Time Series

Grégoire Clarté

Winter-Spring 2026

About the course

Welcome

- Grégoire Clarté [gʁeˈgwaʁ̞ kl̥aʁ̞ˈte]
- Lecturer in Statistics
- Contact: `gclarte@ed.ac.uk`
- Most material will be on learn.
- Office hours: Mondays 14-15.

References

Time Series Analysis and It's Applications, Robert H. Shumway & David Stoffer.
$\Rightarrow$ Available as pdf through the library.
I will not follow exactly this book.

Sources for the course notes:

- Slides and exercises by Ioannis Papasthopoulos (UoE);
- Course notes and exercises by Djalil Chaffaï, Céline Lévy-Leduc & Angelina Roche (Dauphine);
- Course notes by V. Monbet (ENSAI).

You can take notes with paper and a pen.

Syllabus

- Linear stationary time series: Autoregressive (AR), moving average (MA), ARMA.
- Non-stationary time series: integrated ARMA (ARIMA), Box-Jenkins approach to time series modelling.
- Time series forecasting: best linear prediction for stationary time series and the Box-Jenkins method to forecasting.
- Seasonal variation and smoothing: linear filters, seasonal trend decomposition.
- Financial time series: autoregressive conditional heteroscedasticity (ARCH, GARCH), stochastic volatility model, factor model.
- State space models: filtering and predictive distribution, Kalman filter.
- Analysis in the Fourier domain: Time series spectra and the periodogram.

Exam Diet

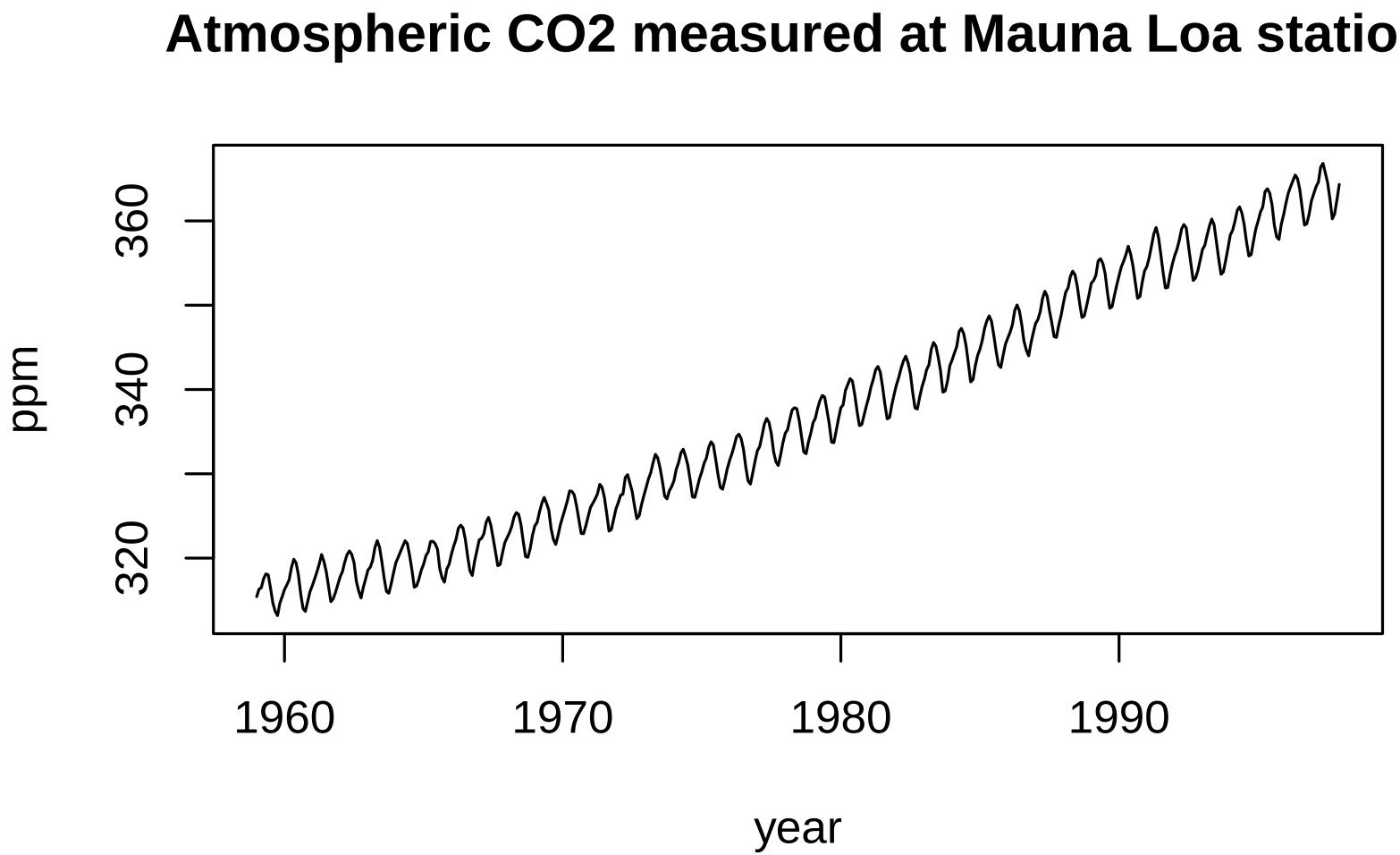
Fully final exam.
We will organise an in class formative test later in the semester, or home voluntary exercises to return to me for formative marking.

NO NOTES WILL BE ALLOWED DURING THE FINAL EXAM.

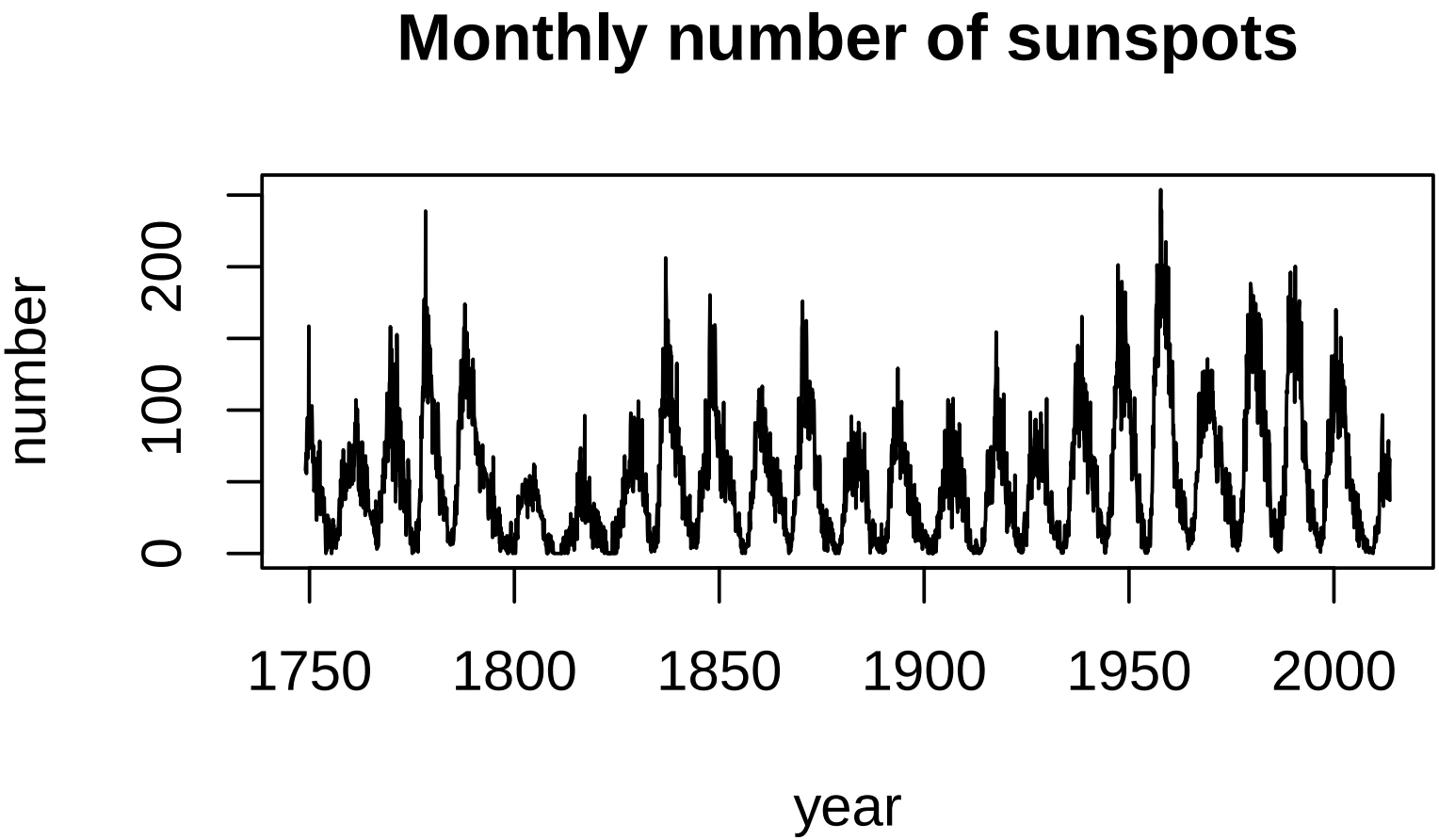
The exam will be similar to the exercises done in class. I will try to do in class exercises with the students writing their solution on the board to get feedback from their colleagues.

Time series basics

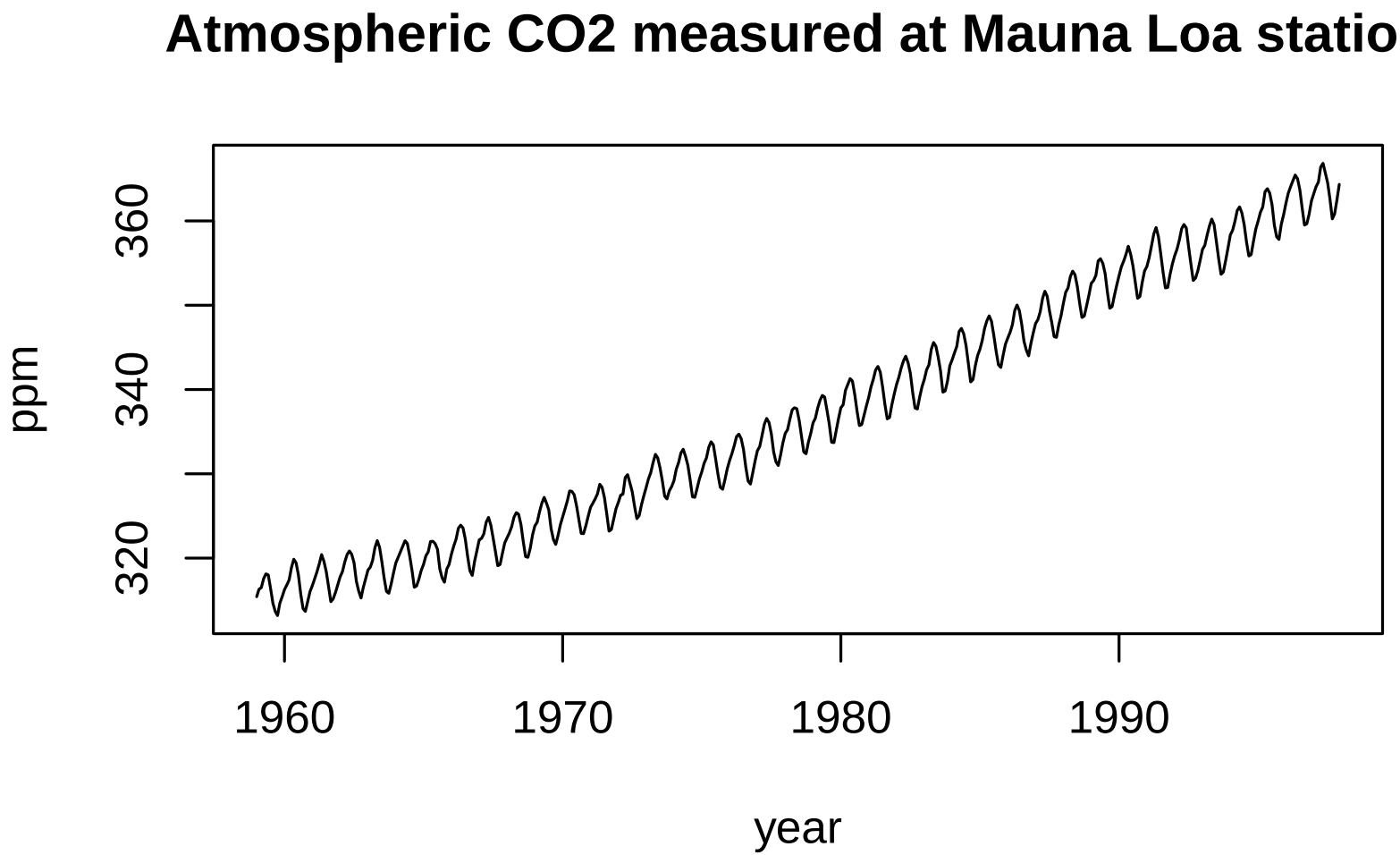
Examples


Atmospheric CO2 measured at Mauna Loa station
ppm
320
340
360
1960
1970
1980
1990
year

Examples


Monthly number of sunspots
number
0
100
200
1750
1800
1850
1900
1950
2000
year

Examples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ACF function