

CoSMoS v2.0

Making Time Series Generation Simple

Simon Michael Papalexiou^{1,2}, Filip Strnad², Yannis Markonis², Francesco Serinaldi³,
Chandra Rupa Rajulapati¹, Salma Hobbi¹, Martin Hanel²

¹Global Institute for Water Security, University of Saskatchewan, Canada

²Faculty of Environmental Sciences, Czech University of Life Sciences Prague

³School of Engineering, Newcastle University, UK

What is CoSMoS?

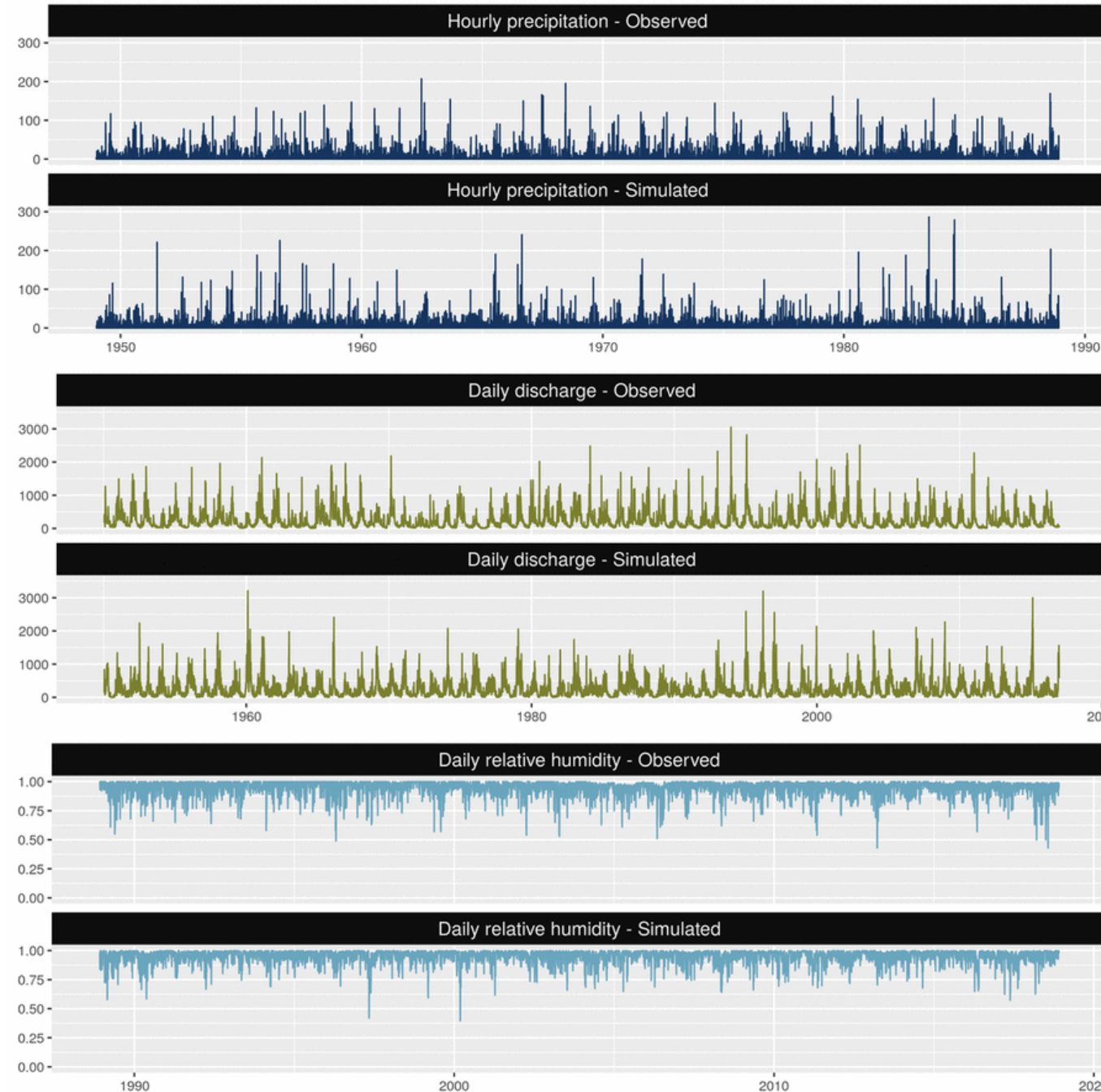
CoSMoS is an R-package available at CRAN

CoSMoS standing for **Complete Stochastic Modelling Solution**, makes time series generation with desired properties easy.

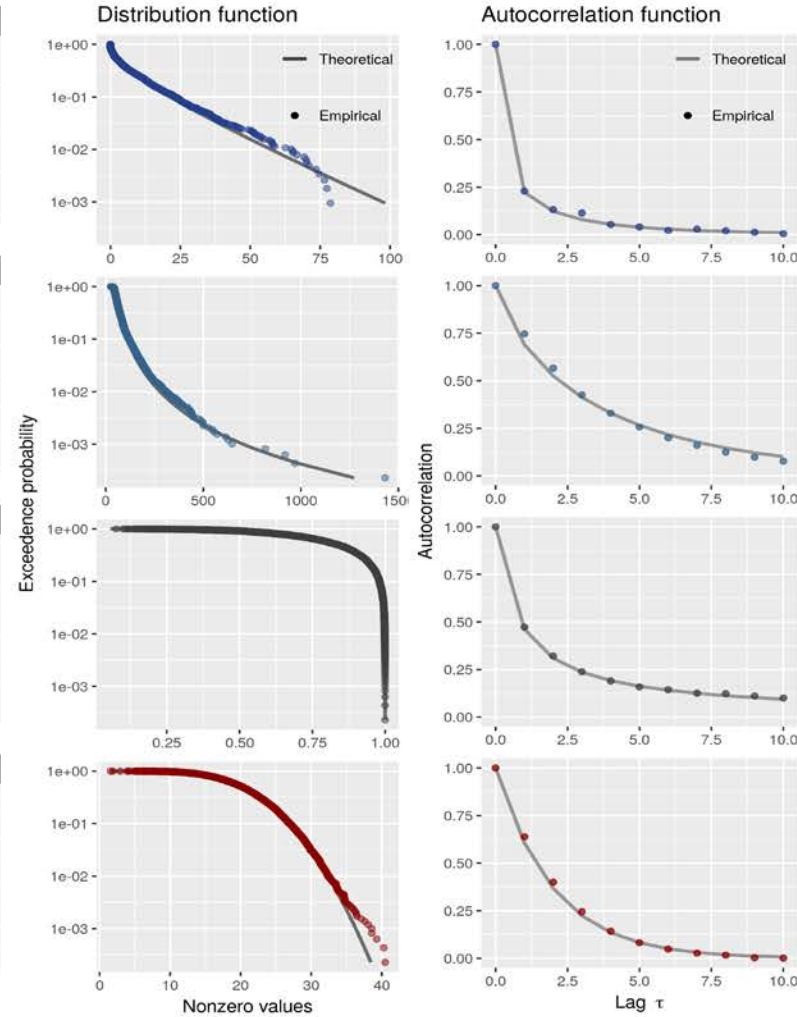
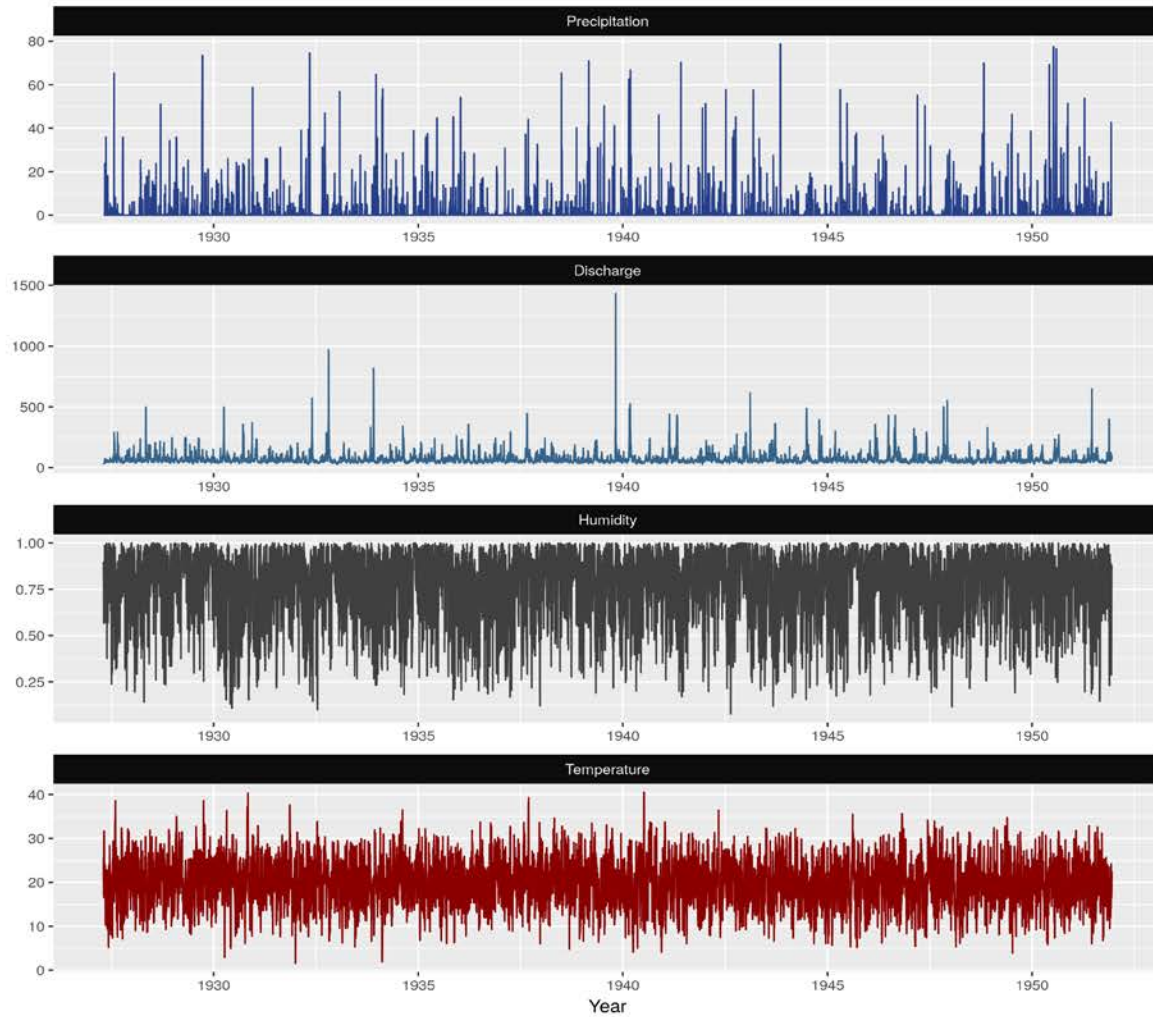
Simulate **precipitation, streamflow, wind speed, relative humidity**, or, any other process in seconds.

Just choose the **probability distribution** and the **autocorrelations** of the time series you wish to generate, and it will do the rest.

Methods can be found in [Papalexiou \(2018\)](#)



CoSMoS-R is easy to use!

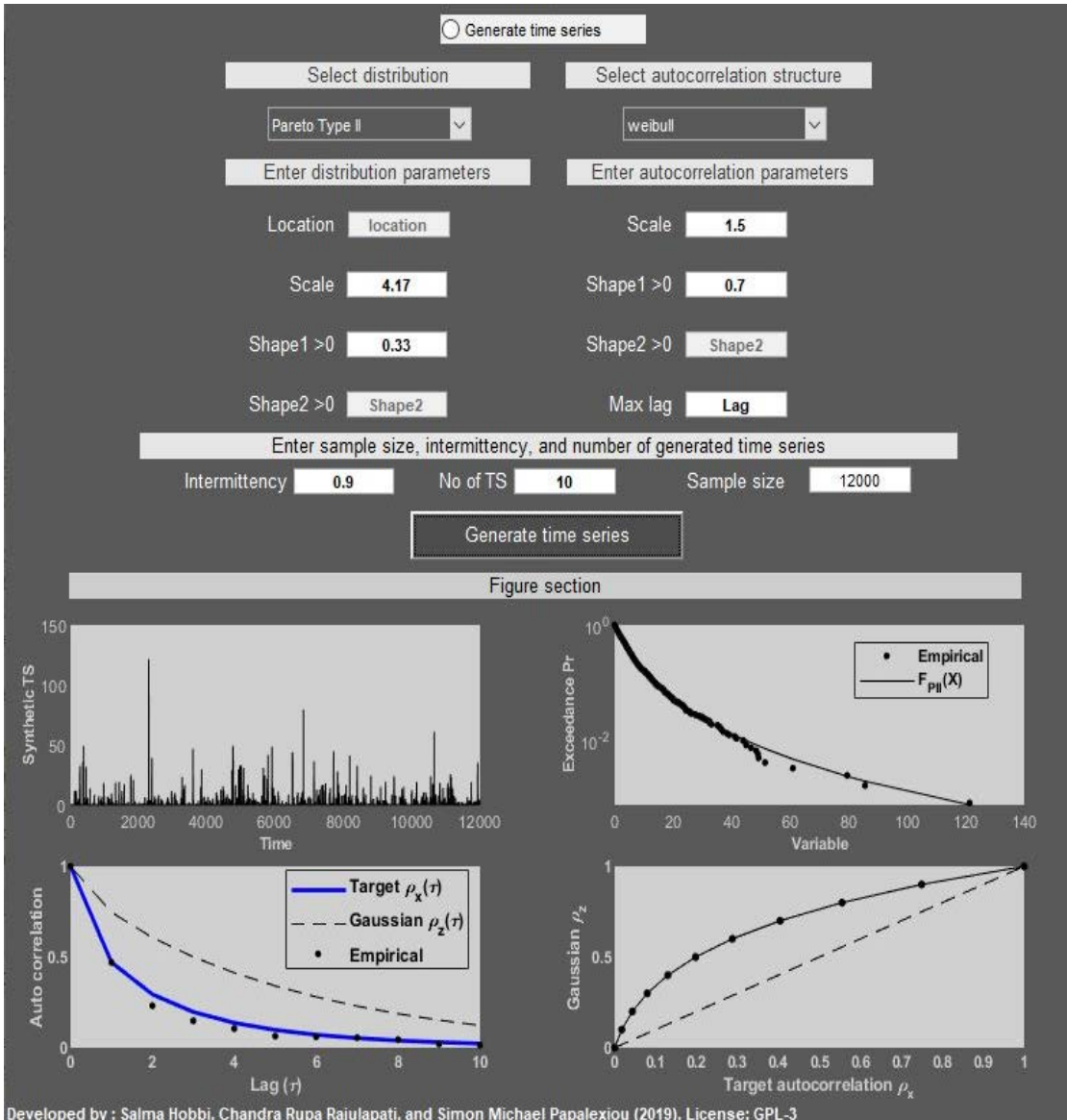


1. Import time series
2. Use the *analyzeTS* function
3. And CoSMoS-R will fit and report on distributions and correlations in a monthly or weekly basis

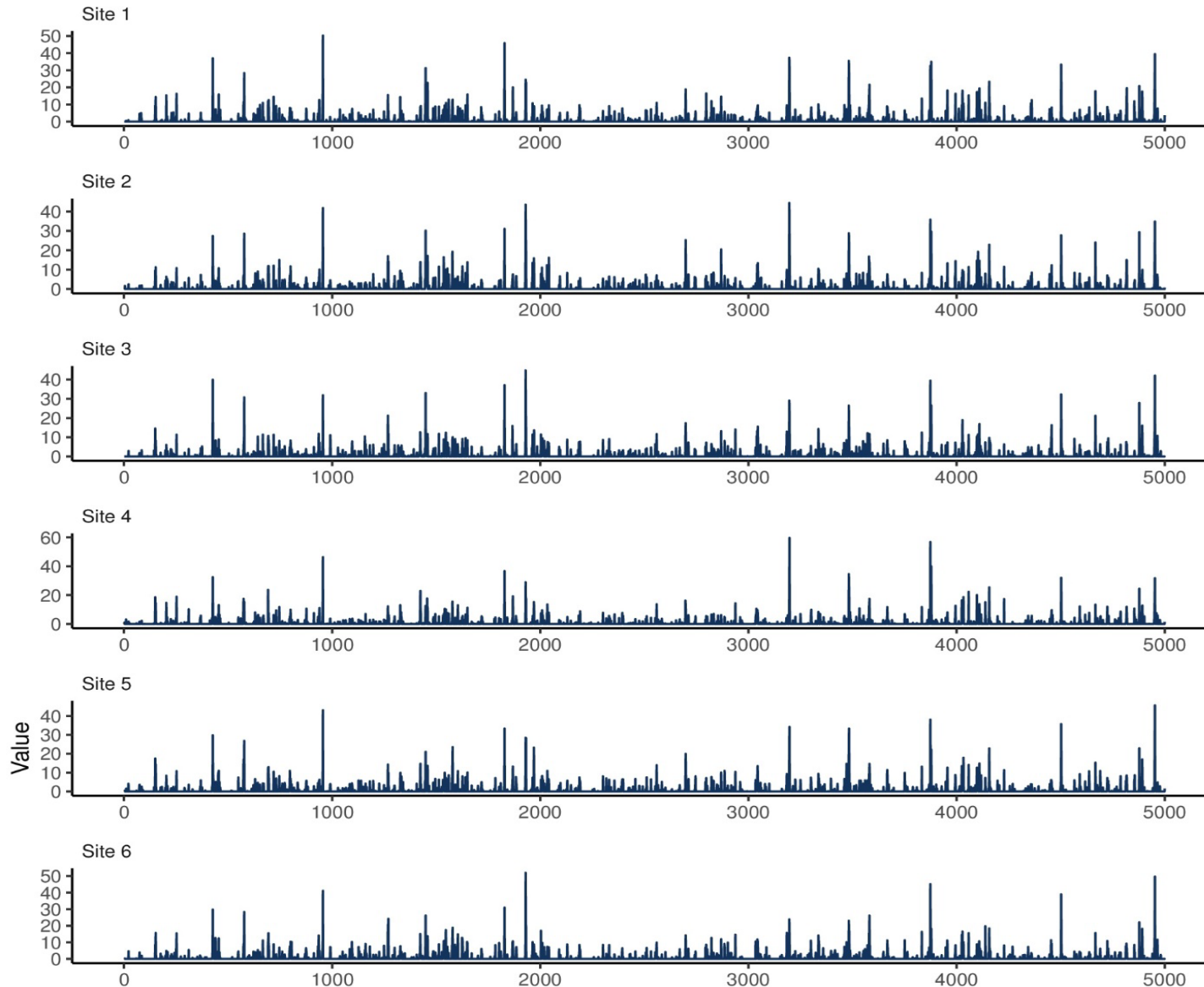
There's a CoSMoS-MATLAB too...

CoSMoS MATLAB available at:

- MathWorks
- GitHub <https://github.com/SMPLab>
- Super simple GUI!
- Select the probability distribution and autocorrelation structure from the drop-down lists.
- Enter the parameters of selected distribution and autocorrelation structure.
- Enter the intermittency value (as probability zero), sample size (time series length), and number of time series you wish to generate.
- Click the “Generate time series” button and that's it!



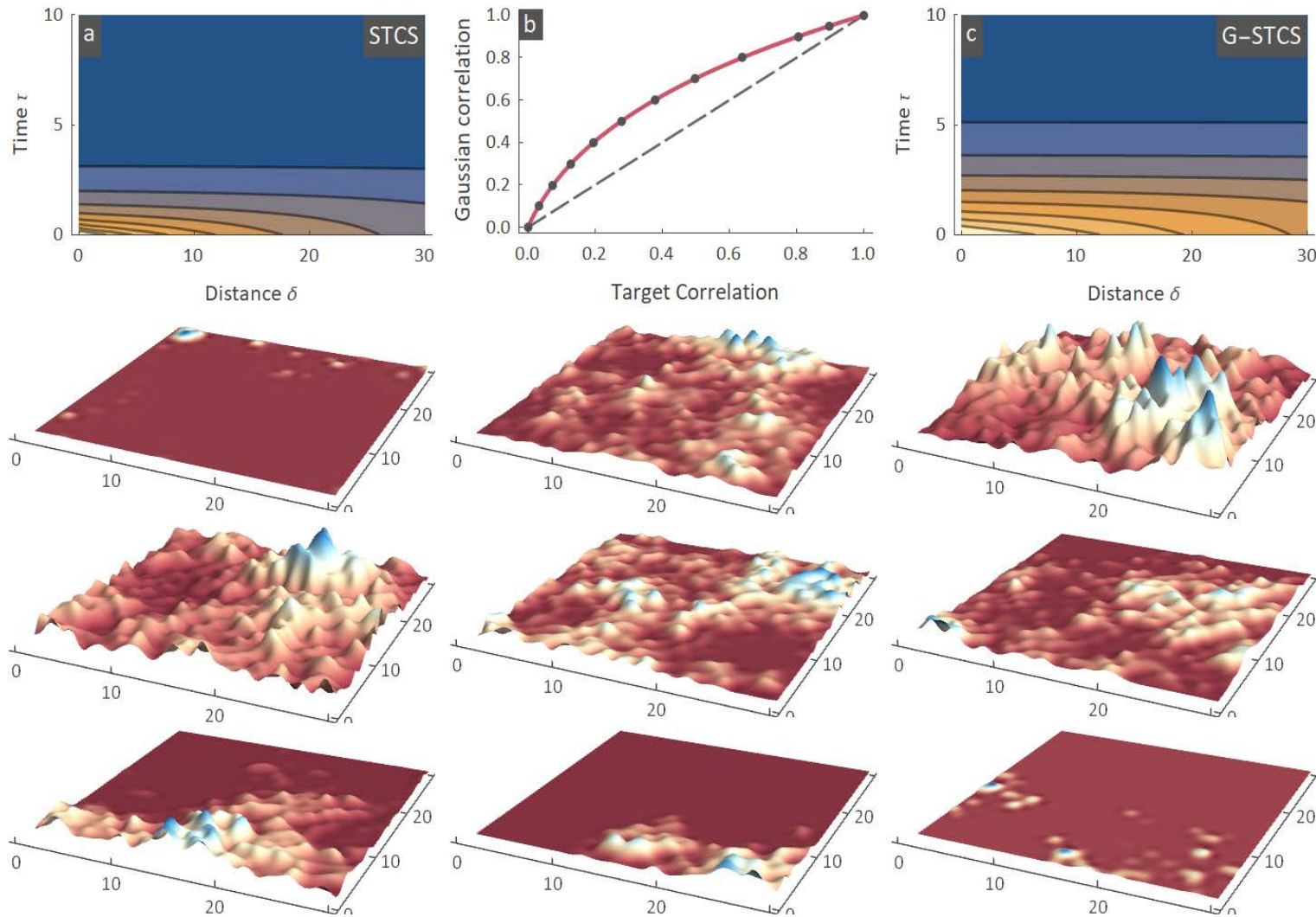
CoSMoS-R v2.0 is coming soon and...



...includes

- Multivariate time series generation at many sites
- Reproduces seasonality, marginal distribution, autocorrelations and cross-correlations at all sites
- And can be applied for precipitation, temperature, wind, streamflow, relative humidity, etc.
- Methods can be found in [Papalexiou \(2018\)](#) and [Papalexiou and Serinaldi \(2020\)](#)

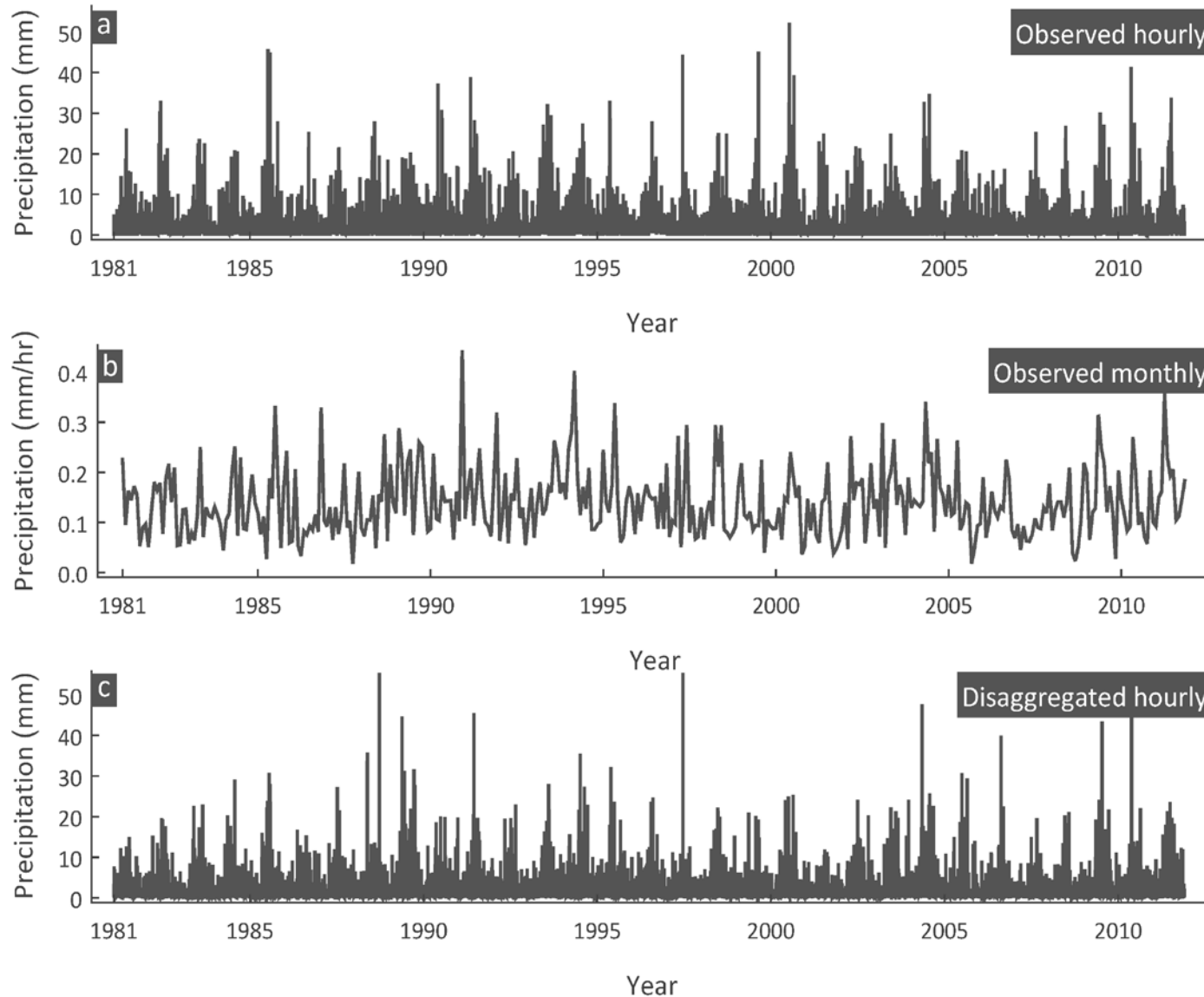
CoSMoS-R v2.0 is coming soon and...



...includes

- Random fields generation reproducing marginal distribution intermittency and spatiotemporal correlation structures.
- Methods and examples can be found in [Papalexiou and Serinaldi \(2020\)](#)

CoSMoS-R v2.0 is coming soon and...



...maybe includes the DiPMaC algorithm for downscaling

- makes simple to downscale time series from coarse scales to any finer scale by preserving the properties at the fine scales...
- Methods and examples for climate models can be found in [Papalexiou et al. \(2018\)](#)

CoSMoS...

...made with 

We released CoSMoS-R a year ago—today (07/05/2020) it has **5825** downloads from CRAN. ~Thank you!

We announce updates on: <https://twitter.com/simonpapalexiou>

References

- Papalexiou, S.M., & Serinaldi, F. (2020). Random Fields Simplified: Preserving Marginal Distributions, Correlations, and Intermittency, With Applications From Rainfall to Humidity. *Water Resources Research*, 56(2), e2019WR026331. <https://doi.org/10.1029/2019WR026331>
- Papalexiou, S.M. (2018). Unified theory for stochastic modelling of hydroclimatic processes: Preserving marginal distributions, correlation structures, and intermittency. *Advances in Water Resources*, 115, 234–252. <https://doi.org/10.1016/j.advwatres.2018.02.013>
- Papalexiou, S.M., Markonis, Y., Lombardo, F., AghaKouchak, A., & Foufoula-Georgiou, E. (2018). Precise Temporal Disaggregation Preserving Marginals and Correlations (DiPMaC) for Stationary and Nonstationary Processes. *Water Resources Research*. <https://doi.org/10.1029/2018WR022726>