IDEA Lab

University of Idaho

SPATIOTEMPORAL WEIGHTED REGRESSION

Chao Ma, Xiang Que, Marshall Xiaogang Ma

DEPARTMENT OF COMPUTER SCIENCE

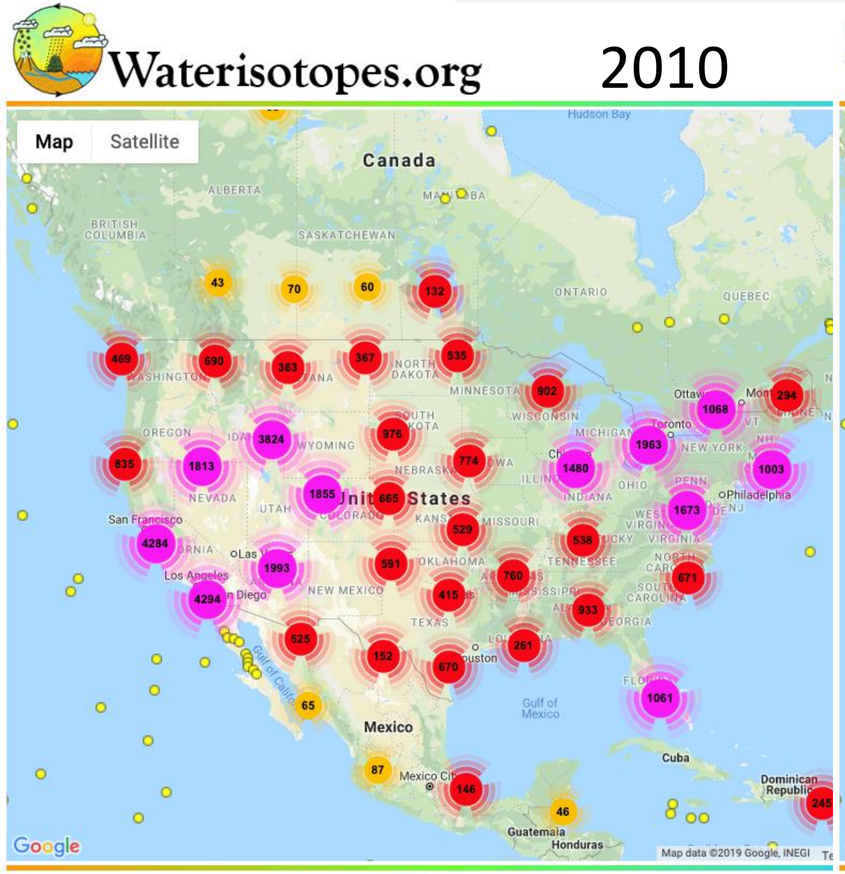
UNIVERSITY OF IDAHO

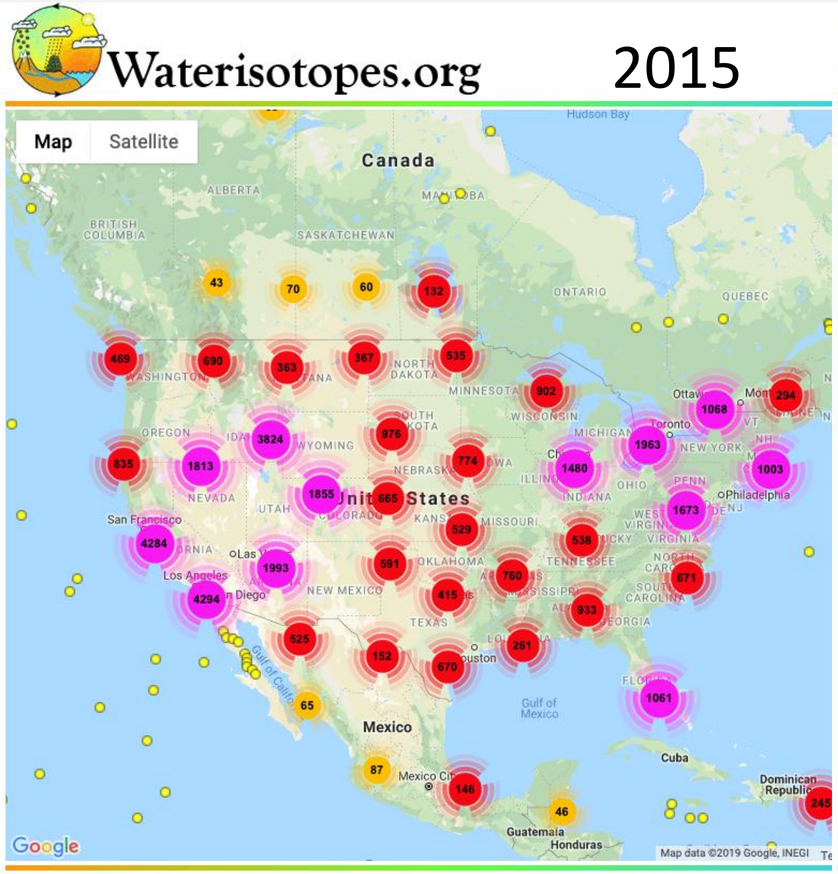
OUTLINE-STWR

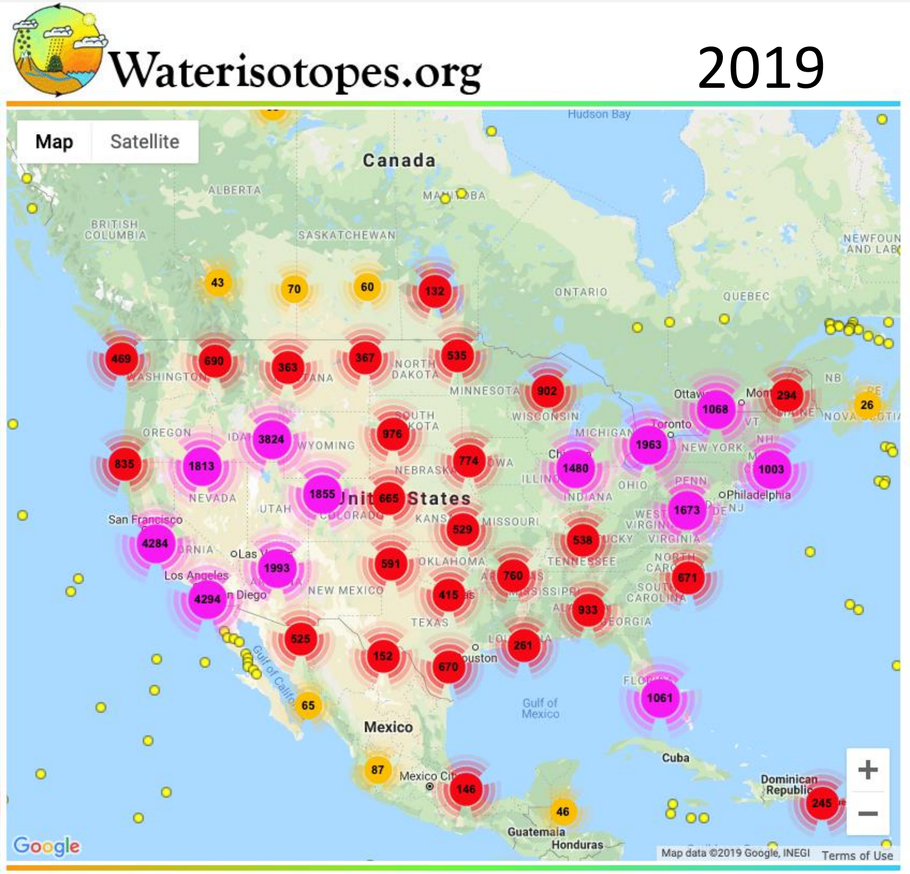
- MOTIVATION
- METHOD
- CASE STUDY
  - Simulated Data
  - Real-world Data
- CONCLUSIONS

MOTIVATION

- Geographic processes of temporal and spatial data
- Interpolation / out-of-sample prediction
- NO Ordinary Least Squares regression (OLS)



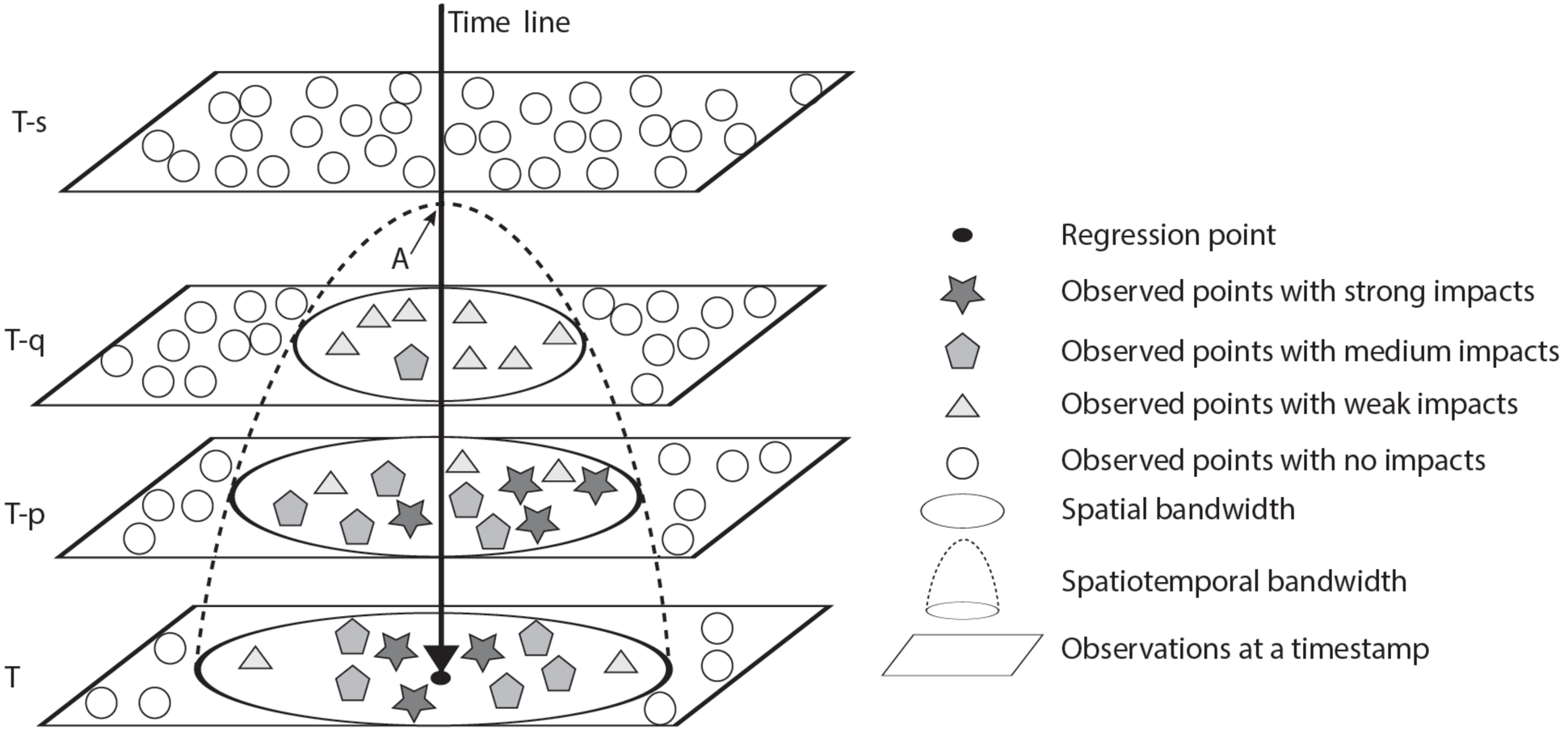


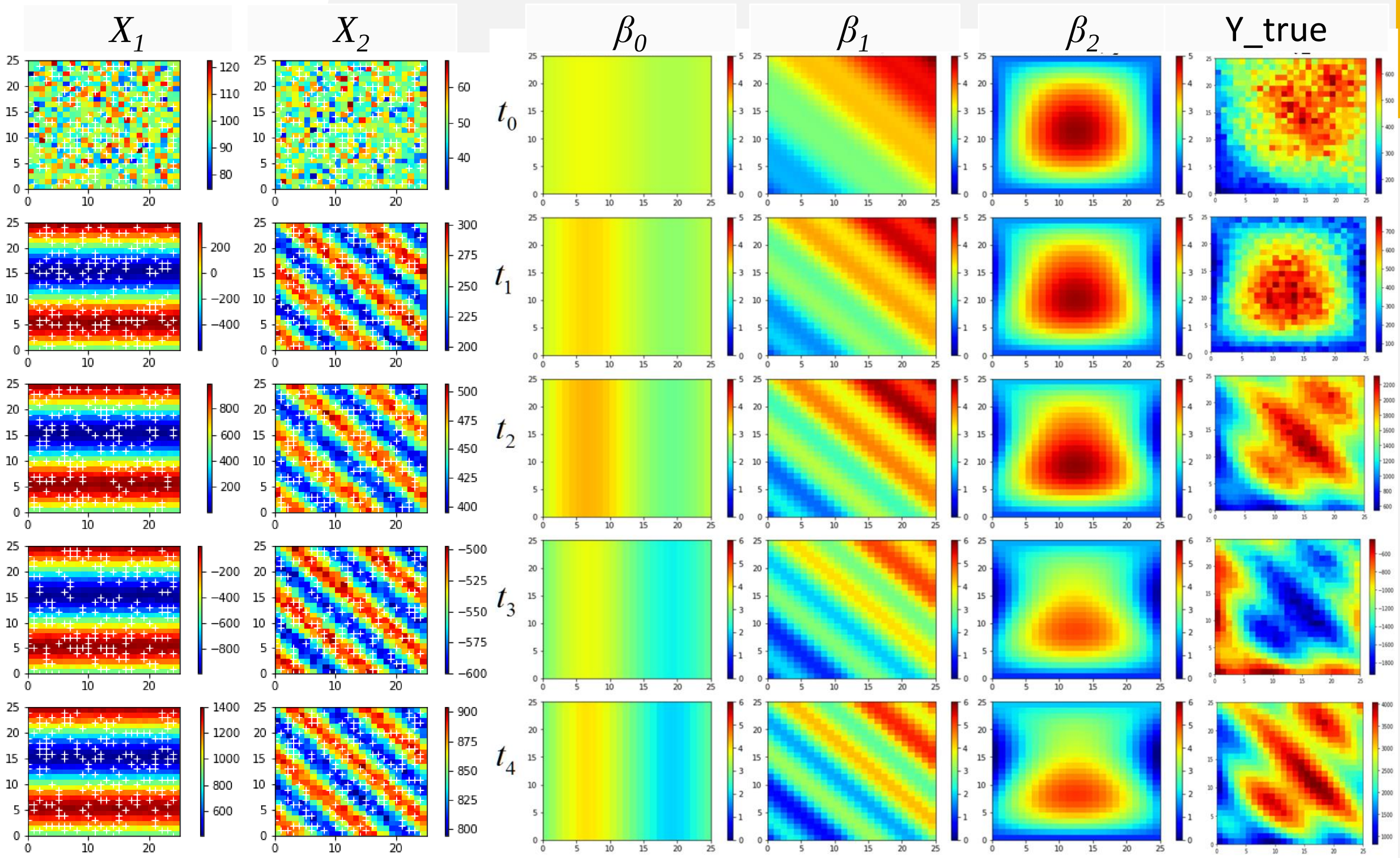


METHOD

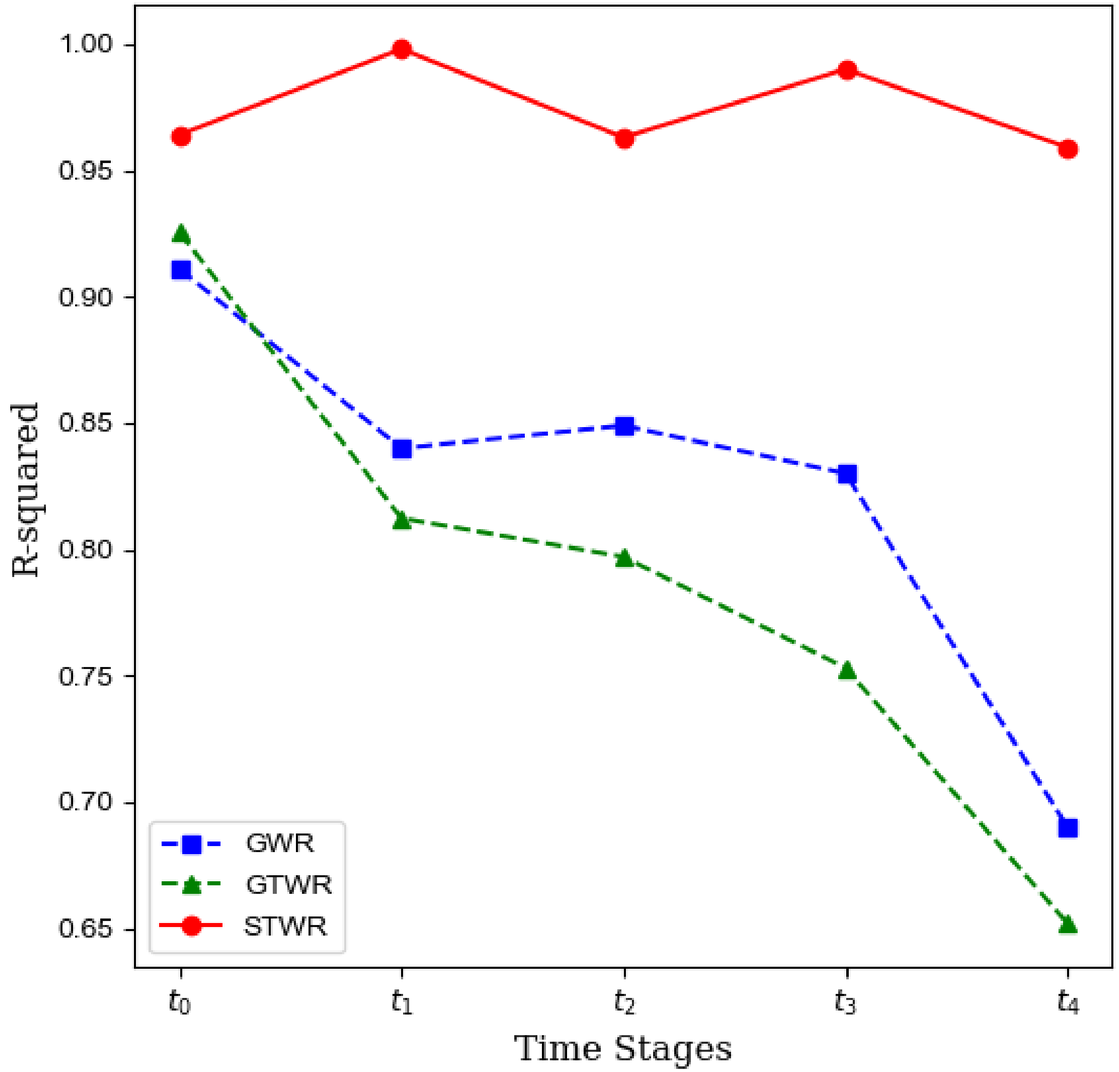
Spatiotemporal Weighted Regression

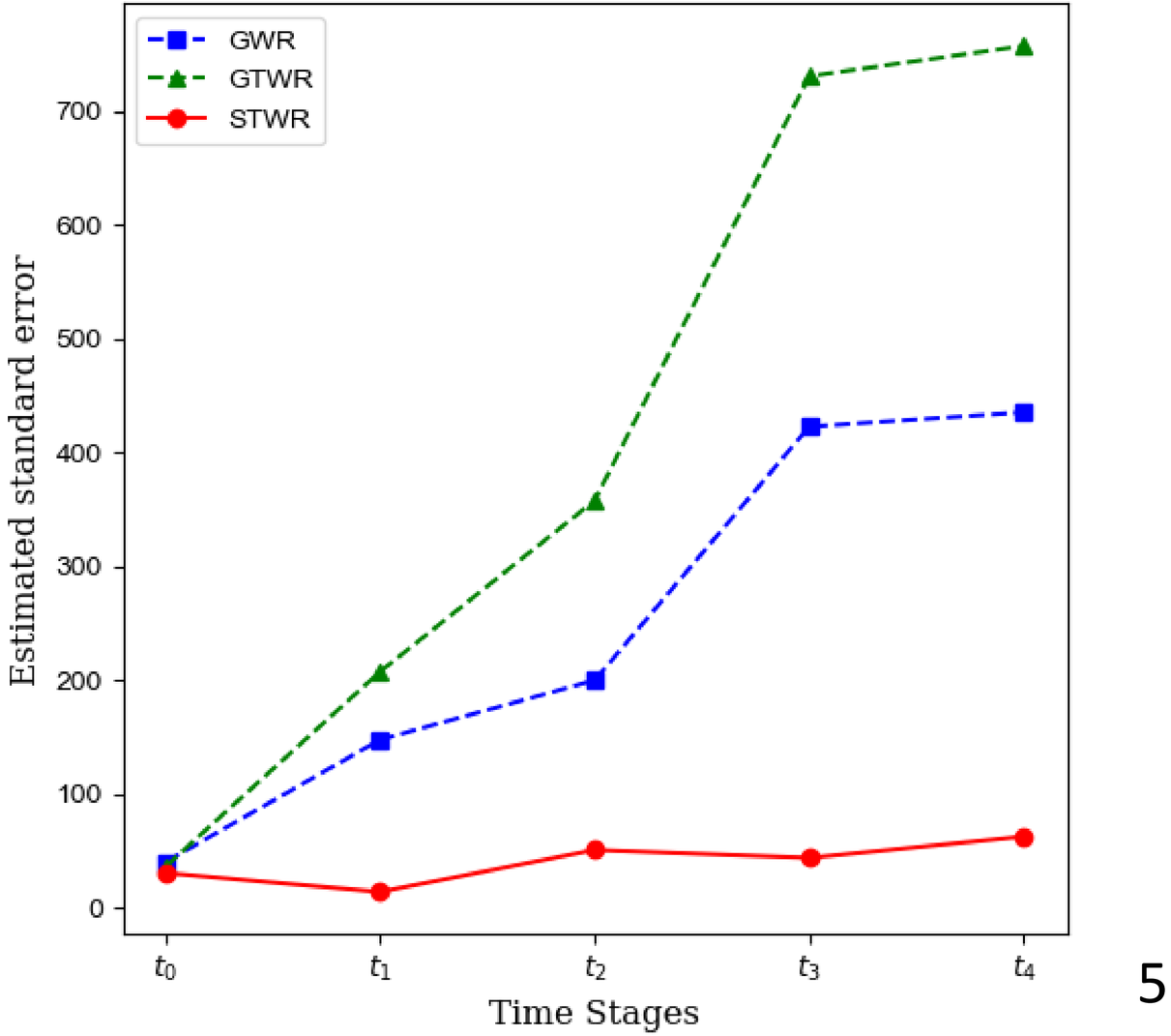
- **Weight ∝ time and space distance**



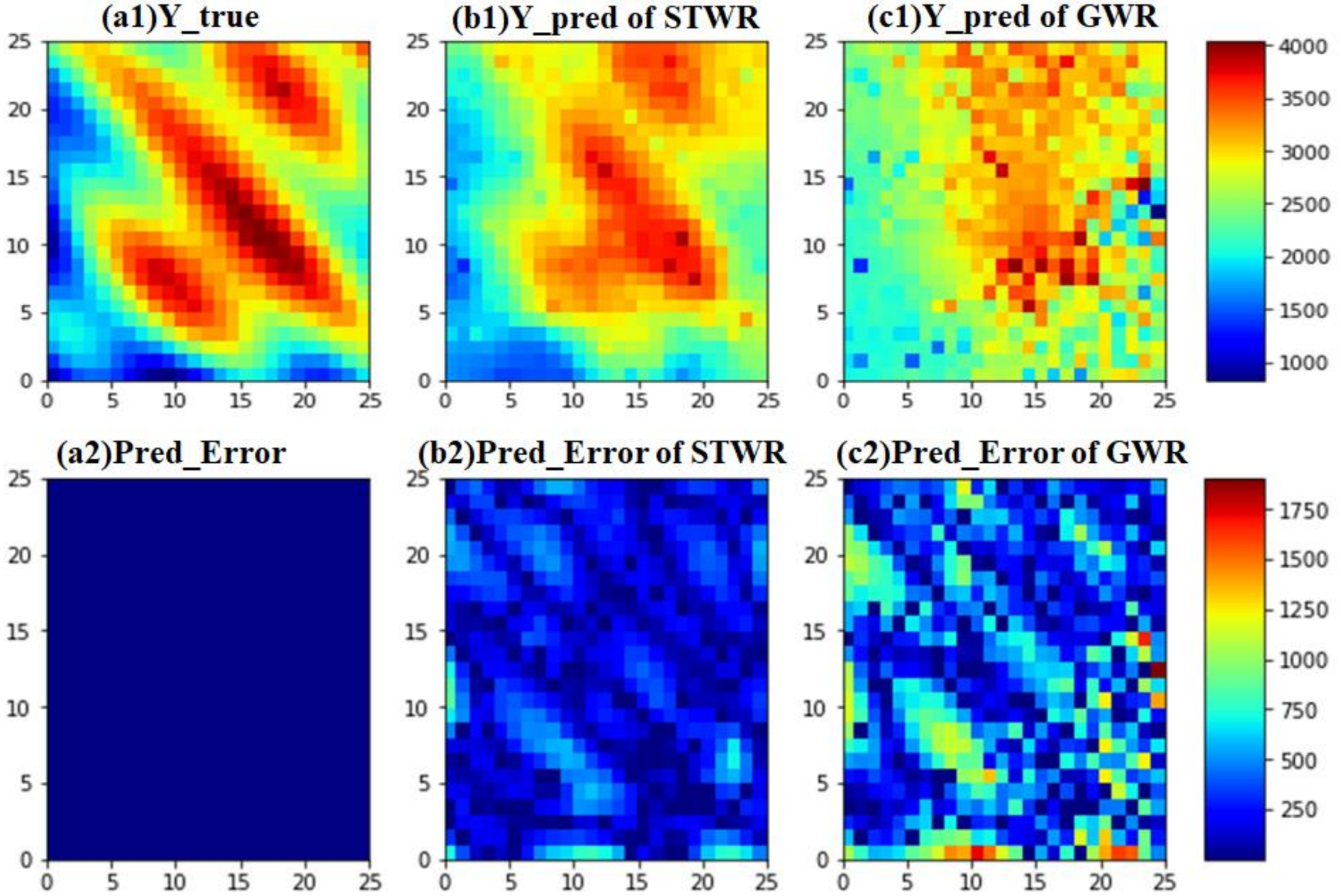

X_1
X_2
β_0
β_1
β_2
Y_true
t_0
t_1
t_2
t_3
t_4

RESULTS-1:
R^2, ESTIMATED STANDARD ERROR





RESULTS-2 ERROR OF PREDICTION



EXPERIMENT WITH REAL-WORLD DATA

precipitation δ2H isotope map

Daily average δ^2H from three days (Oct.29 – 31, 2012)

$$y_i = \beta_0 + \beta_1 ppt + \beta_2 tmean + \beta_3 height + \varepsilon_i$$

Data source of water isotopes δ^2H

http://wateriso.utah.edu/waterisotopes/pages/spatial_db/SPATIAL_DB.html

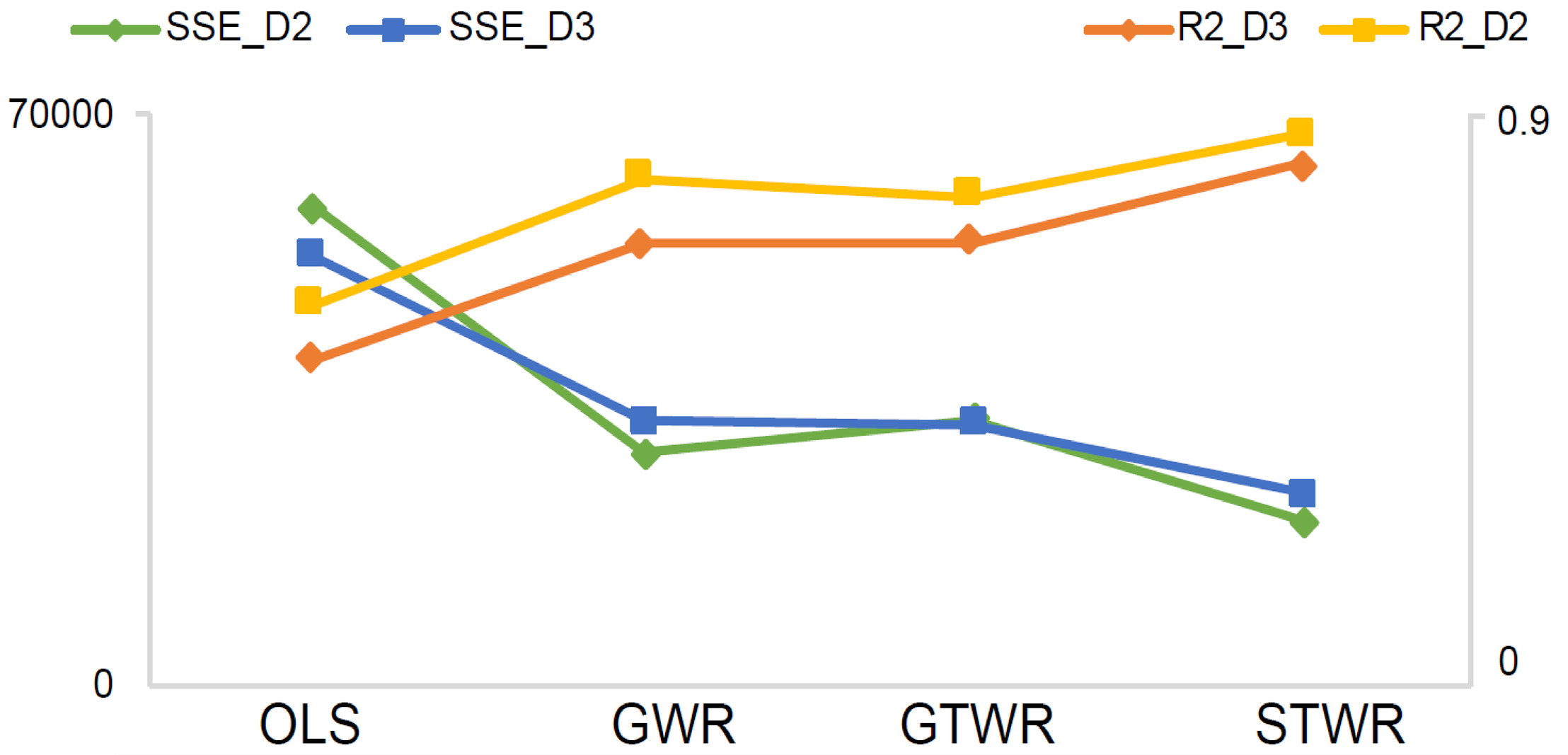
http://www.prism.oregonstate.edu

https://topotools.cr.usgs.gov/gmted_viewer/viewer.htm

CASE STUDY: REAL-WORLD DATA

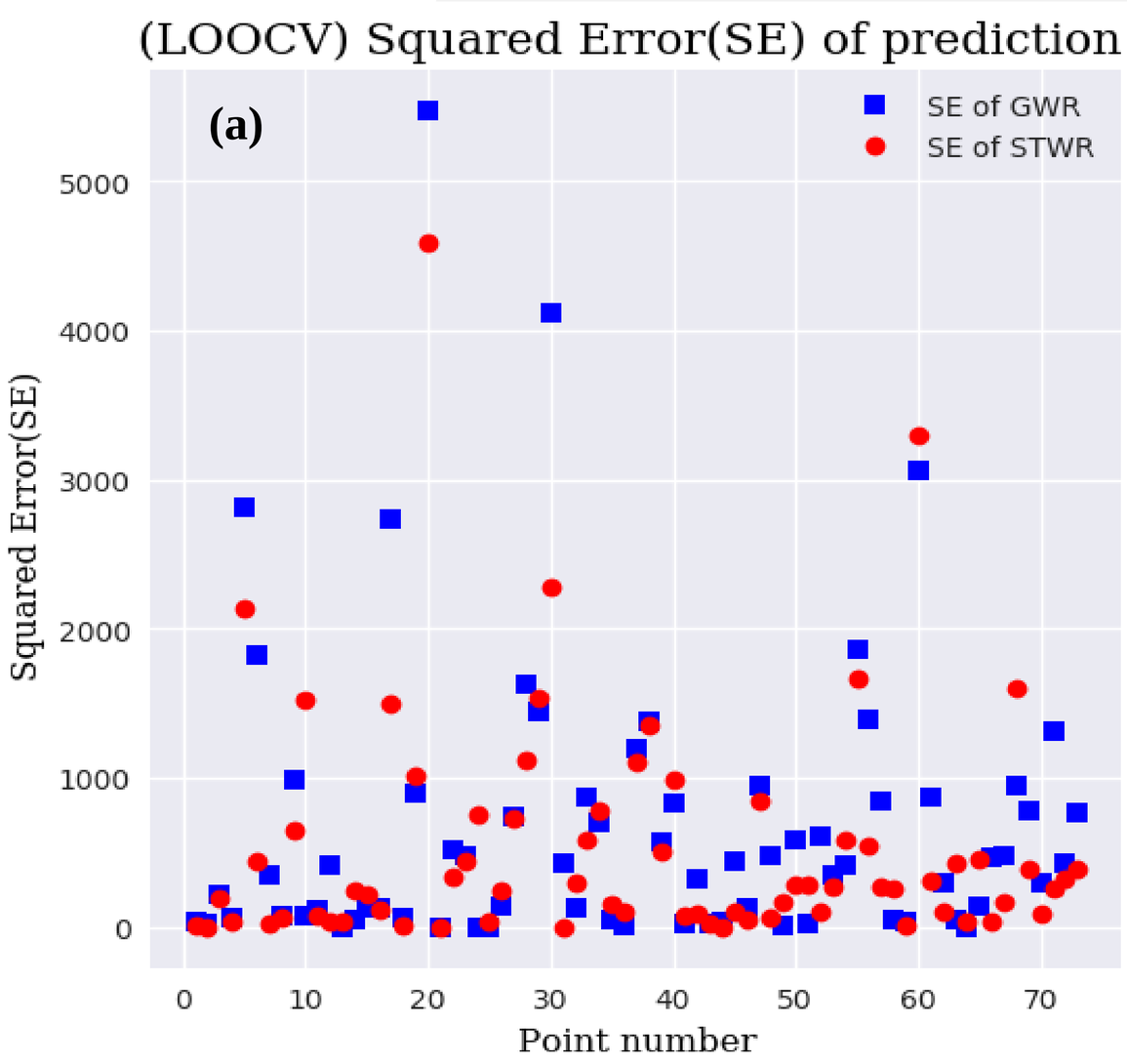
precipitation δ2H isotope map

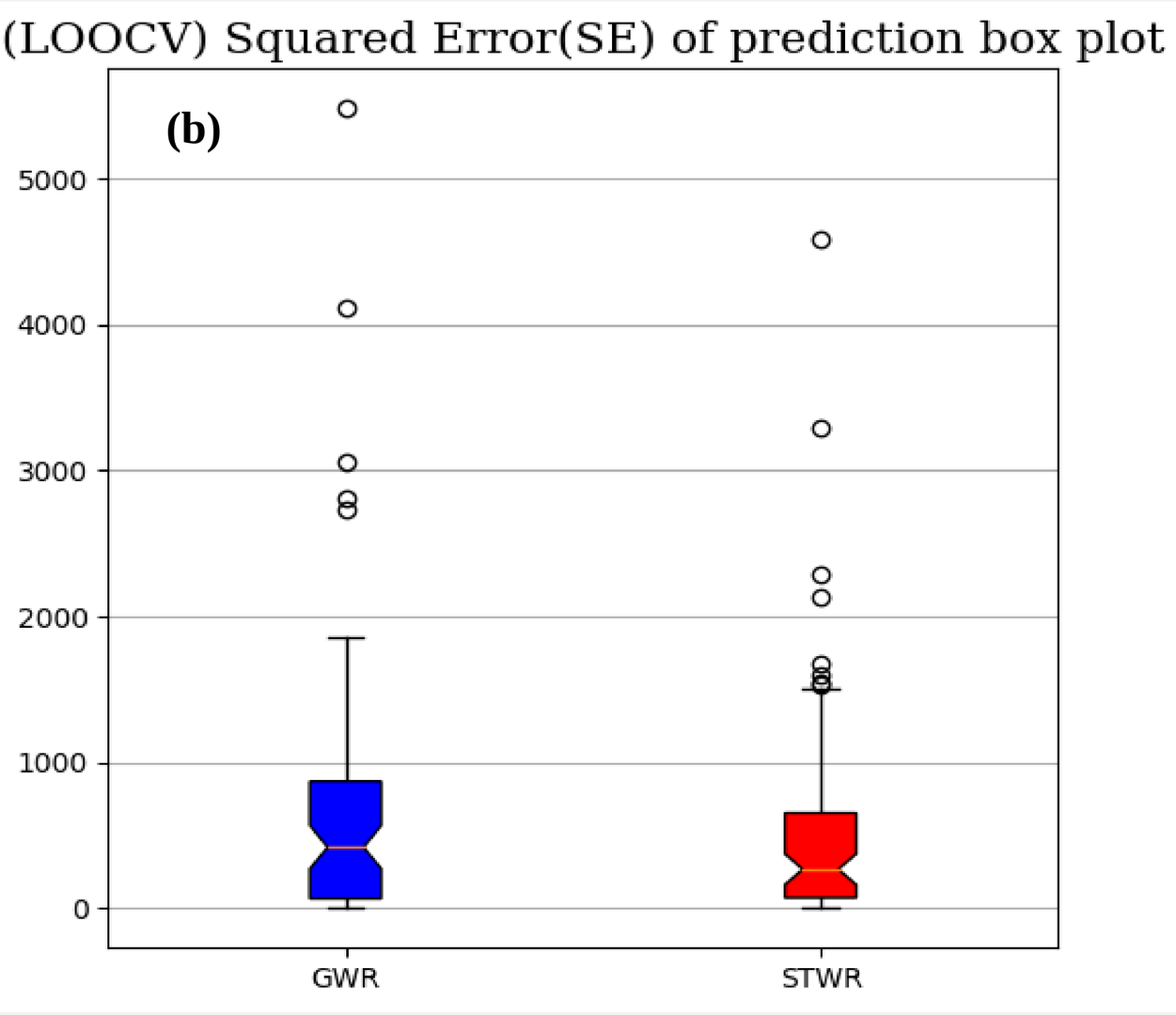
Results of model performance with real-world data



CASE STUDY: REAL-WORLD DATA

Comparison Results of precipitation δ^2H



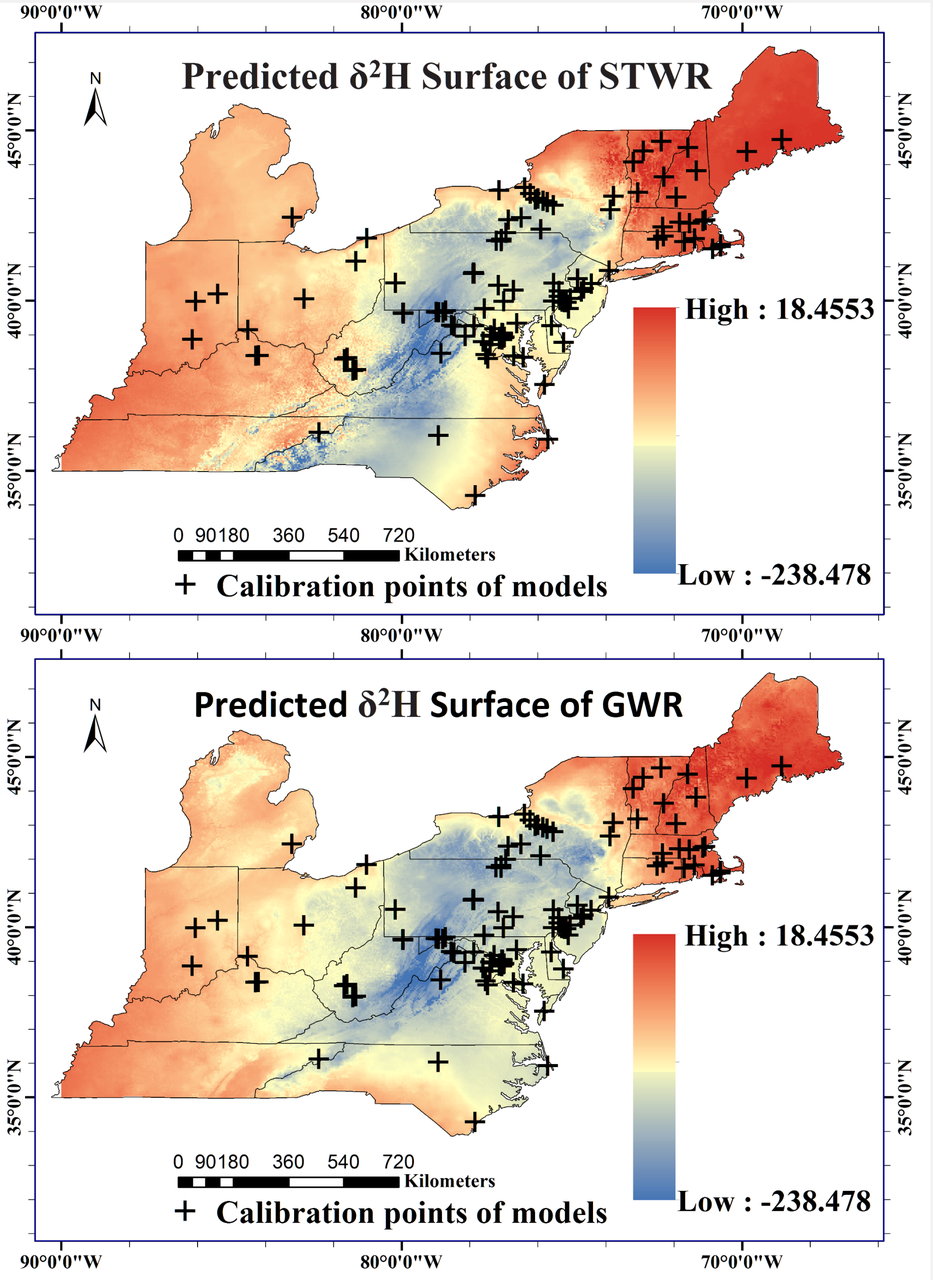


CASE STUDY: REAL-WORLD DATA

Comparison Results of precipitation δ^2H

Study areas located at
Northeastern United States
Oct.31, 2012

Predicted Surface of
Water Isotopes δ^2H



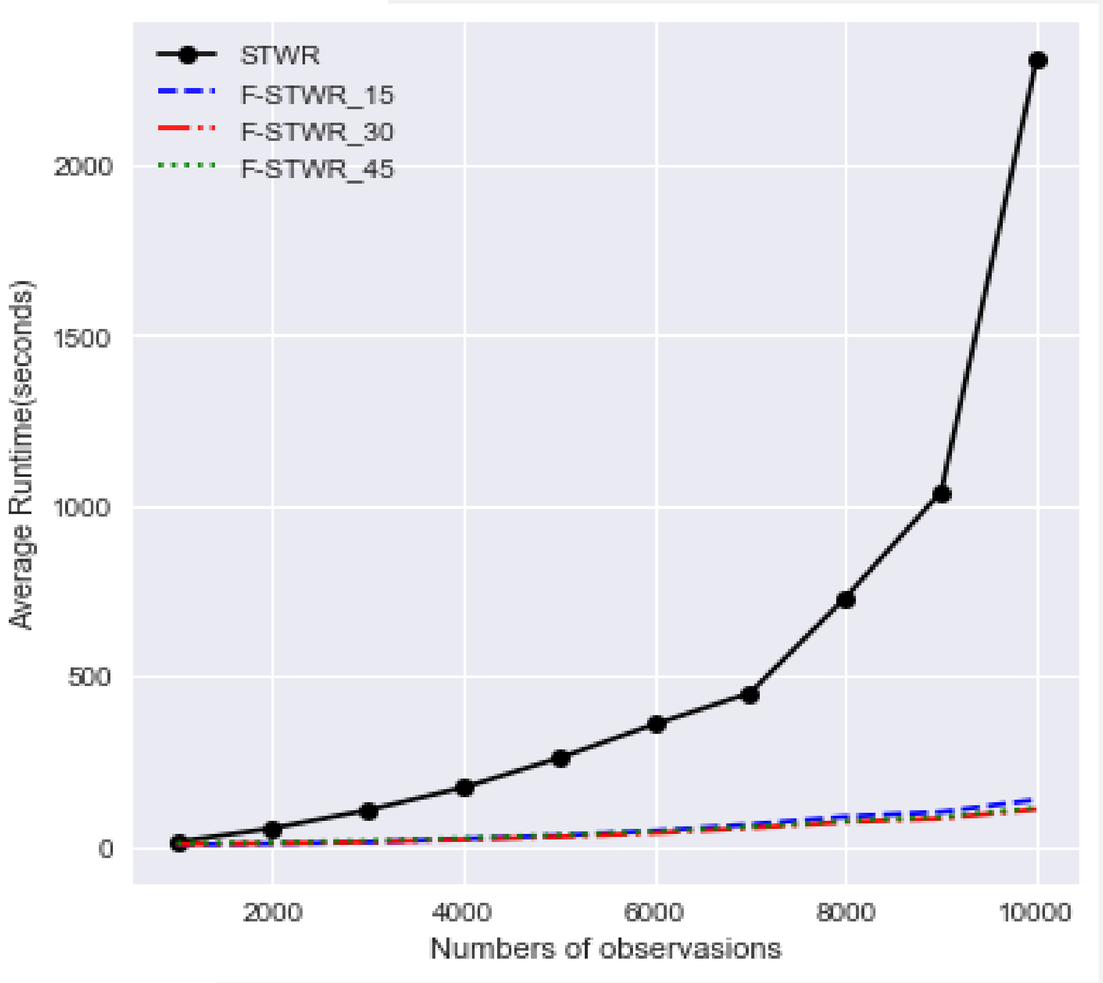
CONCLUSIONS

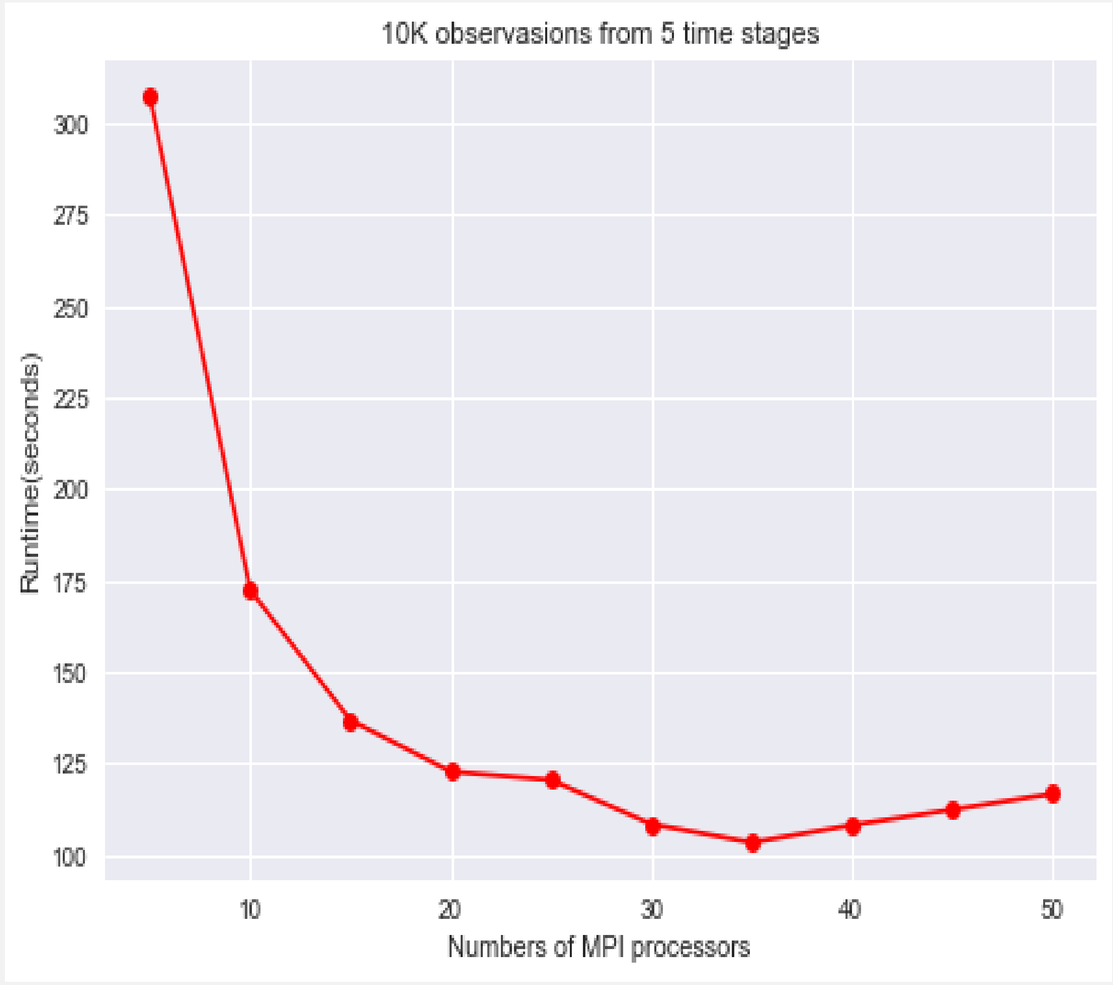
- STWR is a powerful tool to analyze geographic processes and interpolations of spatiotemporal data

- To do 1: Predications for future time stages

- To do 2: Apply STWR to different disciplines. E.g. house prices, environmental science, biology, geology …

Parallel computing for large scale spatiotemporal data





House prices of 204611 observations from 19 years

CONTACTS

IDEA Lab

University of Idaho

Marshall Ma
max@uidaho.edu

Xiang Que
xiangq@uidaho.edu
quexiang@fafu.edu.cn

Chao Ma
chao@uidaho.edu