

# Estimate Drawdown Caused by Groundwater Pumping

The background of the slide is a stylized landscape. It features dark blue mountains in the foreground and a large, light purple mountain on the right. A bright yellow sun is partially obscured by the purple mountain. The sky is a dark blue gradient with several small white stars.

Using Transfer noise functions

Aditi Bhardwaj

# Introduction

## Assumption in ARIMA

The conditions under which the data for the time series process is collected remains the same.

## Transfer Function Noise Model

If however, these conditions change over time, ARIMA models can be improved by introducing certain inputs reflecting these changes in the process conditions

## Example

The estimation of the effect of interventions in the groundwater system (such as groundwater pumping and changes in surface water levels),

# Transfer Function Noise Models

The basic model structure of a TFN model to simulate a Time series may be written as:

$$h(t) = \sum_{m=1}^M h_m(t) + d + r(t)$$

Where  $h(t)$  is an observed time series,  
 $h_m(t)$  is the contribution of stress  $m$  to  $h$ ,  $d$  is the base elevation of the model,  $r(t)$  are the residuals

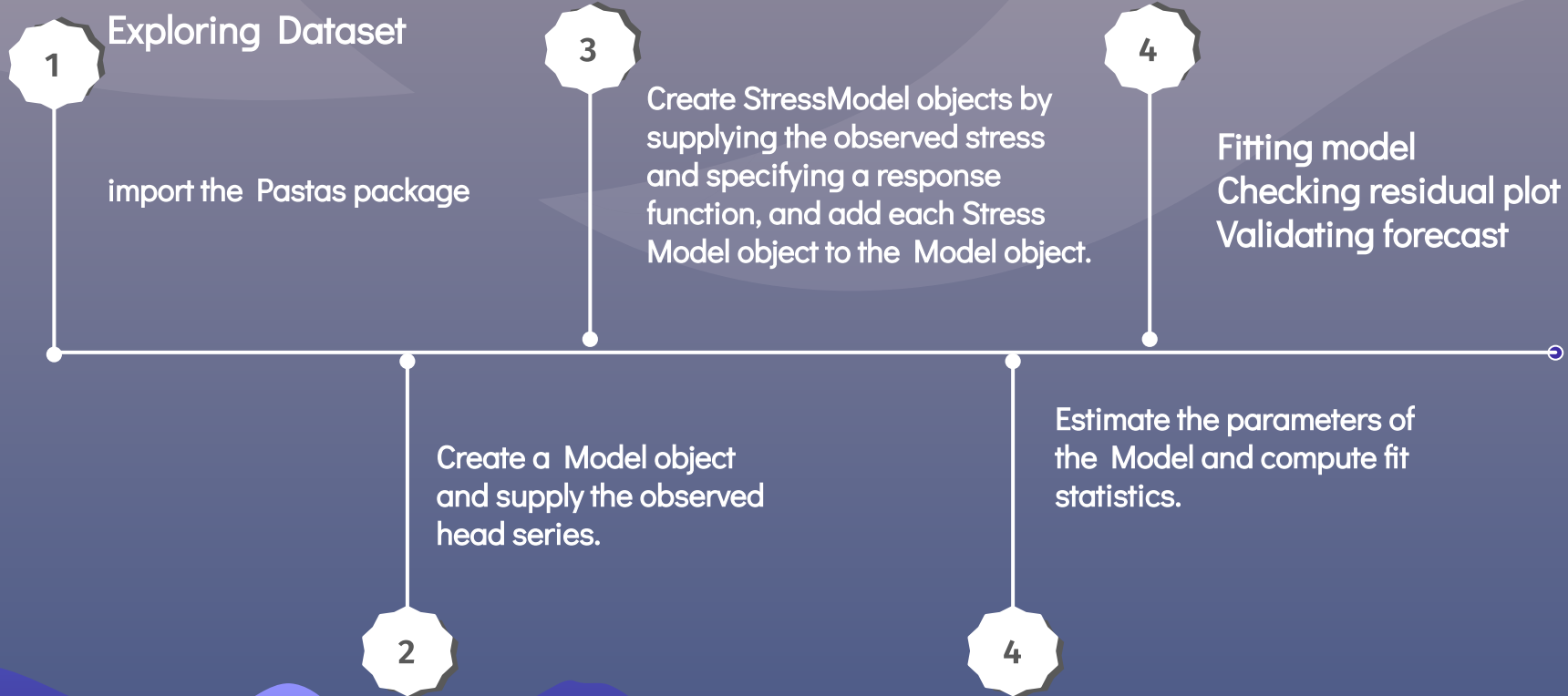
The contribution of stress  $m$  to the head is computed through convolution  
where  $S_m$  is a time series of stress  $m$ , and  $\theta_m$  is the impulse response function for stress  $m$

$$h_m(t) = \int_{-\infty}^t S_m(\tau) \theta_m(t - \tau) d\tau$$

$$\theta(t) = A \frac{t^{n-1}}{a^n \Gamma(n)} e^{-t/a} \quad t \geq 0$$

A commonly used impulse response function is the scaled Gamma distribution.  
where  $A$  is the scaling factor,  $a$  and  $n$  are shape parameters, and  $\Gamma$  is the Gamma function

# Approach followed



# Thanks

References:

[science direct- Article](#)

[science direct](#)

[NCBI](#)