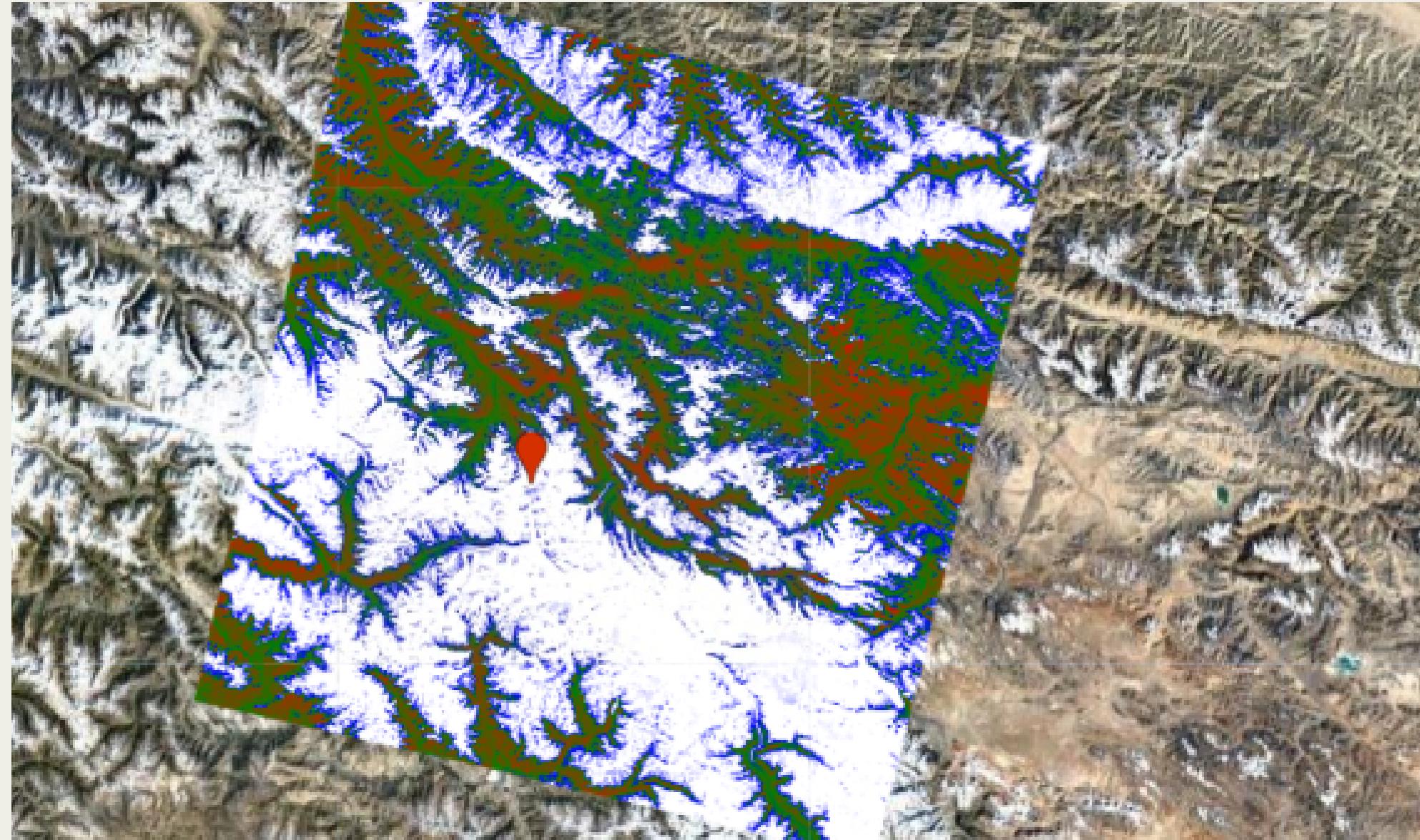


Analysis of Snow Cover in Manali using NDSI and Time series



Introduction - What is NDSI ?



Normalized Difference Snow Index

$$\text{NDSI} = (\text{NIR} - \text{SWIR}) / (\text{NIR} + \text{SWIR})$$

- Snow covered pixels have NDSI value closer to 1
- Snow covered percentage is calculated by dividing the snow covered pixels by total no. of pixels

Introduction - Monetary Gains ?

The image shows two news articles side-by-side. The left article is from PBS News Hour, featuring a dark header with the PBS News Hour logo and a menu icon. The main headline reads "Shrinking Snow Means Steep Slide for Ski Industry" by Rebecca Jacobson, Inside Energy. Below the headline is a "Leave your feedback" button. The right article is from THE ASPEN TIMES, with a header including "ASPN TIMES WEEKLY" and "Snowmass Sun". The main headline reads "Local ski resorts see winter shrink as frost days decline, snow melts sooner, temps rise". Both articles have a "Go Deeper" section with links to "coping with climate change", "science wednesday", and "ski". A blue advertisement for Adobe Creative Cloud is visible at the bottom of the right column.

PBS NEWS HOUR

By –
Rebecca Jacobson,
Inside Energy

Leave your feedback

Shrinking Snow Means Steep Slide for Ski Industry

Nation Feb 27, 2013 11:51 AM EDT

Go Deeper

coping with climate change

science wednesday

ski

THE ASPEN TIMES | ASPN TIMES WEEKLY | Snowmass Sun

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YOUR AD HERE »

Local ski resorts see winter shrink as frost days decline, snow melts sooner, temps rise

News FOLLOW NEWS Jul 6, 2023

- Global Skiing industry is expected to reach 2.32 billion USD by 2032
- The number of active ski resorts is also increasing
- Climate change is resulting in faster melting

Introduction - Monetary Gains ?



- Ski resorts can forecast the expected snow cover for a certain region based on historical data

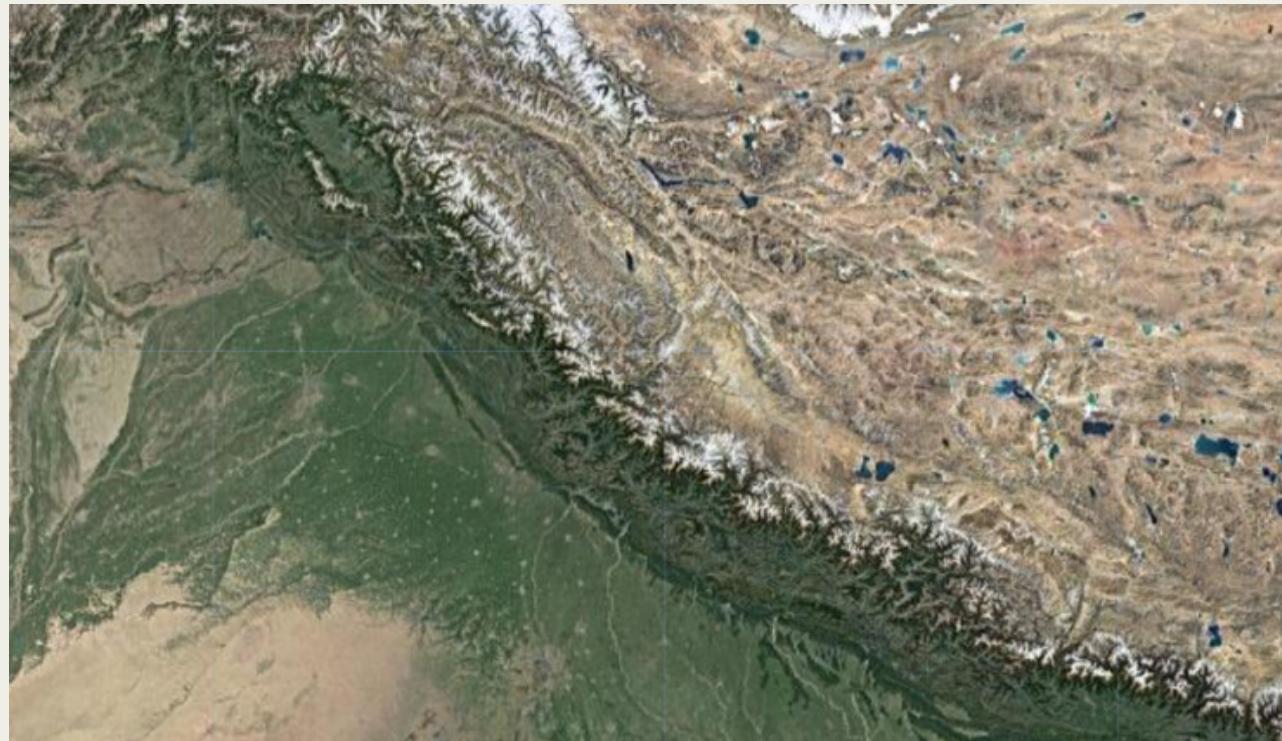
Procedure :- Data Collection and Preprocessing



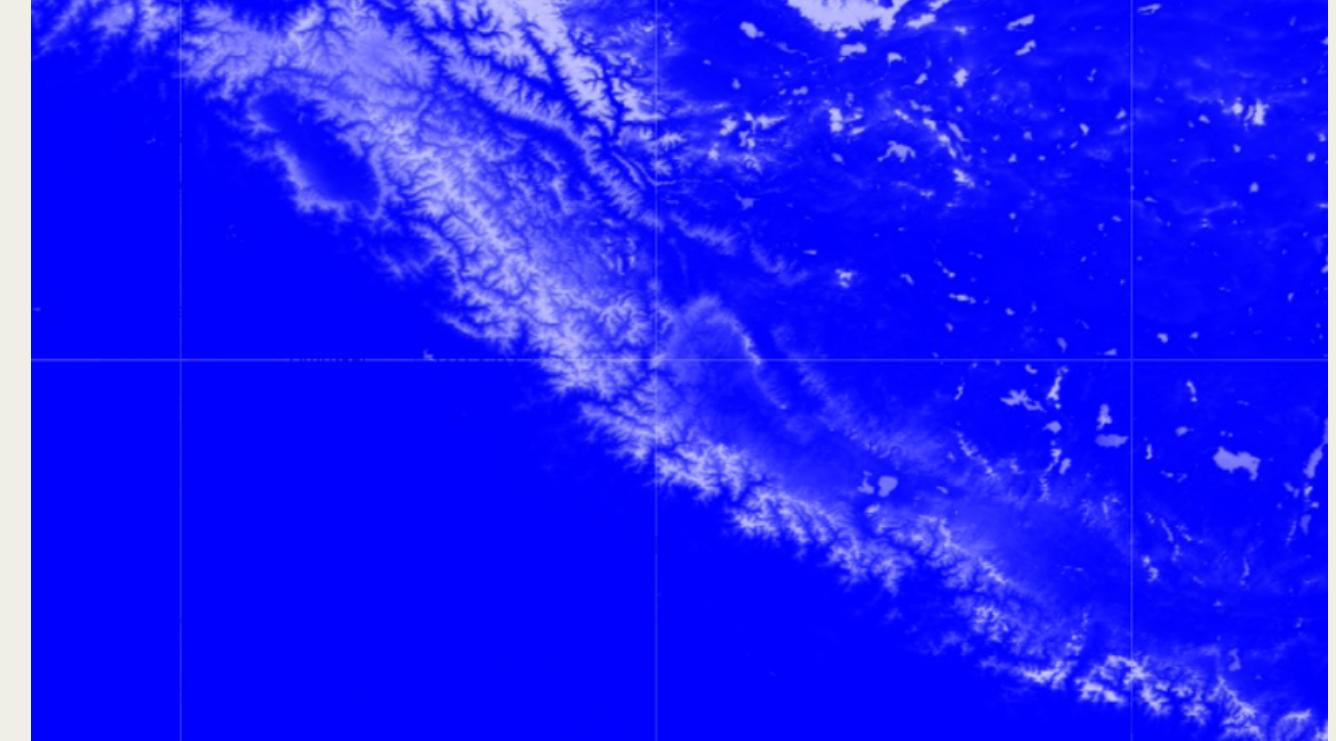
Google Earth Engine

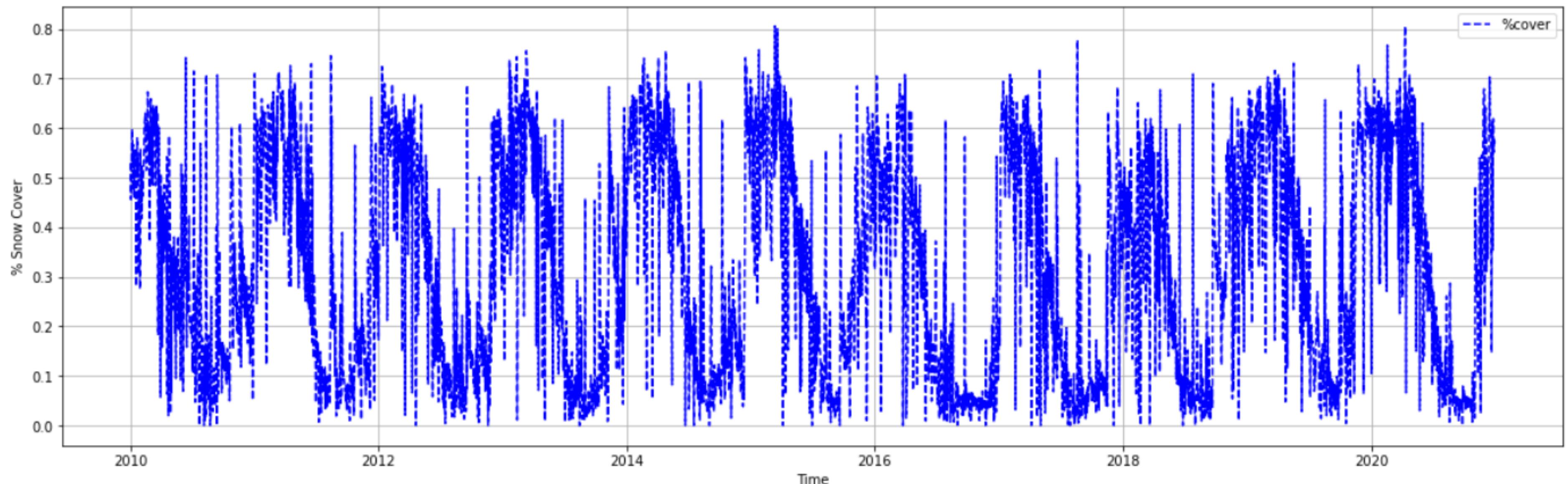
- Data from 2010 to 2020 was extracted from Manali region using Google Earth Engine's MODIS dataset taken from NASA satellites of Terra and Aqua.
- After NDSI conversion the % of snow cover was calculated ie.

$$\% \text{ snow cover} = \frac{\sum_{i=0}^n \text{Snow covered pixels}}{\sum_{i=0}^n \text{Total pixels}}$$



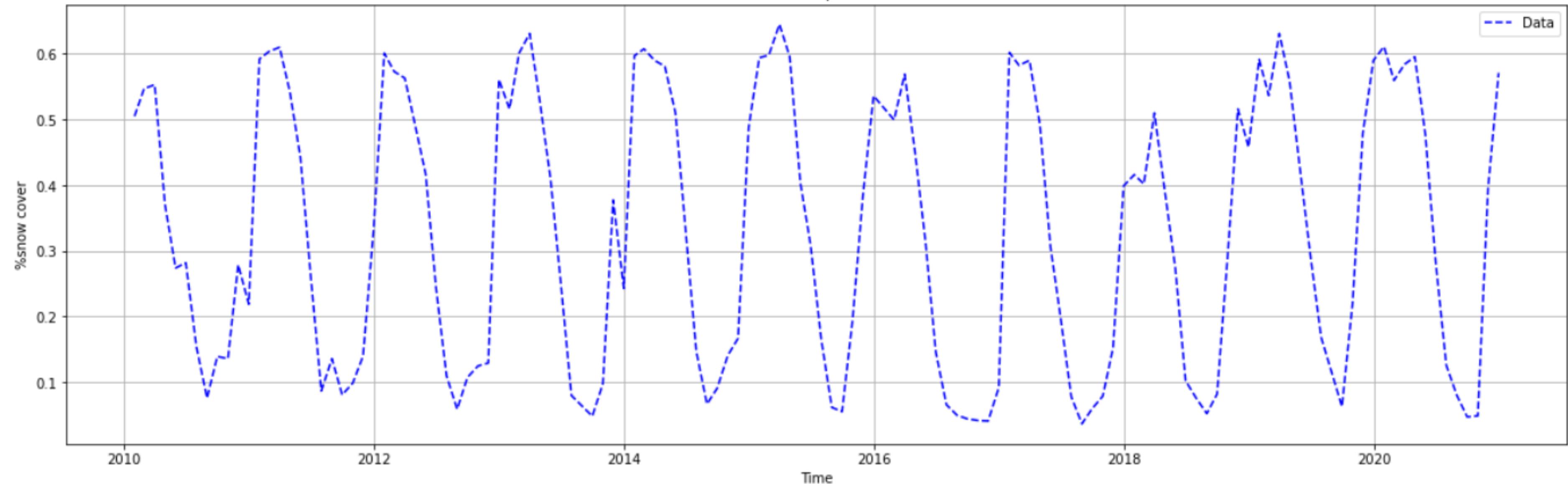
**After NDSI
conversion**





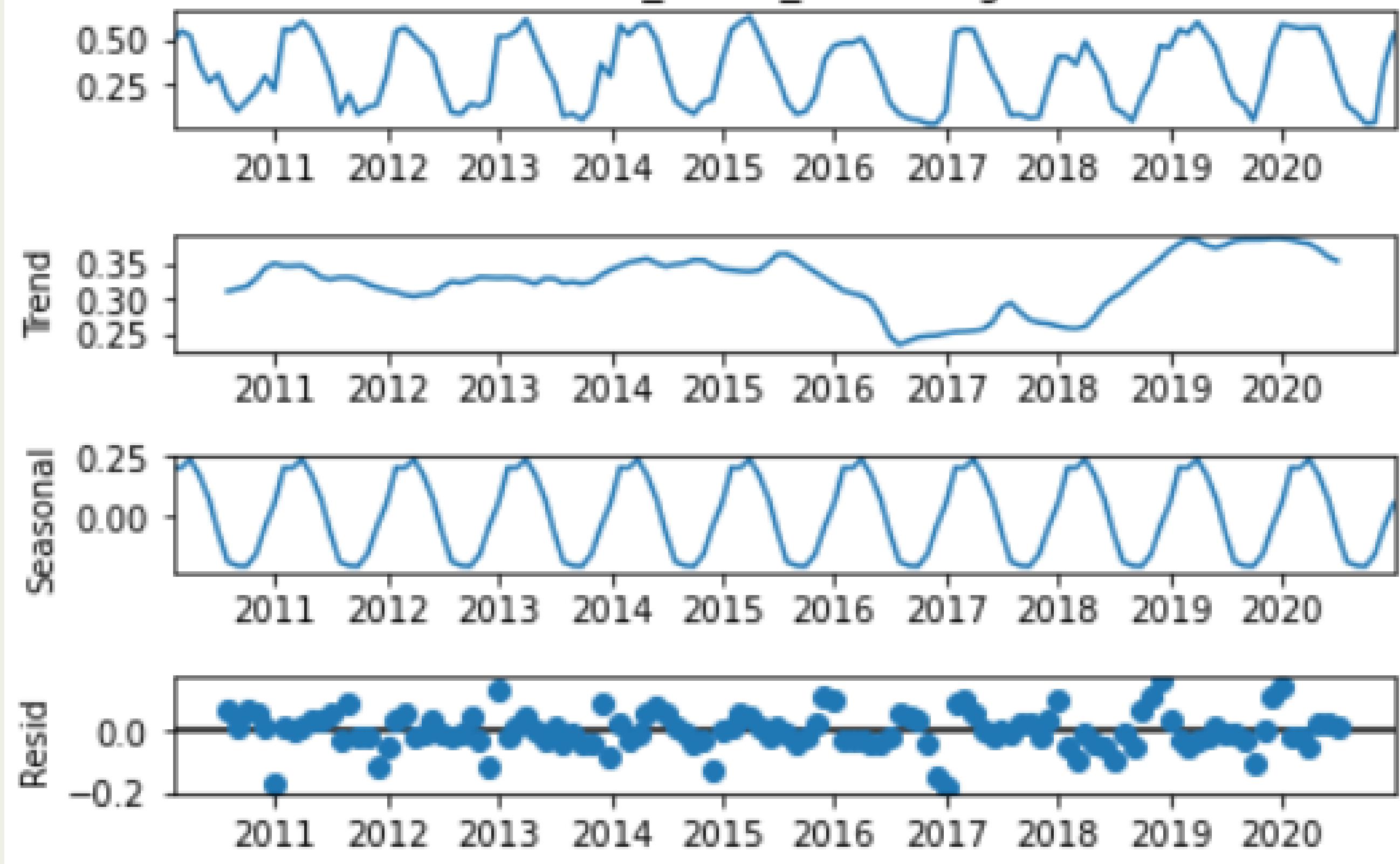
dataset with noise

Resampled



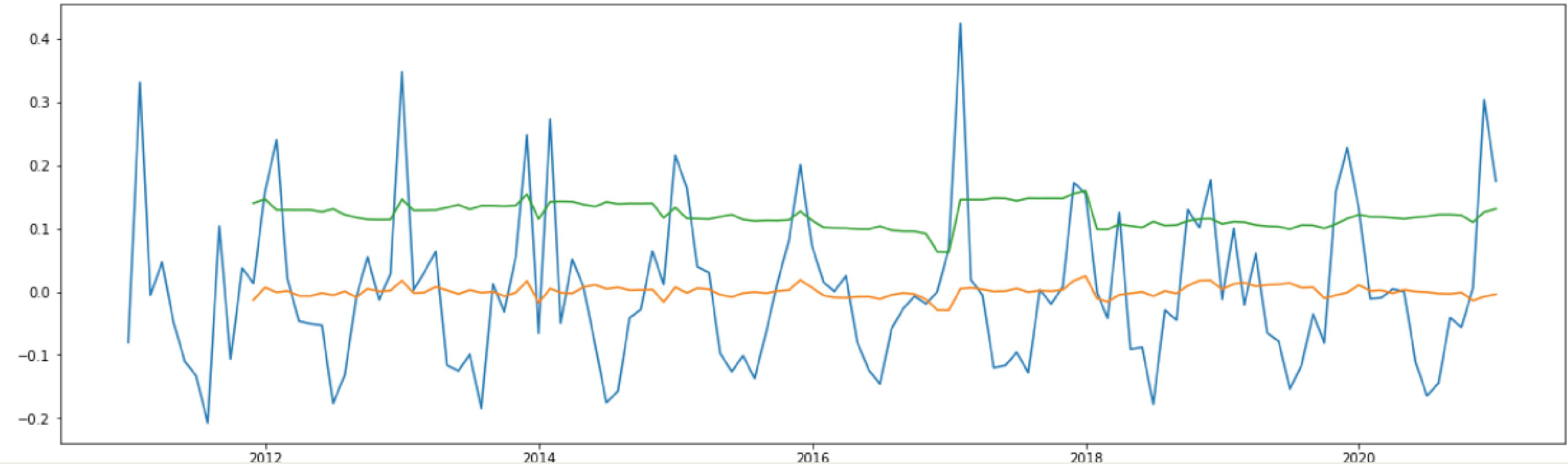
resampled dataset

Snow_Cover_Percentage



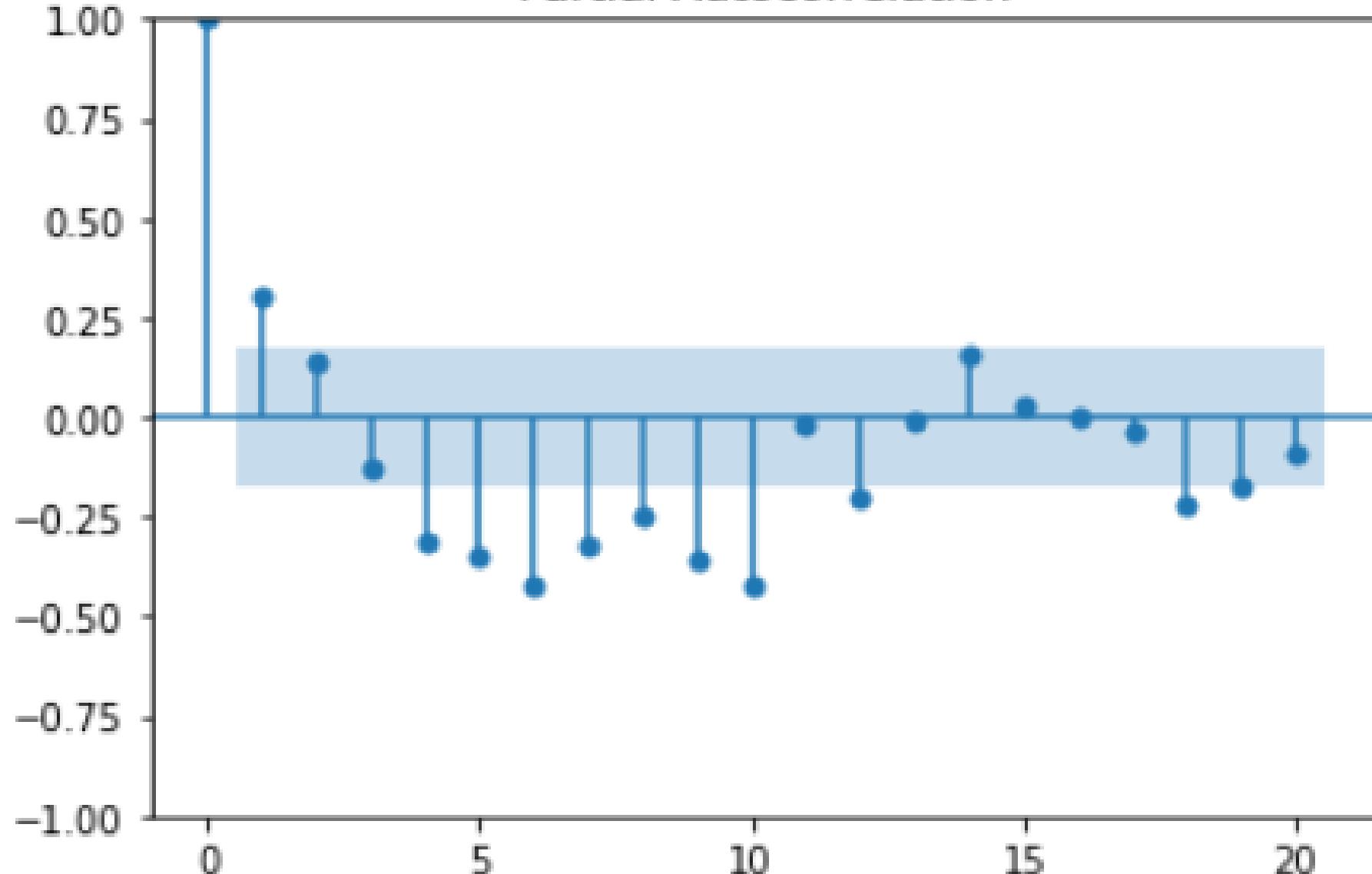
Seasonal Decompose

```
Test Statistics           -3.977376
p-value                  0.001534
#lags used                13.000000
number of observations used    107.000000
dtype: float64
crticality 1% : -3.492995948509562
crticality 5% : -2.888954648057252
crticality 10% : -2.58139291903223
```

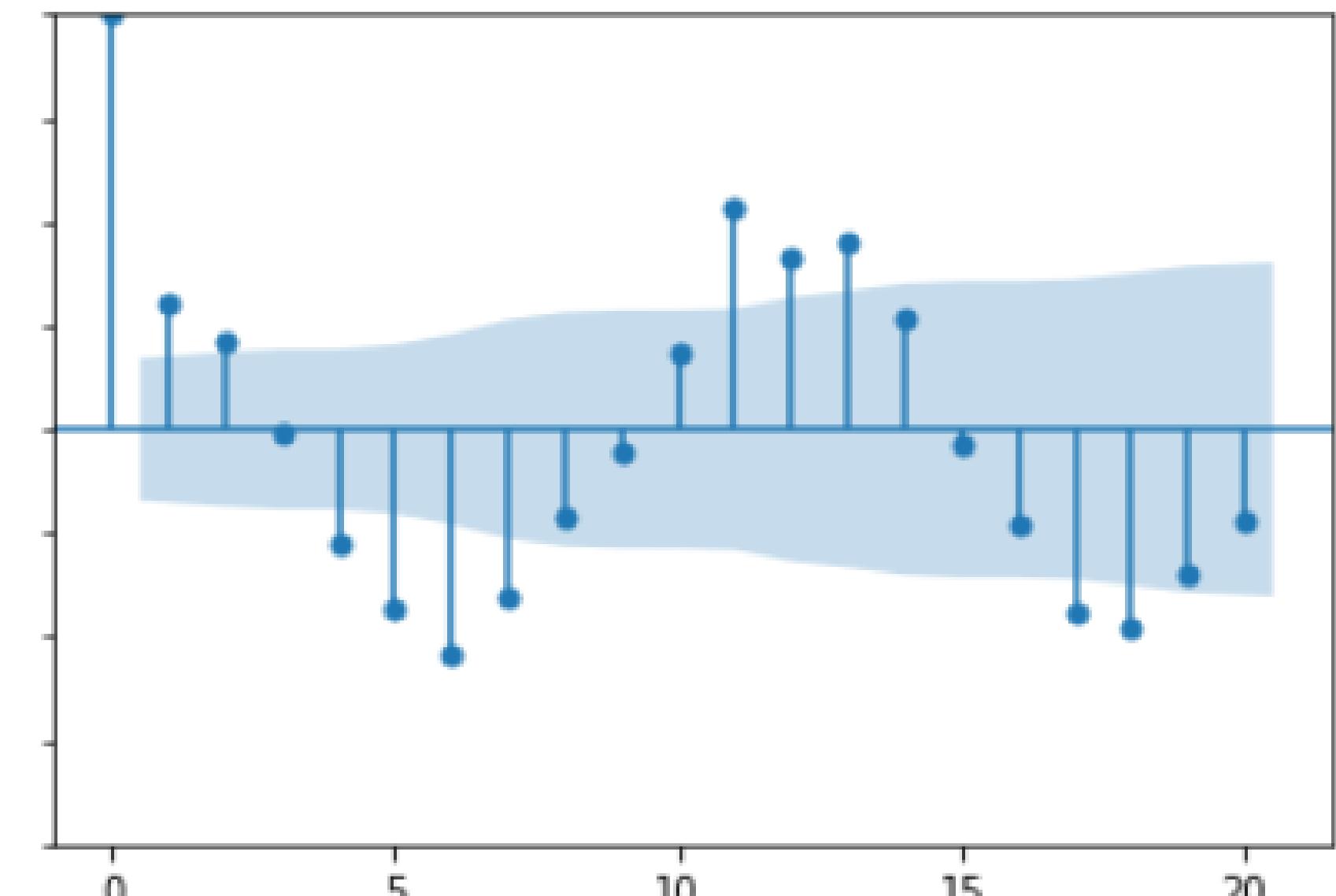


Stationarity achieved with shift-differencing once

Partial Autocorrelation



Autocorrelation

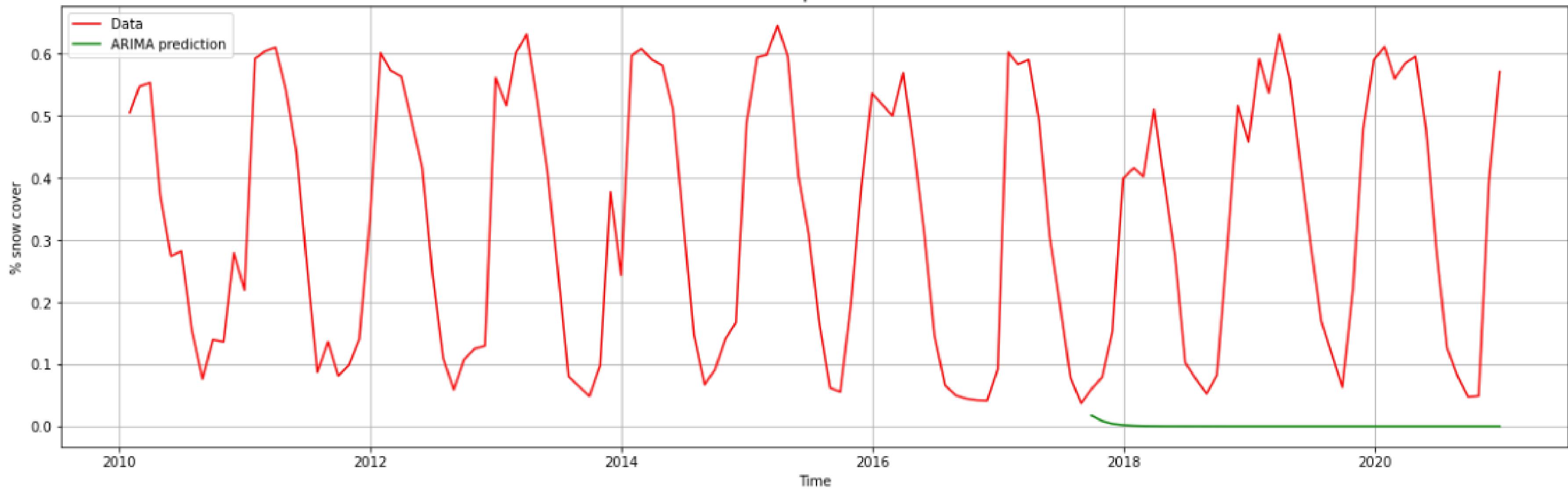


PACF and ACF plots

$(p,d,q) = (1,1,1)$

$(p,d,q,s) = (1,1,1,12)$

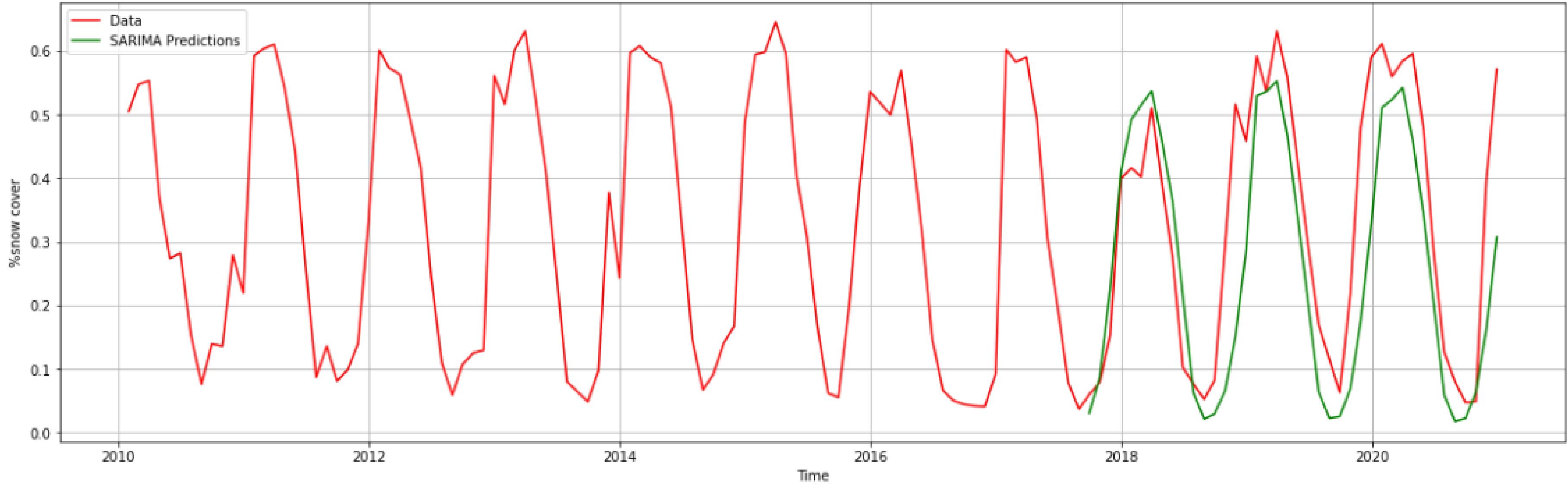
ARIMA prediction



ARIMA results

MSE: 0.1520574941056795

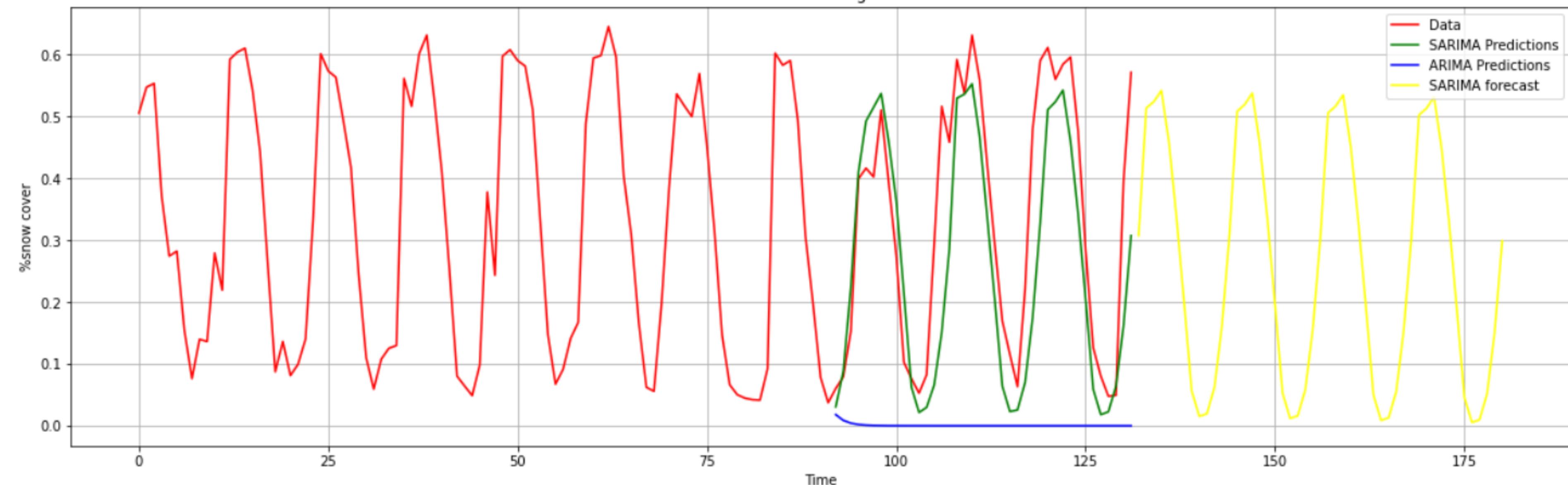
SARIMA predictions



SARIMA results

MSE: 0.017432157234285844

Forecasting



SARIMA Forecasts

THANK YOU

