EGU General Assembly 2022

This presentation participates in OSPP

Outstanding Student & PhD candidate Presentation contest

Downscaling WGHM-Based Groundwater Storage Data Using Regression Method: A Regional Study over Qazvin Plain, Iran

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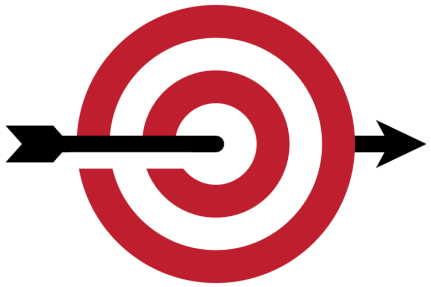
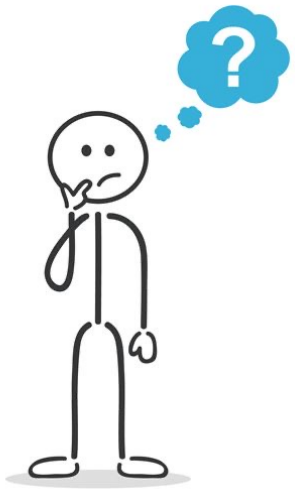


Aim

1. Downscaling Groundwater Storage Anomaly (GWSA) from coarse 0.5-degree resolution to a 0.1-degree from 2002 to 2016
2. Increasing spatial details
3. Providing a reliable model with ease of use that can be used for similar conditions

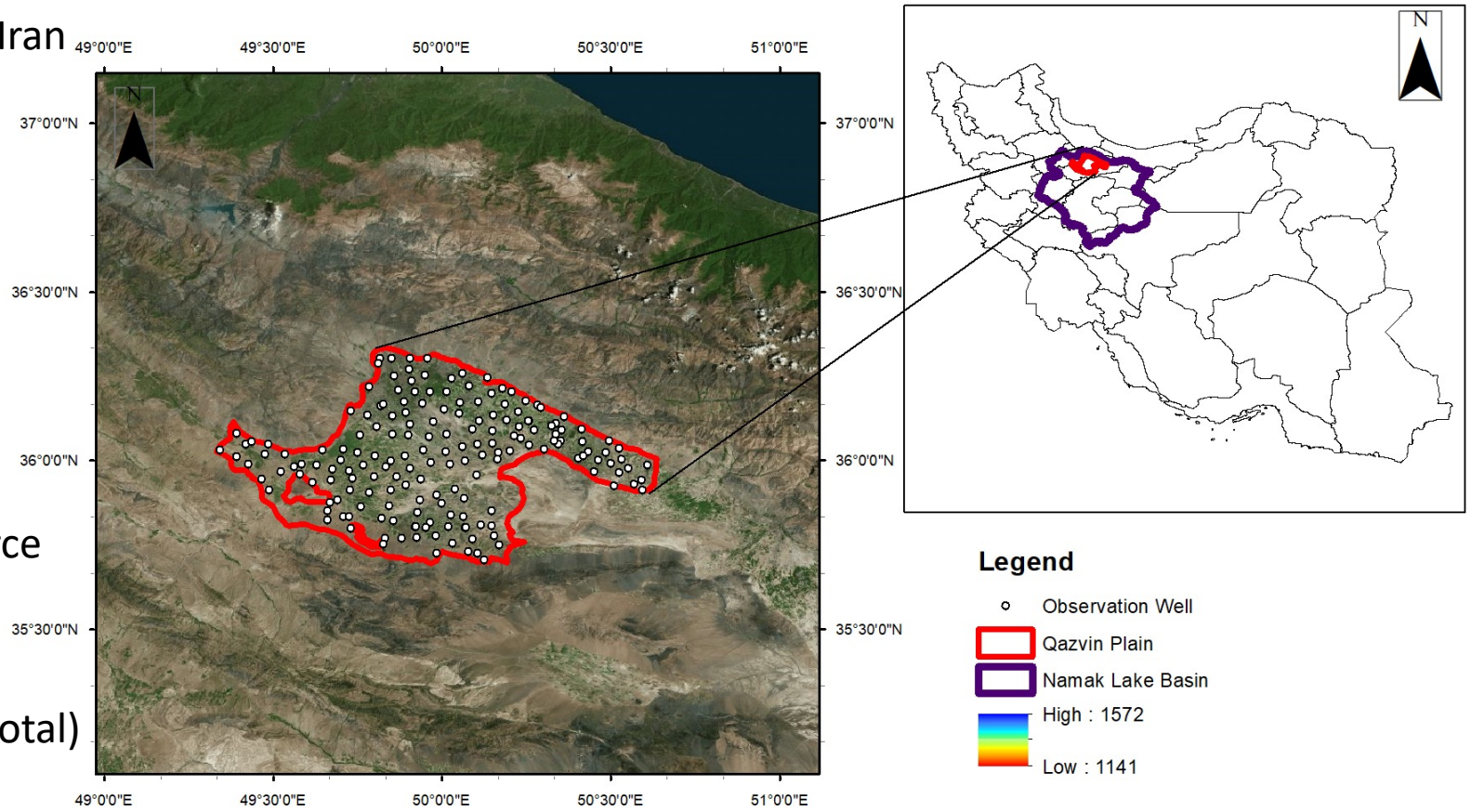


Method

1. Gathering and selecting suitable 0.1-degree auxiliary data (ERA5-LAND and IMERG products)
2. Training different regression models to achieve a model with the lowest MSE (Linear, Ridge, **Polynomial degree-2**, and K-nearest Neighbors)
3. Evaluating results with region's observation wells

Study Region

- Qazvin plain is located in north-central Iran
- The largest aquifer in Namak Lake basin
- 4737km^2 area
- 256.6mm annual precipitation average
- 5% of country agricultural products
- Groundwater is the main irrigation source
- GWS depleted about **34m** last 50 years
- 99 trustworthy observation wells (180 total)



PREPARATION PHASE

-Data gathering

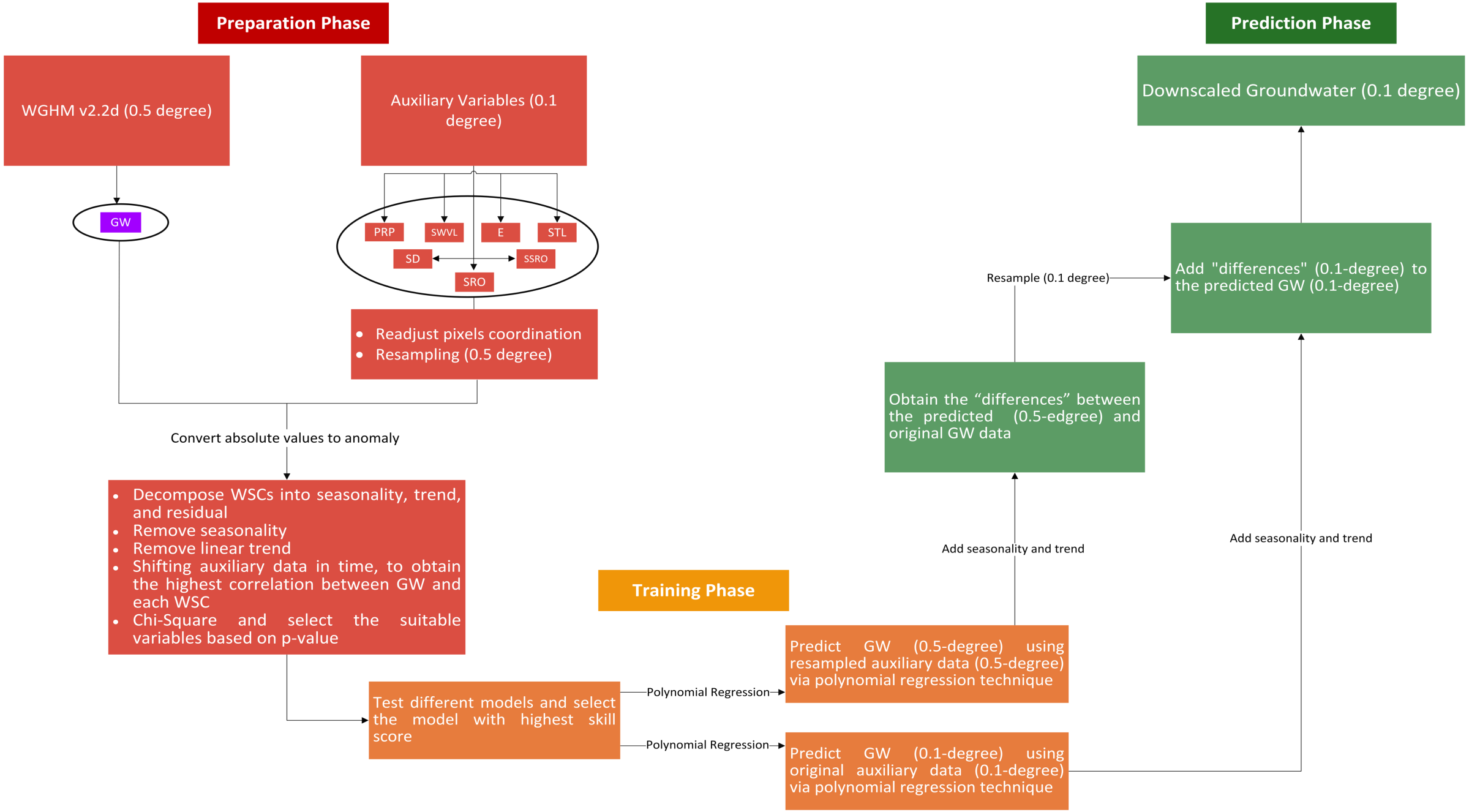
-Data preprocessing

TRAINING PHASE

- Training and validating the models

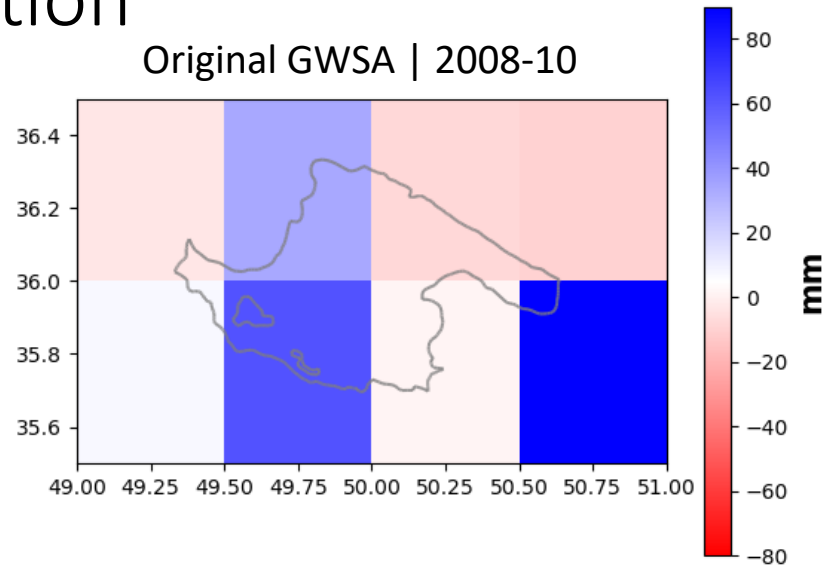
PREDICTION PHASE

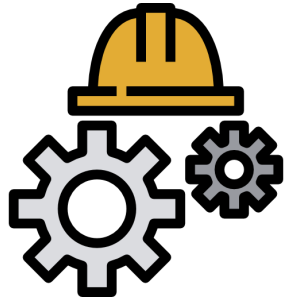
- 0.1-degree downscaled product


Preparation Phase
WGHM v2.2d (0.5 degree)
Auxiliary Variables (0.1 degree)
GW
PRP
SWVL
E
STL
SD
SSRO
SRO
Readjust pixels coordination
Resampling (0.5 degree)
Convert absolute values to anomaly
Decompose WSCs into seasonality, trend, and residual
Remove seasonality
Remove linear trend
Shifting auxiliary data in time, to obtain the highest correlation between GW and each WSC
Chi-Square and select the suitable variables based on p-value
Training Phase
Test different models and select the model with highest skill score
Polynomial Regression
Predict GW (0.5-degree) using resampled auxiliary data (0.5-degree) via polynomial regression technique
Polynomial Regression
Predict GW (0.1-degree) using original auxiliary data (0.1-degree) via polynomial regression technique
Add seasonality and trend
Obtain the “differences” between the predicted (0.5-edgree) and original GW data
Resample (0.1 degree)
Add "differences" (0.1-degree) to the predicted GW (0.1-degree)
Add seasonality and trend
Prediction Phase
Downscaled Groundwater (0.1 degree)

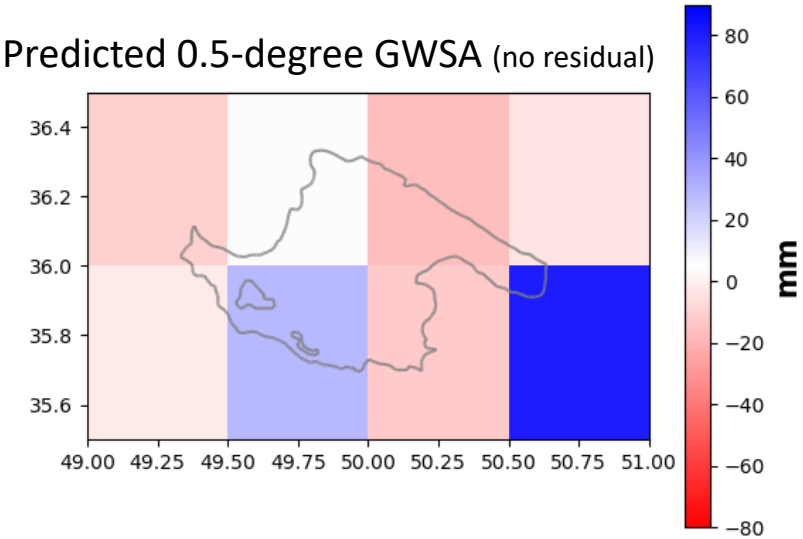
Spatial details completion

Original GWSA | 2008-10

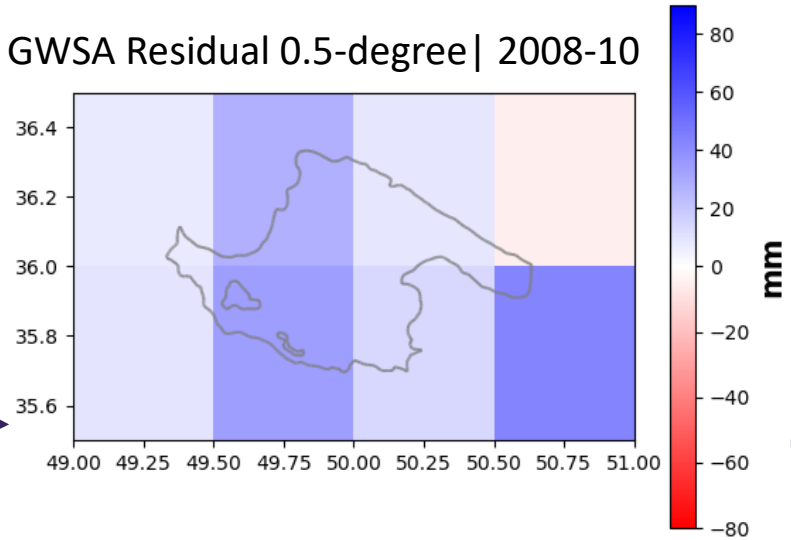




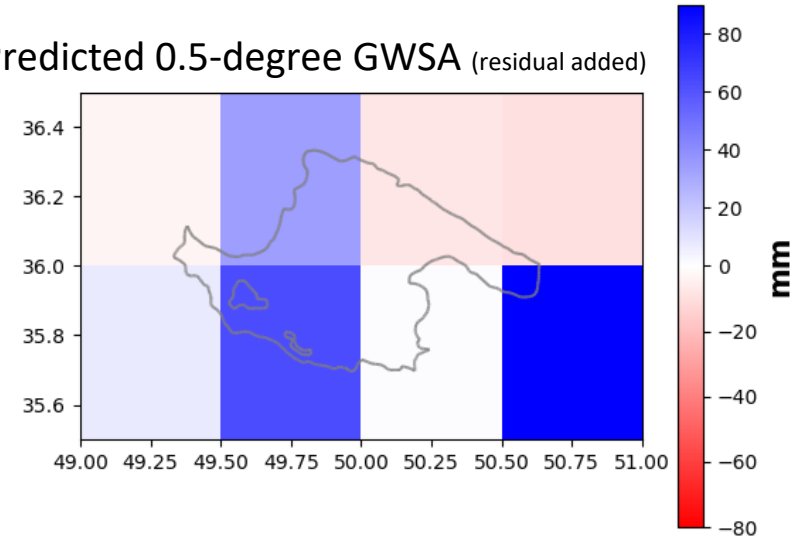
Predicted 0.5-degree GWSA (no residual)



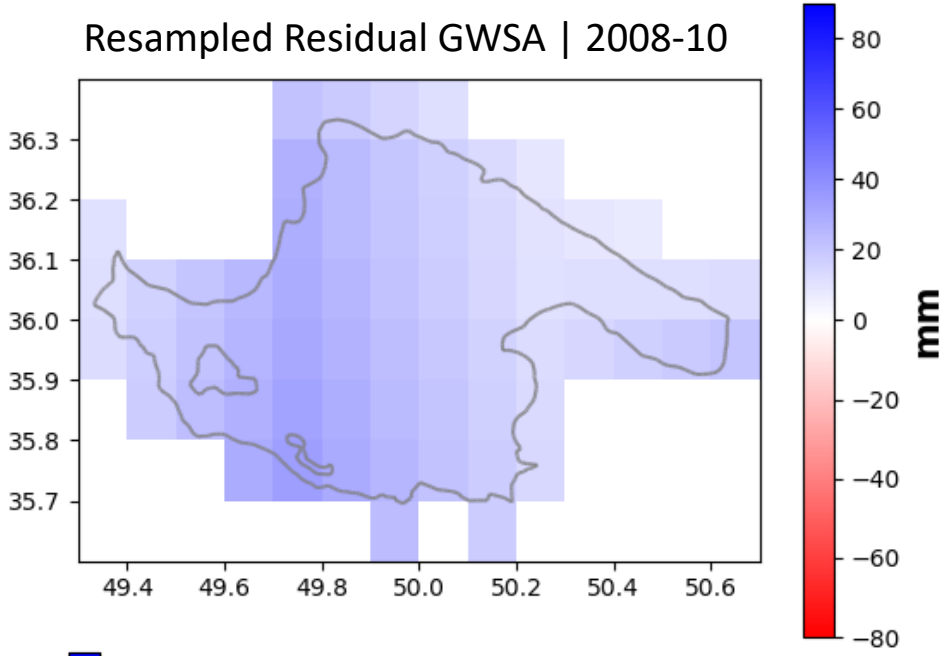
GWSA Residual 0.5-degree| 2008-10



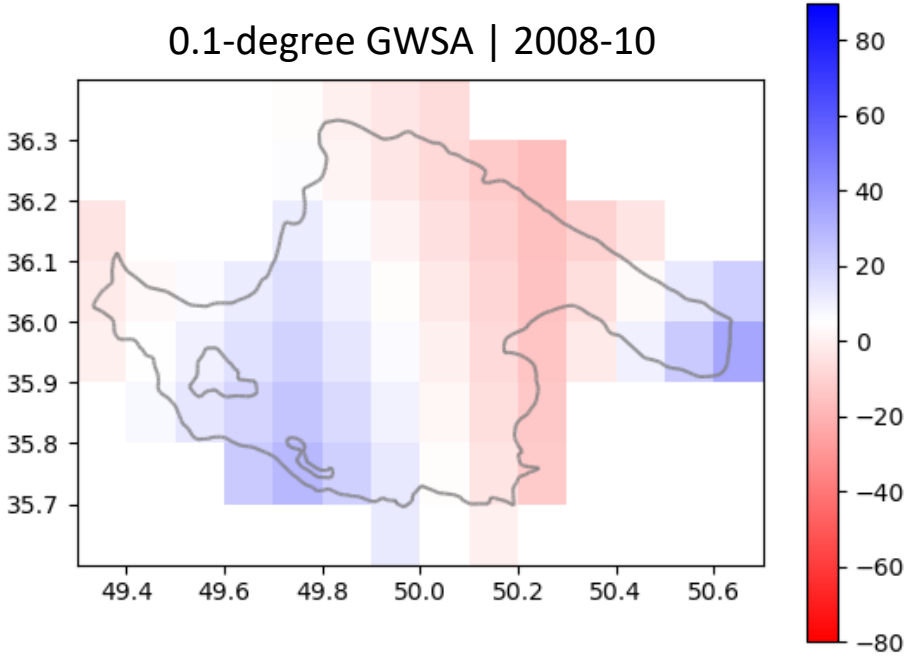
Predicted 0.5-degree GWSA (residual added)



Resampled Residual GWSA | 2008-10



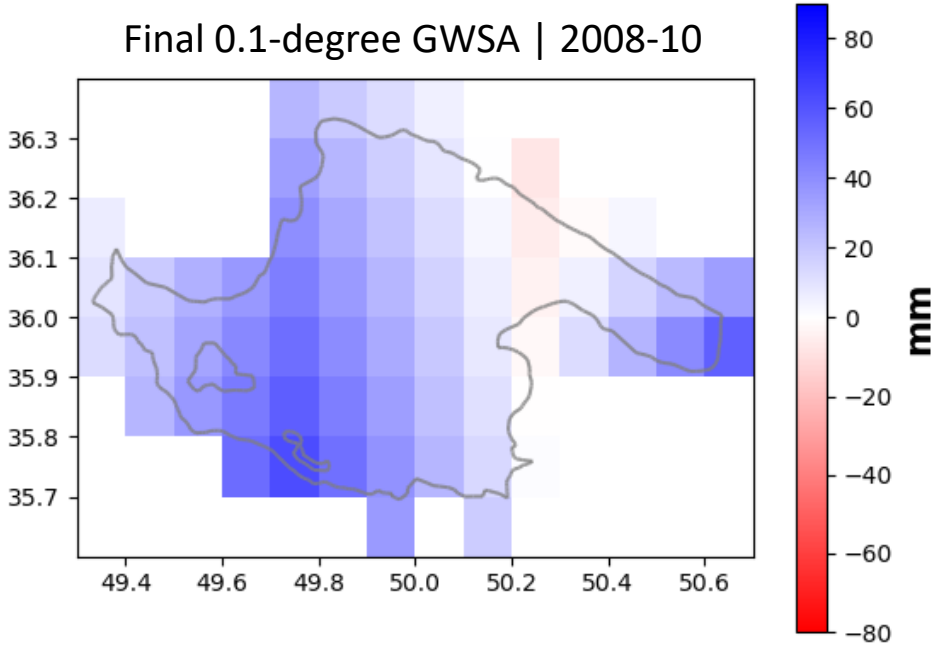
0.1-degree GWSA | 2008-10



”differences” added

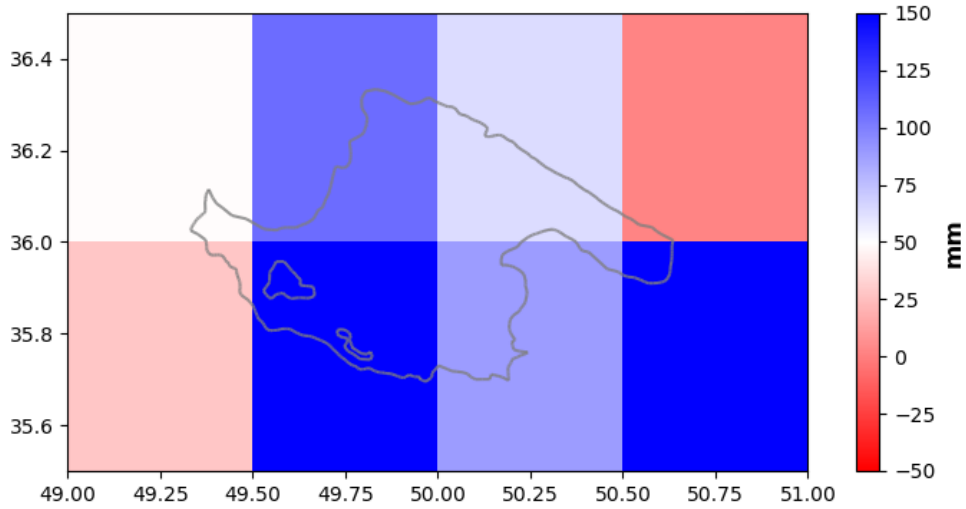
Seasonality
Residuals
Trend

Final 0.1-degree GWSA | 2008-10

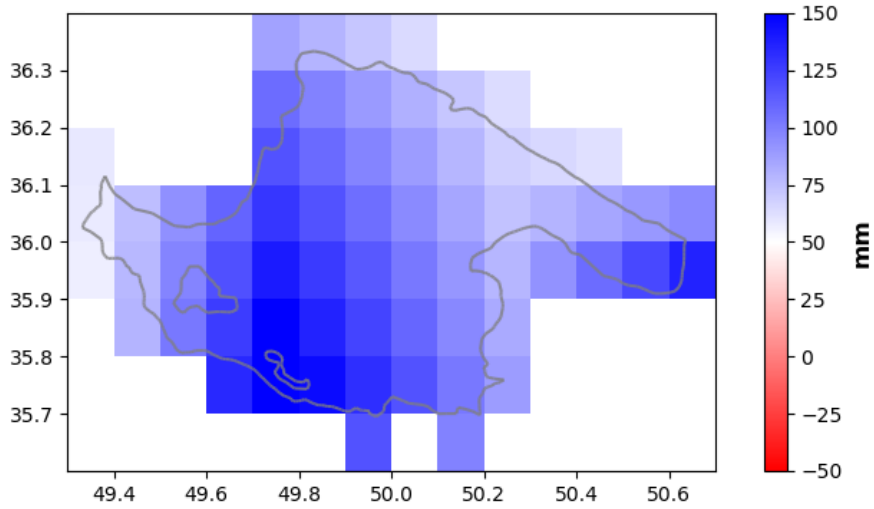


Results & Evaluation

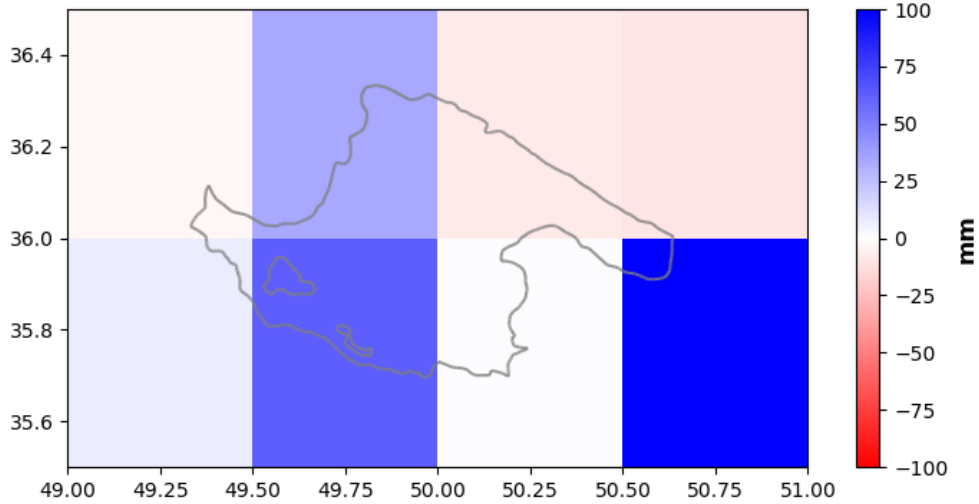
Original GWSA | 2008-04



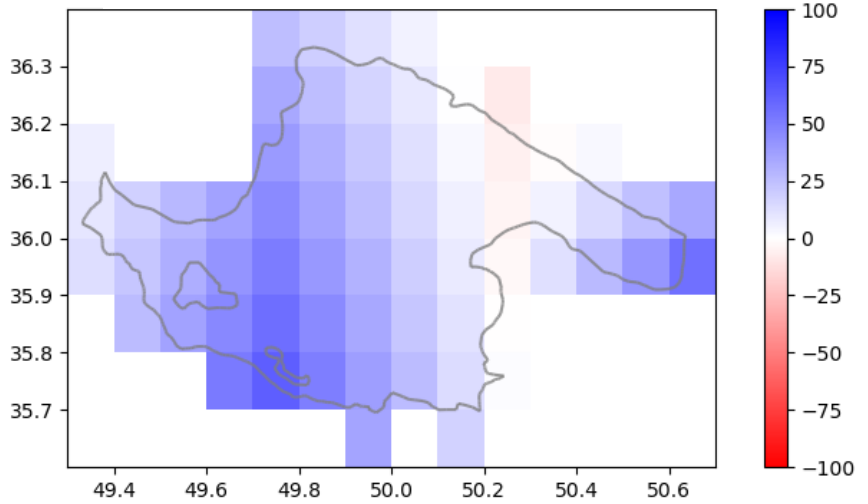
0.1-degree GWSA | 2008-04



Original GWSA | 2008-10



0.1-degree GWSA | 2008-10



The original data

8 pixels

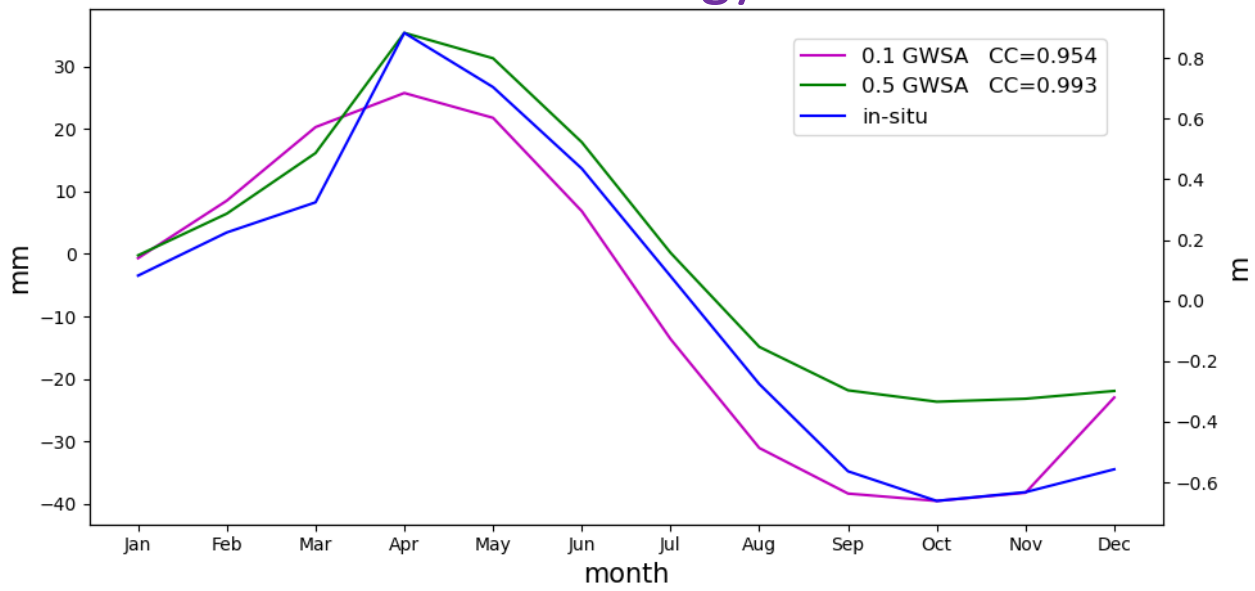
The predicted data

112 pixels

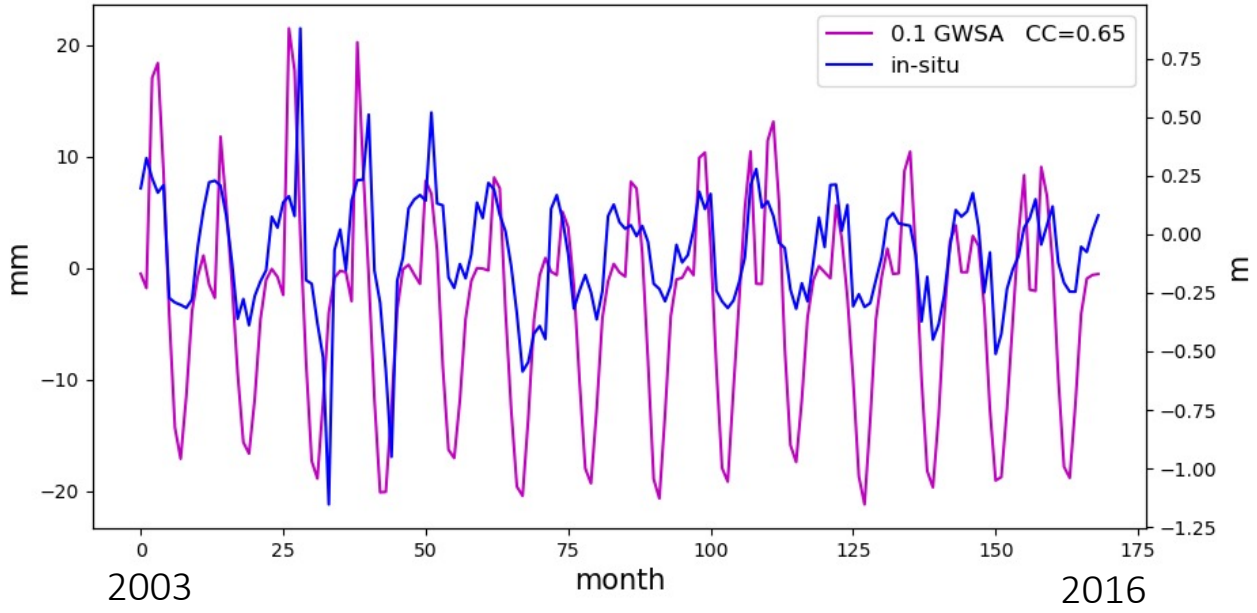
Correlation Coefficients

- Climatology: **0.954**
- GWSA: **0.991**
- GWSC: **0.991**

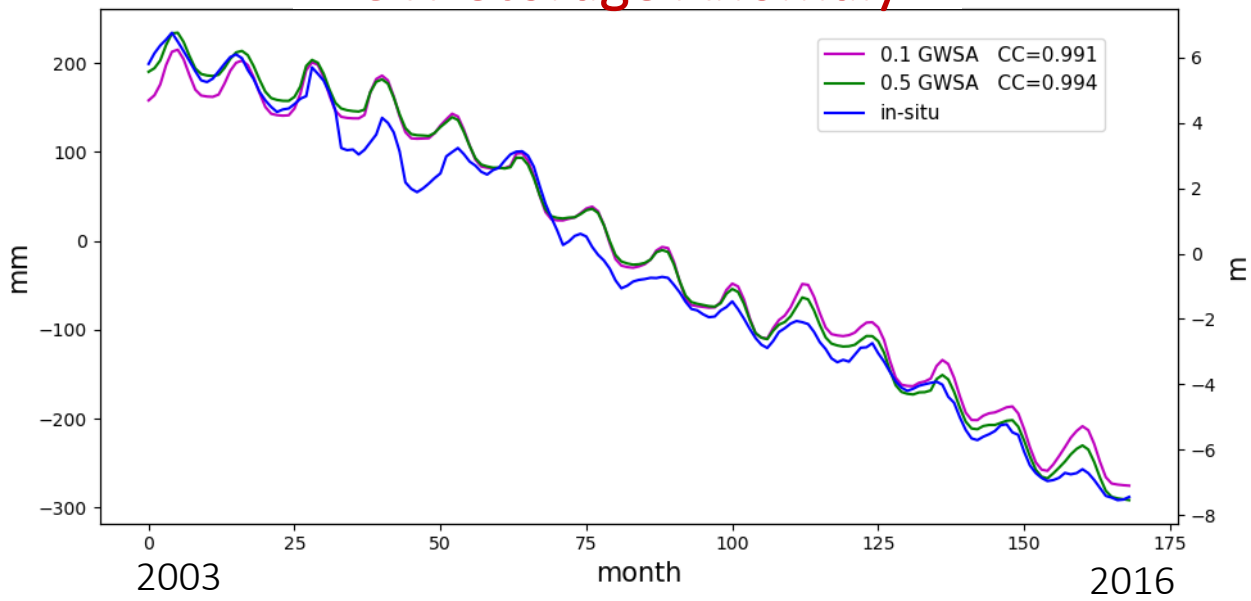
Climatology



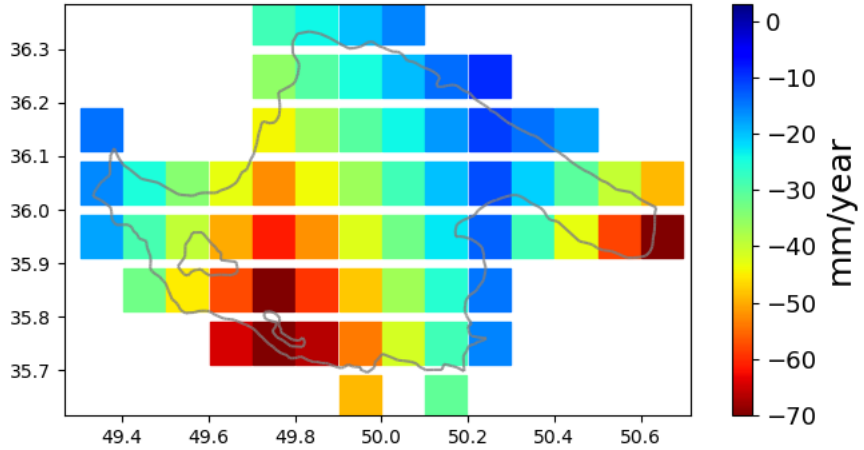
GW Storage Changes



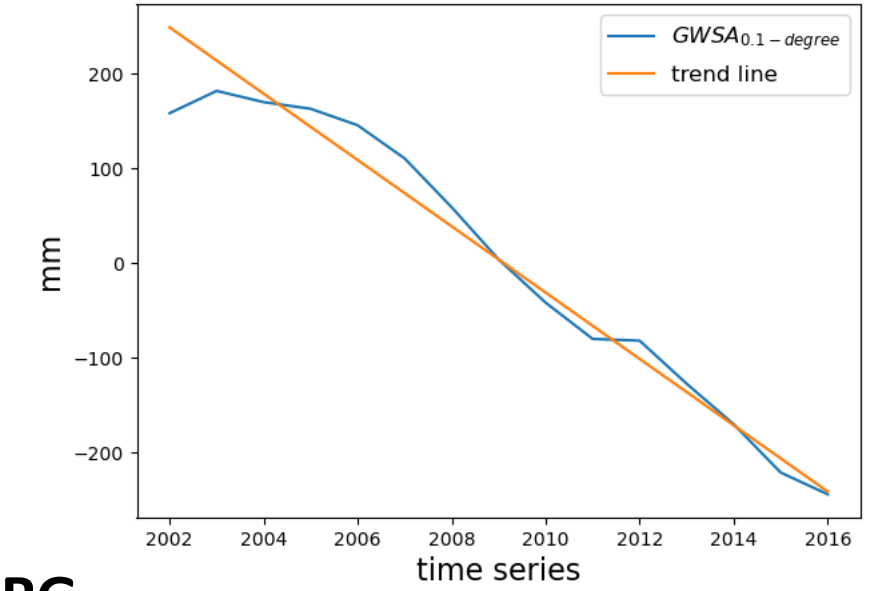
GW Storage Anomaly



0.1-degree GWSA Spatial Trend



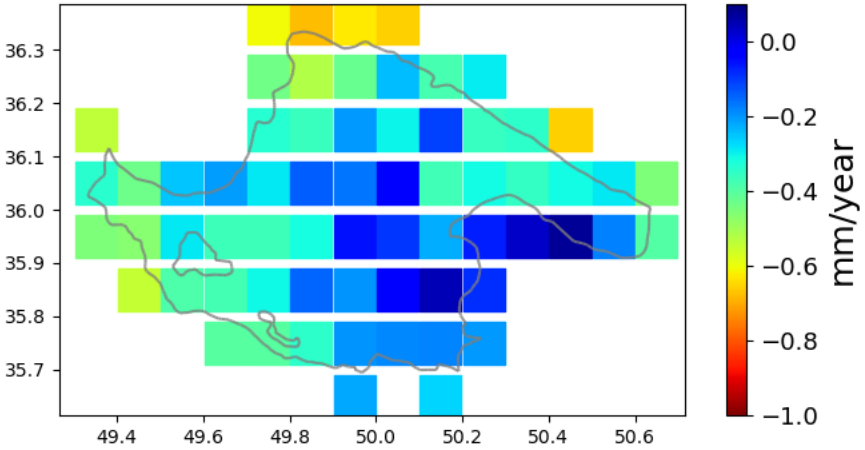
0.1-degree GWSA Linear Trend



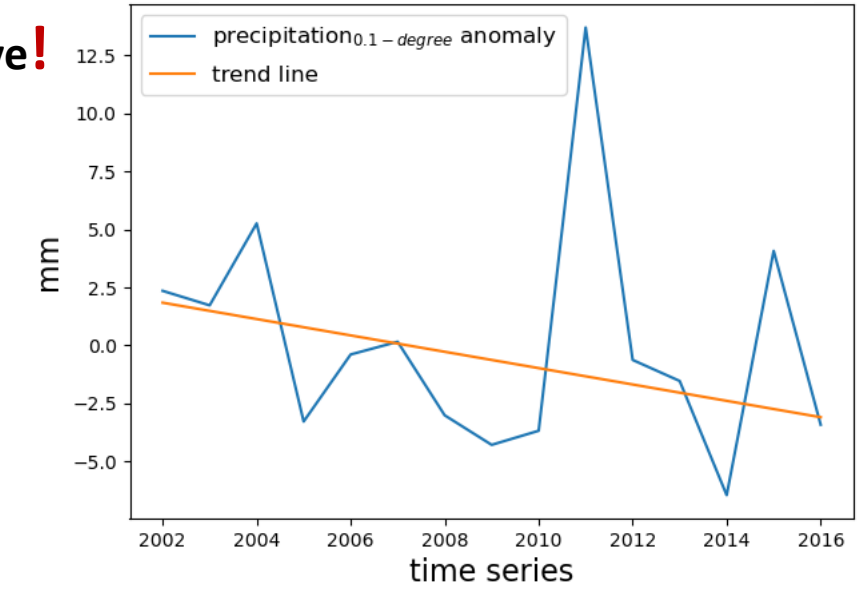
GWSA ≫ IMERG

!Not So Relative!

0.1-degree IMERG Spatial Trend



0.1-degree IMERG Linear Trend



Open for a PhD position

1. The developed downscaling technique is able to learn from high-resolution auxiliary data to capture GWSA features at higher spatial resolution

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2. decreasing precipitation anomaly contributes minimally to the decreasing GWSA which can be resulting from human withdrawals for agriculture

https://financialtribune.com/sites/default/files/field/image/shahrivar1/13_Hamouns1.jpg