Interrupted Time Series Analyses

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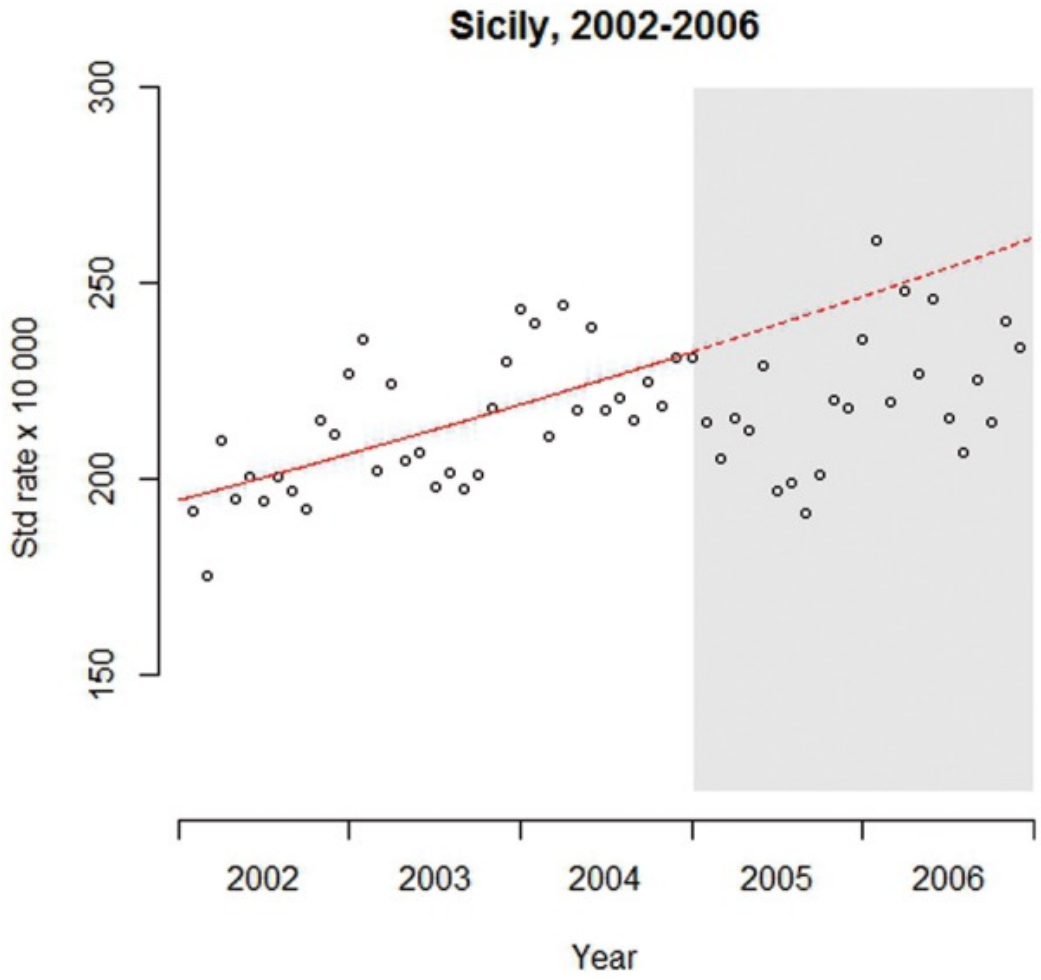
Interrupted Time Series Analysis



Deciding if an ITS analysis is appropriate

Intervention:

- Clear moment in time in which the intervention is introduced.

Outcome:

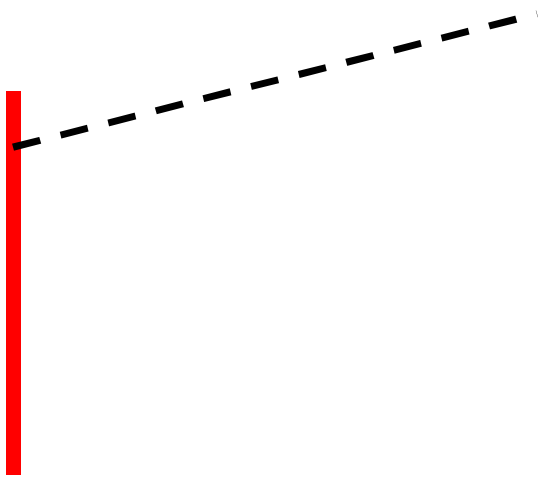
- Can be count, continuous or binary
- Short-term outcomes (ie. those that are expected to change relatively quickly after an intervention) … or those that have a clearly defined lag before impact

Data requirements:

- Sequential measures of the outcome both before and after the intervention
- Routine data
- No fixed recommendation for number of time points

Number of time points and power

Power increases with the number of time points, but its not always preferable to have more data points:



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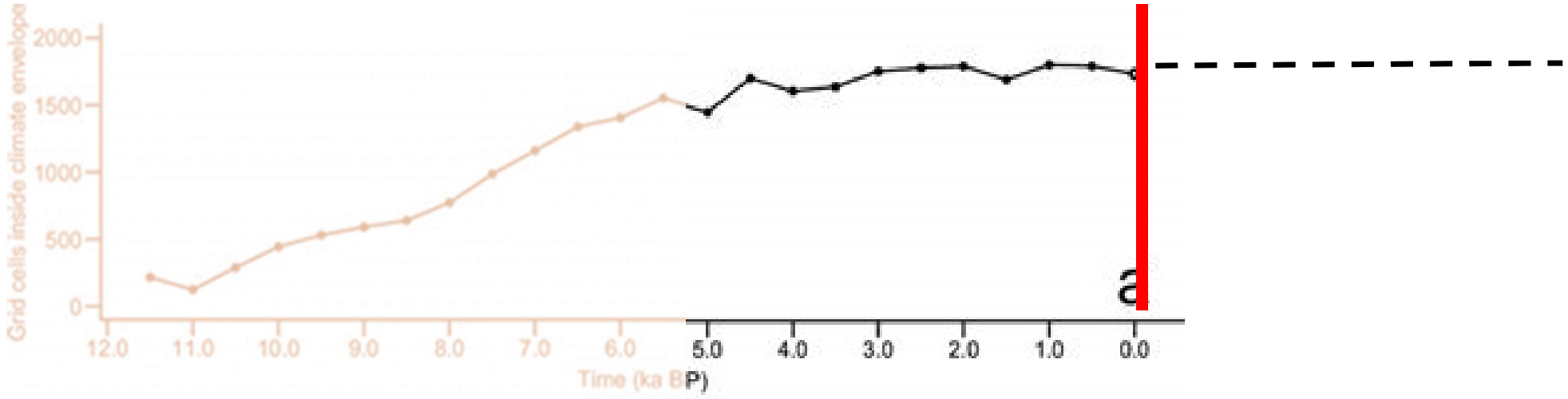
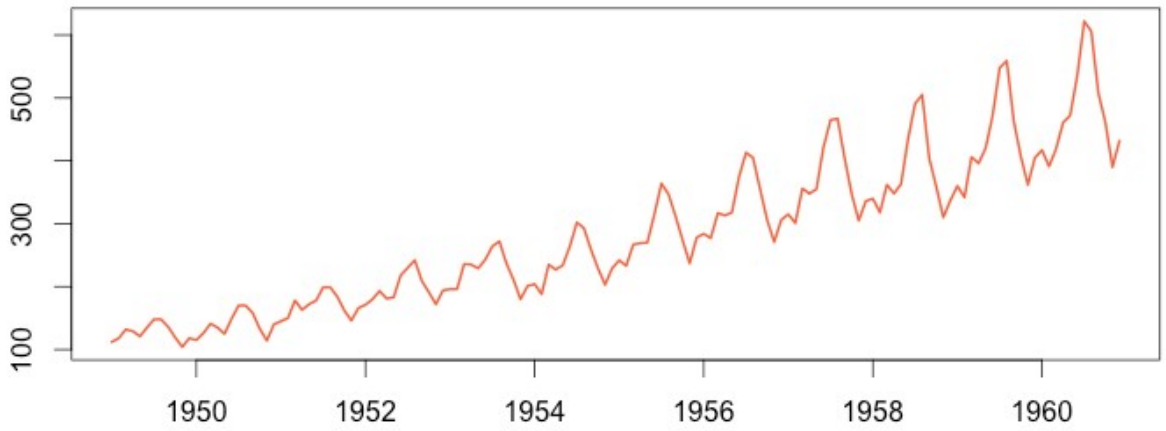


Important to visually inspect data.

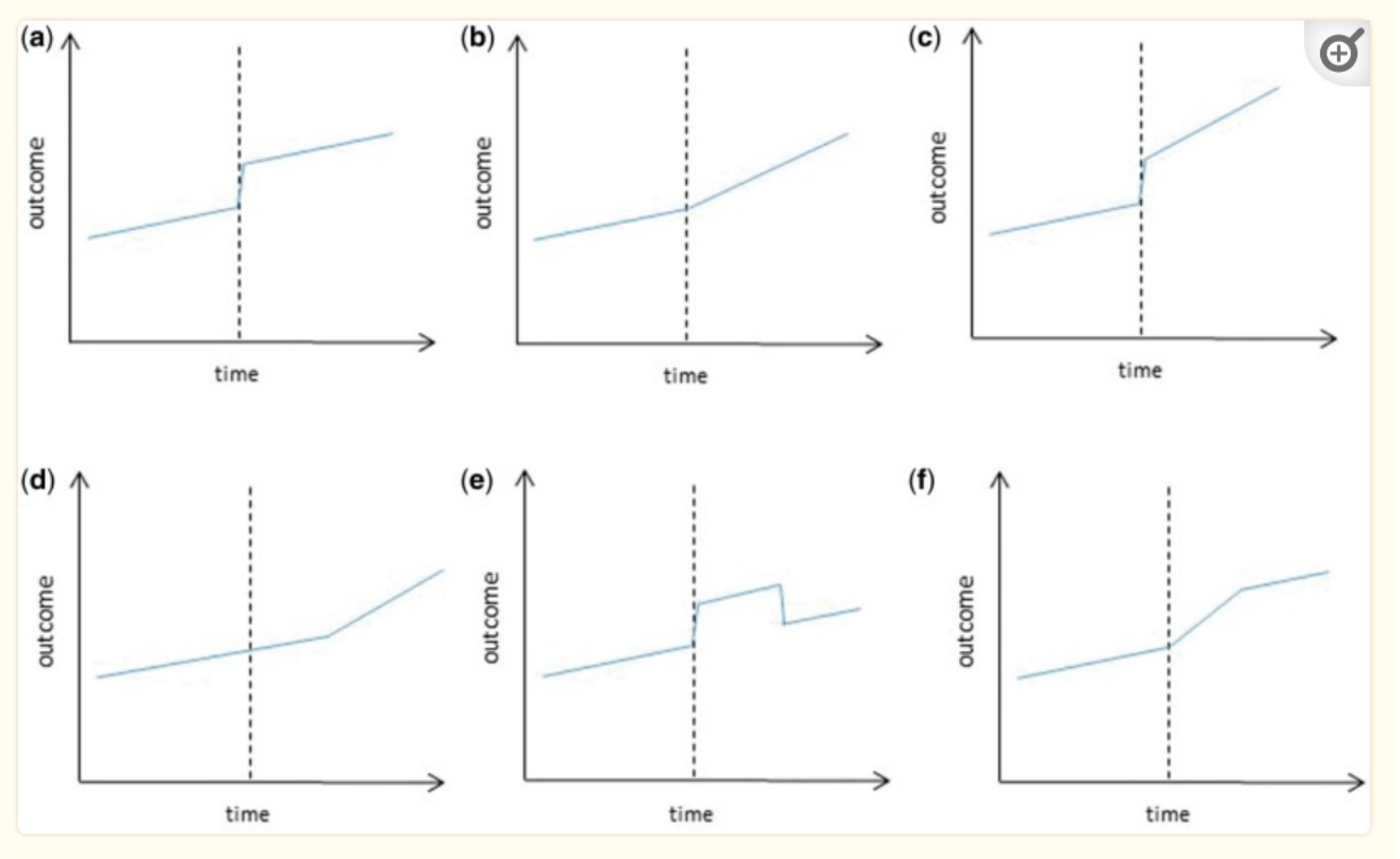
Number of time points and power

Power also depends on various other factors:

- Distribution of data points before and after the intervention
- variability within the data
- strength of effect
- and the presence of confounding effects such as seasonality.



Choosing an appropriate model



Regression Methods

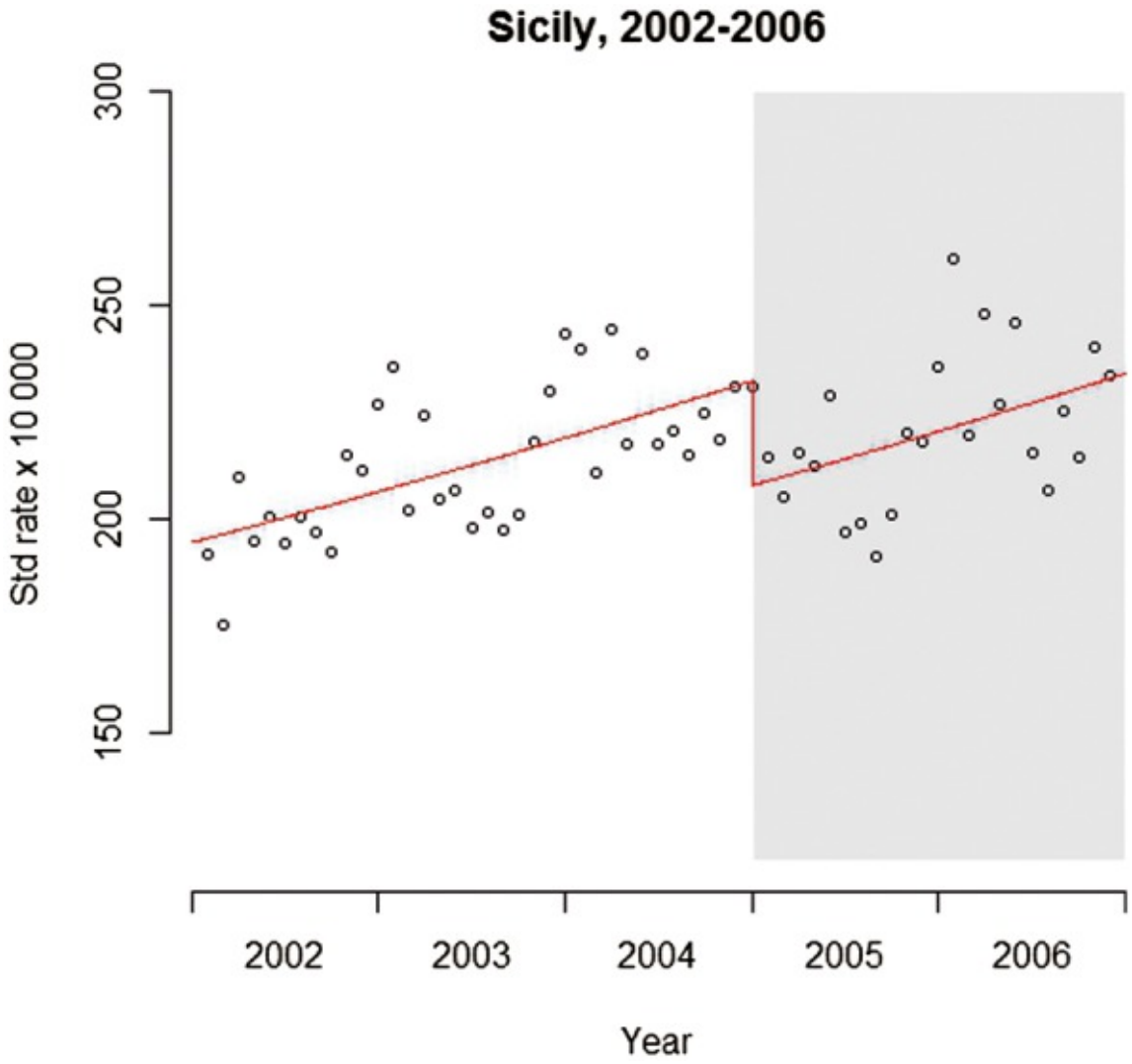
A minimum of three variables are required for an ITS analysis:

T: the time elapsed since the start of the study
X_t : a binary variable indicating pre-intervention period (0) or the post-intervention period (1);
Y_t: the outcome at time t.

In standard ITS analyses, the following segmented regression model is used:

$$Y_t = \beta_0 + \beta_1 T + \beta_2 X_t + \beta_3 T X_t$$

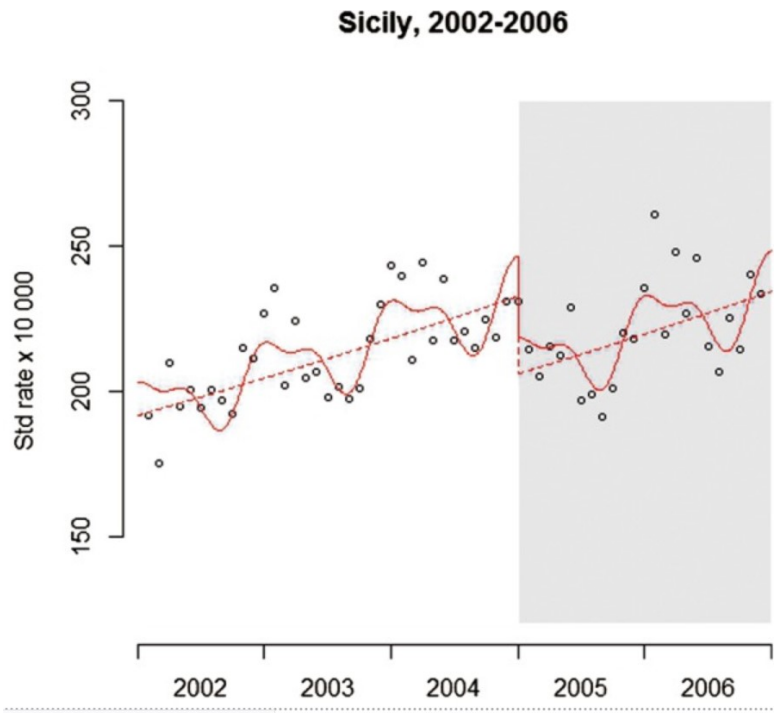
β_0 represents the baseline level at $T = 0$,
β_1 is interpreted as the change in outcome associated with a time unit increase (representing the underlying pre-intervention trend),
β_2 is the level change following the intervention
β_3 indicates the slope change following the intervention (using the interaction between time and intervention: TX_t).


Sicily, 2002-2006
Std rate x 10 000
300
250
200
150
2002
2003
2004
2005
2006
Year

Addressing methodological issues

Seasonality:

- Risk of Bias
- Autocorrelation



Managing seasonality:

- model stratified by the calendar month (or other time period)
- more complex functions such as ‘Fourier terms’ or ‘spline’

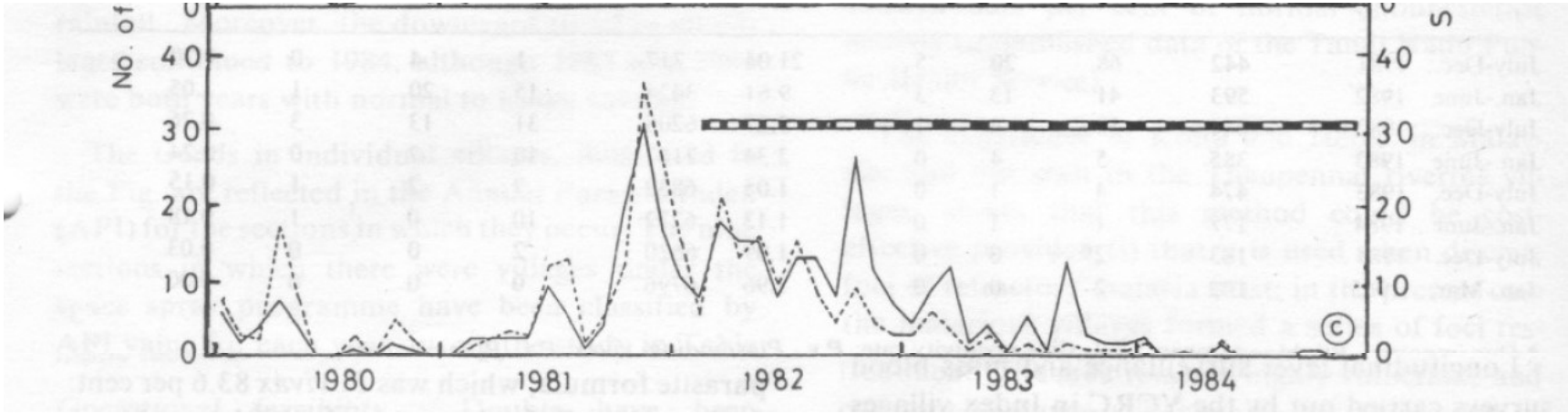
Addressing methodological issues

Other time-varying confounders:

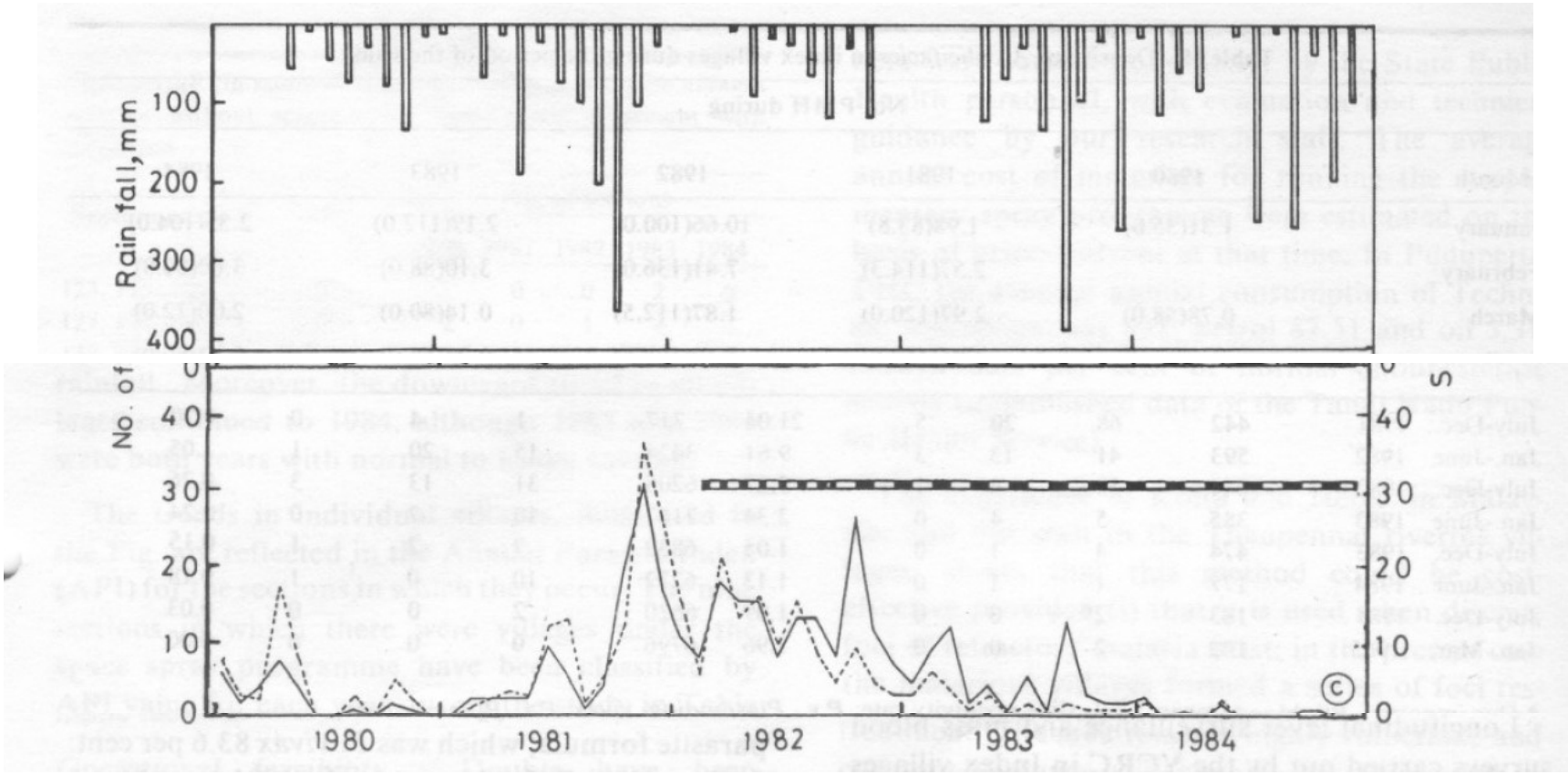
- ITS typically unaffected by typical confounding variables which remain fairly constant over time
- Can be affected by more rapidly-changing time varying confounders
- Seasonality
- Weather events

Addressing methodological issues

Time-varying confounders:



Addressing methodological issues



Addressing methodological issues

Time-varying confounders:

- Other natural events affecting the outcome
- Other interventions targeting the same outcome

Managing time-varying confounders:

- Where measured, include variables representing them in the regression model
- If unknown or unmeasured, there are some design adaptations.
- Controlled ITS, multiple baseline design, introduction and withdrawal