Applying artificial intelligence in modeling the relationship of tree ring growth index with different climate variables

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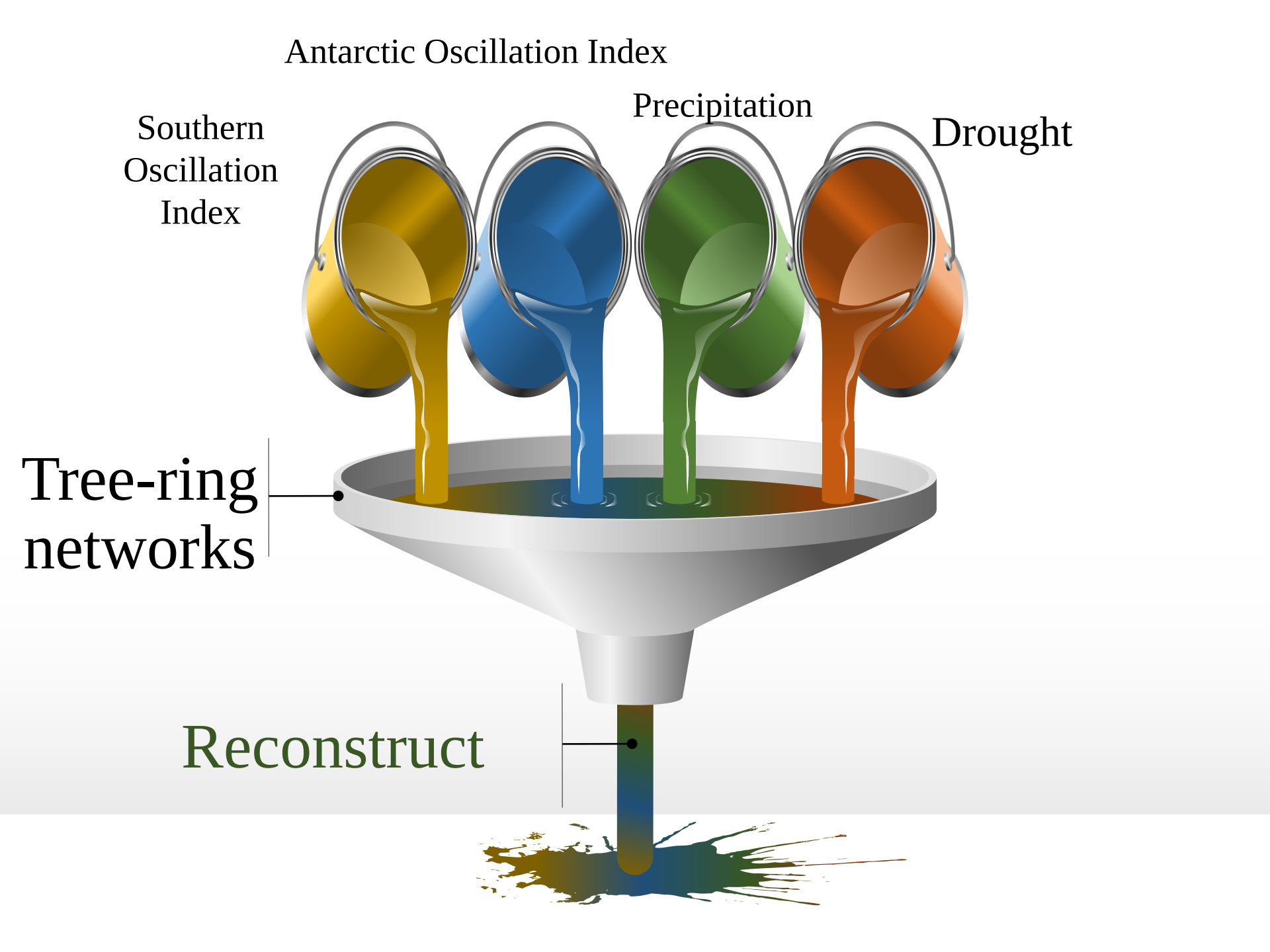
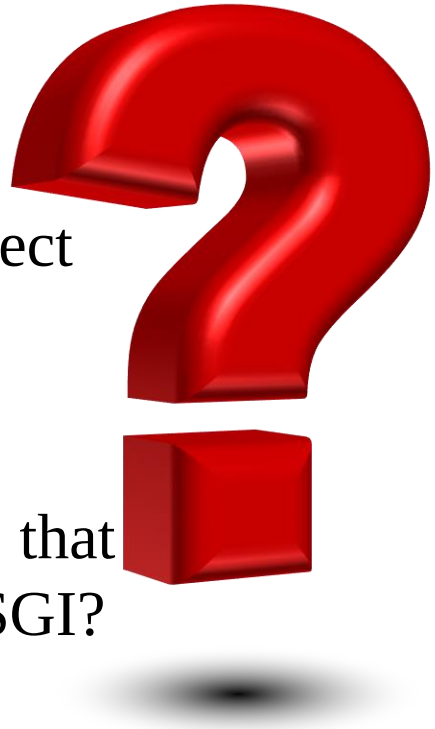

Antarctic Oscillation Index
Precipitation
Southern Oscillation Index
Drought
Tree-ring networks
Reconstruct

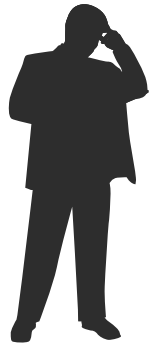
Objectives

1. How do climate variables and drought events affect the TRSGI in north-eastern South Korea?

2. Are there any trends in long-term climate data that demonstrate the effects of climate change on TRSGI?

3. Novel AI approach to create a better performing model of the relationships between TRWI and climate variables





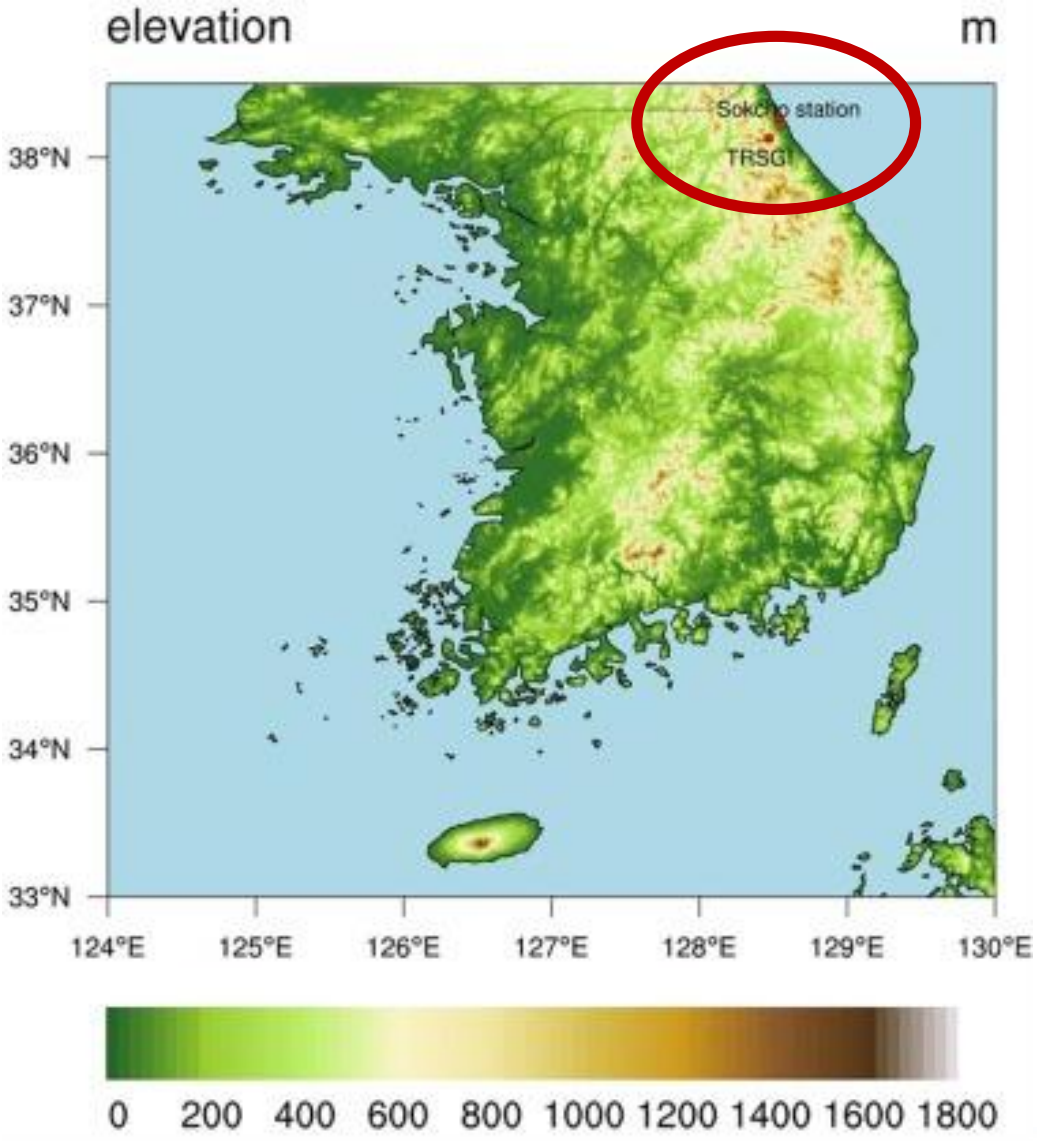
Artificial Intelligence (AI) and ML

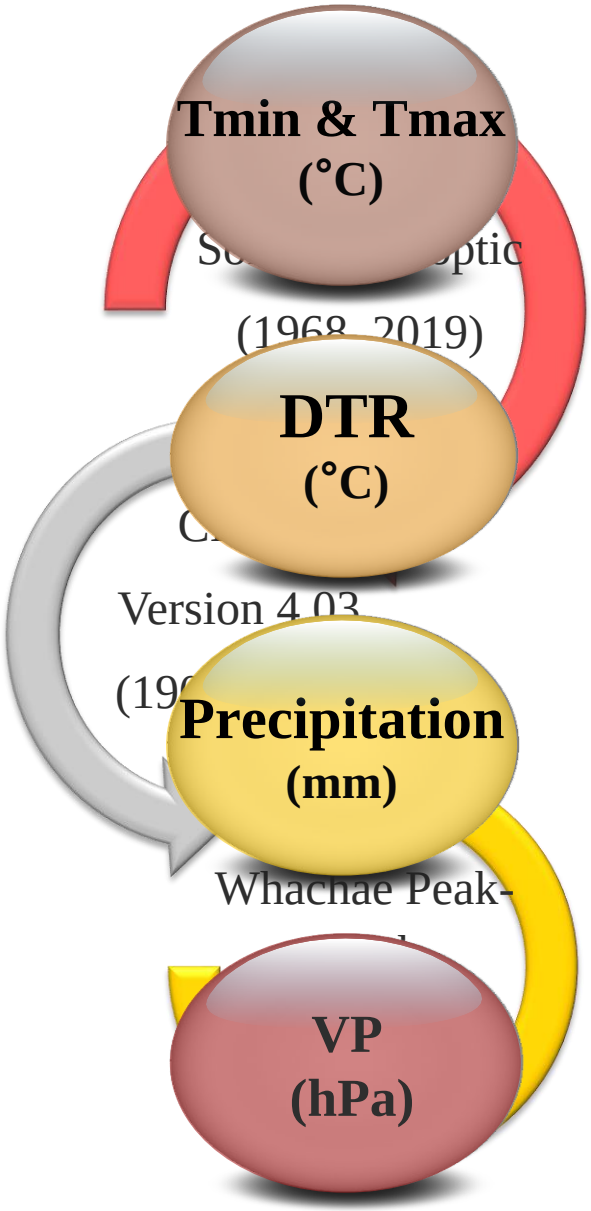
- **AI** is a branch of computer sciences that emphasizes the development of **intelligence** machines, thinking and working like humans.

- **AI** works by combining large amounts of data with fast, iterative processing and intelligent algorithms, allowing the software to learn automatically from patterns or features in the data.

ML is an important tool for prediction climate and weather data.

Materials and Methods

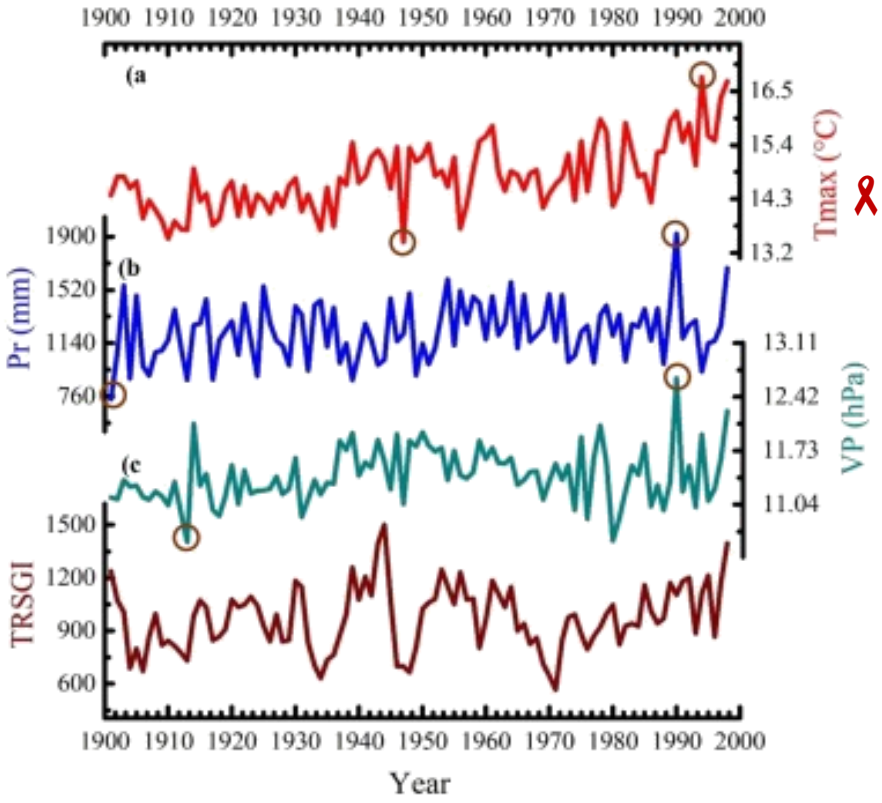




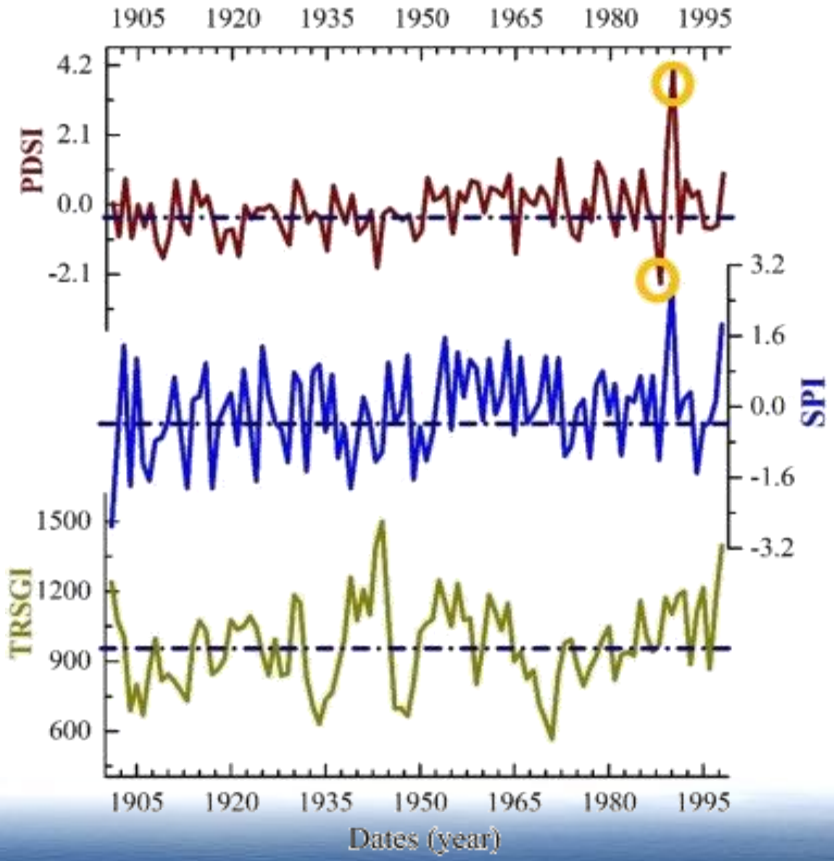
Materials and Methods

1. Multiple Linear Regression (MLR)
2. Stepwise Regression (SR)
3. Artificial Neural Networks(ANNs), NARX
4. NARX and de-noised Wavelet models

Results

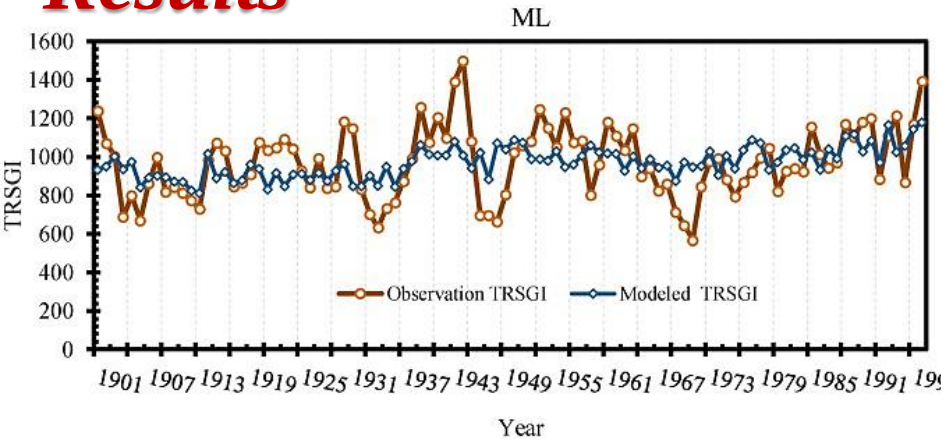


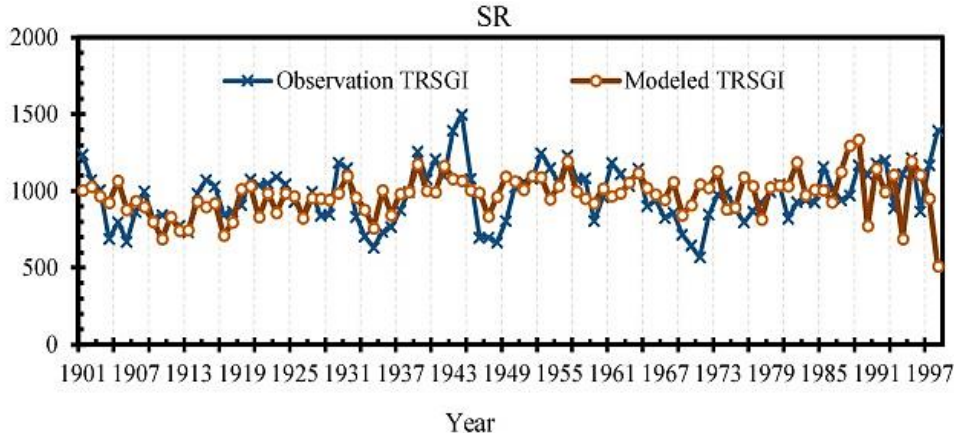
- We cannot identify years for the maximum and minimum TRSGI versus other climate variable, despite the existence of several similar changes in different year.



- Although Scharnweber et al. (2011) found that decreasing TRW rates in recent years have been related to drier conditions, we did not find speci fic trends in the effect of drought on TRSGI.

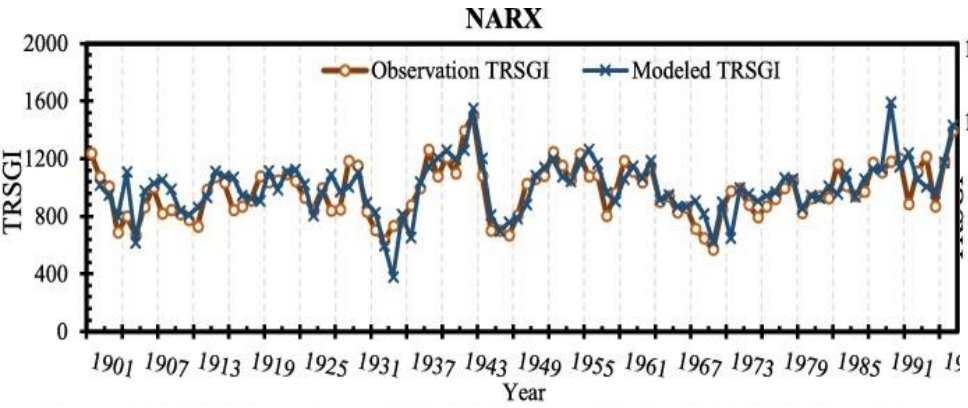
Results

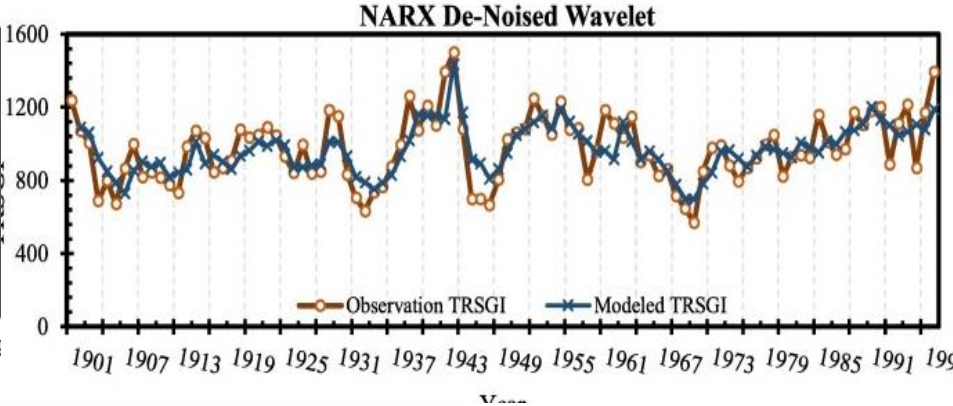




$$\mathrm{TRSGI} = 33.45 \times \mathrm{Tmin} - 221.47 \times \mathrm{Tmax} + 254.47 \times \mathrm{Tm} + 259.59 \times \mathrm{DTR} + 0.051 \times \mathrm{PR} + 68.75 \times \mathrm{VP} - 1482.75$$

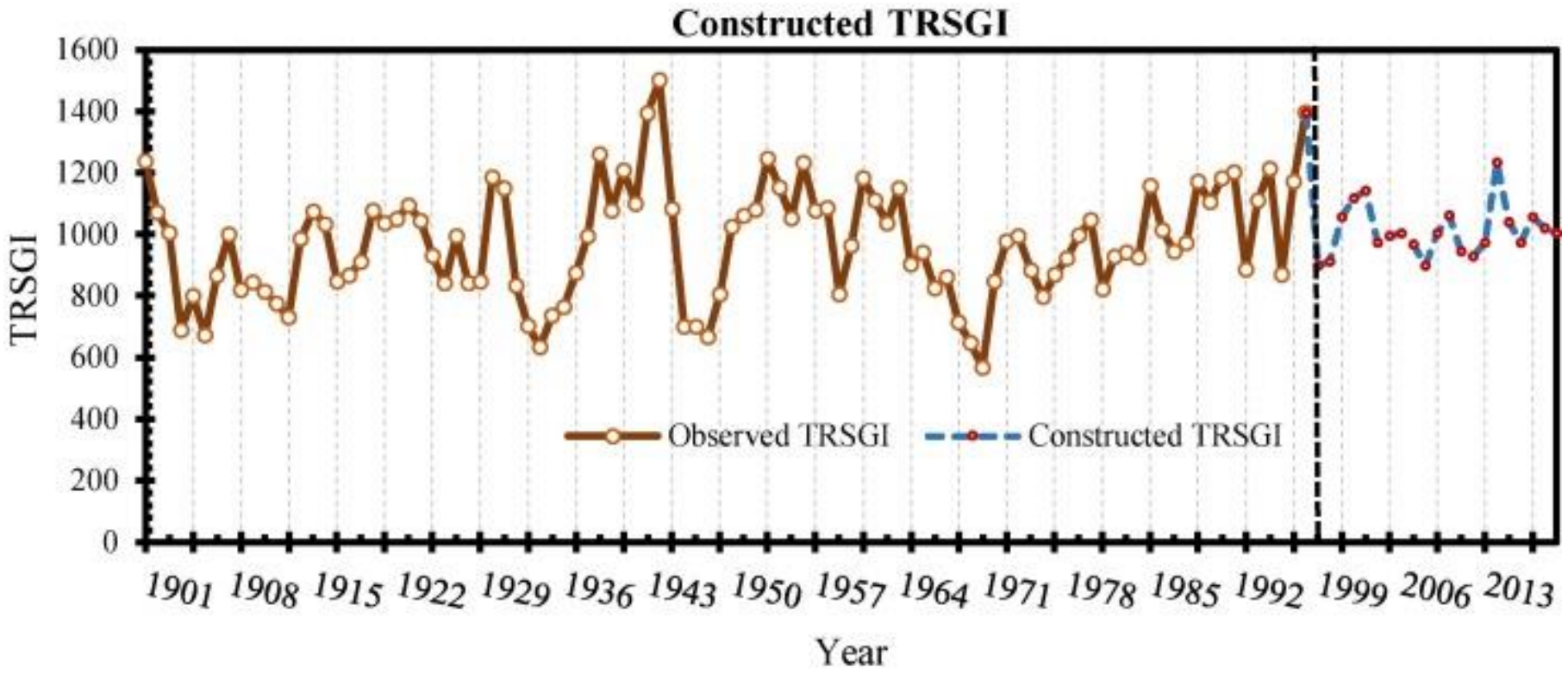
$$\mathrm{TRSGI} \cong 1 + \alpha_1 \times Tmin \times VP + \alpha_2 \times VP^2 + \alpha_3 \times Tmin \times \log 10\,(|Tmin|) + \alpha_4 \times Tmax \times \log 10\,(|Tmin|)$$





		d	MAE	r	NSE
70%	NARX	0.86	89.77	0.80	0.60
	NARX-DNW	0.89	87.98	0.81	0.64
30%	NARX	0.82	93.54	0.70	0.25
	NARX-DNW	0.83	87.26	0.74	0.55

Constructing TRSGI for 1999–2019



Conclusion

- We developed, tested, and applied the models for inferring past climate, based on the understanding of how TRSGI changes in relation to six climate variables.

- The response of TRW to drought events varied based on differences with respect to several parameters, such as species and elevation.

- Our comparison shows that the NARX de-noised wavelet model was useful for constructing TRSGI data for past and future periods.

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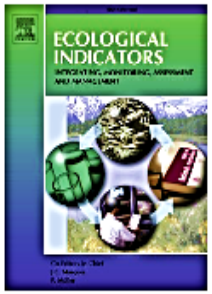

Original Articles

Modelling and reconstructing tree ring growth index with climate variables through artificial intelligence and statistical methods

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ABSTRACT

Climate variables play an important role in the increase of tree ring width (TRW), which is one of the primary paleoclimate signals. In this study, we apply new methods for understanding tree growth responses to climate variables under anthropogenic climate change. This study uses regression and artificial intelligence (AI)

Thank You !


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