



Decades dedicated to the rissaga research

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Fotografia: Josep Gornés

Ciutadella, Balearic Islands, Western Mediterranean



Ciutadella harbour



Platja Gran





Ciutadella, June 2006



Meteotsunami (rissaga)

Ciutadella, June 2006



Meteotsunami (rissaga)

Ciutadella, June 2006



Meteotsunami (rissaga)

Ciutadella, June 2006



Meteotsunami (rissaga)

Ciudadella, June 2006

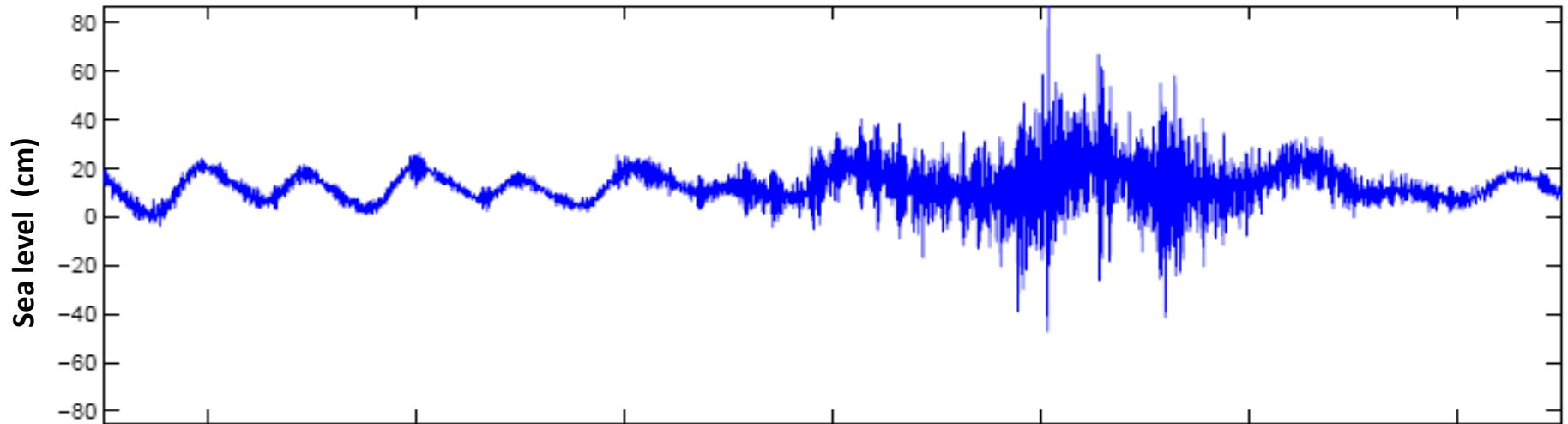


Meteotsunami (rissaga)



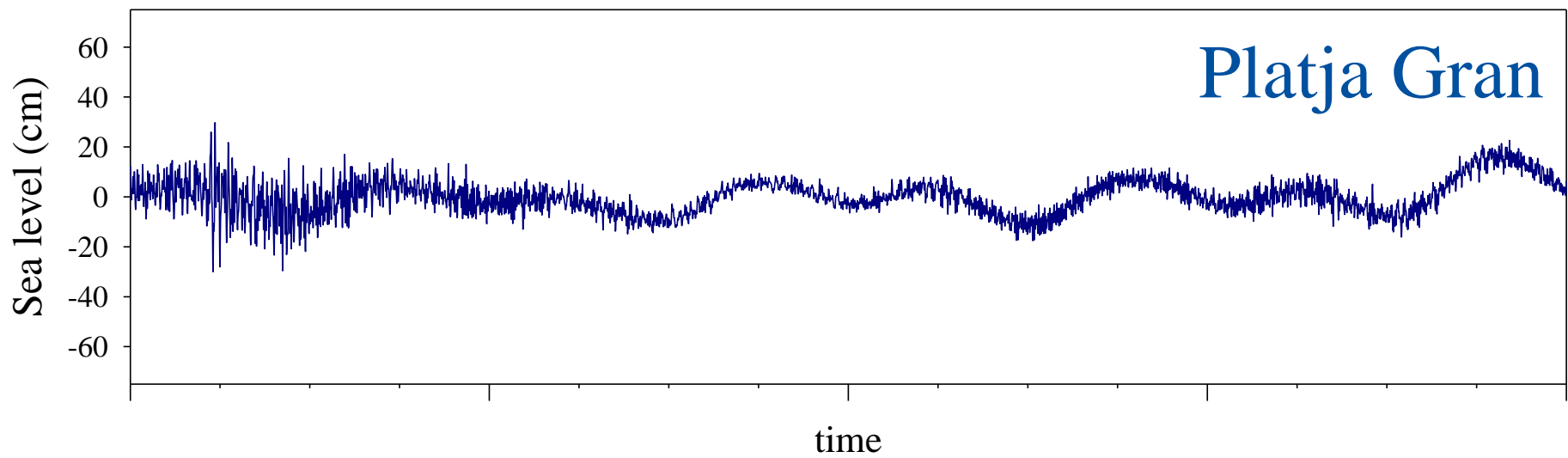
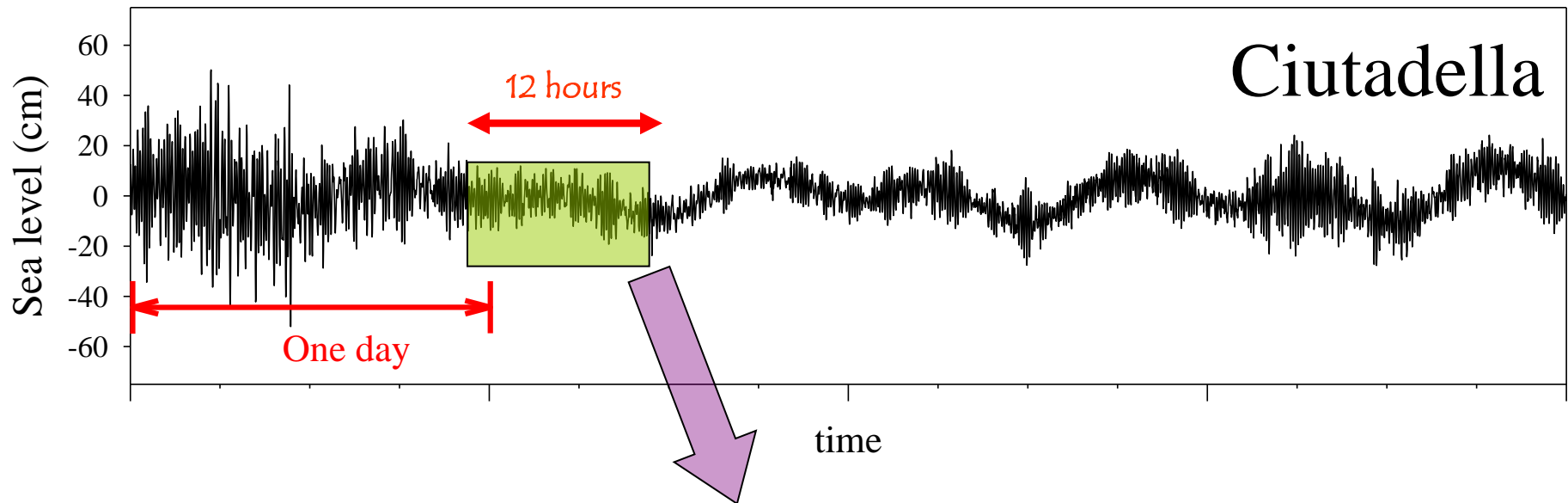
Two minutes and a half !!!

Ciutadella

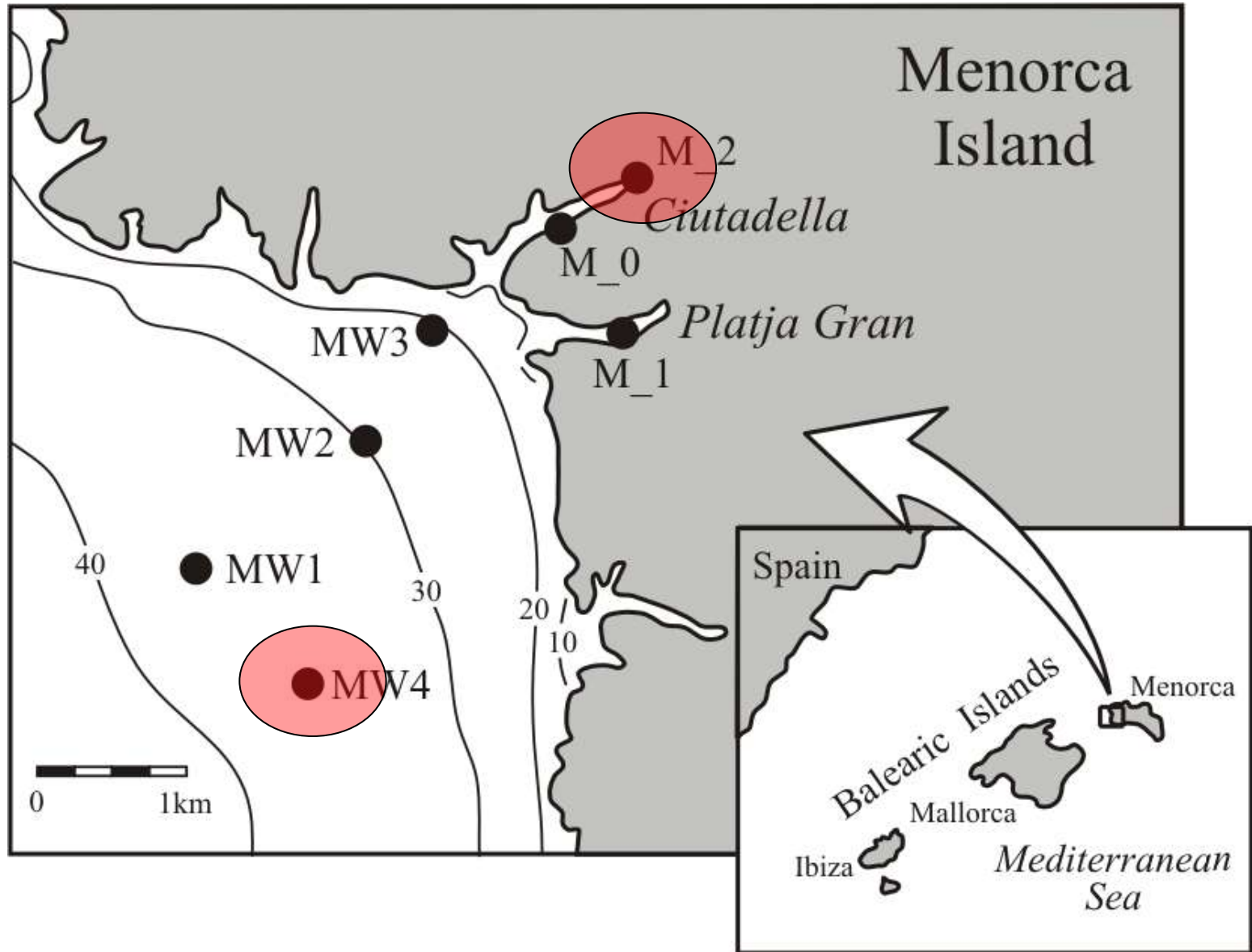


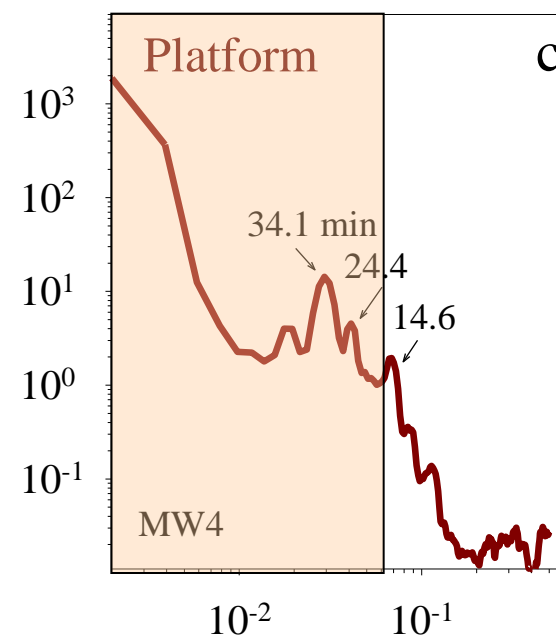
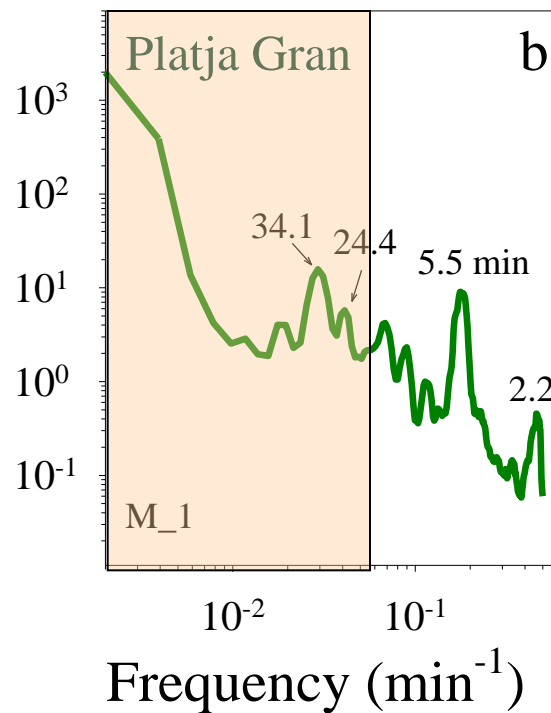
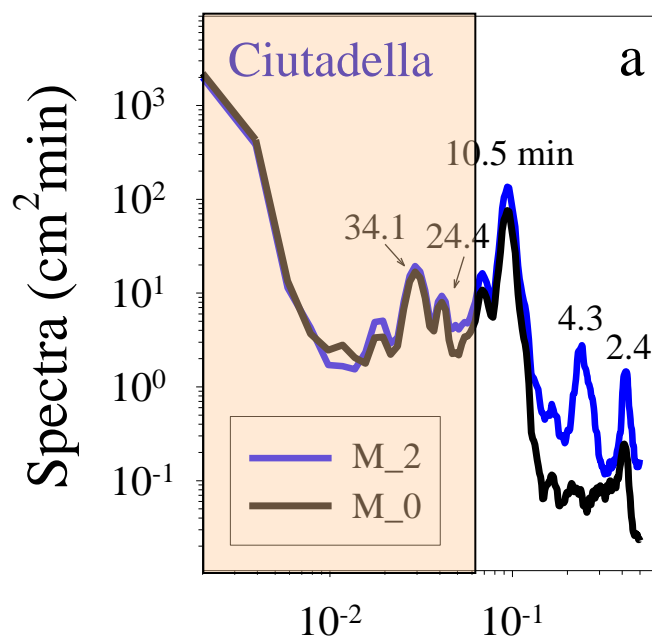
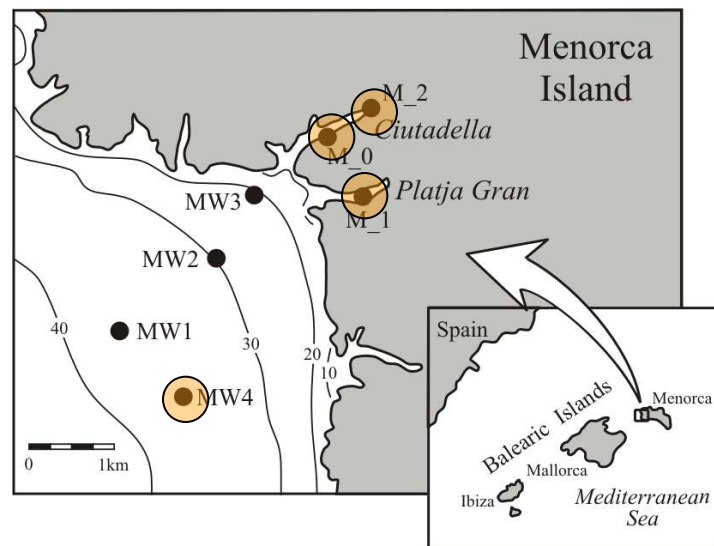
← **One week** →

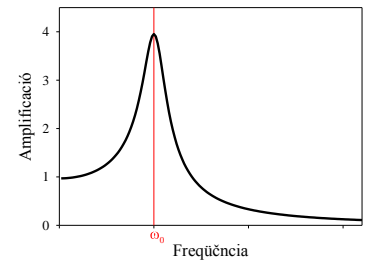
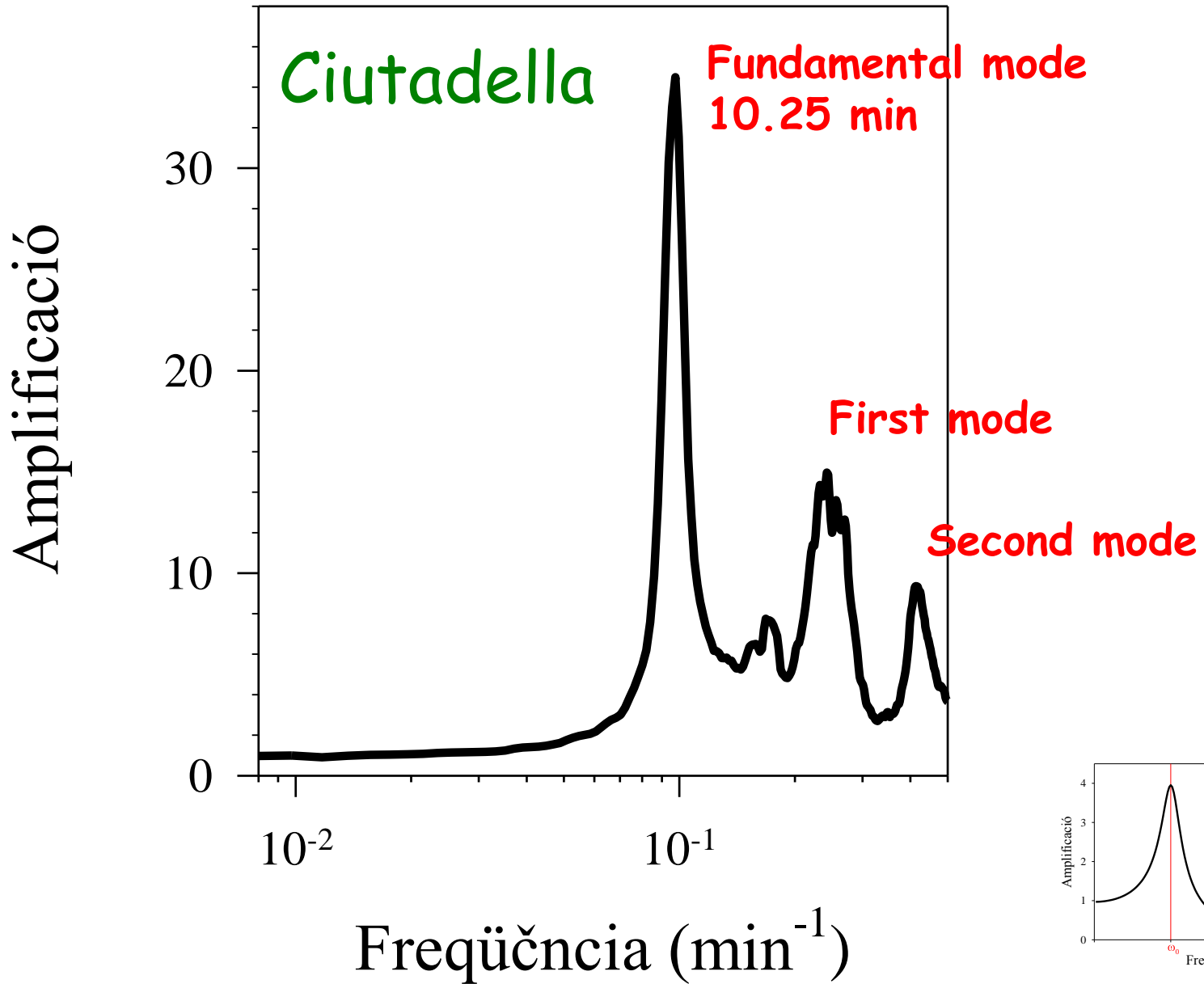
October 2007



Estiu 1997





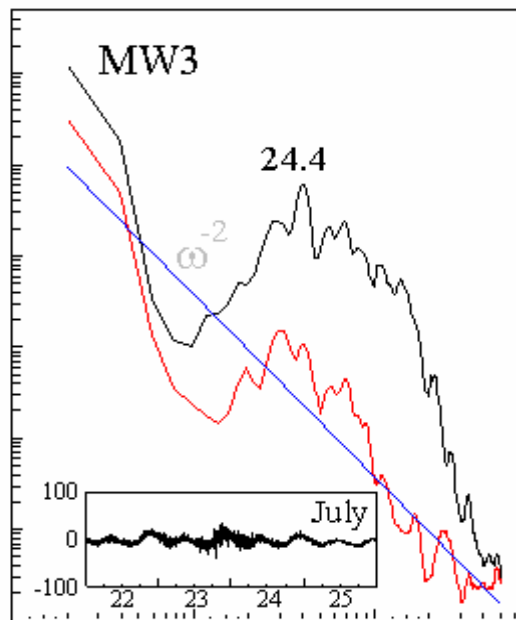
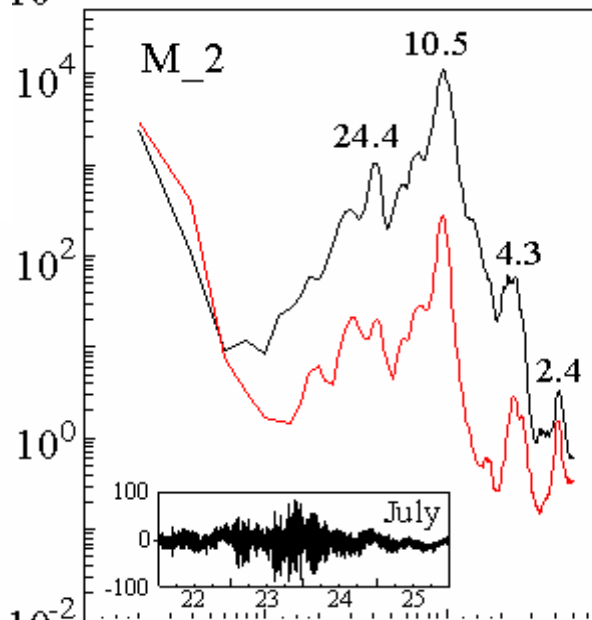
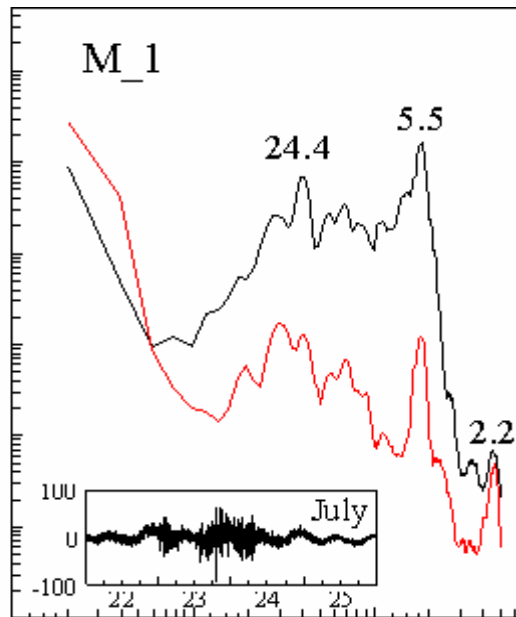
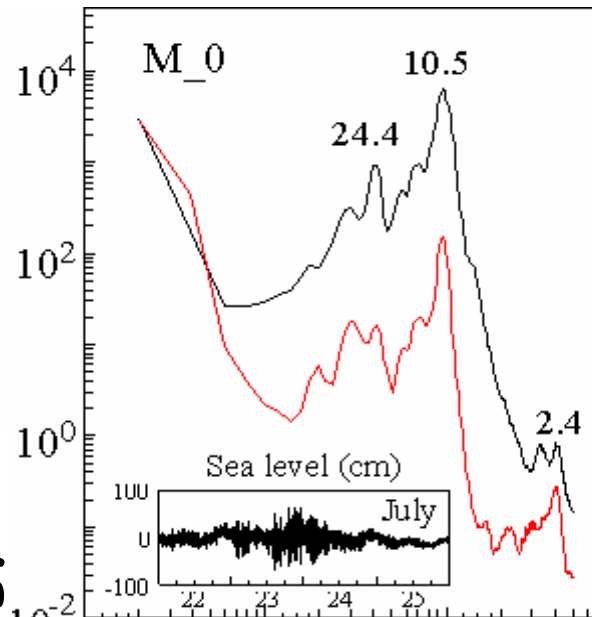


We know how is the harbour
response, but

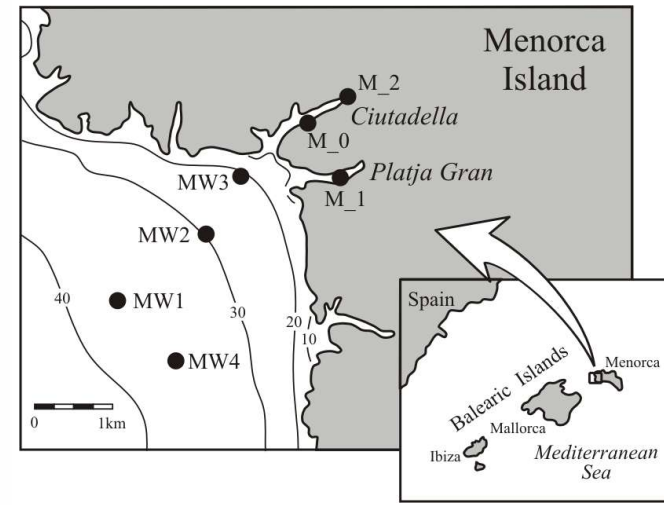
... what is the forcing?

What do we have outside and
when?

Energy



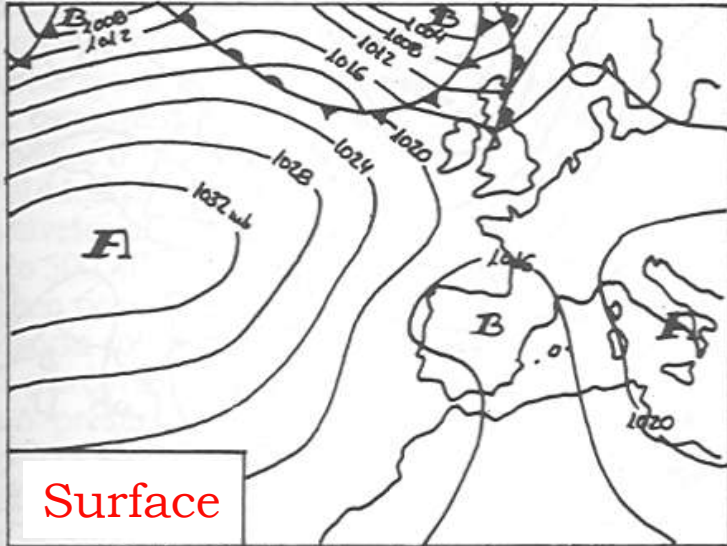
LAST 1997



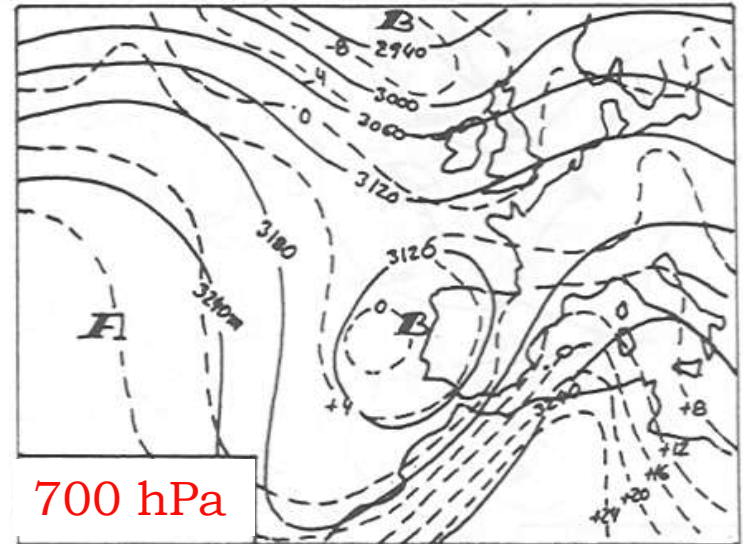
Frequency (min⁻¹)

- The Western Mediterranean is a region with low seismic activity
- This activity is generally of low intensity and restricted to the Alboran Sea and the Algerian Basin.
- Large sea level oscillations observed in Ciutadella and other harbours in the Balearic Islands have an atmospheric origin.

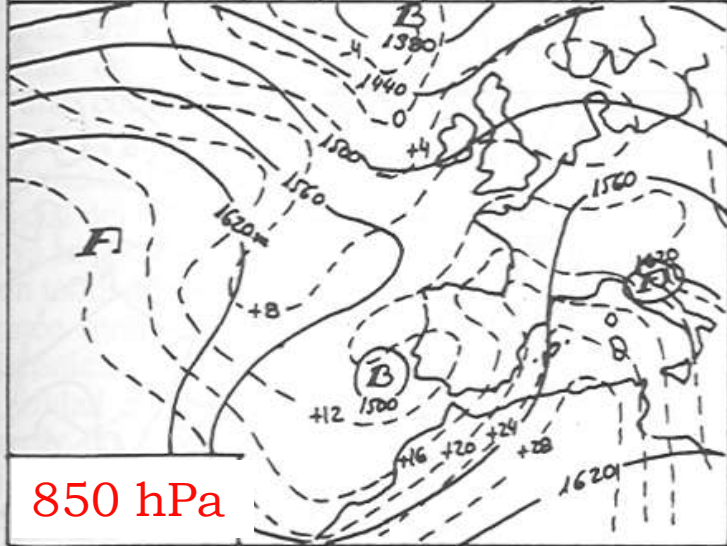
METEOTSUNAMIS



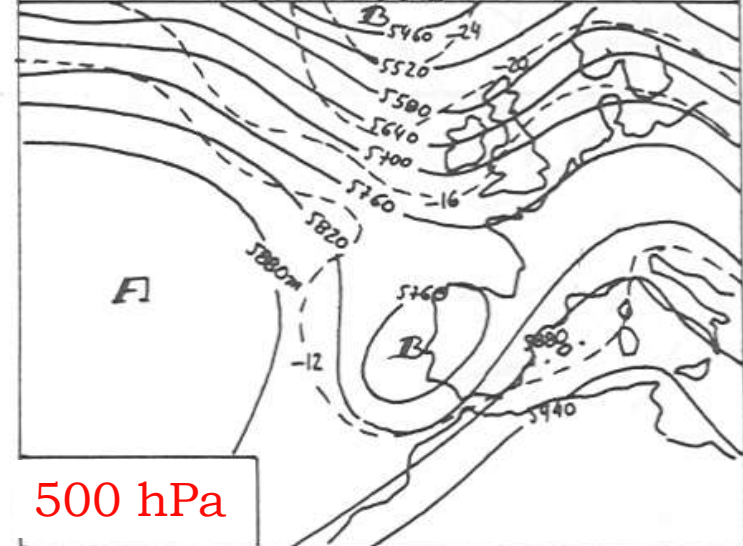
Surface



700 hPa



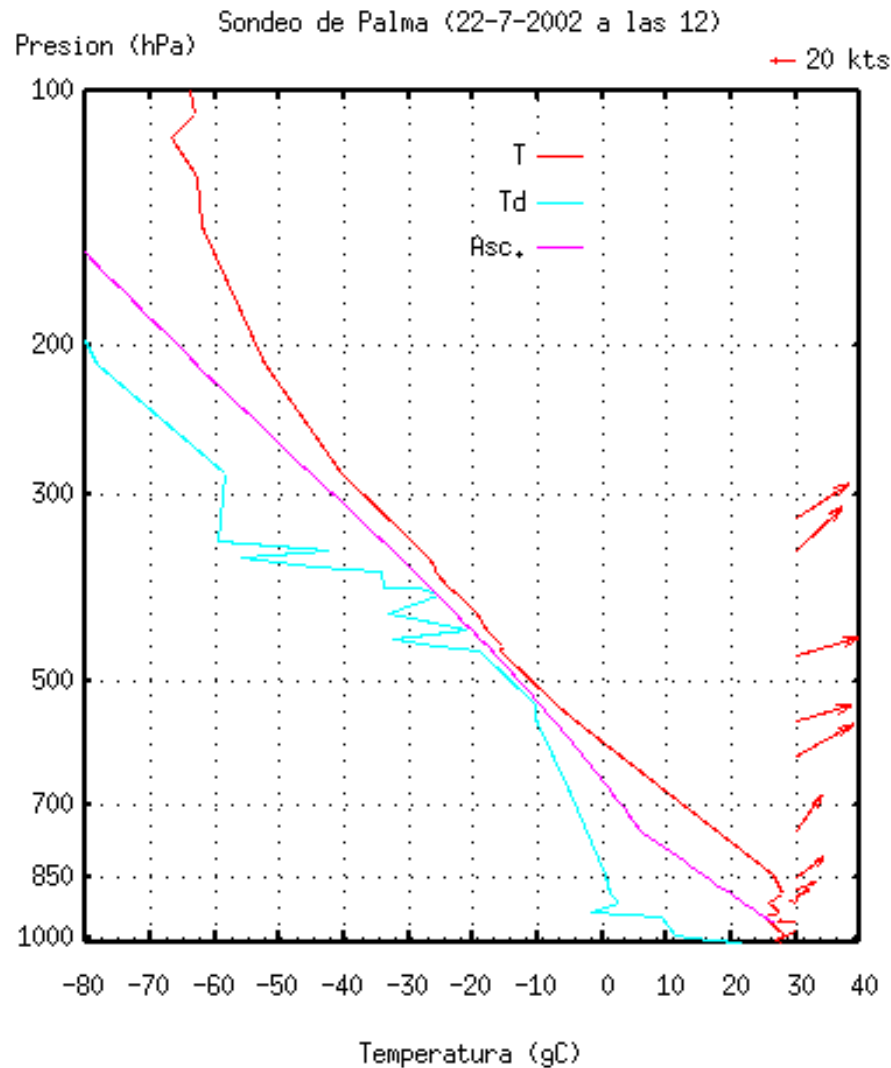
850 hPa

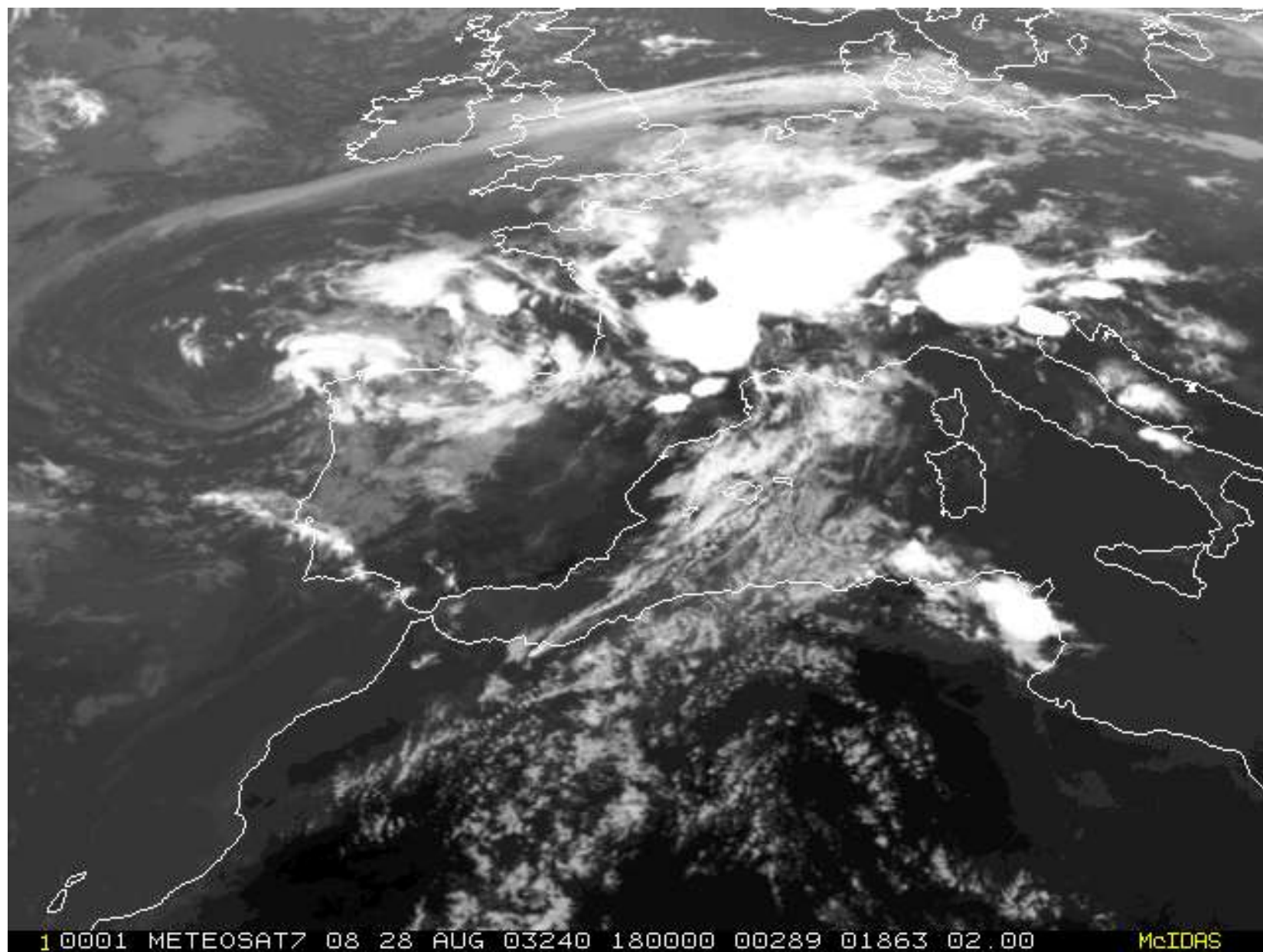


500 hPa

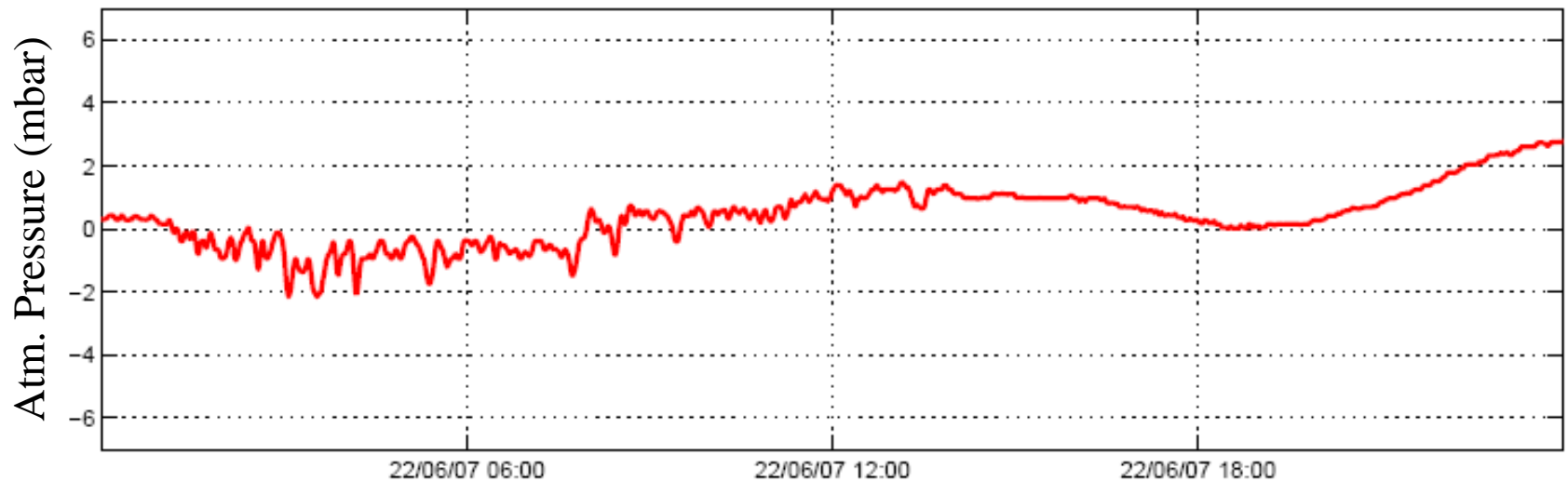
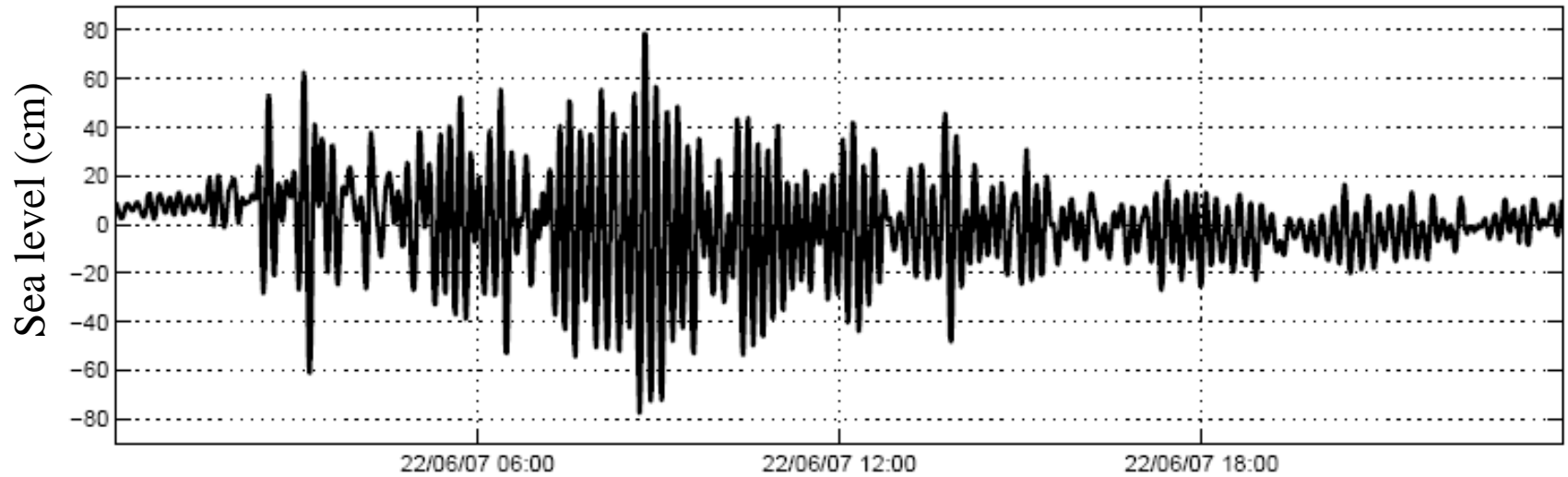
Weather maps 20 June 1984, 12.00 GMT

Palma vertical sounding

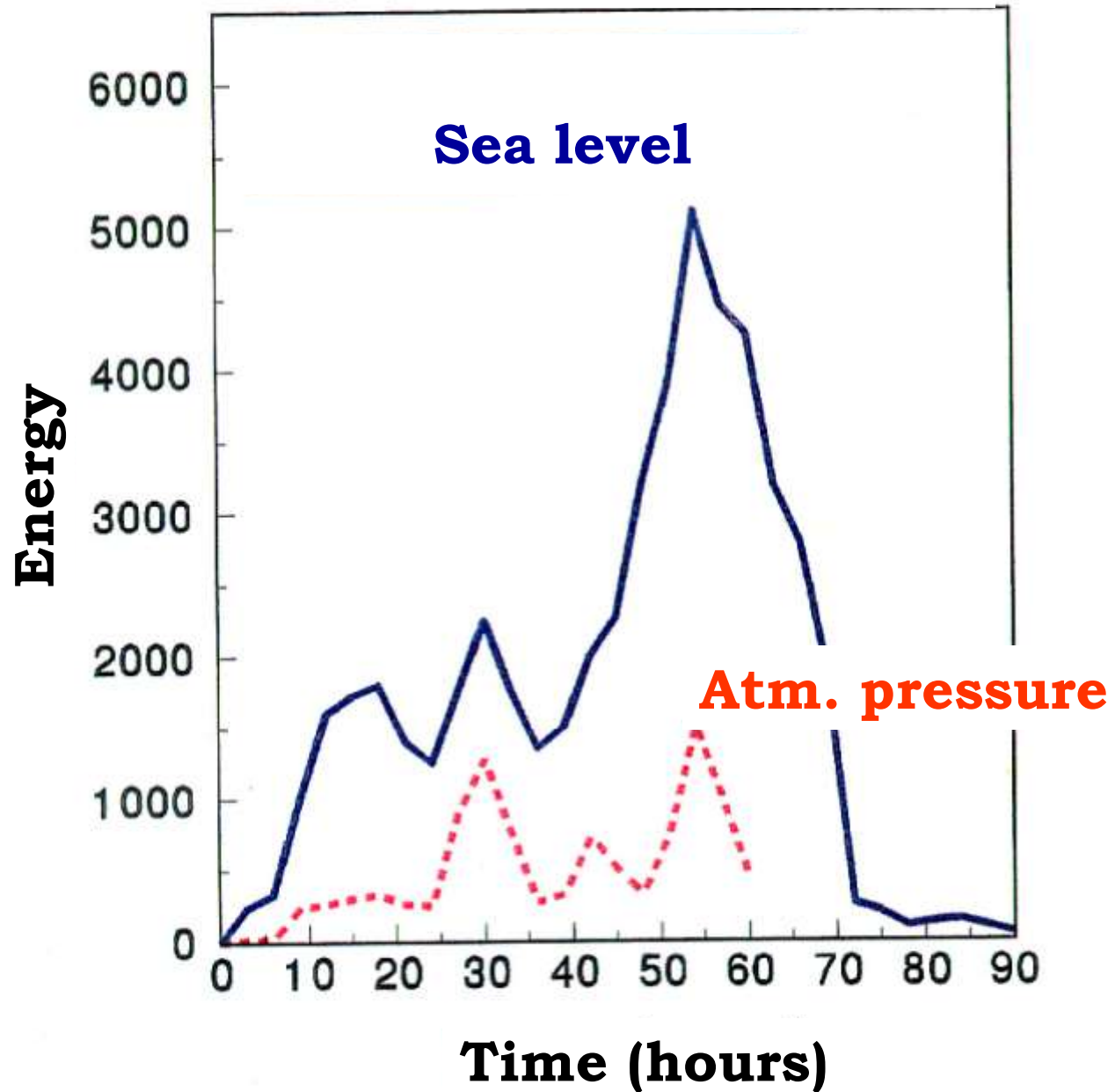




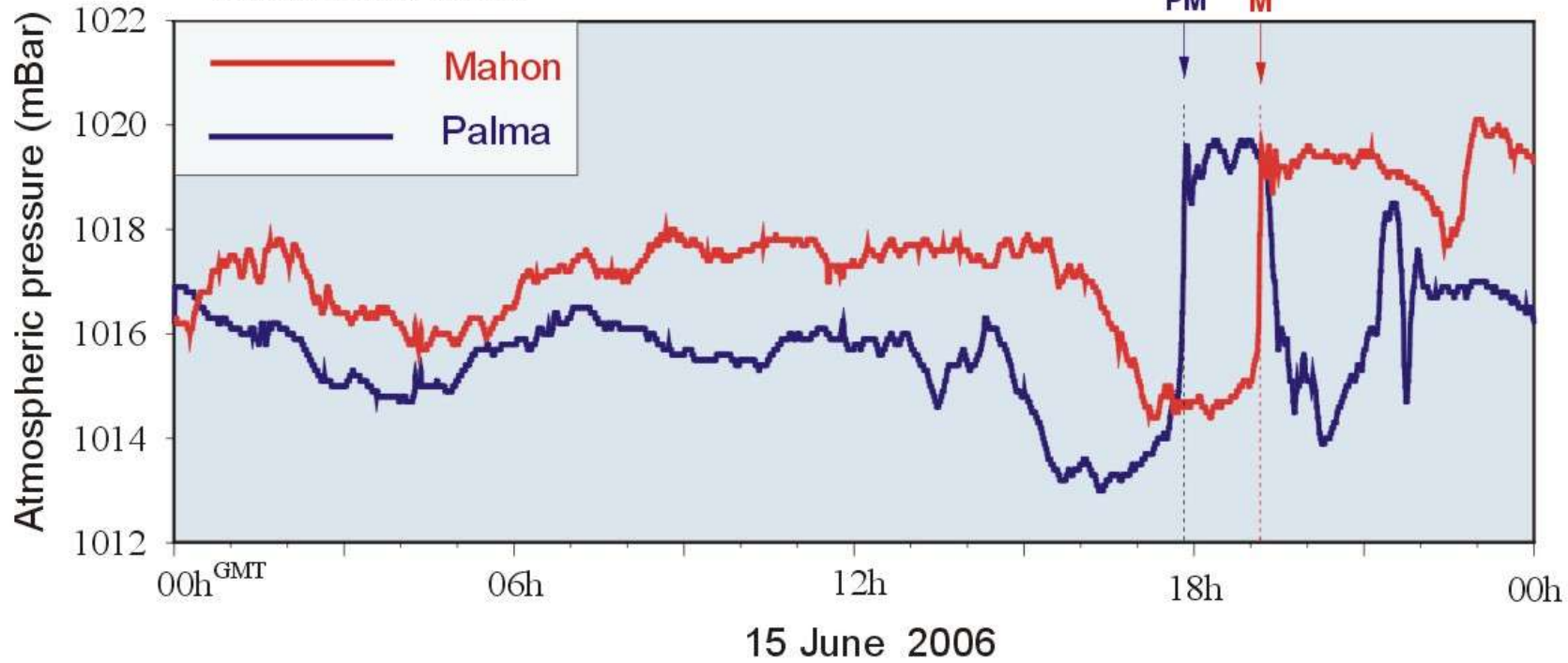
Ciutadella 22 June 2007



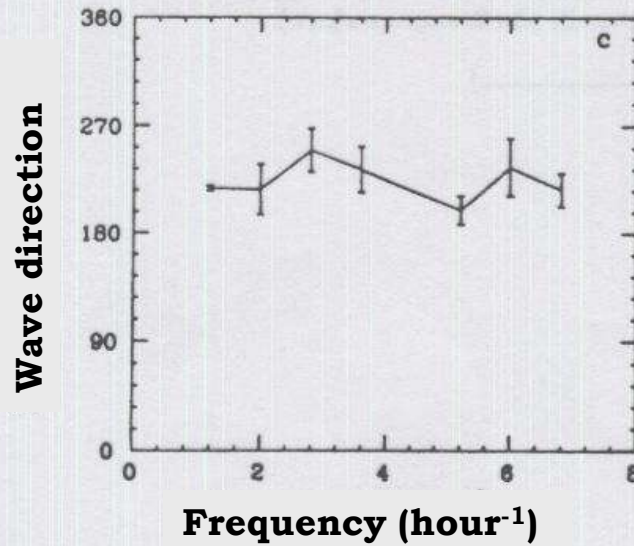
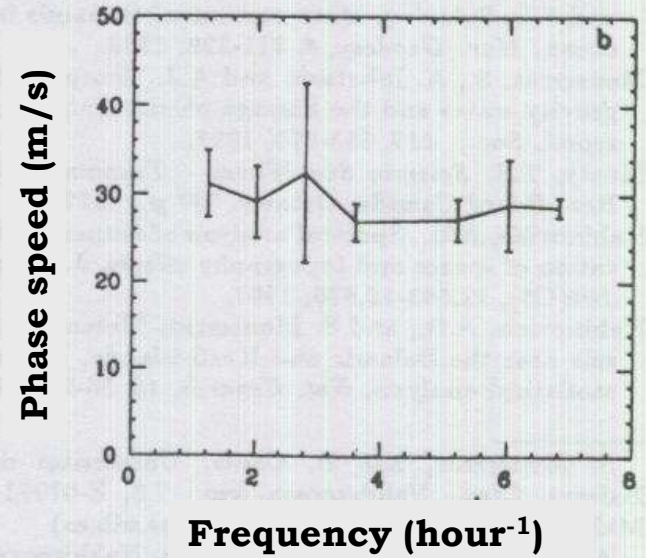
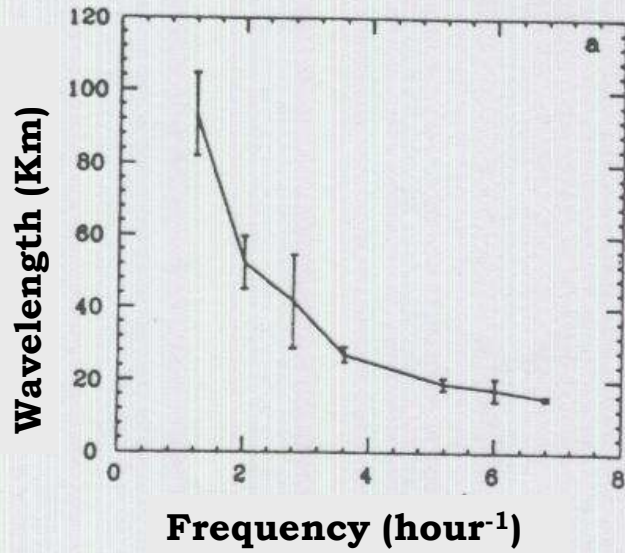
4-7 July 1989



Ciutadella 2006



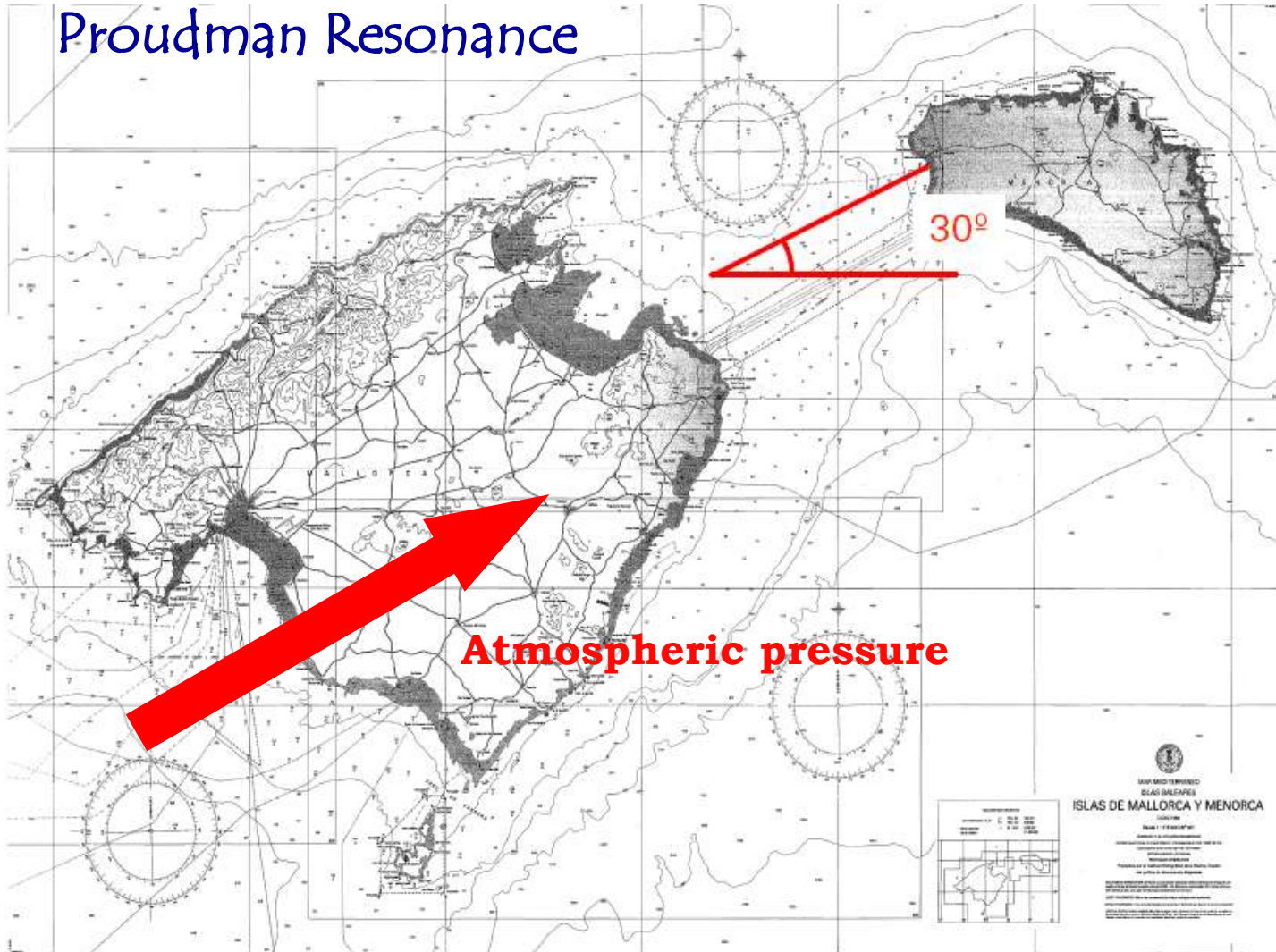
24-26 Sep 1990



Atmospheric pressure main aspects

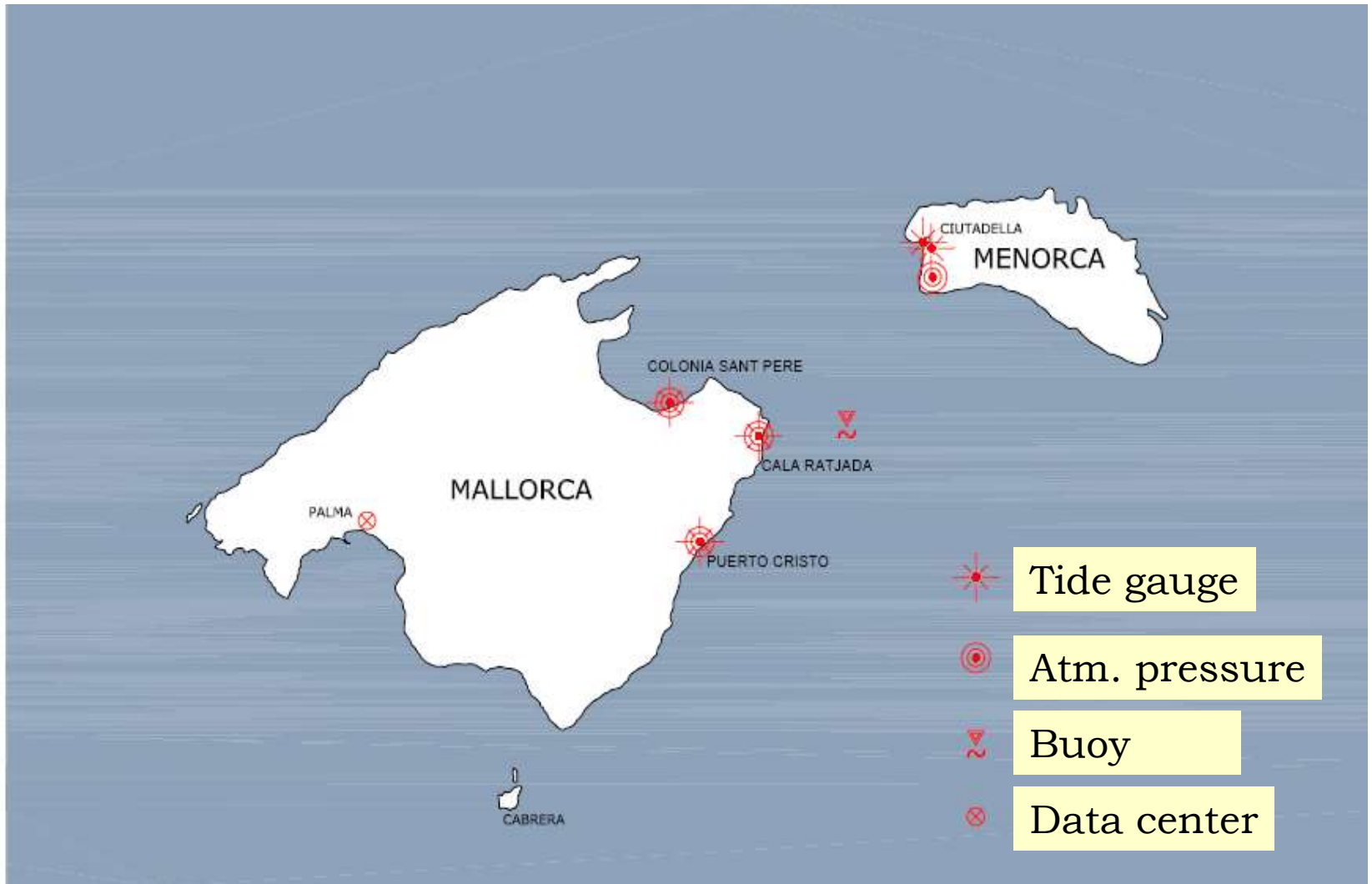
- Non-dispersive waves
- Waves normally travel from the southwest
- Typical phase speeds of 25-30 m/s

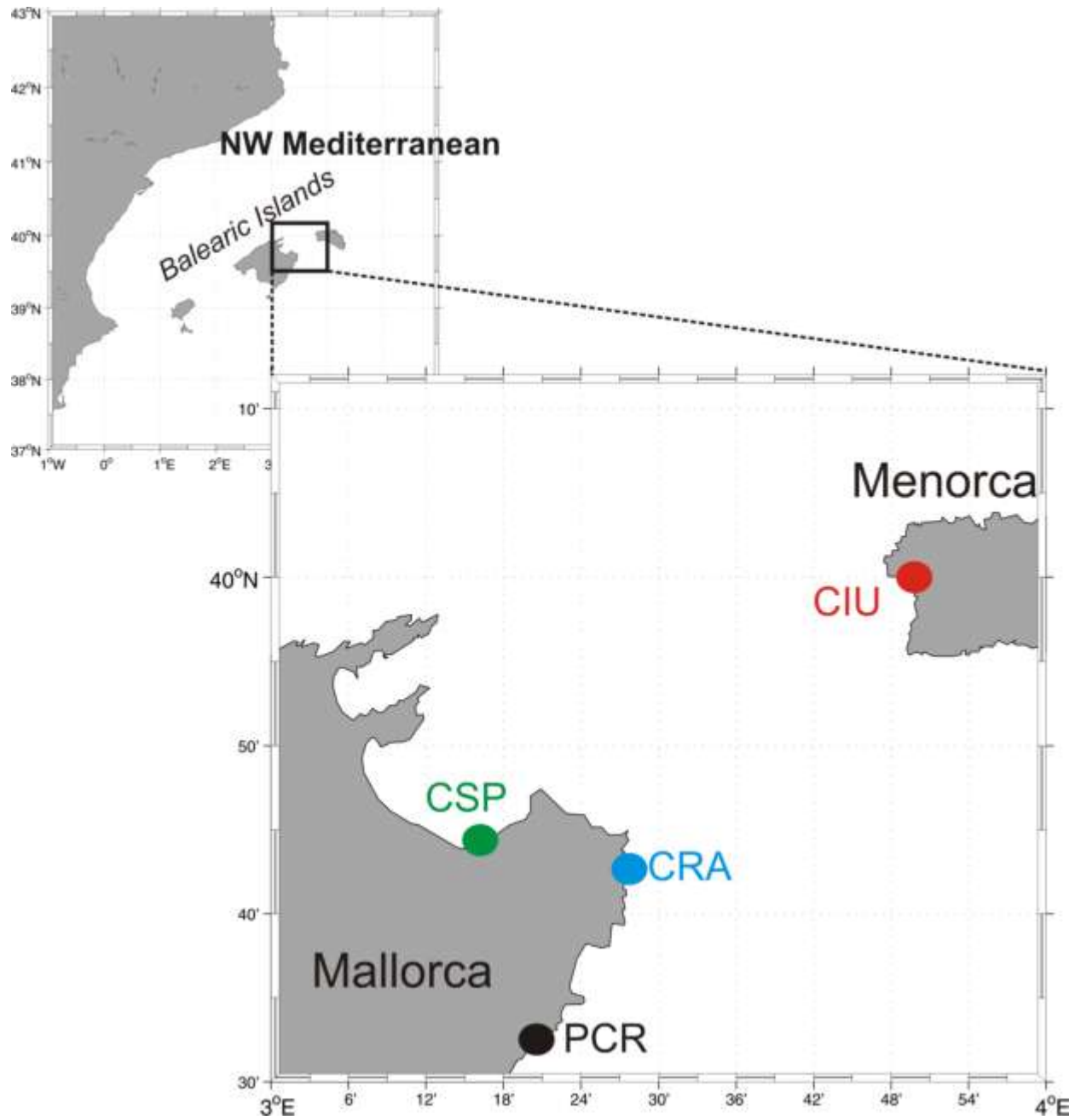
Proudman Resonance



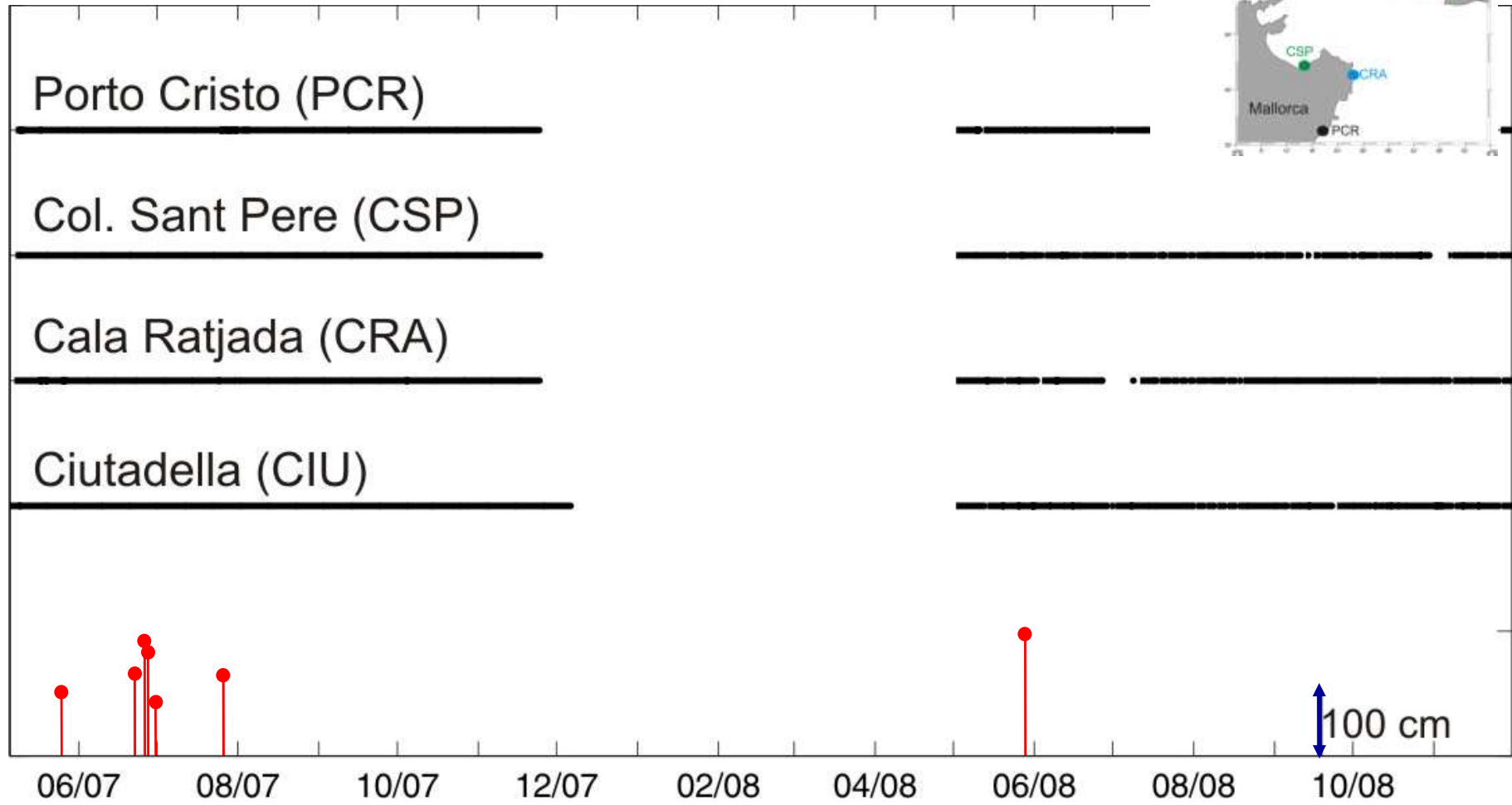
$$C = 25-30 \text{ m/s}$$

Predicting the rissaga

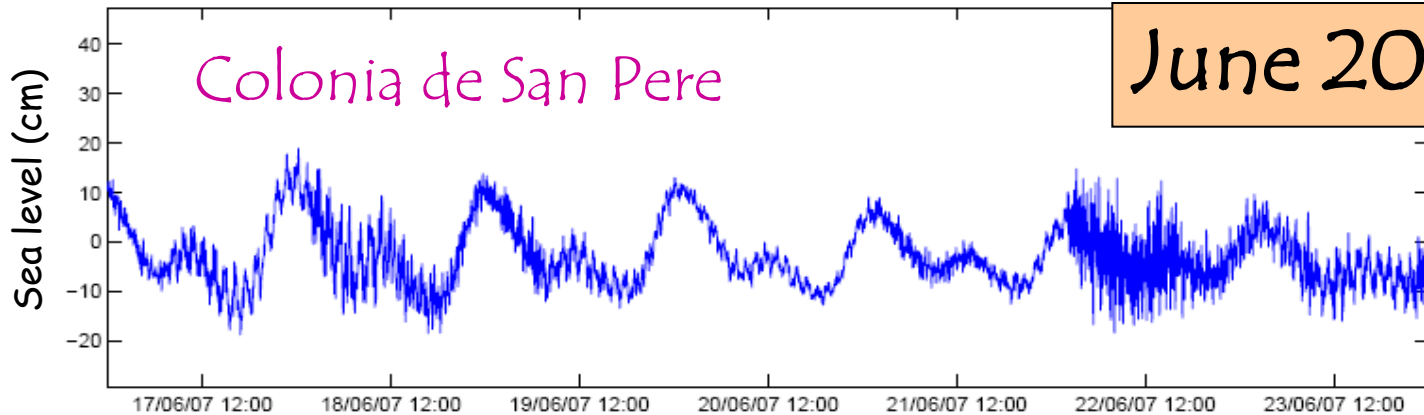
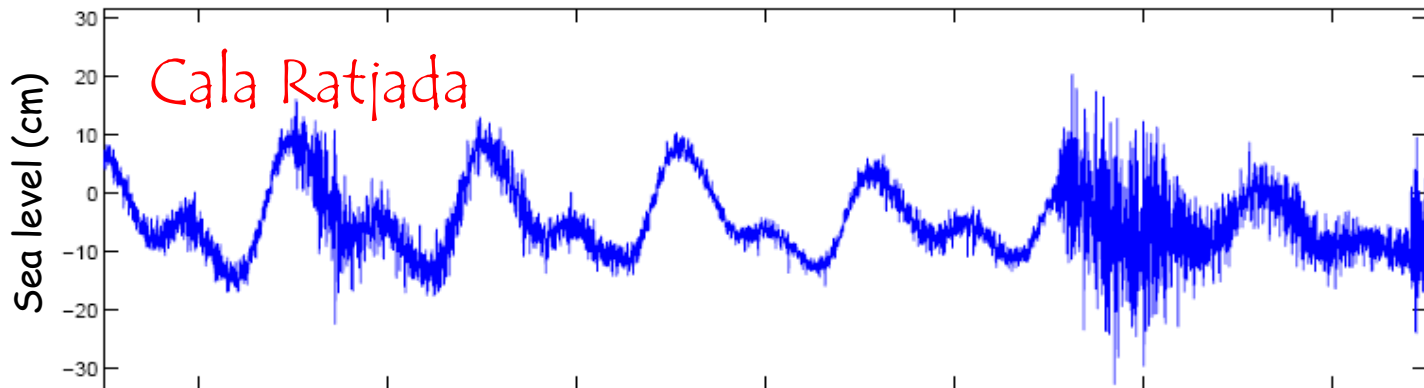
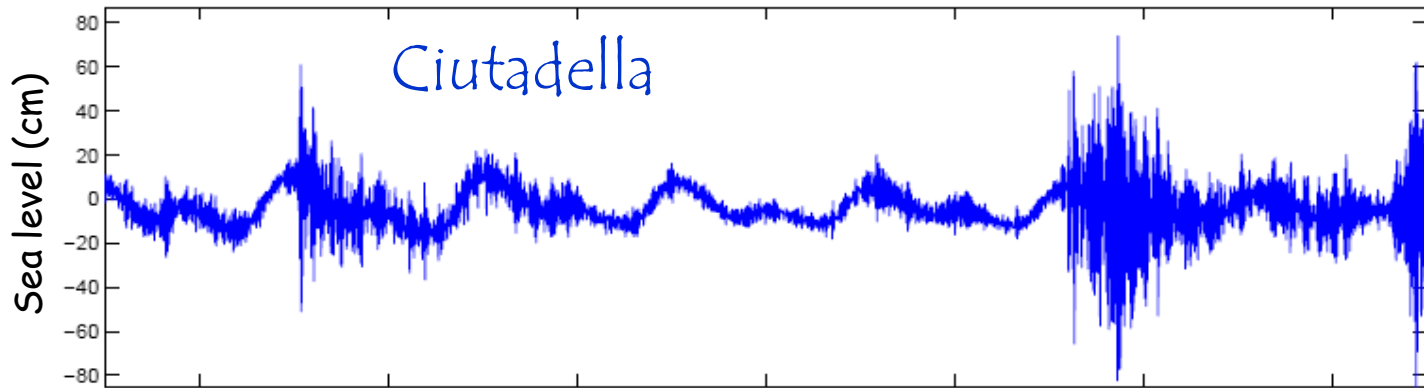




Available data for this study



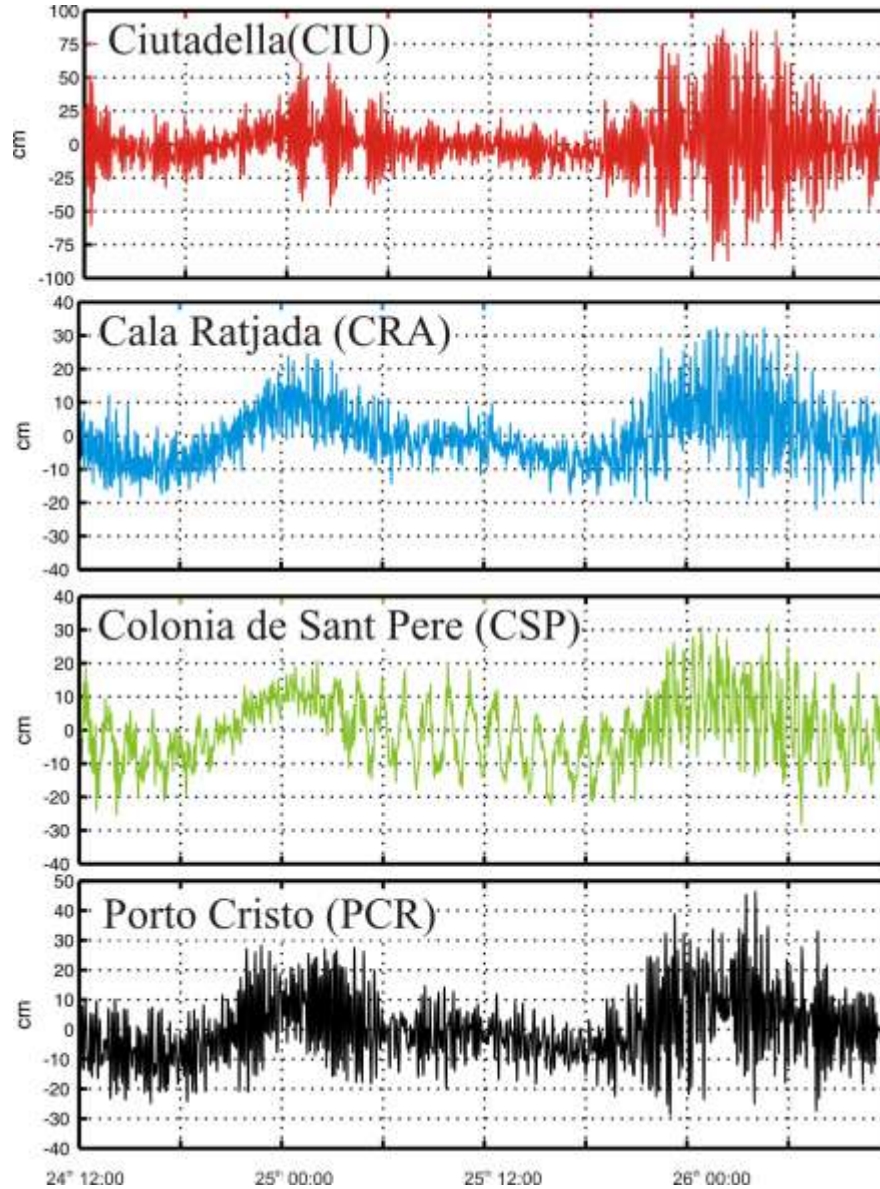
June 2007 – October 2008



June 2007

May 2008

Sea level (cm)



180 cm

60 cm

40 cm

70 cm

← Two days →

SOURCE FUNCTION

Rabinovich (1997)

$$S_{OBS}(\omega) = S_R(\omega) + S_B(\omega)$$

$$S_R(\omega) = T(\omega)E_R(\omega)$$

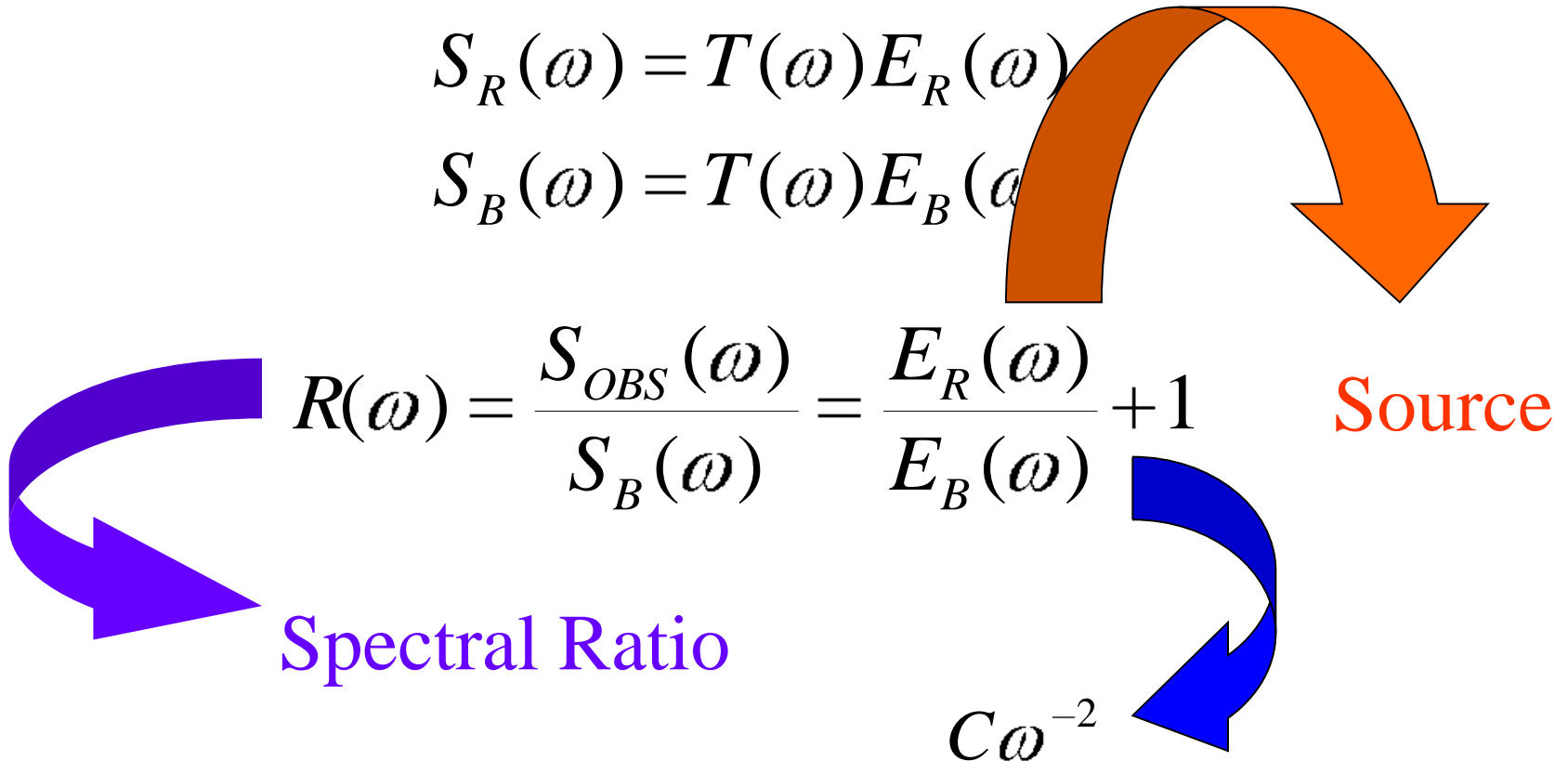
$$S_B(\omega) = T(\omega)E_B(\omega)$$

$$R(\omega) = \frac{S_{OBS}(\omega)}{S_B(\omega)} = \frac{E_R(\omega)}{E_B(\omega)} + 1$$

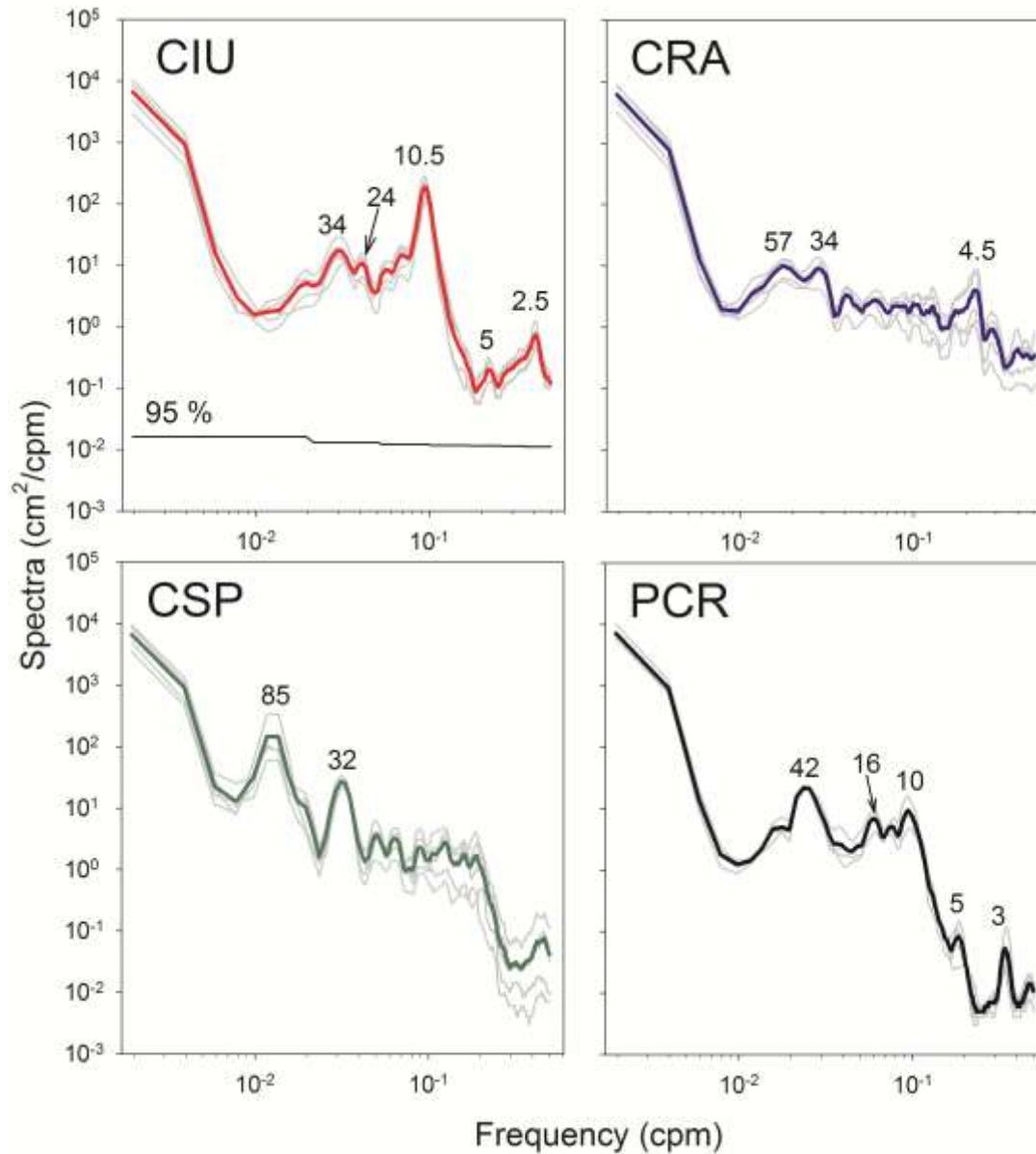
Spectral Ratio

$$C\omega^{-2}$$

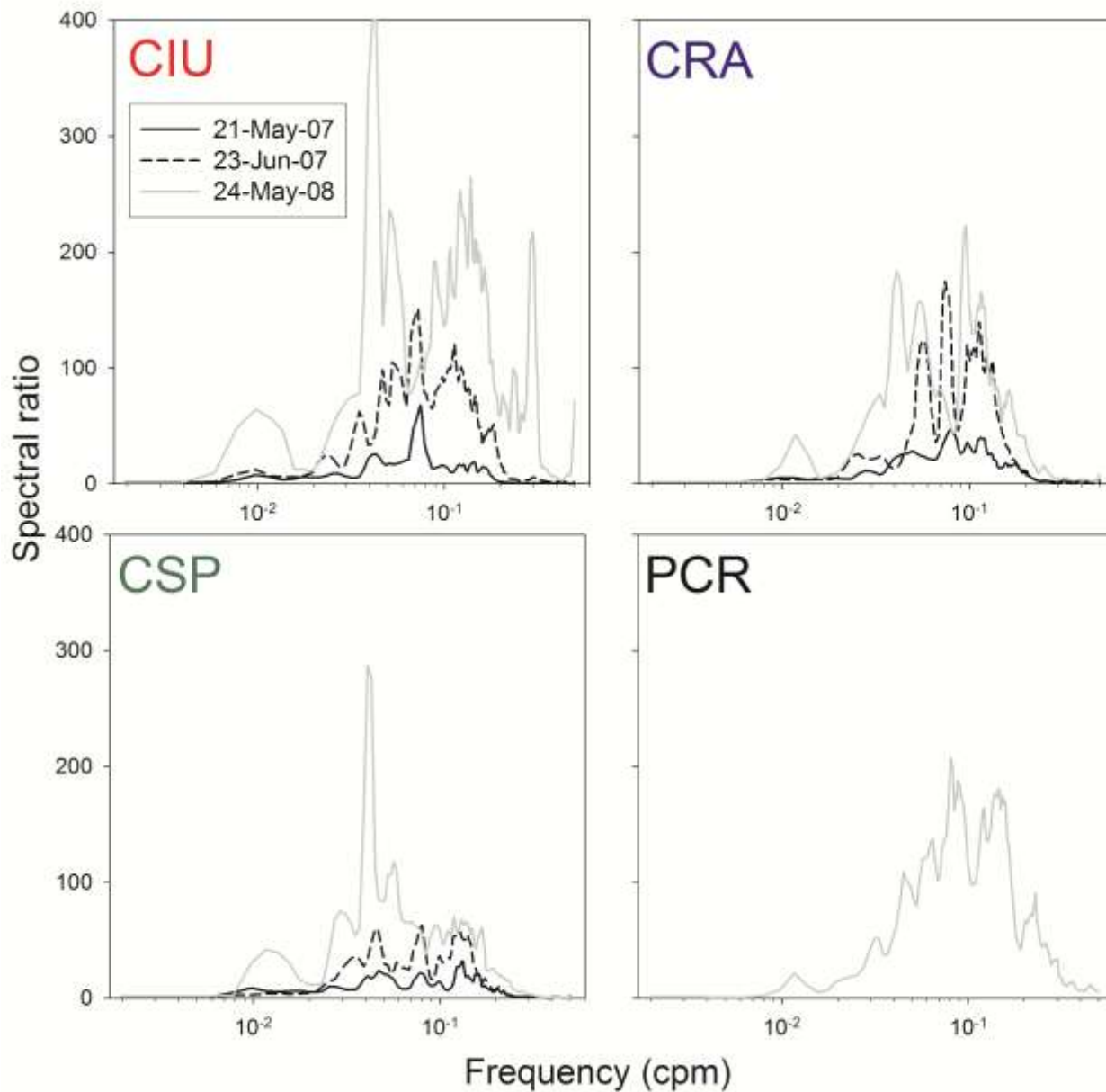
Source



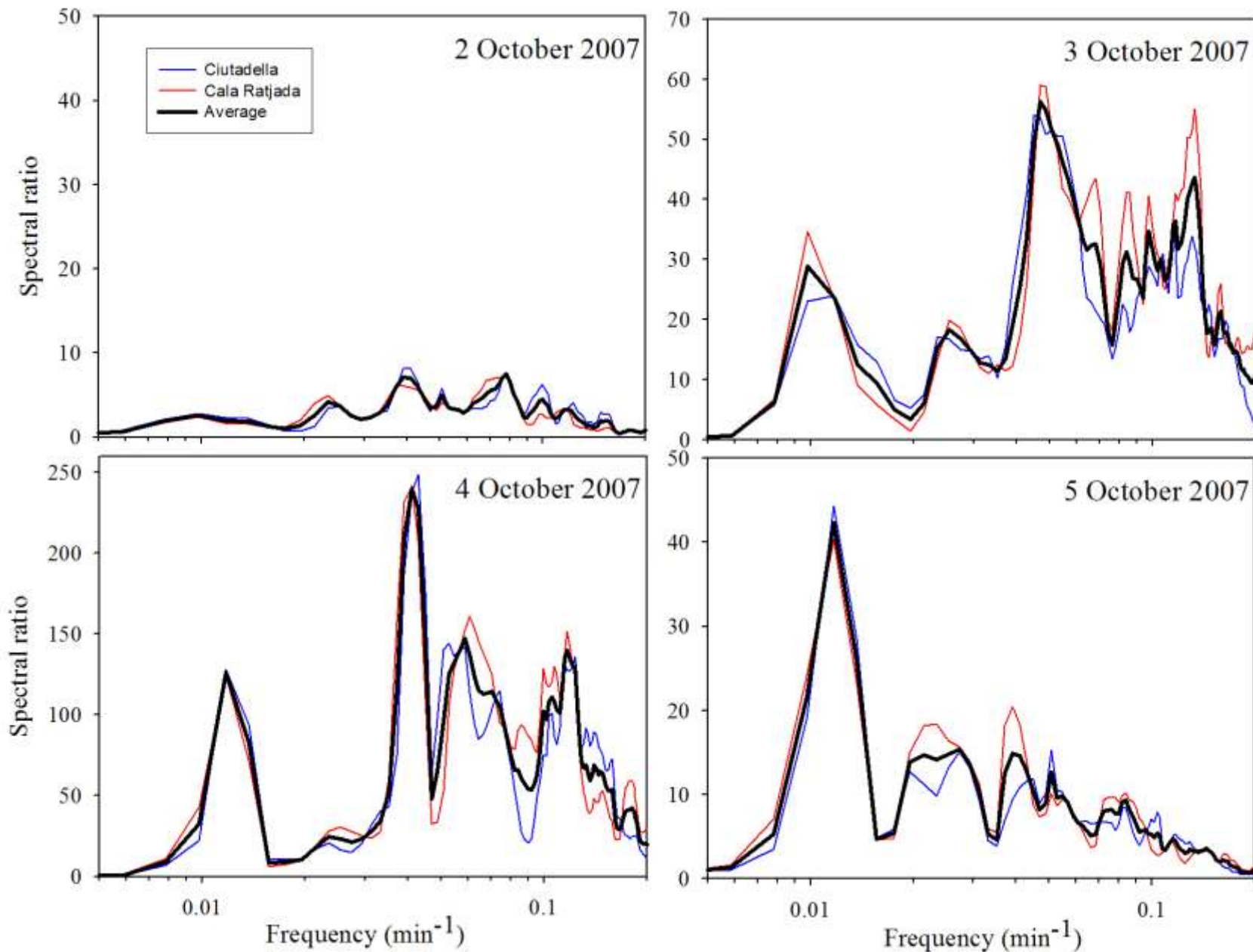
Topographic response (S_B)



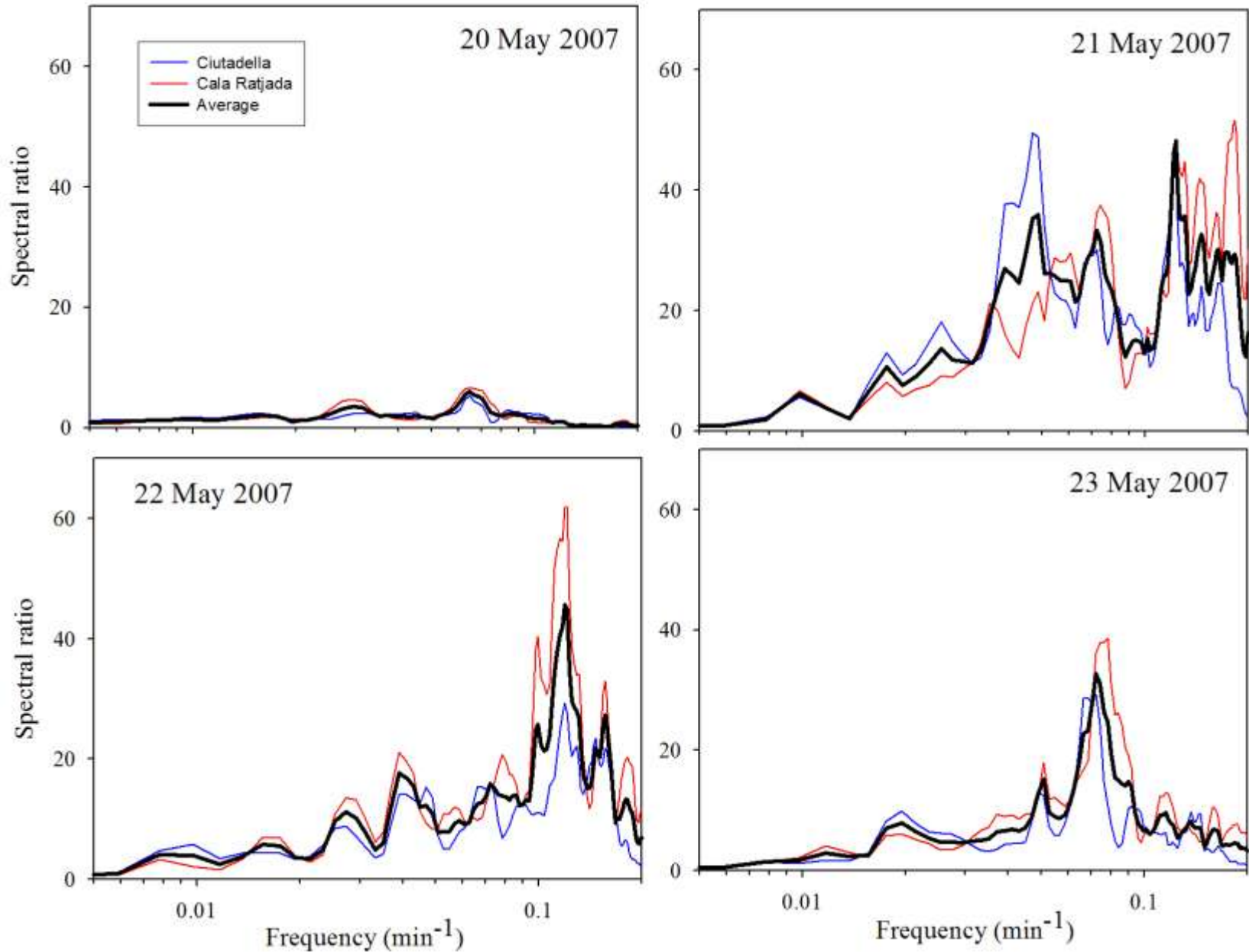
Spectral ratio (Source)



Spectral ratios



Spectral ratios



May 2008

