



Milano 10-12 Settembre 2014  
the future of **THE ITALIAN GEOSCIENCES** of the future



# Paleoclimatic changes occurred during the last two millennia in the central and south Tyrrhenian Sea: a contribution of NEXTDATA project ([www.nextdataproject.it](http://www.nextdataproject.it))



Lirer F.<sup>(1)</sup>, Margaritelli G.<sup>(1), (8)</sup>, Vallefucio M.<sup>(1)</sup>, Agnini C.<sup>(2)</sup>, Anzalone E.<sup>(1)</sup>, Bellucci L.<sup>(3)</sup>, Bonomo S.<sup>(1)</sup>, Capotondi L.<sup>(3)</sup>, Cascella A.<sup>(4)</sup>, Di Rita F.<sup>(5)</sup>, Ferraro, L.<sup>(1)</sup>, Insinga D.D.<sup>(1)</sup>, Magri D.<sup>(5)</sup>, Marsella E.<sup>(1)</sup>, Pappone G.<sup>(6)</sup>, Petrosino P.<sup>(7)</sup>, Rettori R.<sup>(8)</sup>, Sorgato S.<sup>(1)</sup>

1) Istituto per l'Ambiente Marino Costiero (IAMC) - Napoli

2) Dipartimento di Georisorse - Università degli Studi di Padova, Padova

3) Istituto Scienze Marine, ISMAR- CNR, Bologna

4) Istituto Nazionale di Geofisica e Vulcanologia (INGV), Pisa

5) Dipartimento di Biologia Ambientale - Botanica, Università La Sapienza di Roma

6) Dipartimento di Scienze e Tecnologie - Università degli Studi di Napoli "Parthenope", Napoli

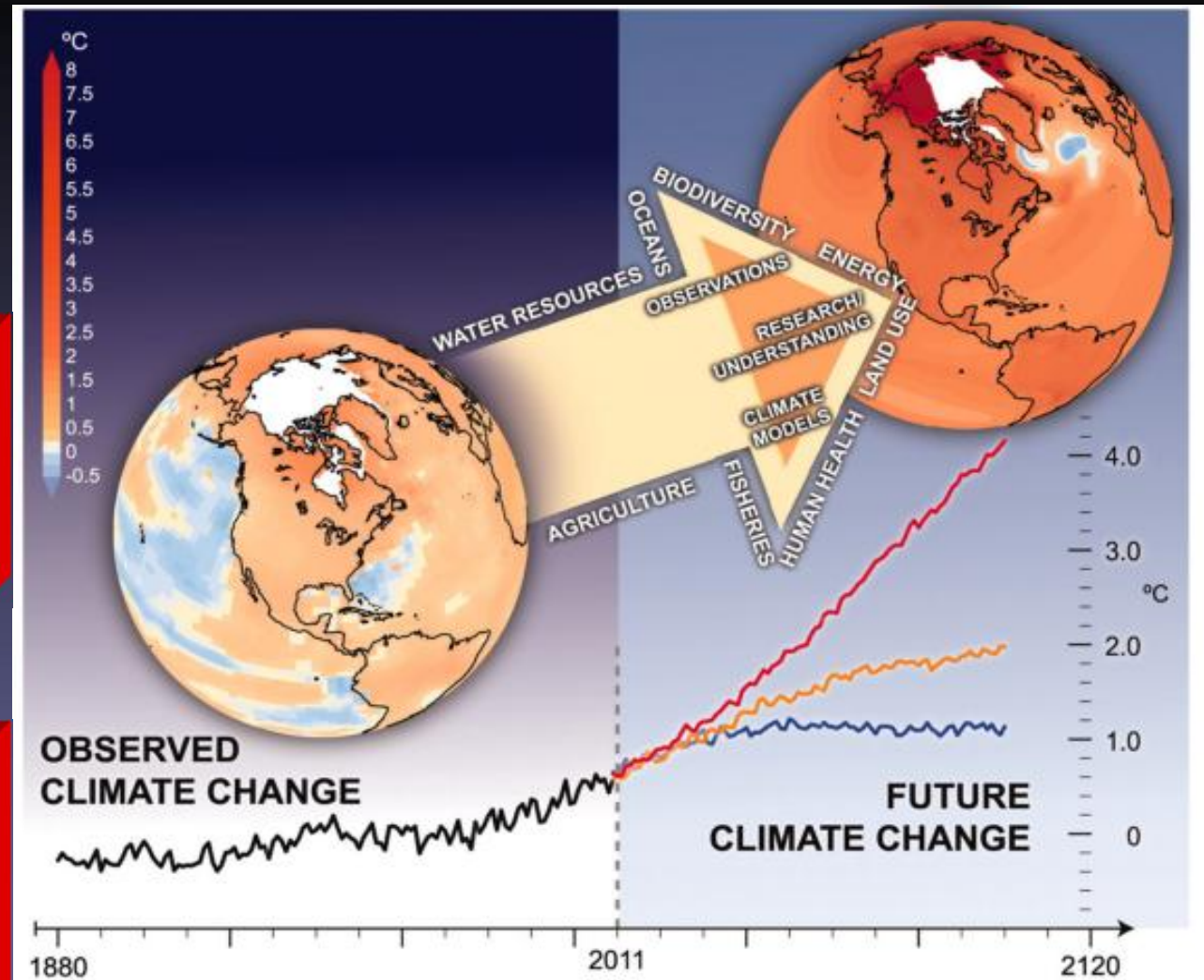
7) DISTAR - Università degli Studi "Federico II", Napoli

8) Dipartimento di Fisica e Geologia - Università di Perugia, Perugia

How will climate in the future?

How will marine ecosystem in the near future?

How will adapt man to climate change in the near future?

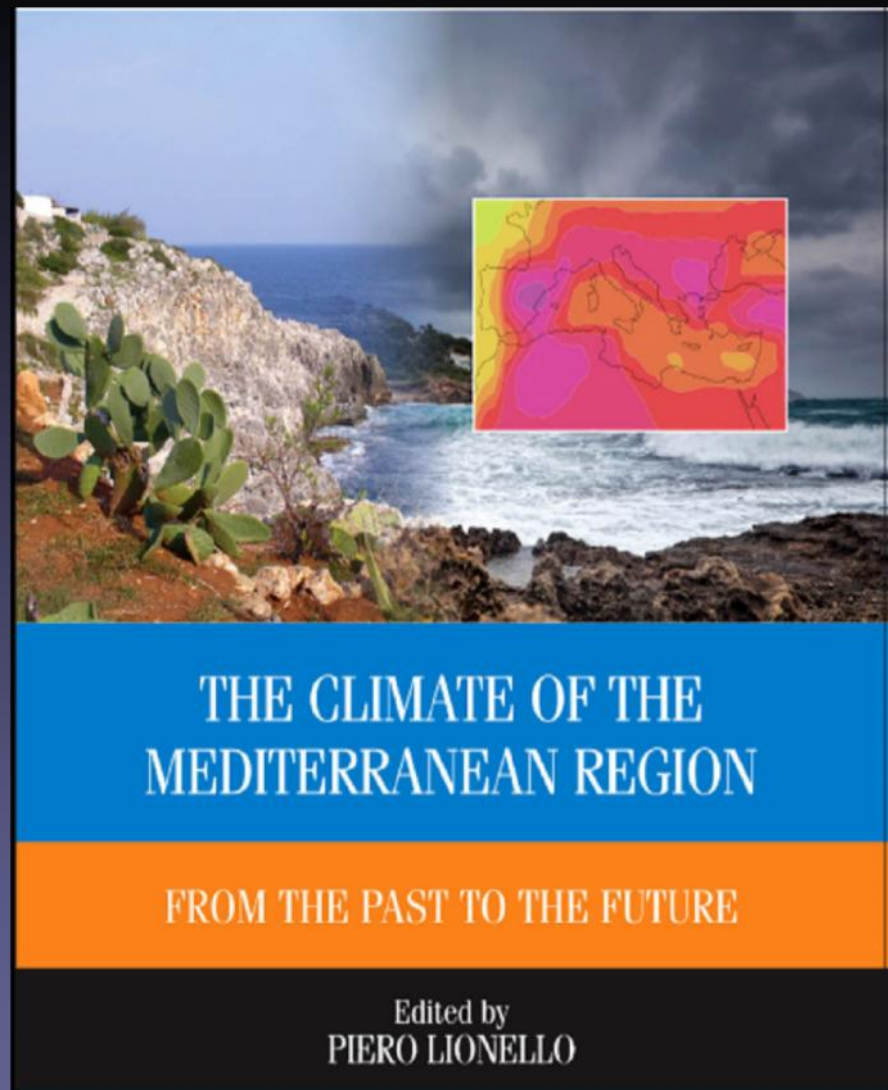


Necessity: the study of time series in order to understand the future changes



Combining information from natural archives, documentary and instrumental data with evidence of past human activity obtained from historical, paleoecological, and archaeological records is of major relevance for our understanding of climate sensitivity, environmental response, ecological processes, and human impact. As has been shown above, temporally and spatially high-resolution climate information from marine archives is still limited.

Luterbacher et al.,  
(2012) - A Review of  
2000 Years of  
Paleoclimatic Evidence in  
the Mediterranean



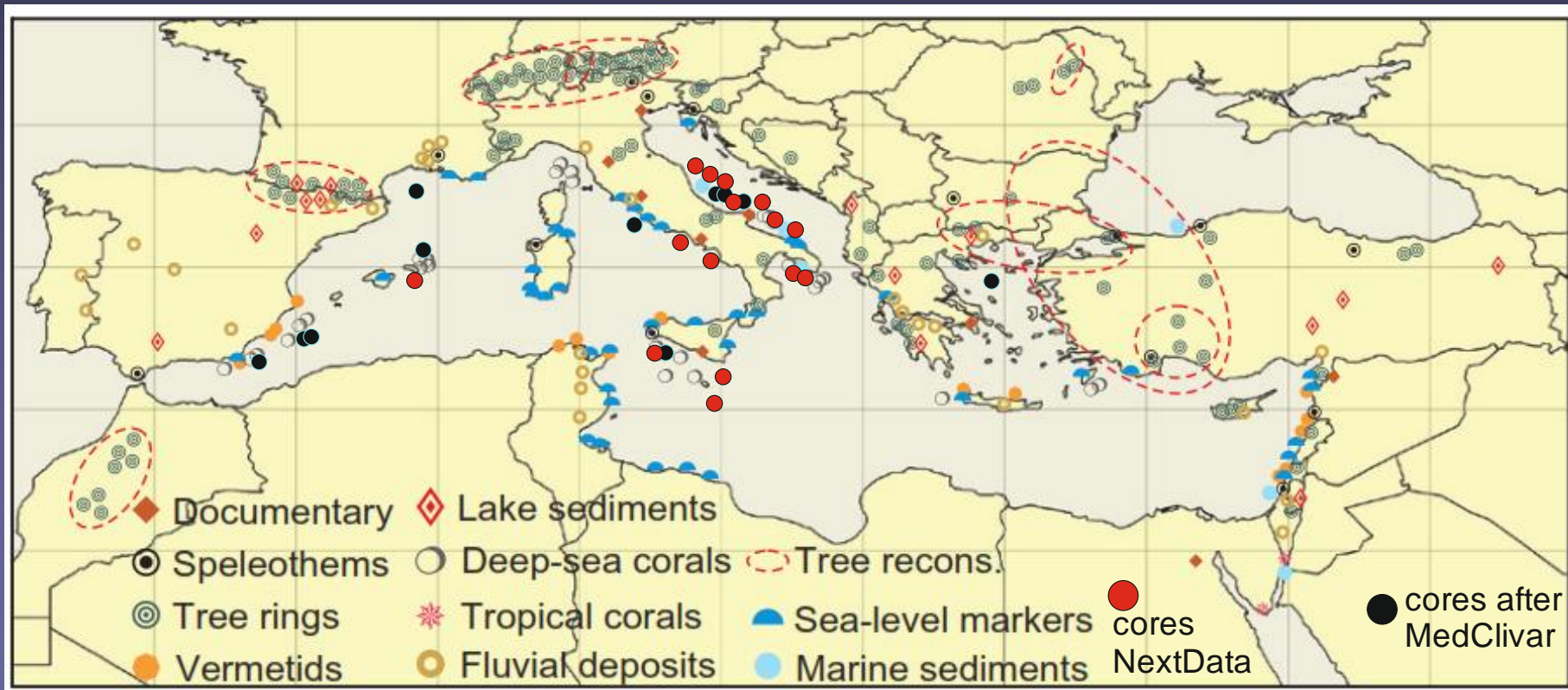
Progetto di Interesse Strategico NEXTDATA: un sistema nazionale per la raccolta, conservazione, accessibilità e diffusione dei dati ambientali e climatici in aree montane e marine



NextData

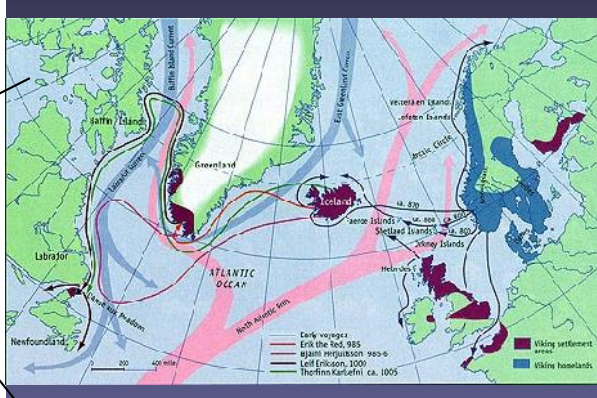
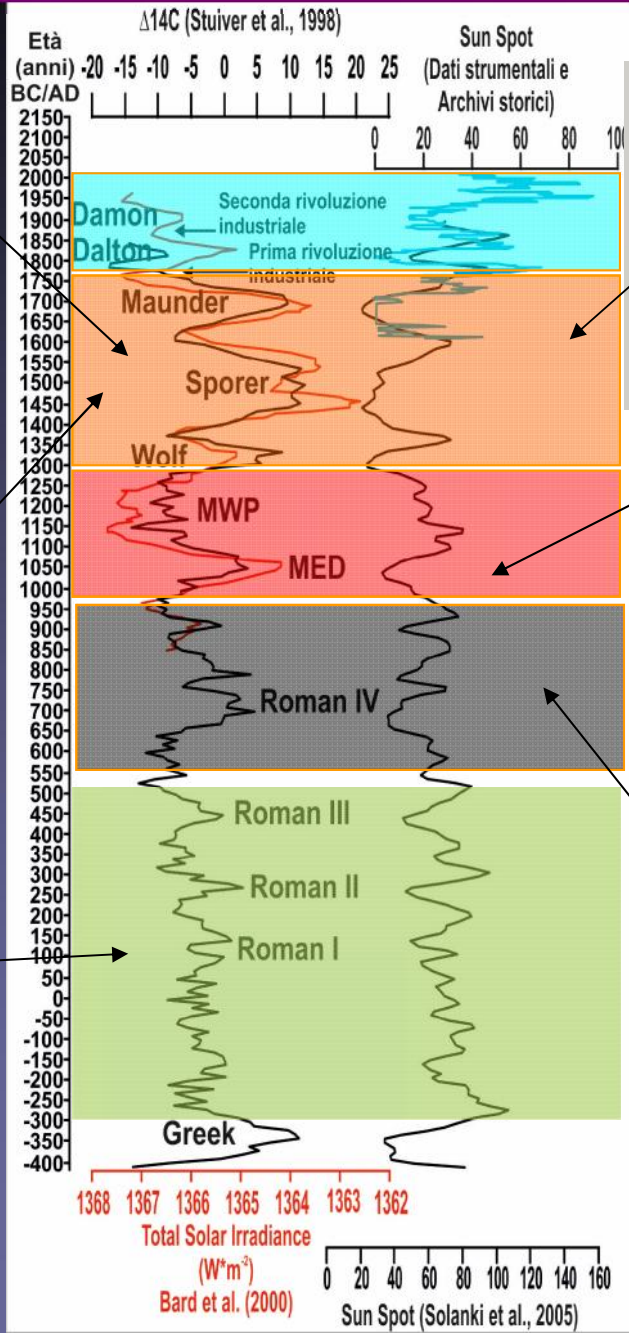
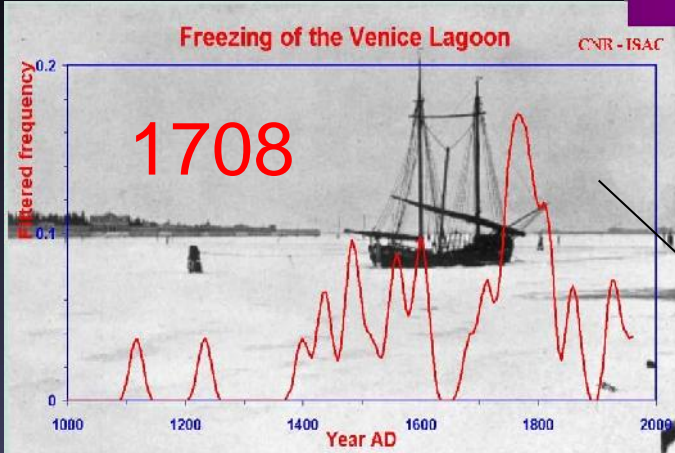


## Sedimentary Archives and historical documents for the last 2000 years





# Subdivision of the last 2000 years

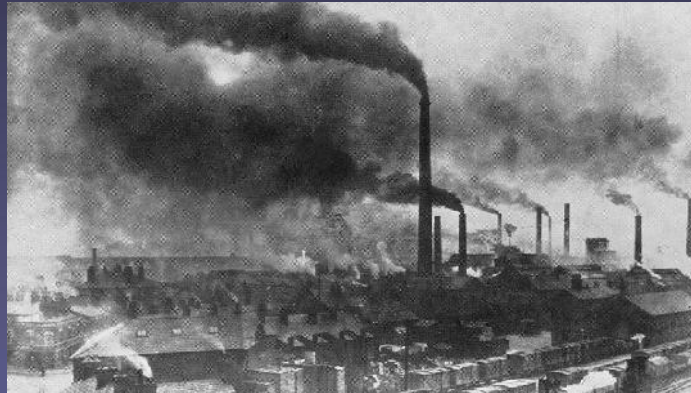




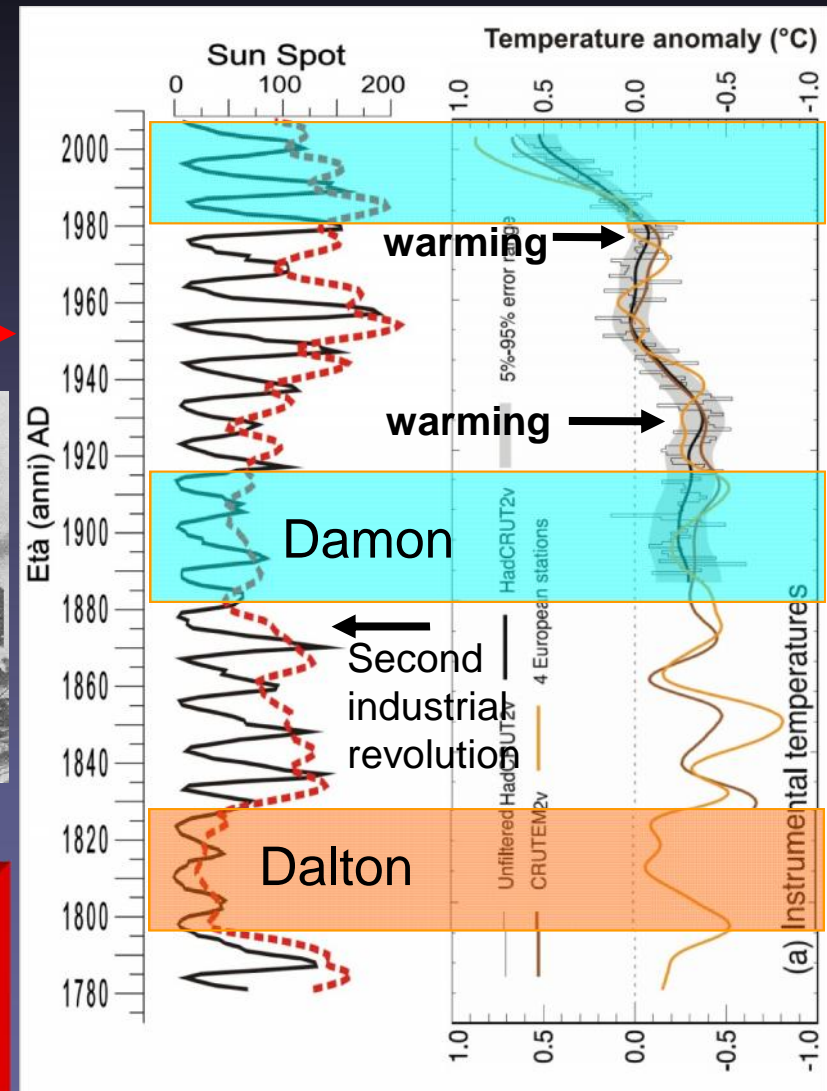
# Subdivision of the last 2000 years

Global warming

Anthropocene

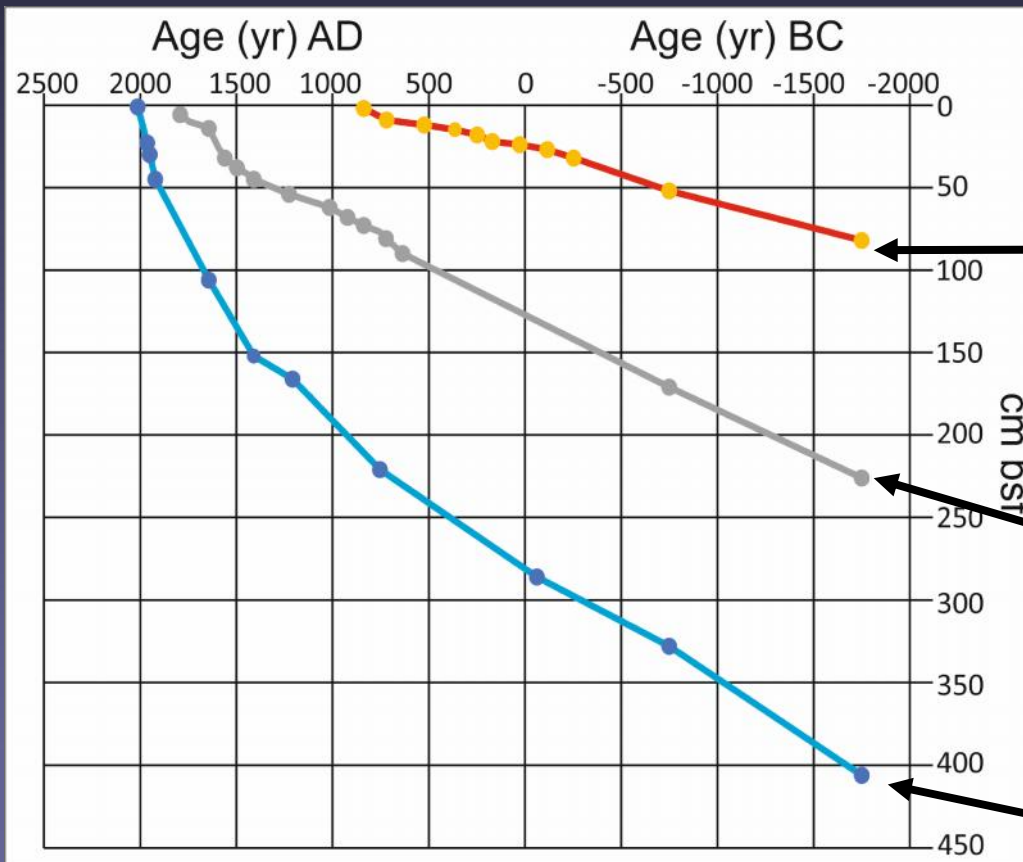


What are the marine areas suitable for recognising these climatic events occurring during the last 2000 years?



# The continental platform ...a key area for monitoring the past climatic changes during the last 2000 years

Mean Sediment.Rate



Sicily Channel

2,5cm/100yr (600 m. w. depth)

Gulf of Gaeta

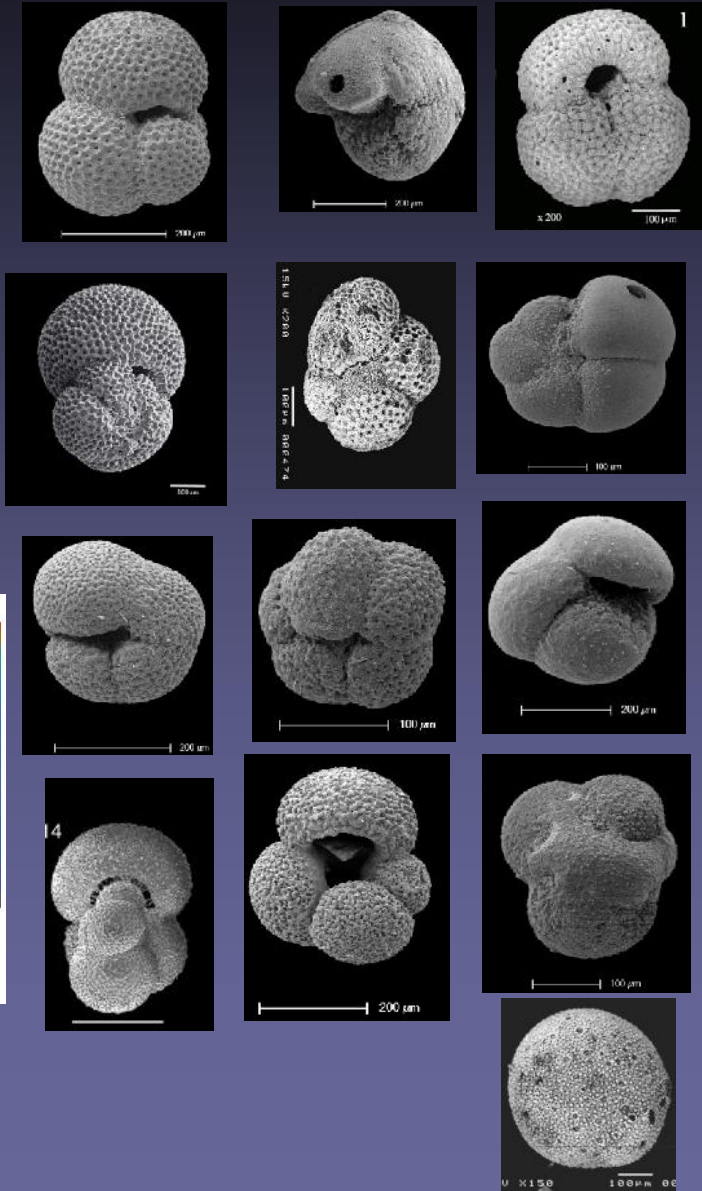
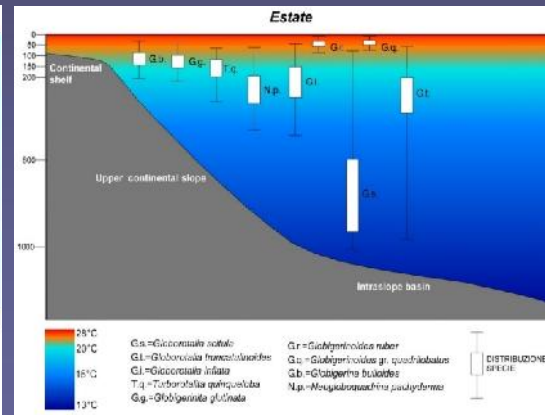
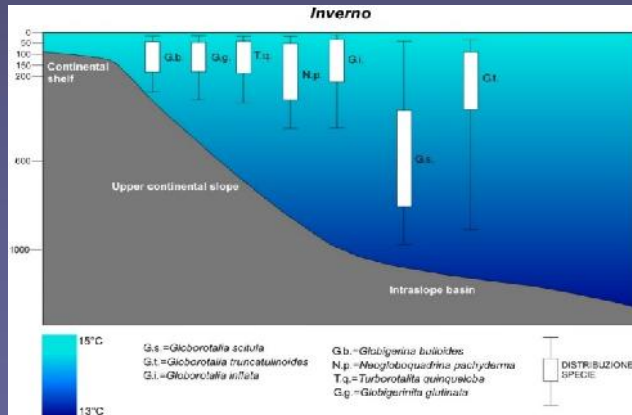
9cm/100yr (120 m. w. depth)

Gulf of Gaeta

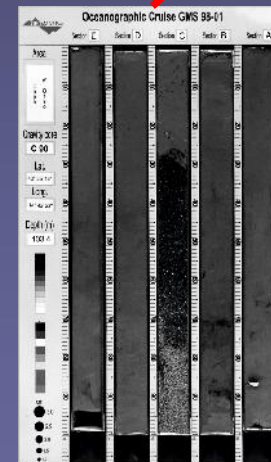
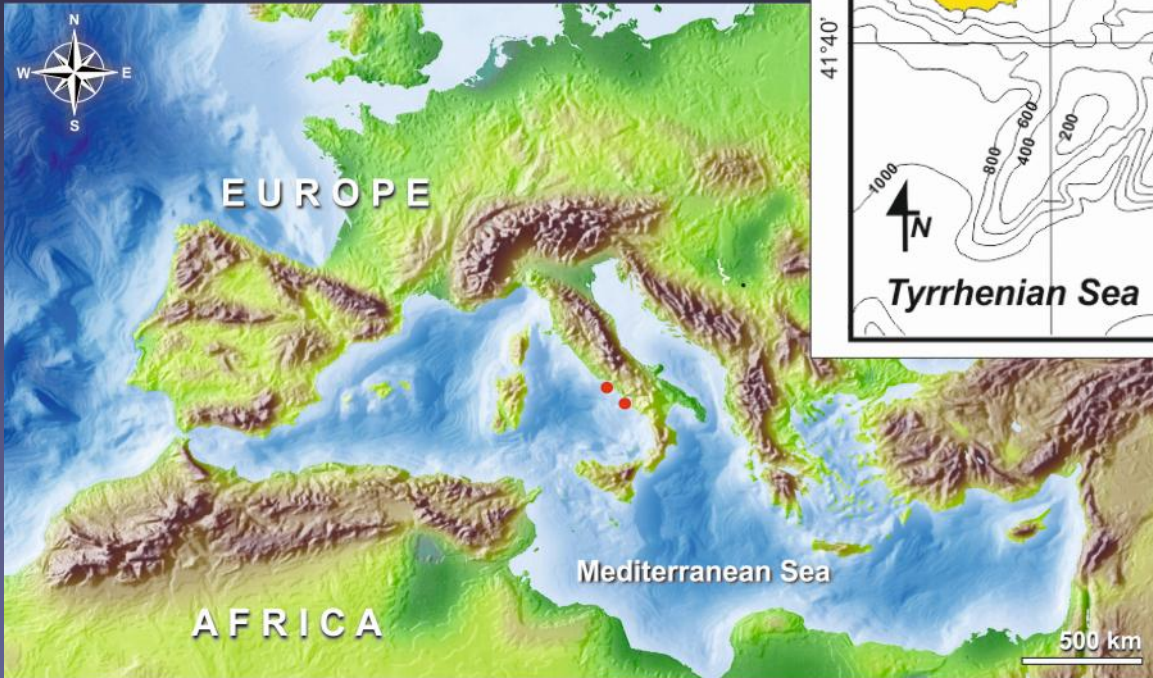
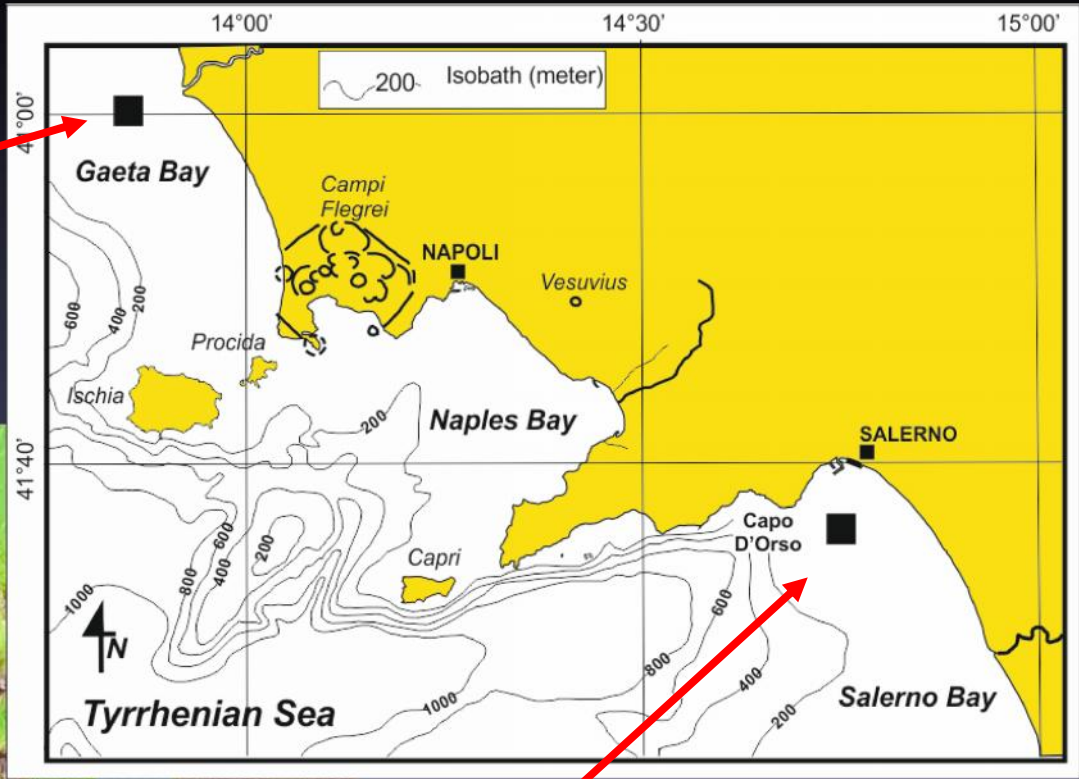
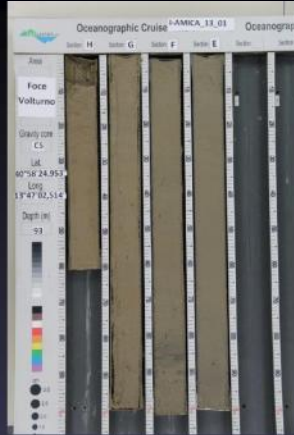
13cm/100yr (93 m. w. depth)

# Tool: the planktonic foraminifera

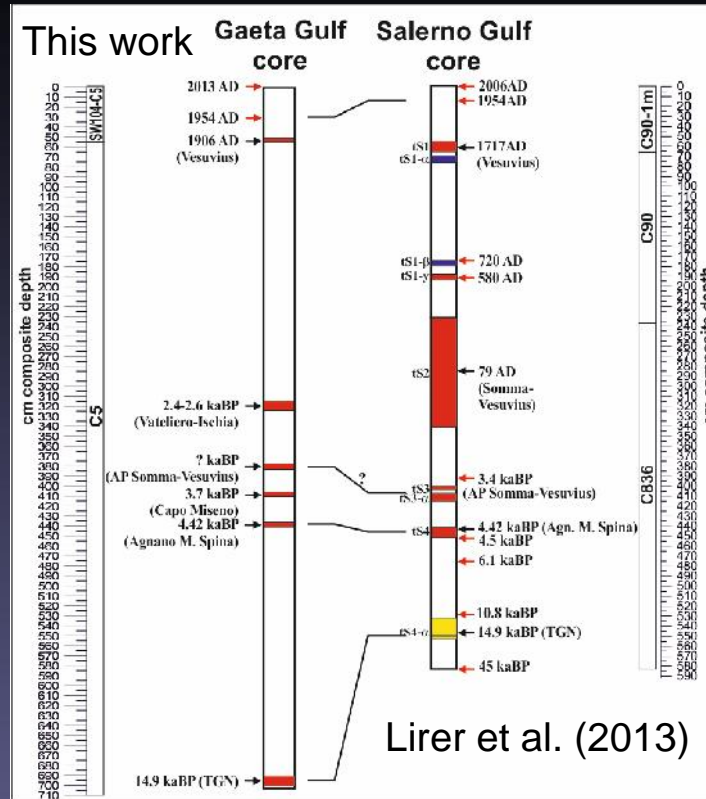
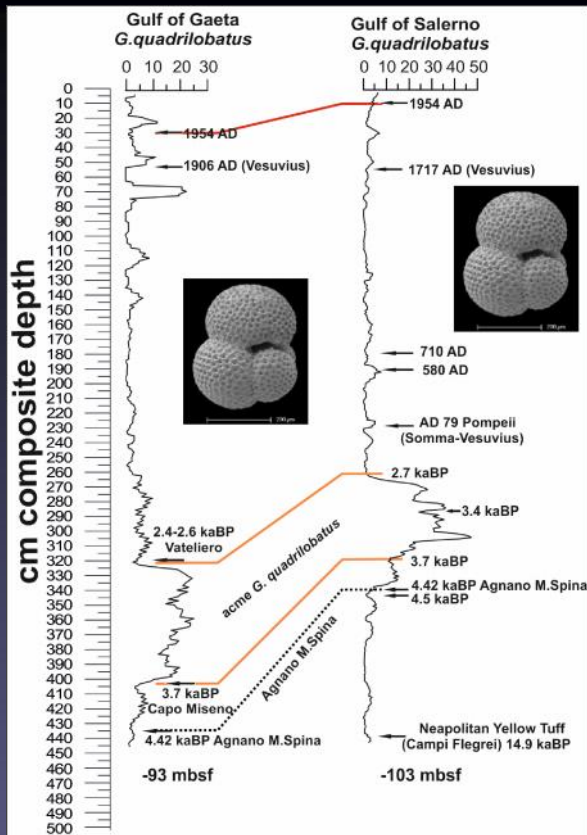
The planktonic foraminifera are commonly used as **proxy** for the paleoceanographic and sea-surface temperature reconstructions because they record the changes of the environmental parameters of the water masses in which they live (Bè & Tolderlund, 1971; Bè, 1977; Fairbanks et al., 1980; Hemleben et al., 1989; Ravelo et al., 1990; Le & Shackleton, 1994; Kucera et al., 2005).







The study areas



Radionuclides  $^{210}\text{Pb}$  e  $^{137}\text{Cs}$

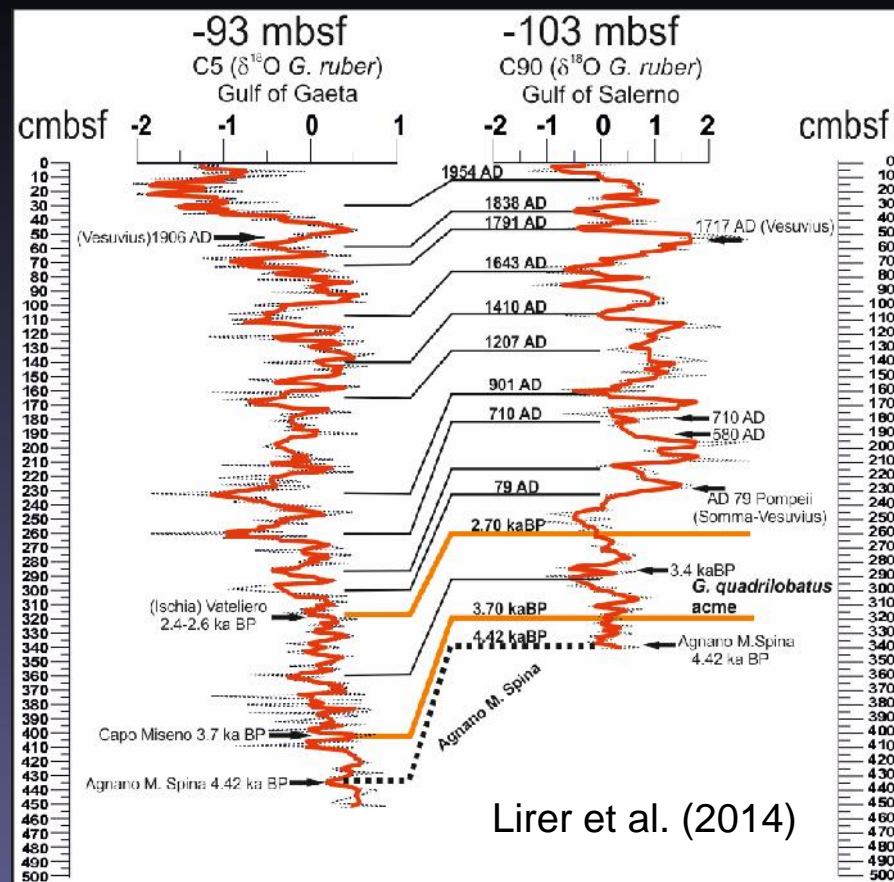
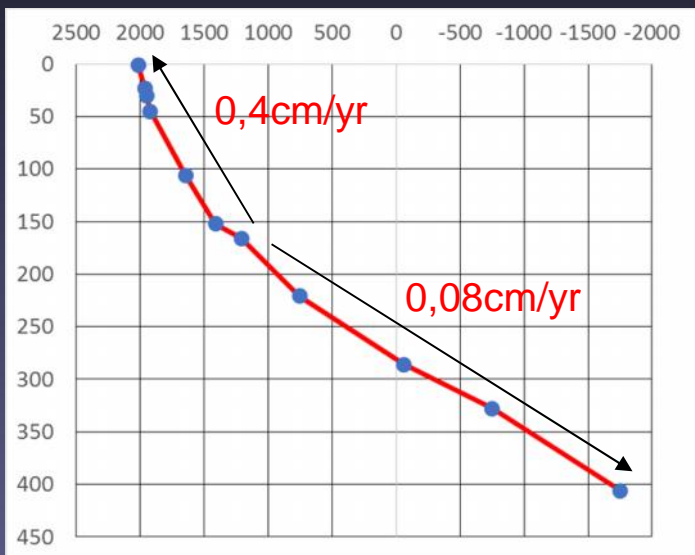
Tefrochronology

AMS  $^{14}\text{C}$

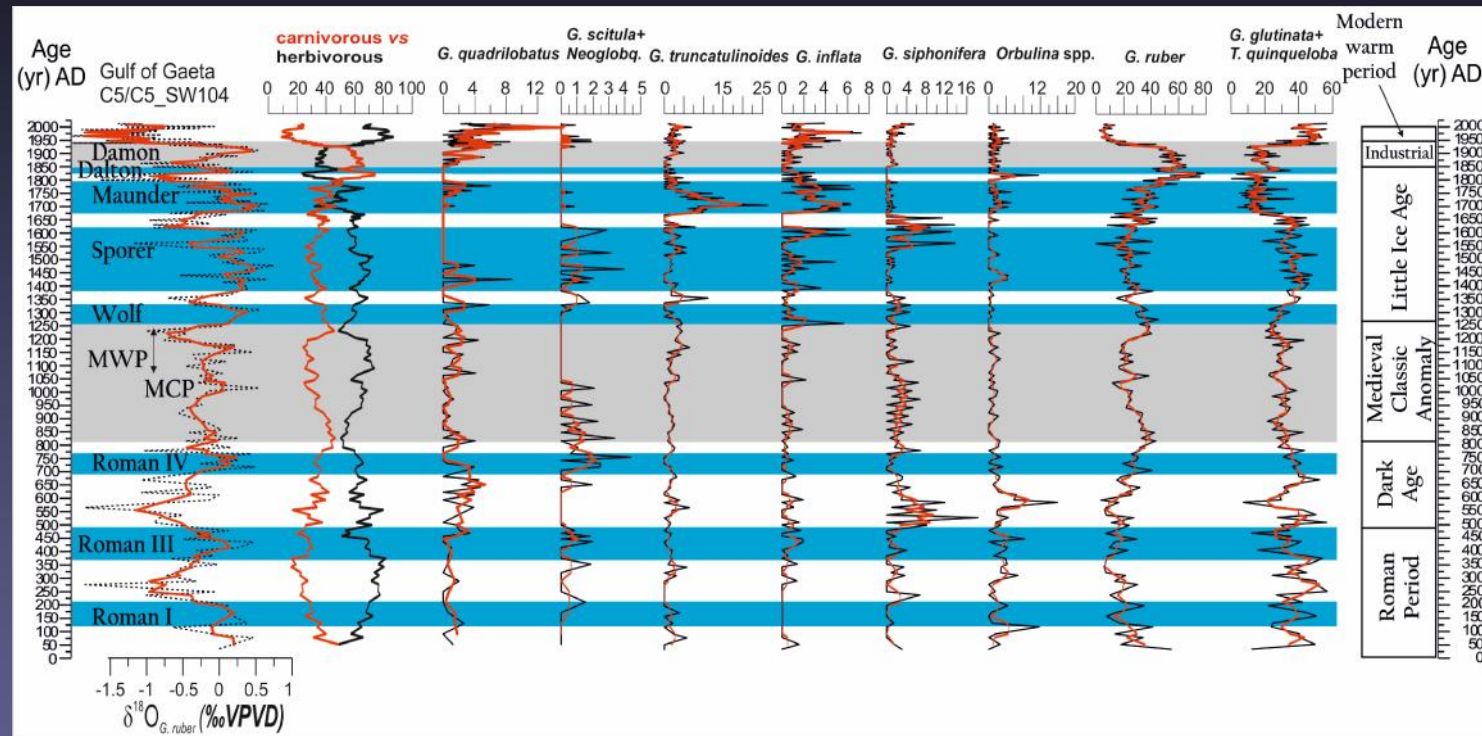
High-resolution Chronology



# Oxygen stable isotopic correlation between cores C5 and C90

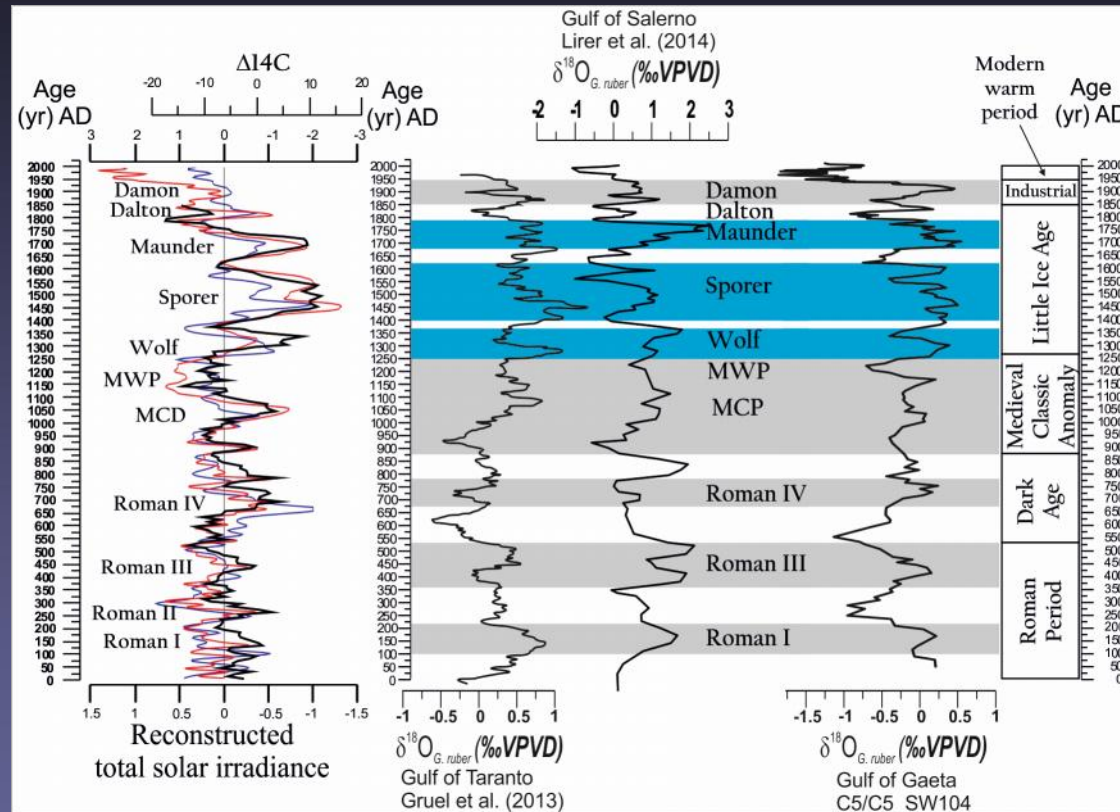


# Planktonic foraminifera and $\delta^{18}\text{O}$ *G. ruber* vs time (AD)



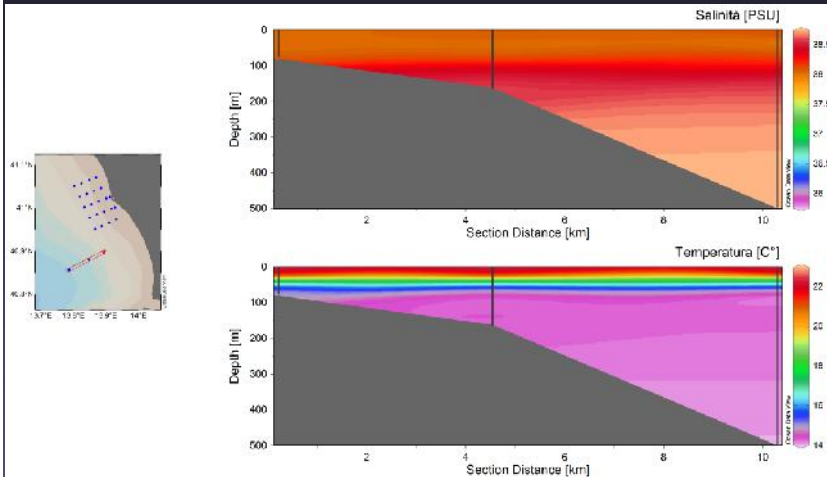


# $\delta^{18}\text{O}$ *G. ruber* Comparison between south-central Tyrrhenian Sea and Gulf of Taranto for the last 2000 years

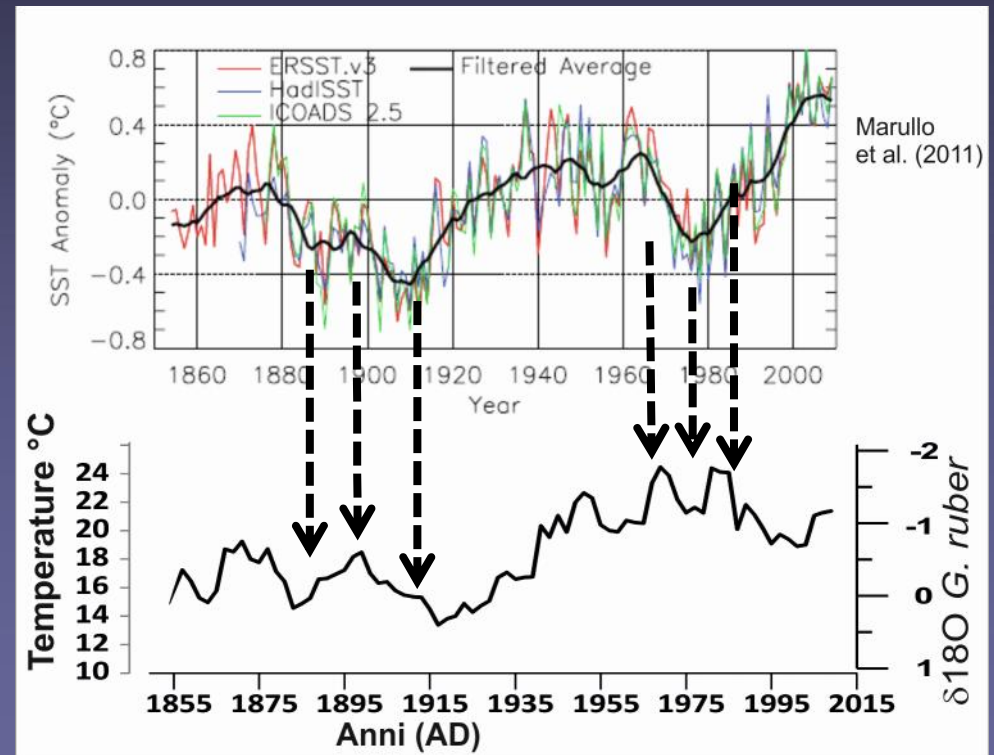


# Gulf of Gaeta Core C5\_SW104

## SST reconstructed from $\delta^{18}O$ *Globigerinoides ruber*

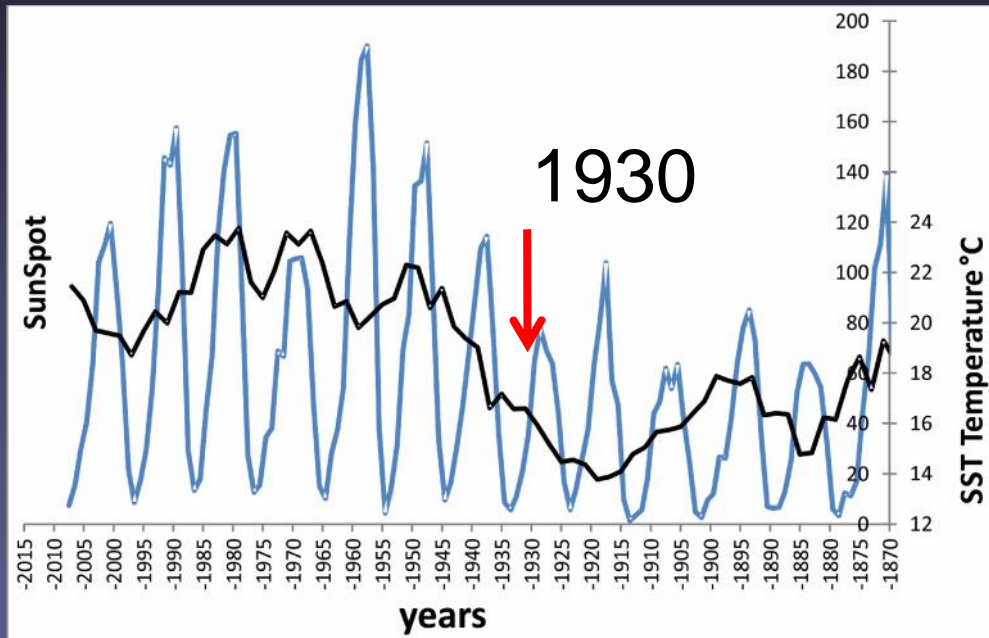


Temperature & Salinity  
October 2013  
from -80 a – 500 mbsf

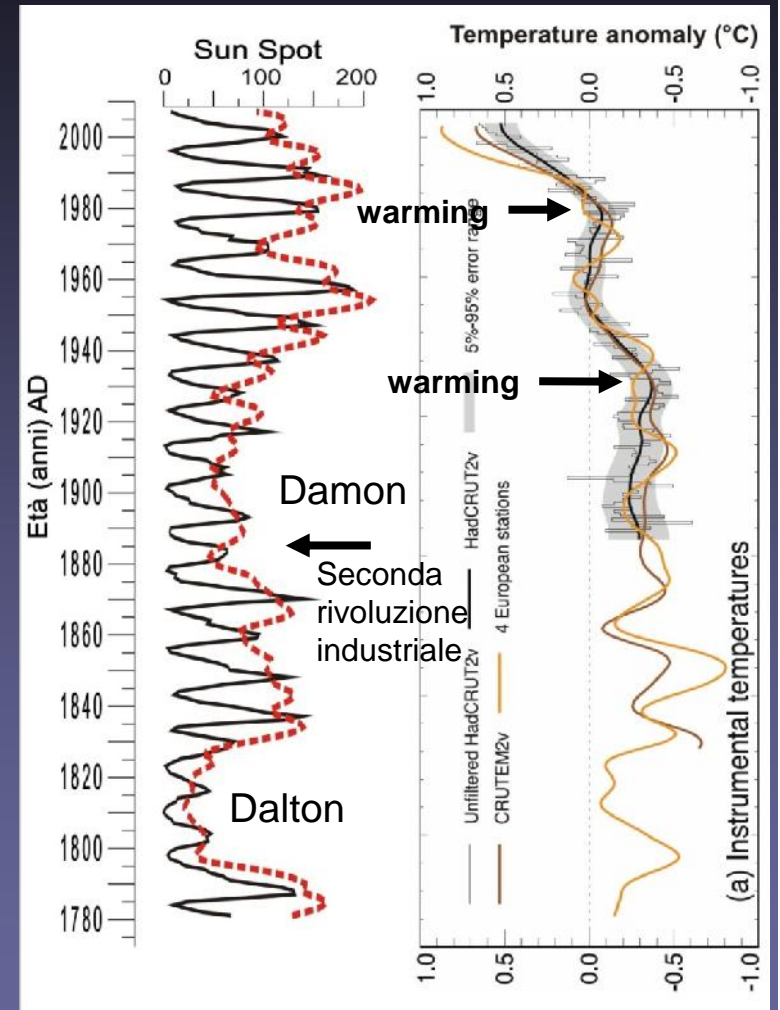




# Comparison between SST from Salerno and Gaeta gulfs and Sun Spot numbers



Blu - Sun spot  
Black- SST Gulf of Gaeta



## Conclusion

- The shallow water environment represents a keystone to document the climatic oscillations during the last 2000 years
- Turnover between carnivorous and herbivorous planktonic foraminifera represents an important tool for monitoring the climatic changes
- Six main climatic phases have been recorded:
  - Roman Period
  - Dark Age
  - Medieval Classic Anomaly
    - Stable climatic condition?
  - Little Ice Age
    - Maunder: maxima in *G. truncatulinoides* left coiled
    - Sporer and Wolf: peaks in cold planktonic foraminiferal species (*G. scitula* + *N. pachyderma*)
  - Industrial Period
    - Strong oligotrophic condition: maxima *G. quadrilobatus*
  - Modern Warm Period
    - Strong increase in sea surface productivity