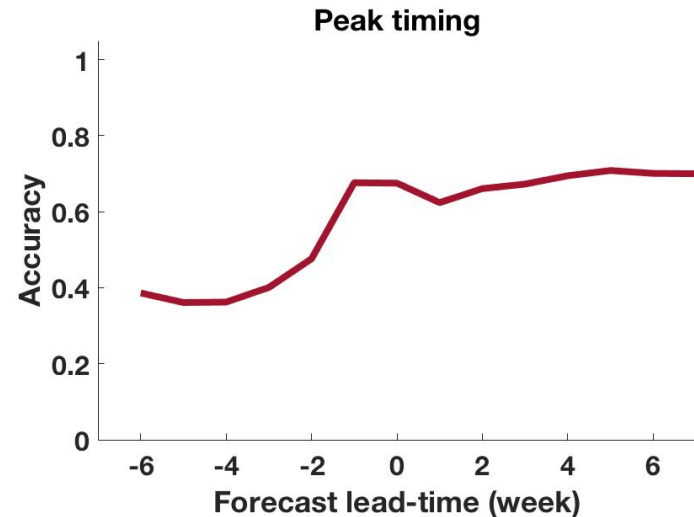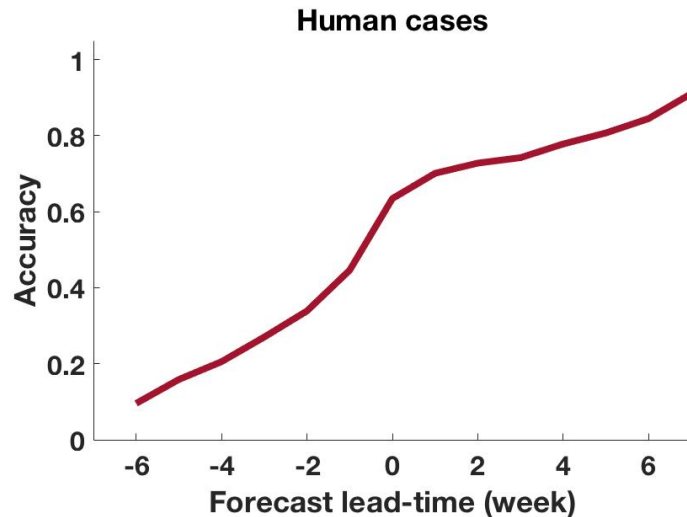
Date

Mount Sinai

Lead Week Explanation

N DeFelice et al. *PLoS computational biology*, *14*(3), e1006047.

Forecast Calibration

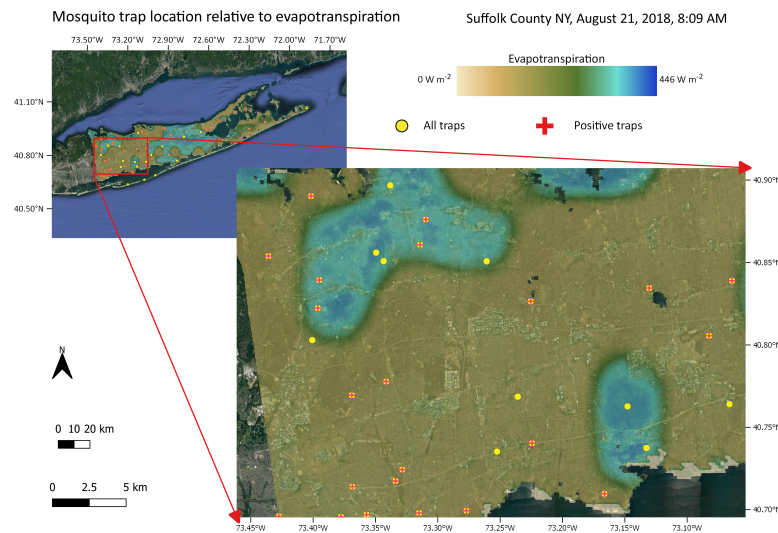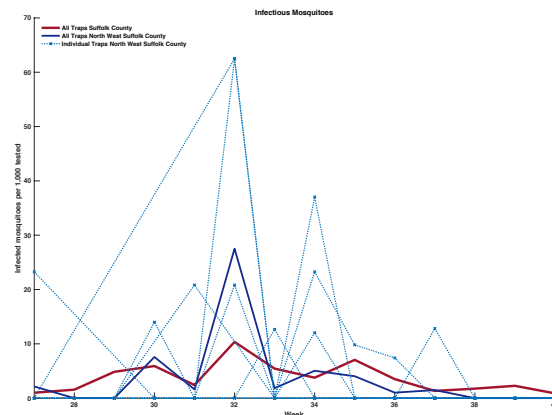N DeFelice et al. *PLoS computational biology*, *14*(3), e1006047.

Objectives

**Task #1
Create Database**

↓

**Task #2
ECOSTRESS Downscaled
WNV Risk**

↓

**Task #3
ECOSTRESS Derived
WVN Forecasts**

↓

**Task #4
Decision App for WNV
Risk**

Infectious Mosquitoes

Mosquito trap location relative to evapotranspiration

Suffolk County NY, August 21, 2018, 8:09 AM

Mount Sinai

Questions?