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Roberta PINI
Lorenzo CASTELLANO
Francesca VALLE'
Cesare RAVAZZI

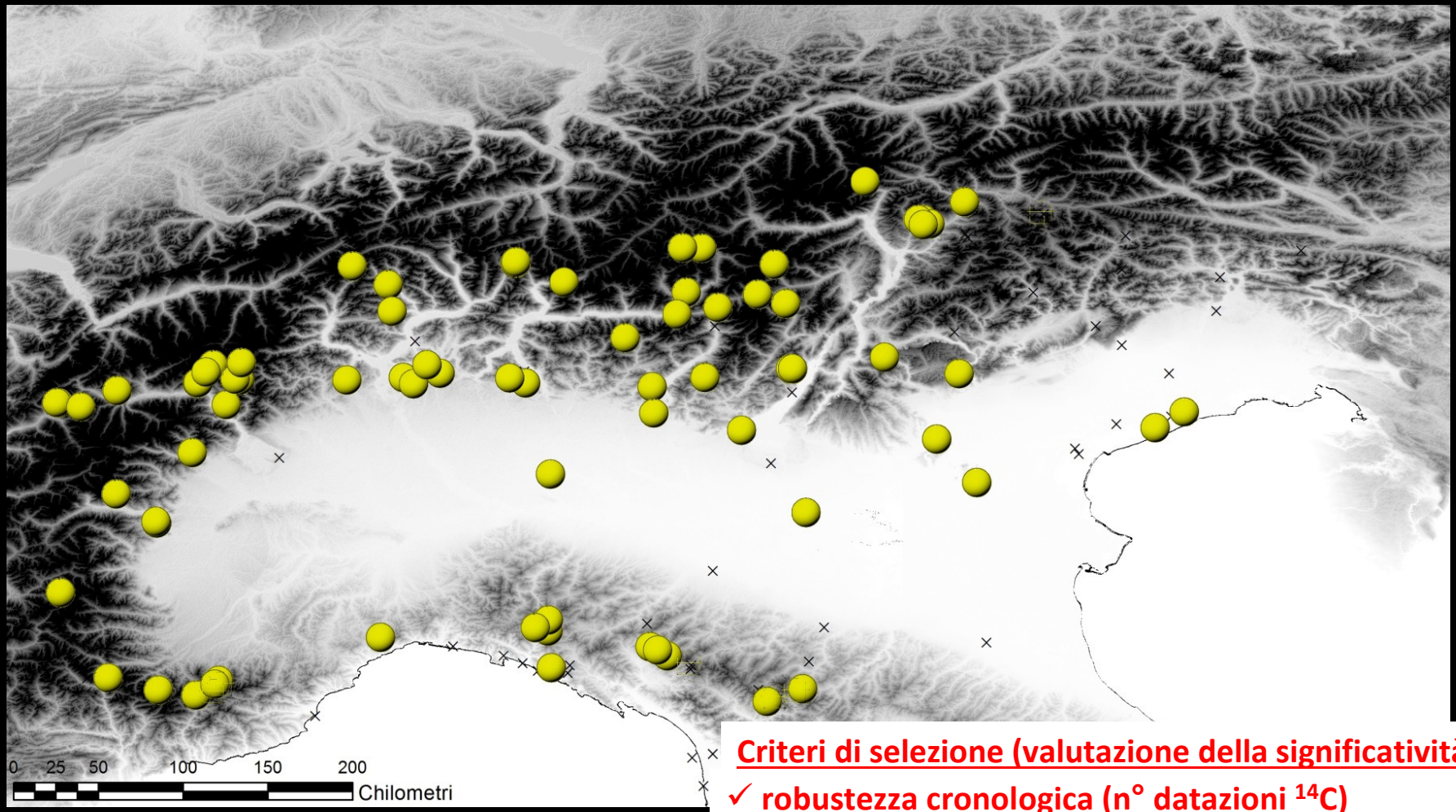
Dal polline al clima: stima quantitativa di parametri climatici per serie polliniche degli ultimi 3mila anni

CNR – IDPA
Laboratorio di Palinologia e Paleoecologia
http://palinologia.disat.unimib.it

New York University
Institute for the Study of the Ancient World
http://isaw.nyu.edu

Università di Milano - Bicocca
Dip. Scienze Ambiente, Territorio e Scienze della Terra
www.disat.unimib.it

siti in Nord Italia

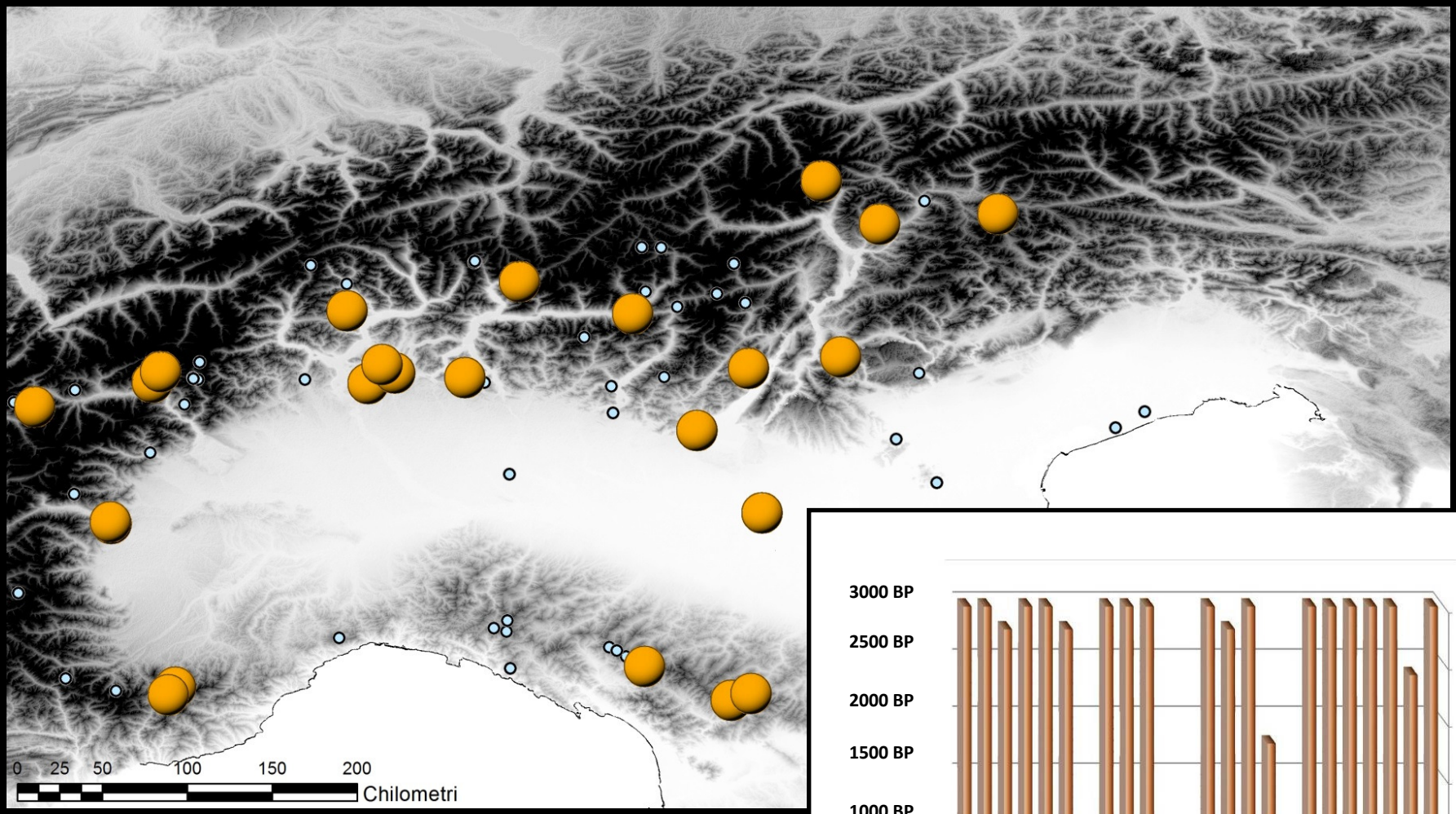


Successioni palinologiche d'ambiente limnico del Nord Italia che interessano gli ultimi 3k yrs: localizzazione e origine dei dati

Criteri di selezione (valutazione della significatività)

- ✓ **robustezza cronologica (n° datazioni ^{14}C)**
- ✓ **risoluzione cronostratigrafica (distanza tra campioni successivi mediamente <100 anni)**
- ✓ **coerenza nella composizione pollinica con i siti circostanti**

N-Italy BEST pollen datasets



Selezione delle successioni palinologiche d'ambiente limnico del Nord Italia che interessano gli ultimi 3k yrs: localizzazione e intervalli cronologici interessati

Il polline come proxy del paleoclima - presupposti

Il polline è una funzione della vegetazione a scala regionale

--> La vegetazione è una funzione del clima

---> Il polline è indirettamente una funzione del clima e può essere utilizzato per la ricostruzione del clima del passato a scala regionale

A three-step approach (Juggins and Birks 2012):

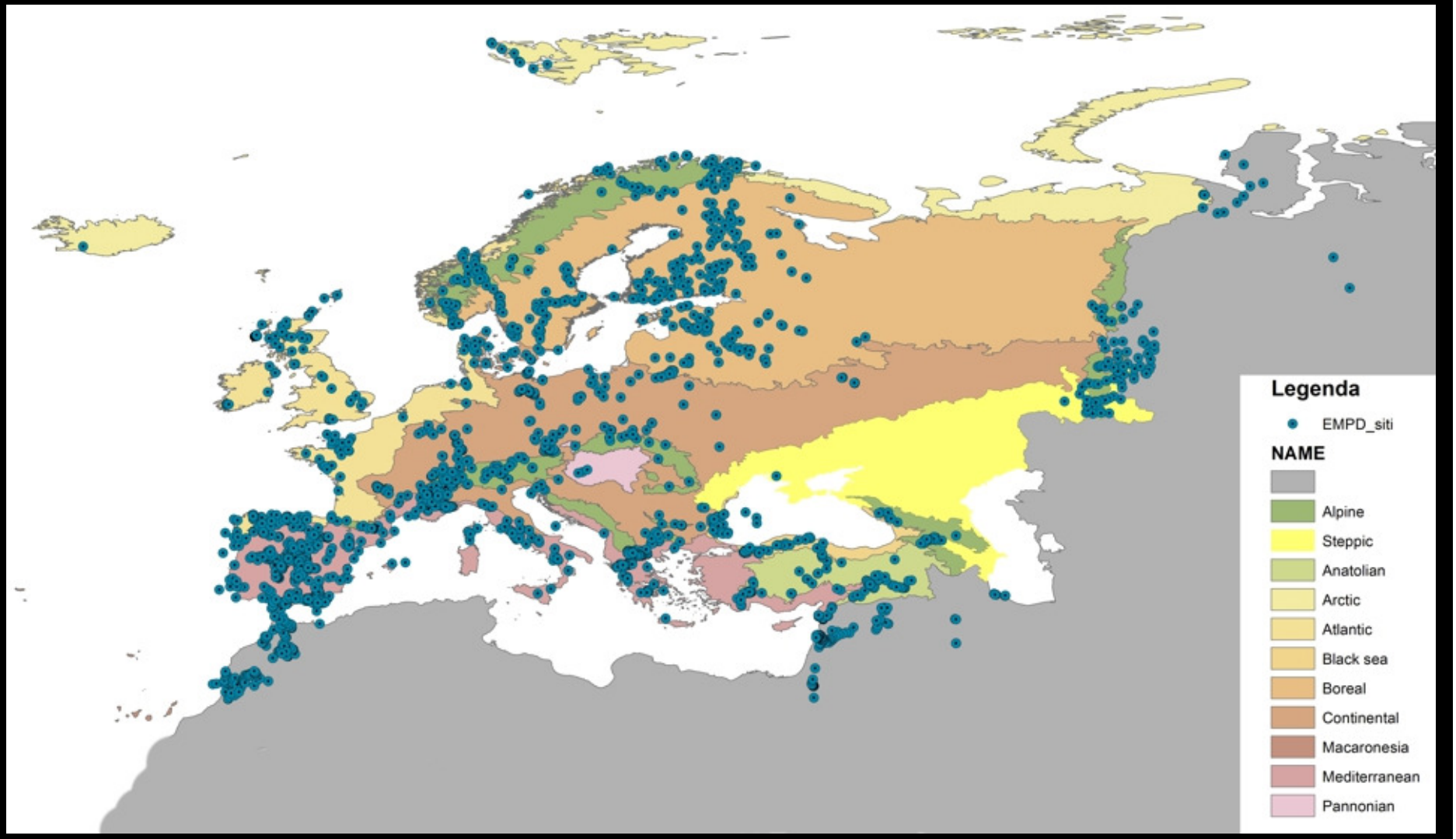
(i) the development of modern pollen-vegetation-climate training sets, to fully understand the relationships between pollen rain, plant distribution and climate

→ accuracy and reliability of reconstructions depend on the size, coverage and quality of the training set!

(ii) the application of numerical techniques to the training sets, to model the relationships between pollen-vegetation occurrences and environmental conditions

(iii) the application of this model to pollen-stratigraphical data

***(i) acquisizione dell'EMPD** (European Modern Pollen Database), il più esteso dataset sulla pioggia pollinica moderna nelle diverse regioni biogeografiche europee*

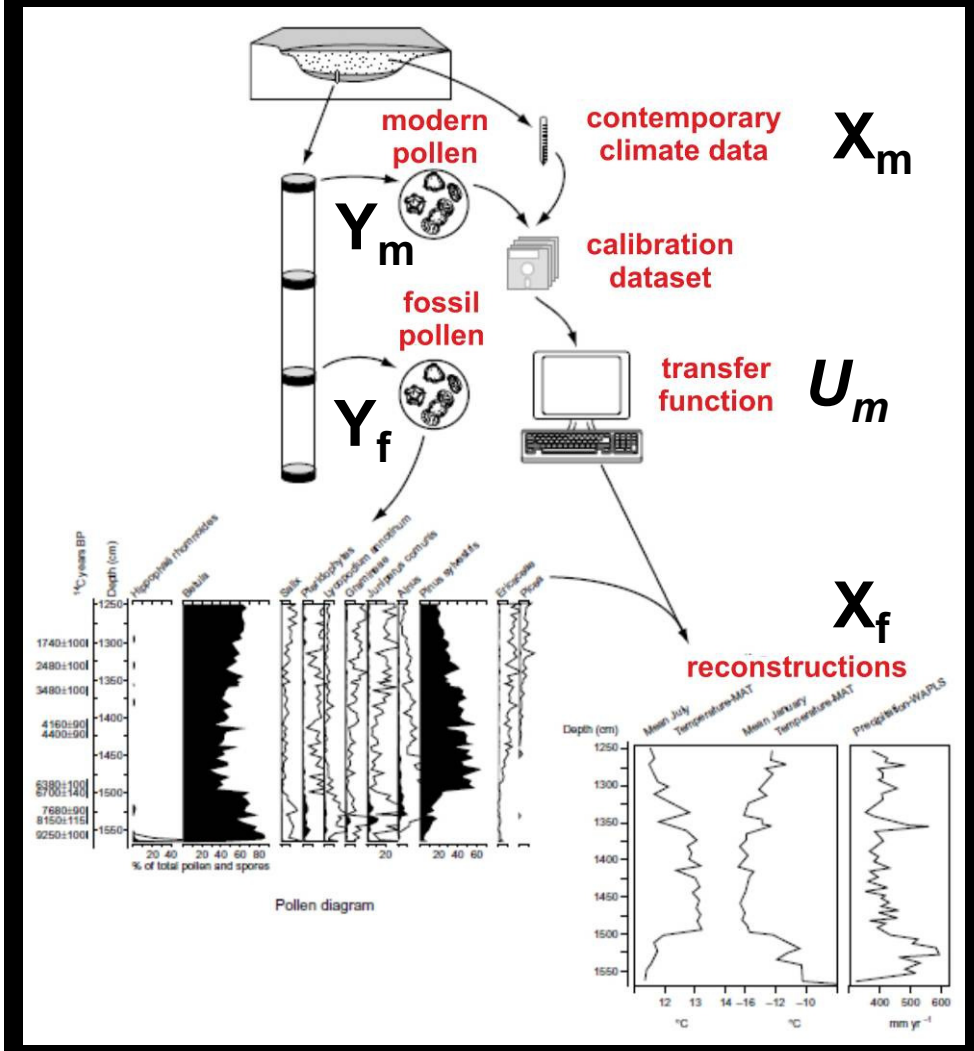


Circa 4800 siti in Europa e Nord Africa (Davis et al., 2013)

Training set per il confronto con spettri pollinici fossili e la definizione di funzioni di trasferimento paleoclimatico

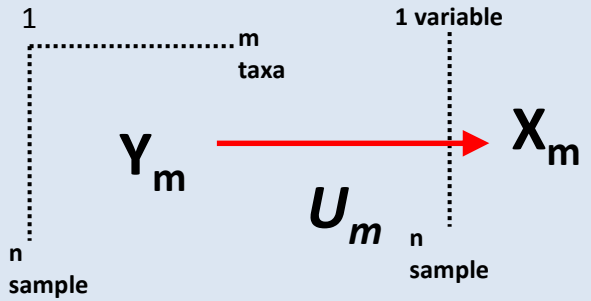
(ii) Applicazione di tecniche d'analisi numerica e lo sviluppo di funzioni di trasferimento

*"The modern relationships between **Y** and **X** are modelled numerically and the resulting transfer function is used to transform the fossil data $\mathbf{Y}_0$ into quantitative estimates of the past environmental variable(s) ($\mathbf{X}_0$)" (Birks 2003)*



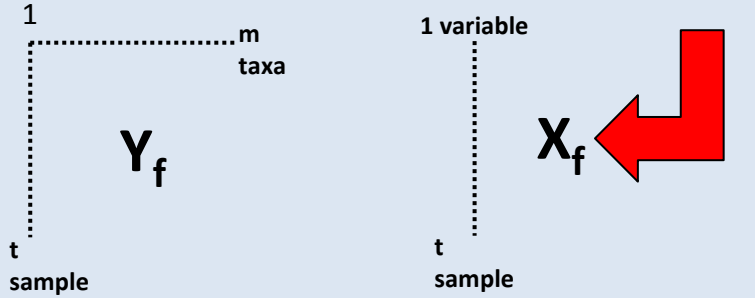
BIOLOGICAL DATA (e.g. Pollen)	ENVIRONMENTAL DATA (e.g. Mean July Temperature)

Training set of modern data



Fossil data

Unknown to be reconstructed



(ii) le tre tecniche di analisi numerica che stiamo impiegando

wMAT = weighted Modern Analogue Technique

coefficienti di similarità/dissimilarità **(*square chord distance*) sono utilizzati per trovare nel training set moderno k- analoghi per ciascuno spettro pollinico fossile. Le variabili ambientali da associare al campione fossile vengono quindi ricostruite come medie pesate delle variabili dei k-analoghi.**

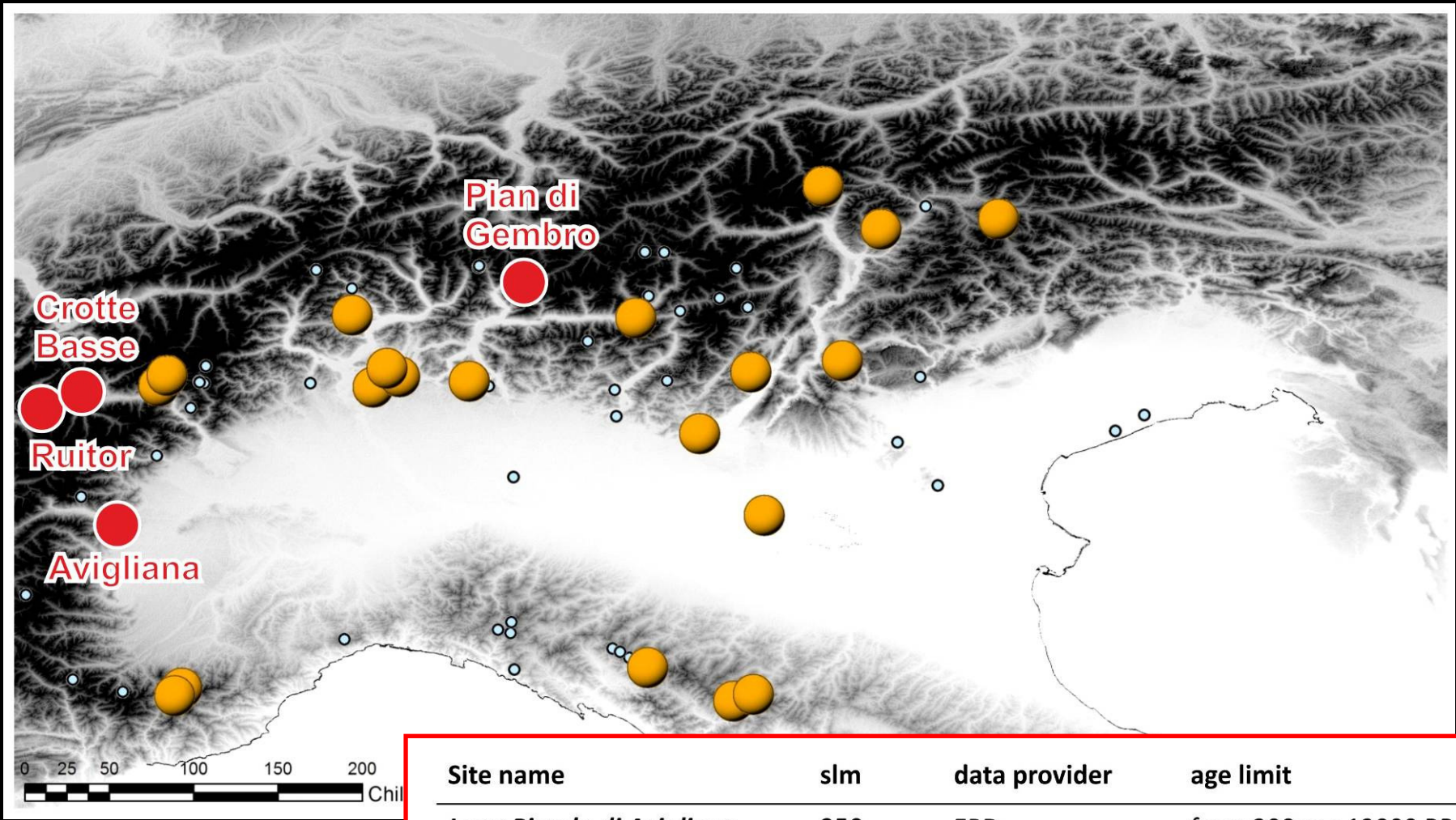
LWWA = Locally Weighted Weighted Averaging

simile alla wMAT, ma prende in considerazione un numero maggiore di analoghi (30-40). Fornisce valori di ottimo e tolleranze per i parametri ambientali, calcolati come medie pesate dei valori che caratterizzano i k-analoghi.

LWWA-PLS = Locally Weighted Weighted Averaging Partial Least Square

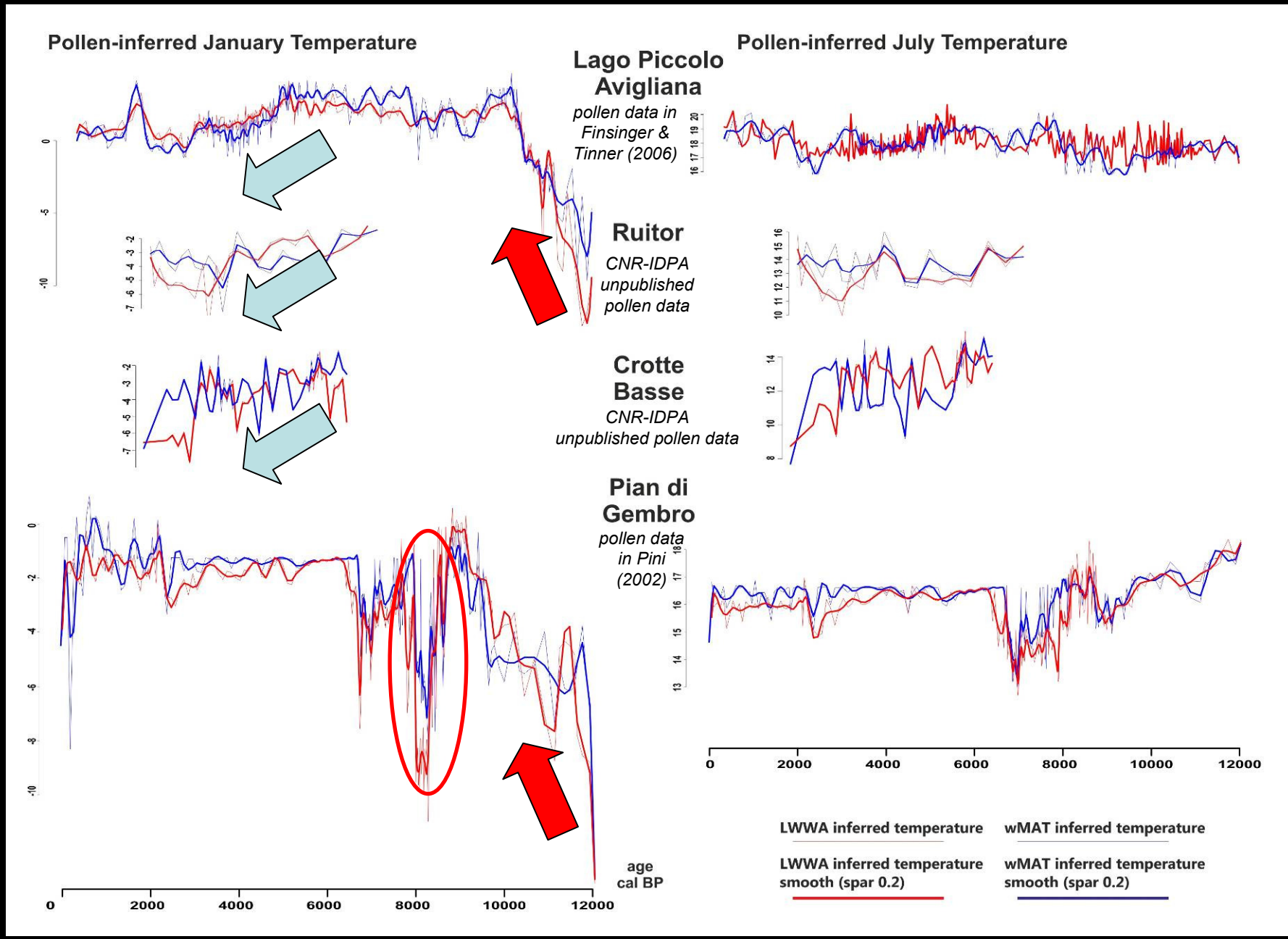
Simile alla LWWA

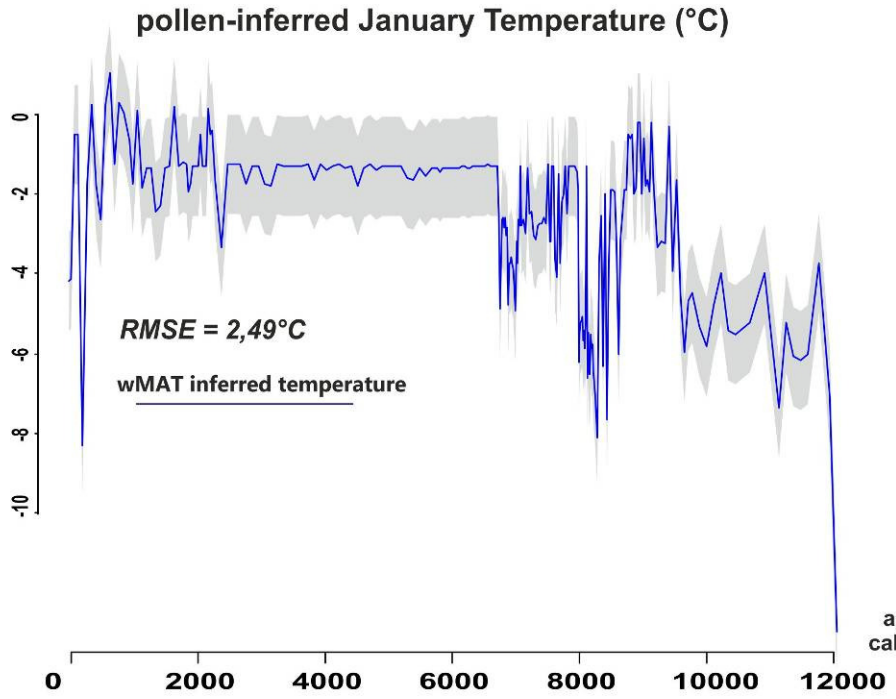
(iii) applicazione delle funzioni di trasferimento su lunghe serie oloceniche



Site name	slm	data provider	age limit
Lago Piccolo di Avigliana	350	EPD	from 300 to >12000 BP
Ruitor - Torbiera Valter	2450	IDPA	from 2000 to 7000 BP
Crotte Basse	2362	IDPA	from 2000 to 6000 BP
Pian di Gembro	1350	IDPA	from -50 to >12000 BP

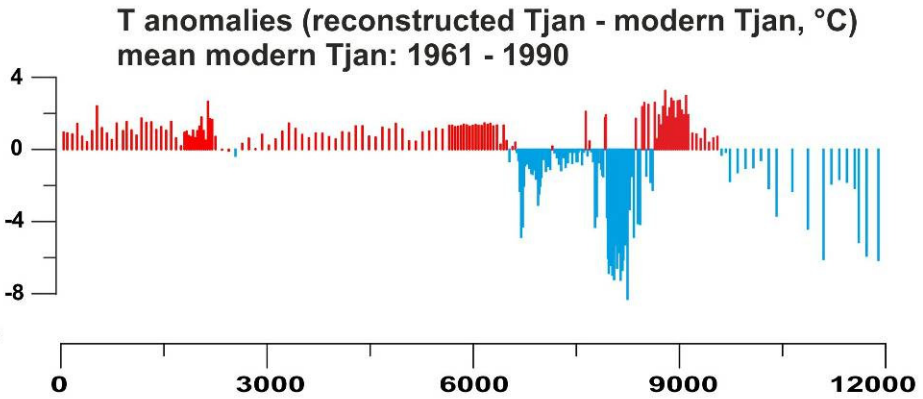
(iii) applicazione delle funzioni di trasferimento su lunghe serie oloceniche

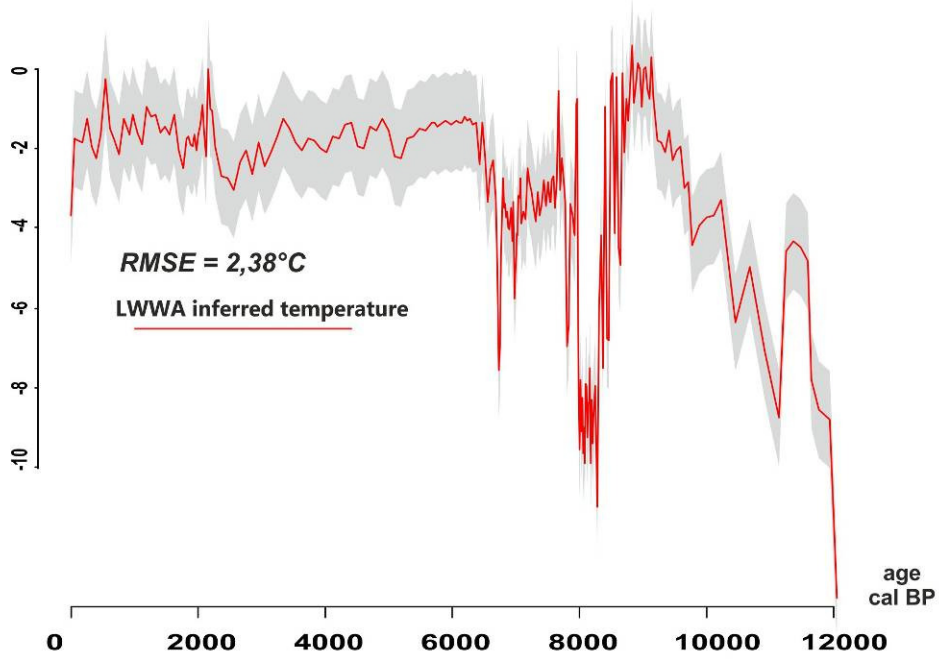


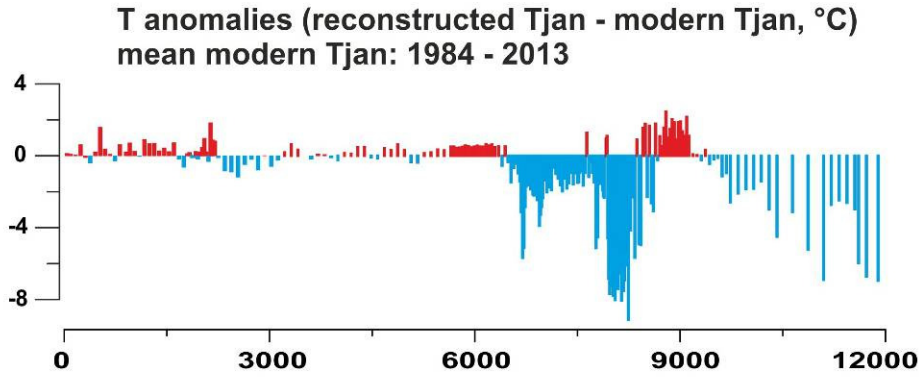


Pian di Gembro
(1350 m asl, Central Alps)

pollen data in Pini (2002)







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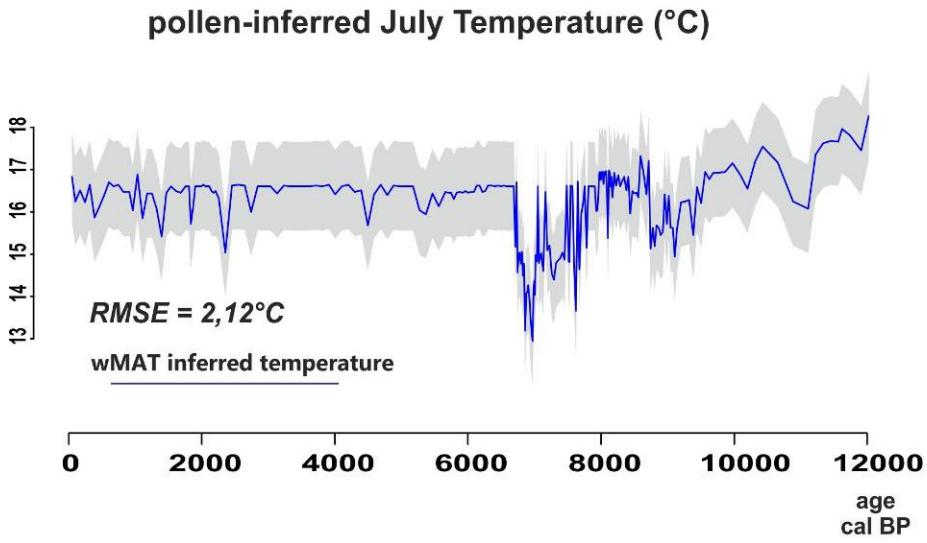
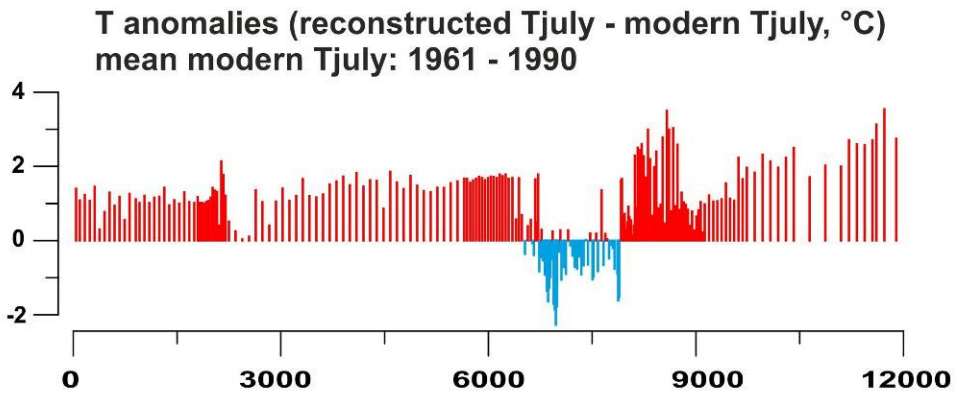
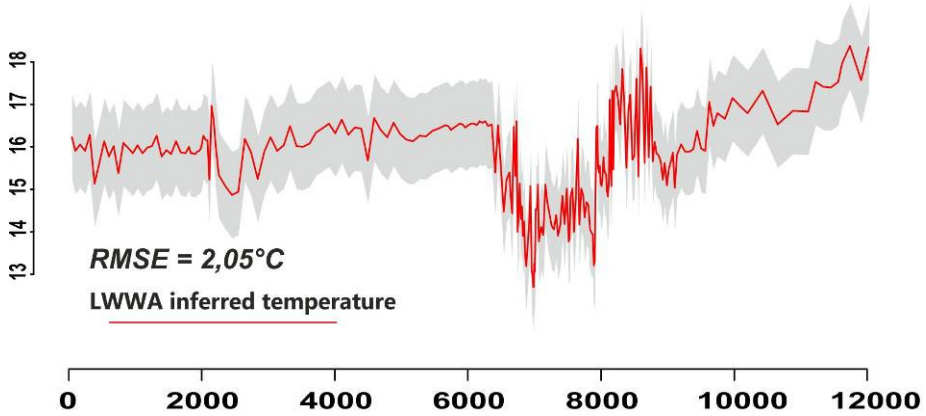
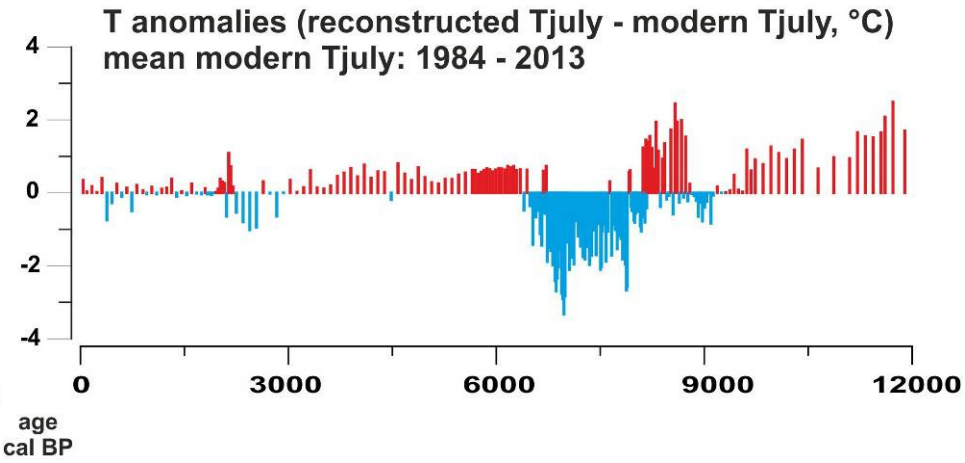


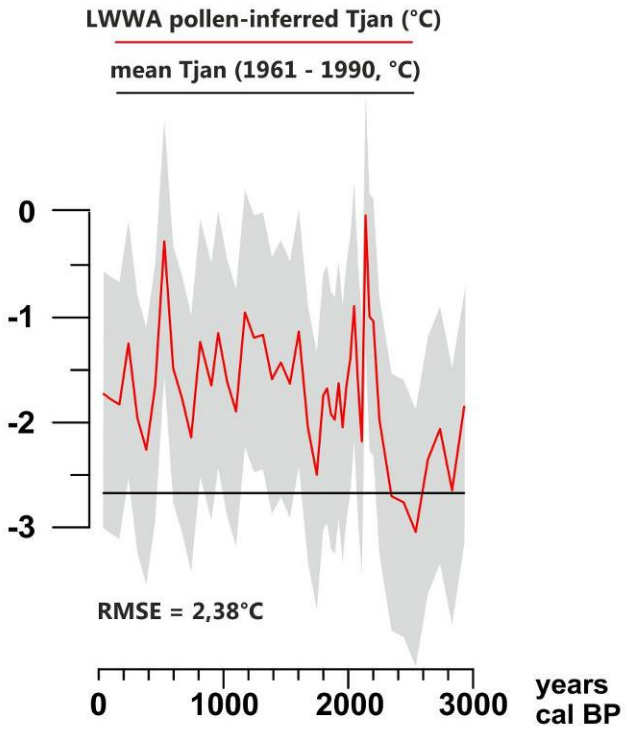


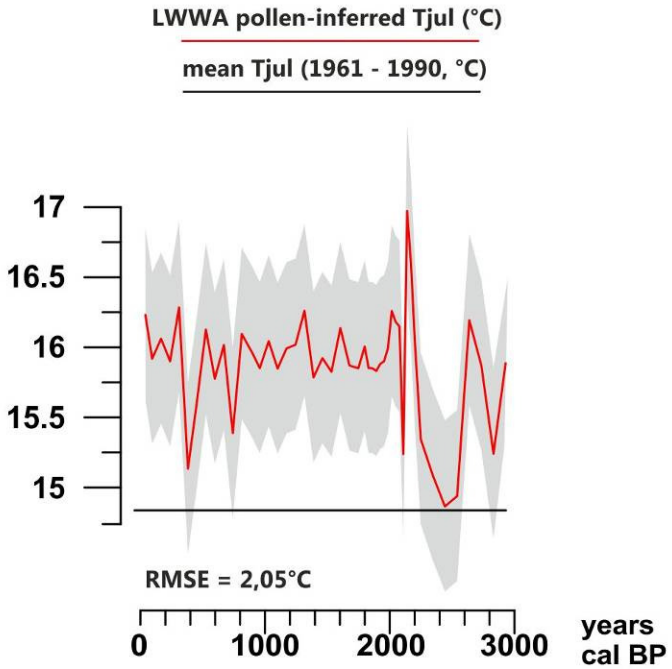


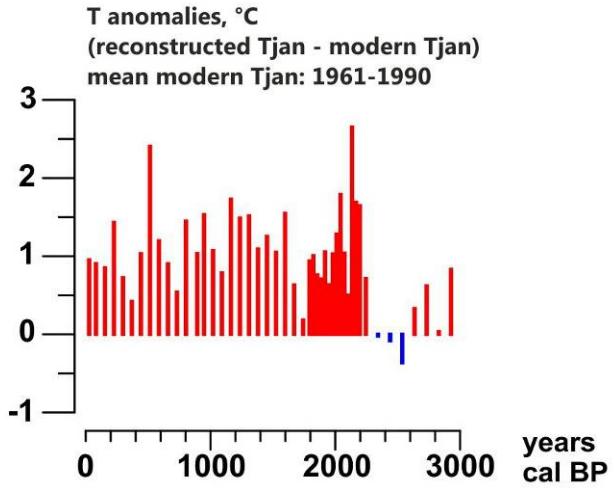


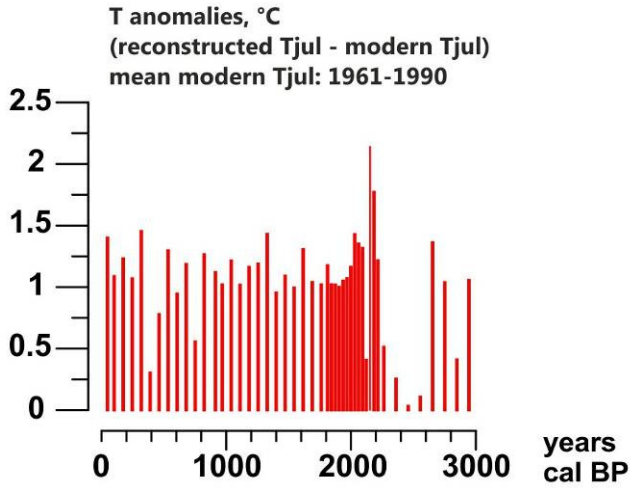
Pian di Gembro: last 3k years

pollen data in Pini (2002)



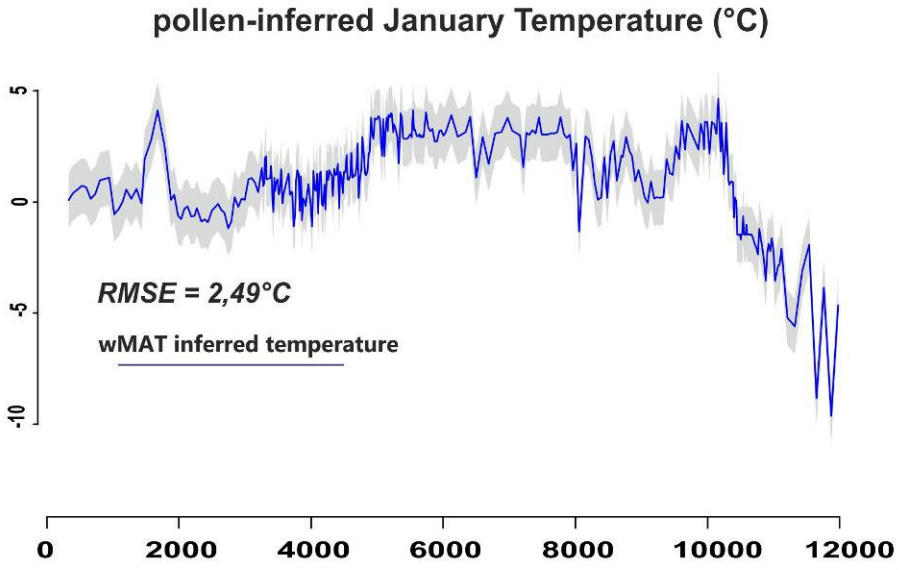


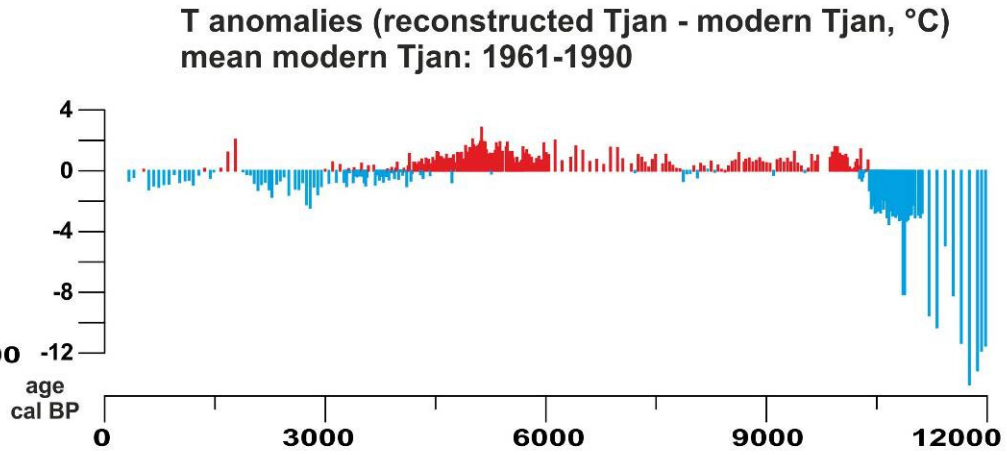


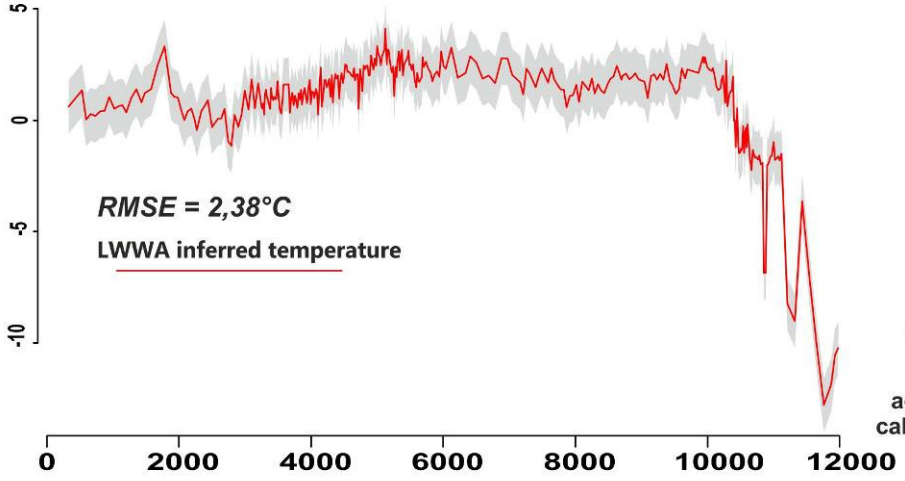


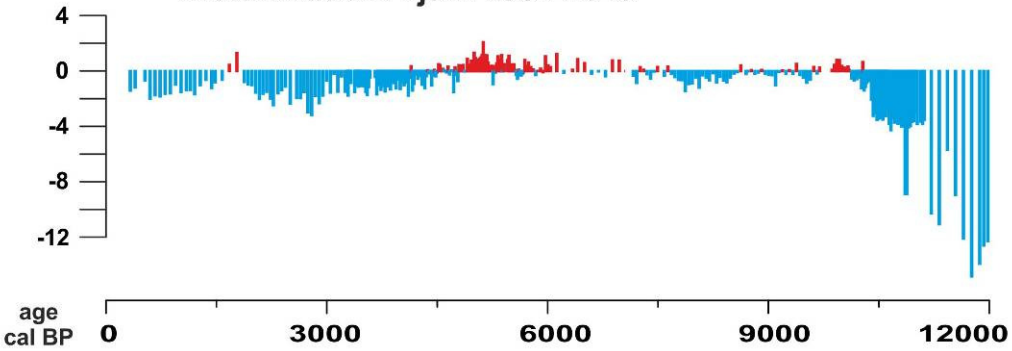
Lago Piccolo Avigliana (356 m asl)

pollen data in Finsinger & Tinner (2006)









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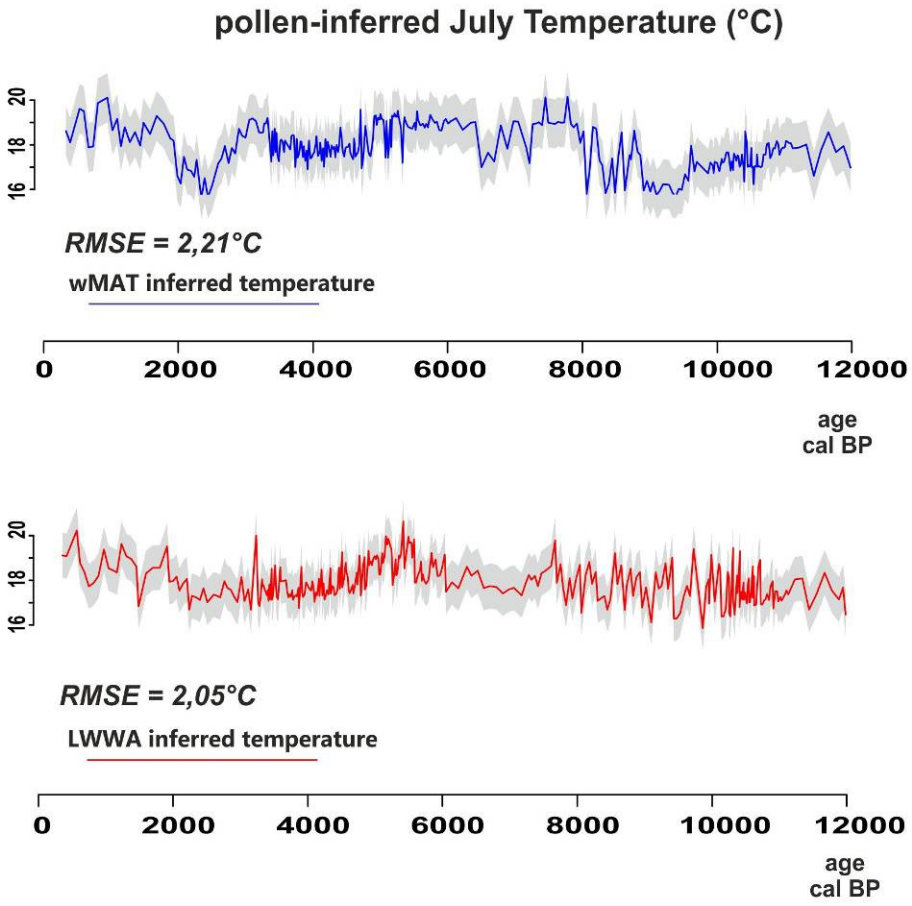
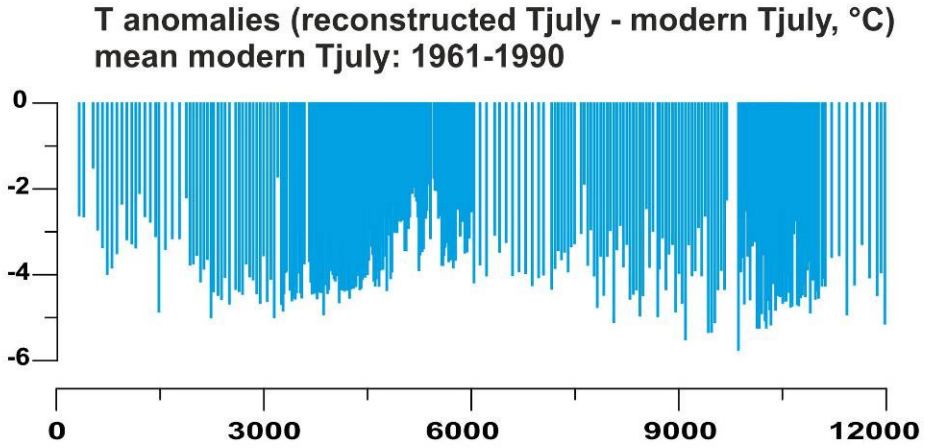
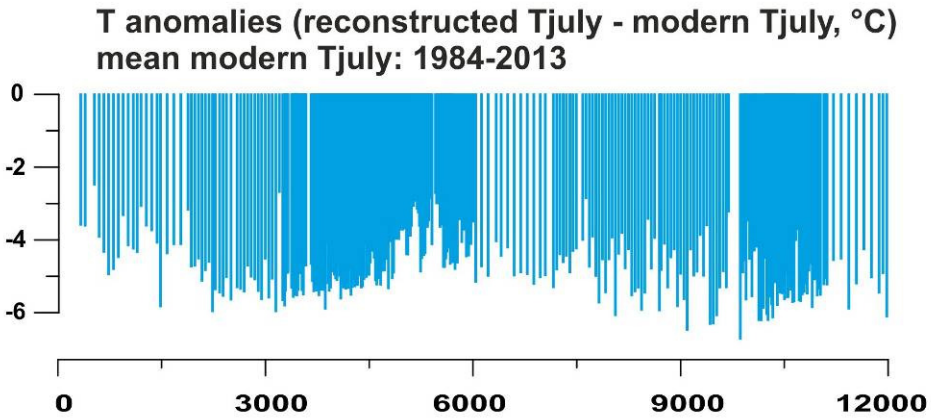
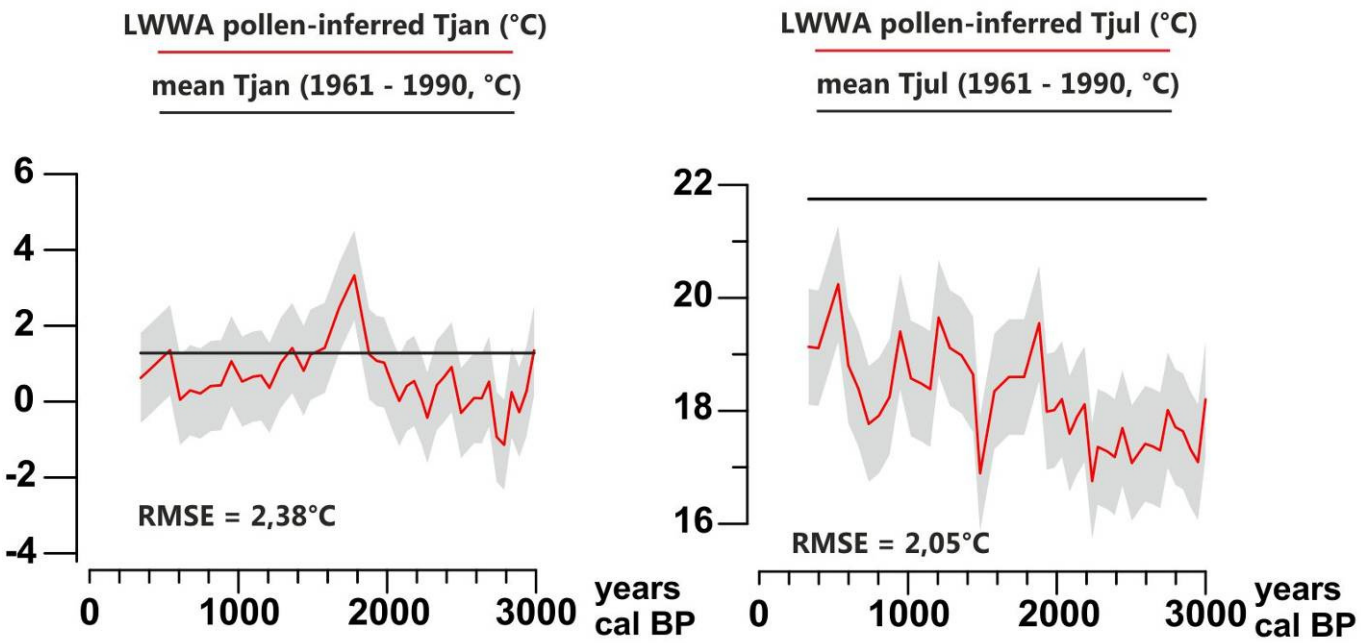


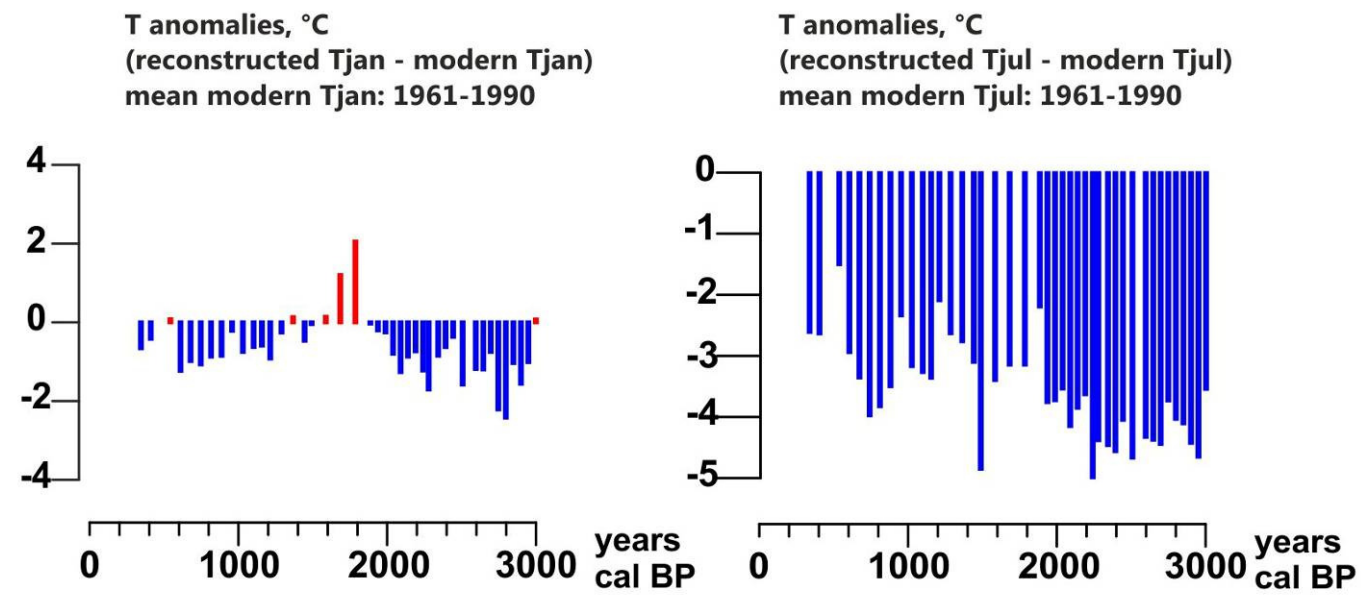


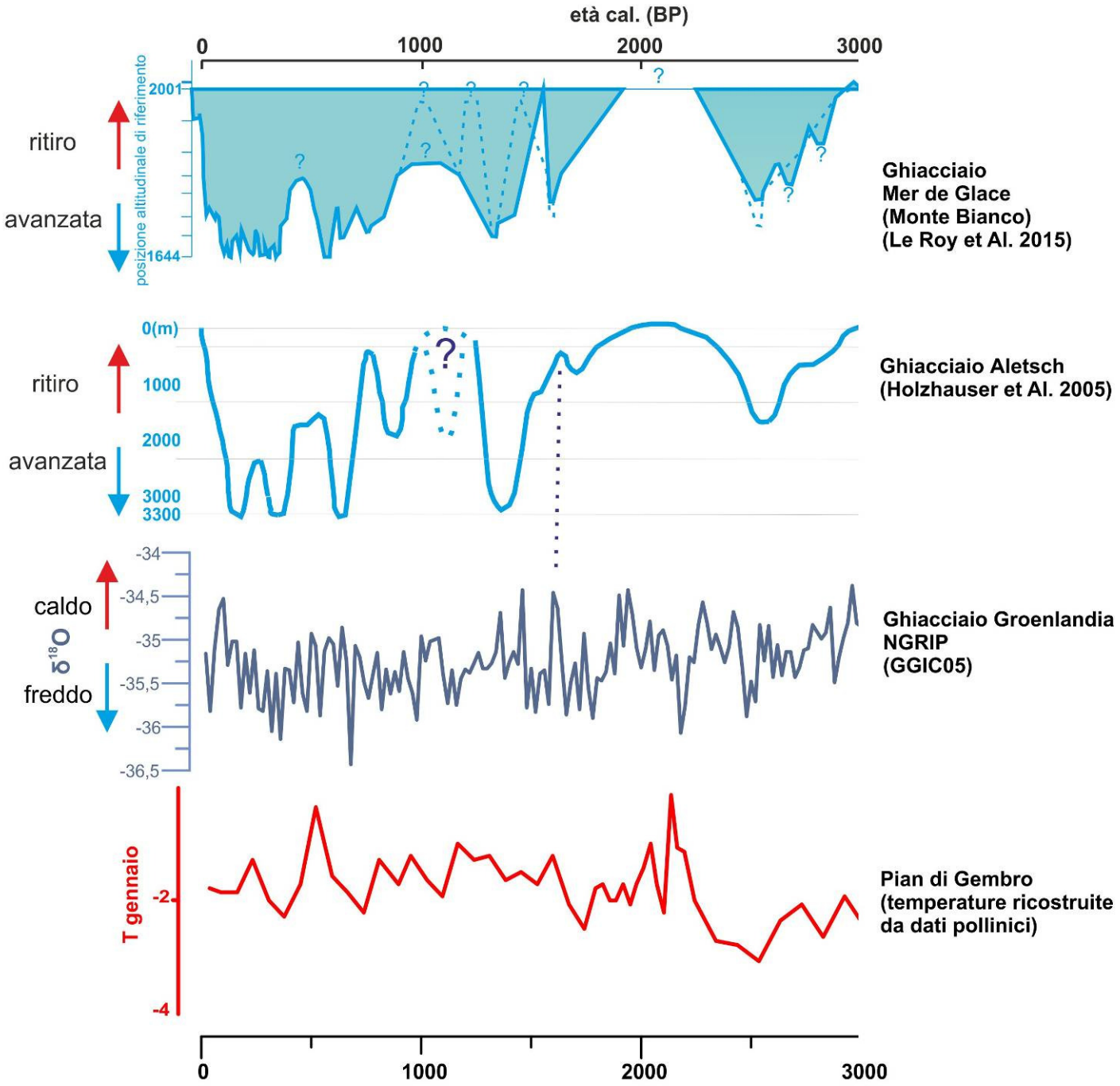


Lago Piccolo Avigliana: last 3k years

pollen data in Finsinger & Tinner (2006)






età cal. (BP)
0
1000
2000
3000
posizione altitudinale di riferimento
2001
1644
ritiro
avanzata
Ghiacciaio
Mer de Glace
(Monte Bianco)
(Le Roy et Al. 2015)
0(m)
1000
2000
3000
3300
ritiro
avanzata
Ghiacciaio Aletsch
(Holzhauser et Al. 2005)
-34
-34,5
-35
-35,5
-36
-36,5
caldo
freddo
δ18O
Ghiacciaio Groenlandia
NGRIP
(GGIC05)
T gennaio
-2
-4
Pian di Gembro
(temperature ricostruite
da dati pollinici)

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Global and Planetary Change

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The climate of North America during the past 2000 years reconstructed from pollen data

A.E. Viau *, M. Ladd, K. Gajewski

Laboratory for Paleoclimatology and Climatology, Department of Geography, University of Ottawa, Ottawa, Ontario, Canada K1N 6N5

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North American Modern Pollen Database

ABSTRACT

The temperature of the warmest month was reconstructed for the past 2000 years using 748 pollen sites from the North American Pollen Database. The Modern Analog Technique was used to quantify paleoclimate conditions using a modern pollen database with calibration sites from across North America. Across North America, both the Medieval Warm Period (MWP) and Little Ice Age (LIA) were cooler than the present (AD 1961–1990). The MWP was warmer than the LIA over at least the boreal and eastern portions of the continent and perhaps across the continent. These reconstructed anomalies during the MWP and LIA are significant anomalies from the long-term neoglacial cooling. The atmospheric circulation was likely dominated by a poleward shift of the summer Subtropical High Pressure system in the North Atlantic during the MWP.

- Ricostruzione della MTWA (Mean T Warmest Month) per gli ultimi 2000 anni
- MTWA per il Periodo Caldo Medioevale e la Piccola Età Glaciale rappresentati come anomalie rispetto all'attuale (1961-1990)

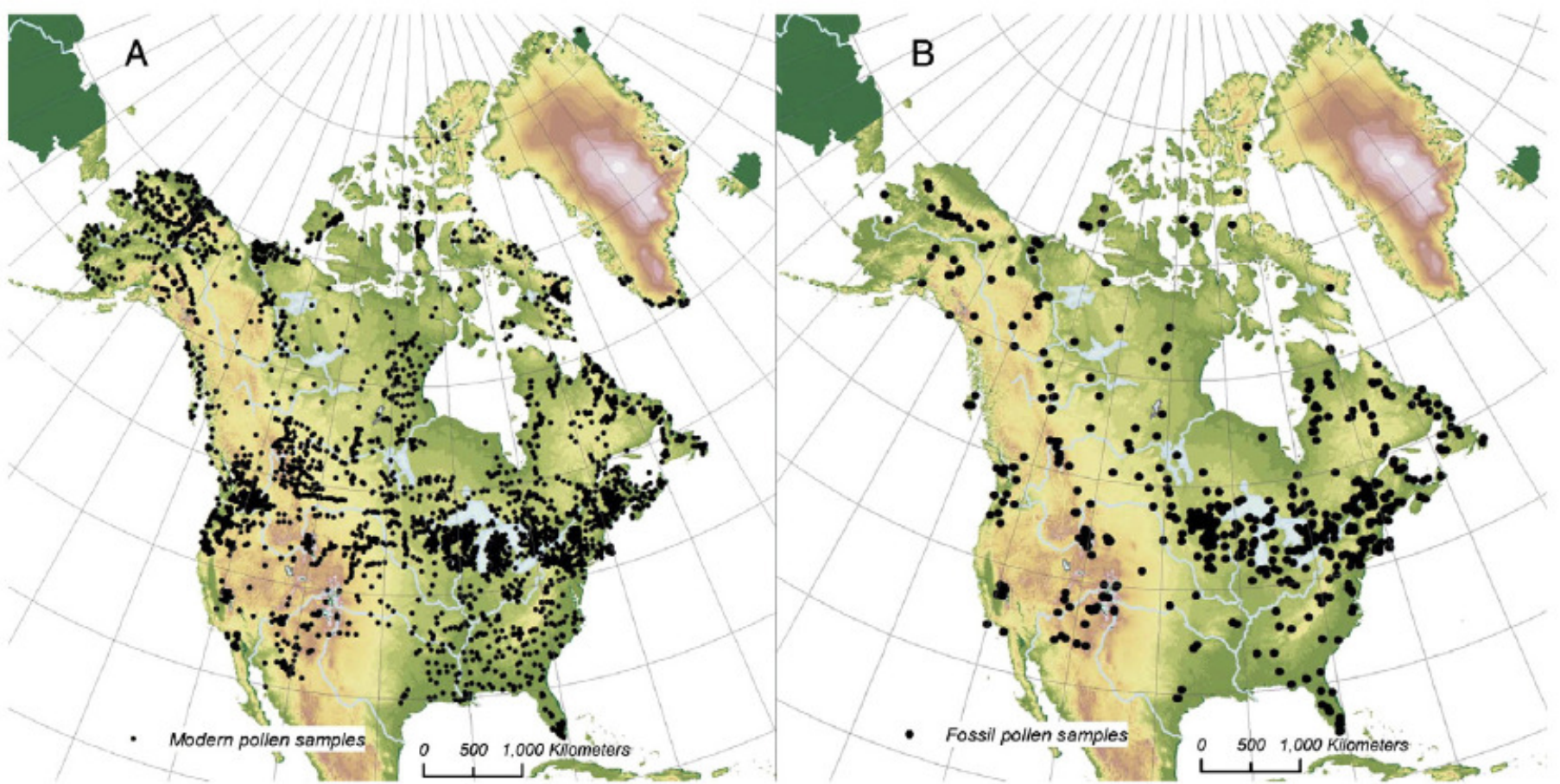
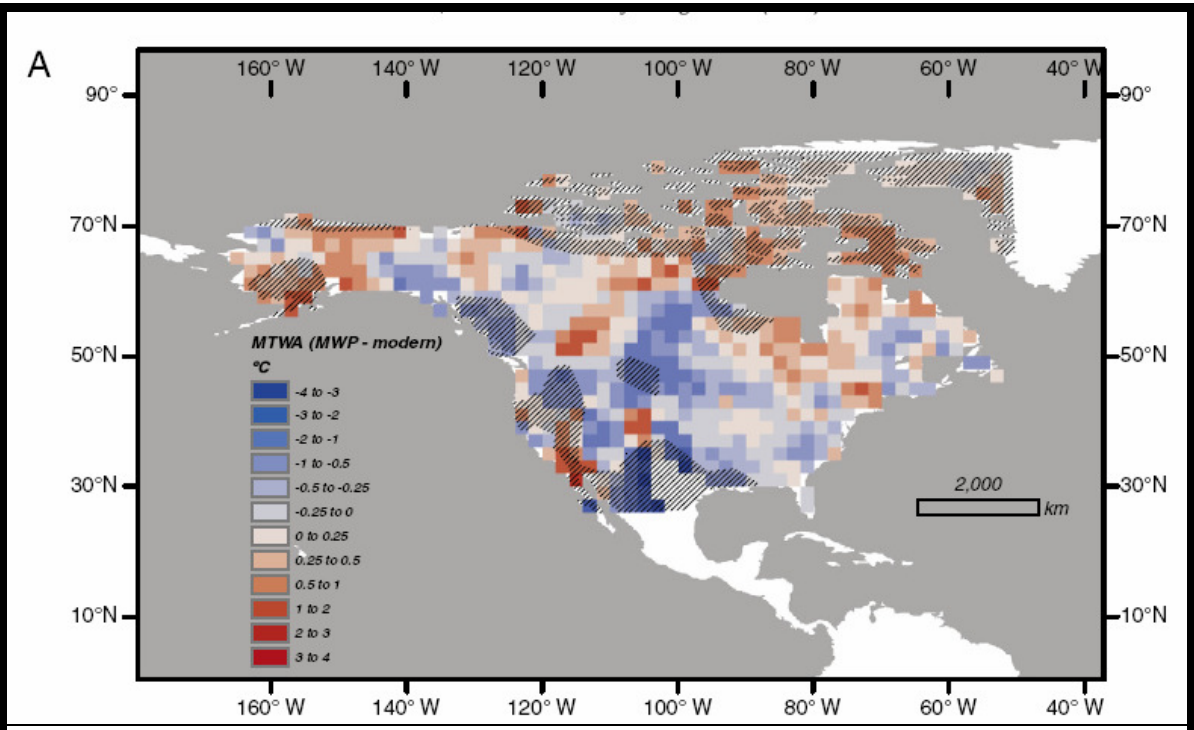
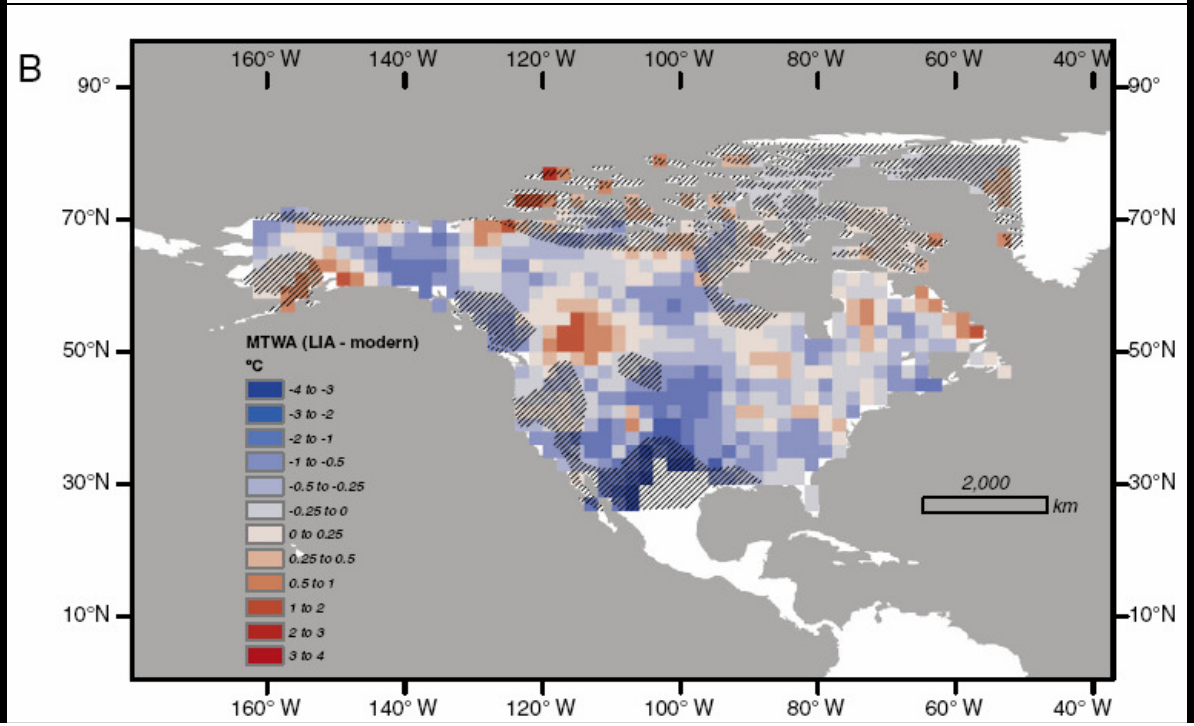


Fig. 1. Location of samples used in this study. (A) Modern pollen sites (Whitmore et al., 2005). (B) Fossil pollen sites (Grimm, 2011).

- Dataset di pioggia pollinica moderna e dati climatici: North American Pollen Database
- tecnica impiegata: MAT

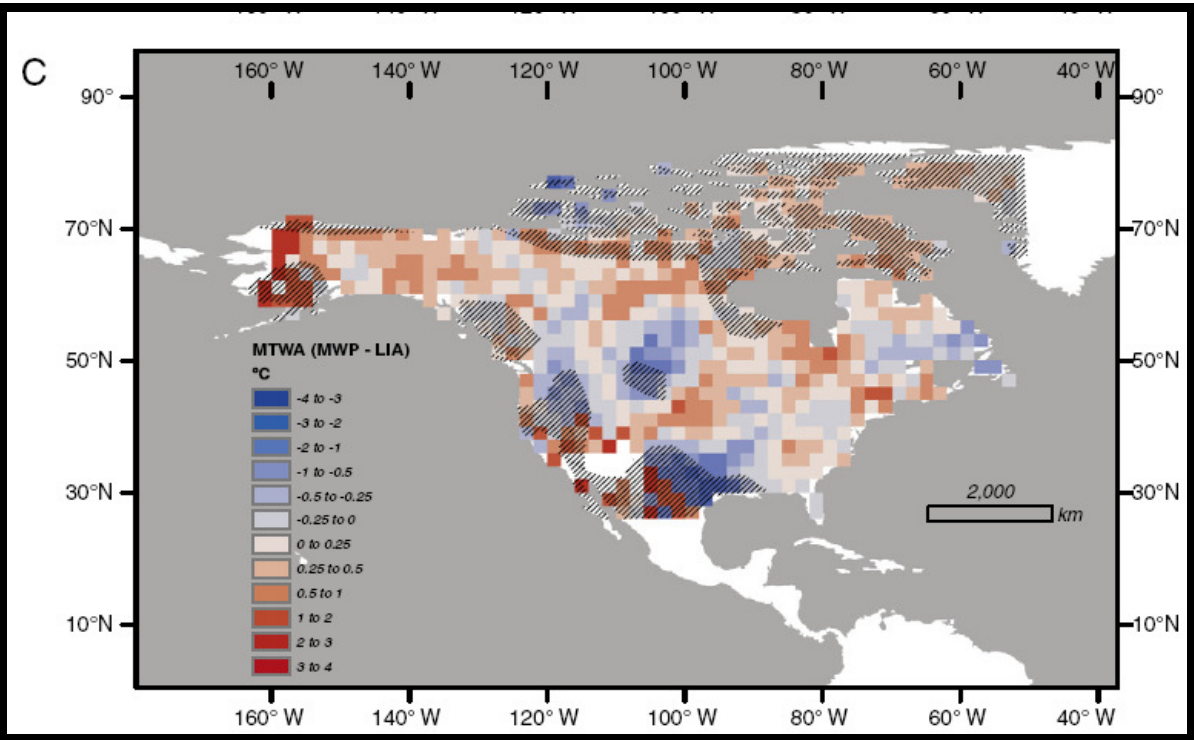




Carte delle anomalie ottenute tramite *"ordinary prediction kriging (spherical)"*

anomalie MWP - attuale

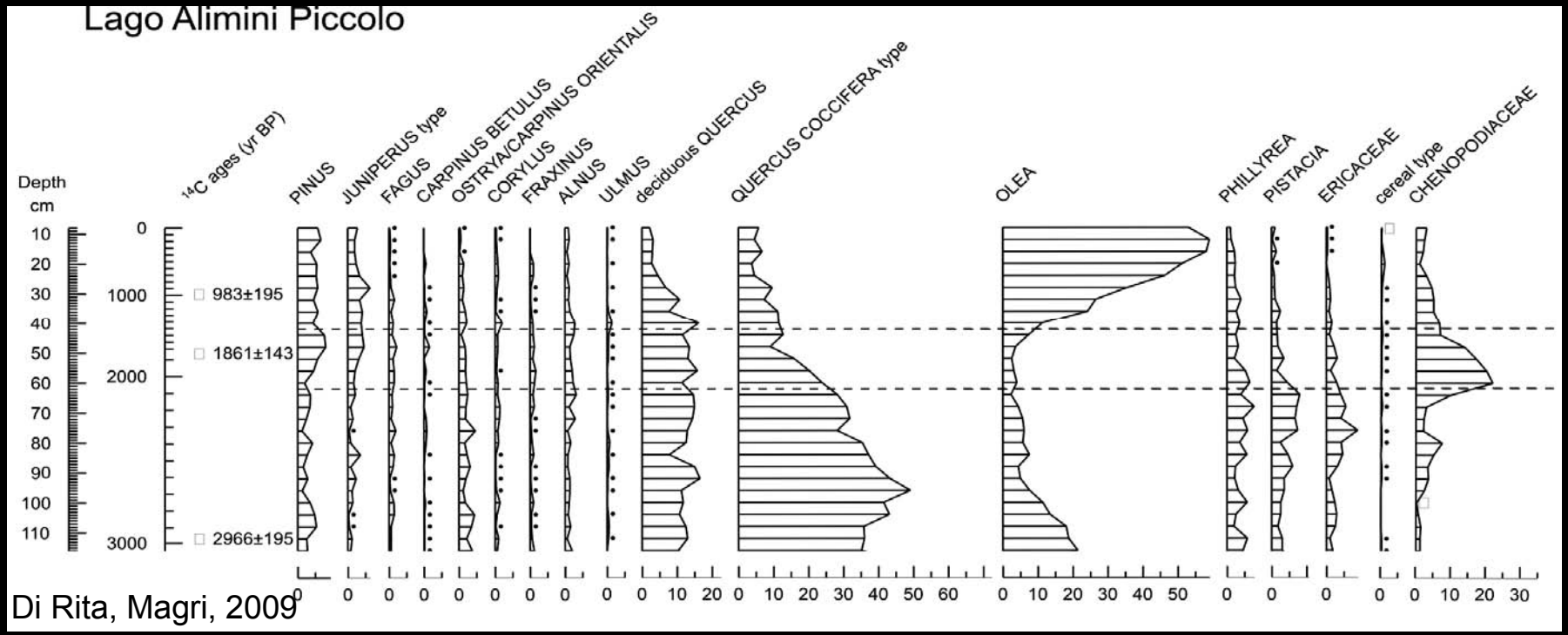
anomalie LIA - attuale



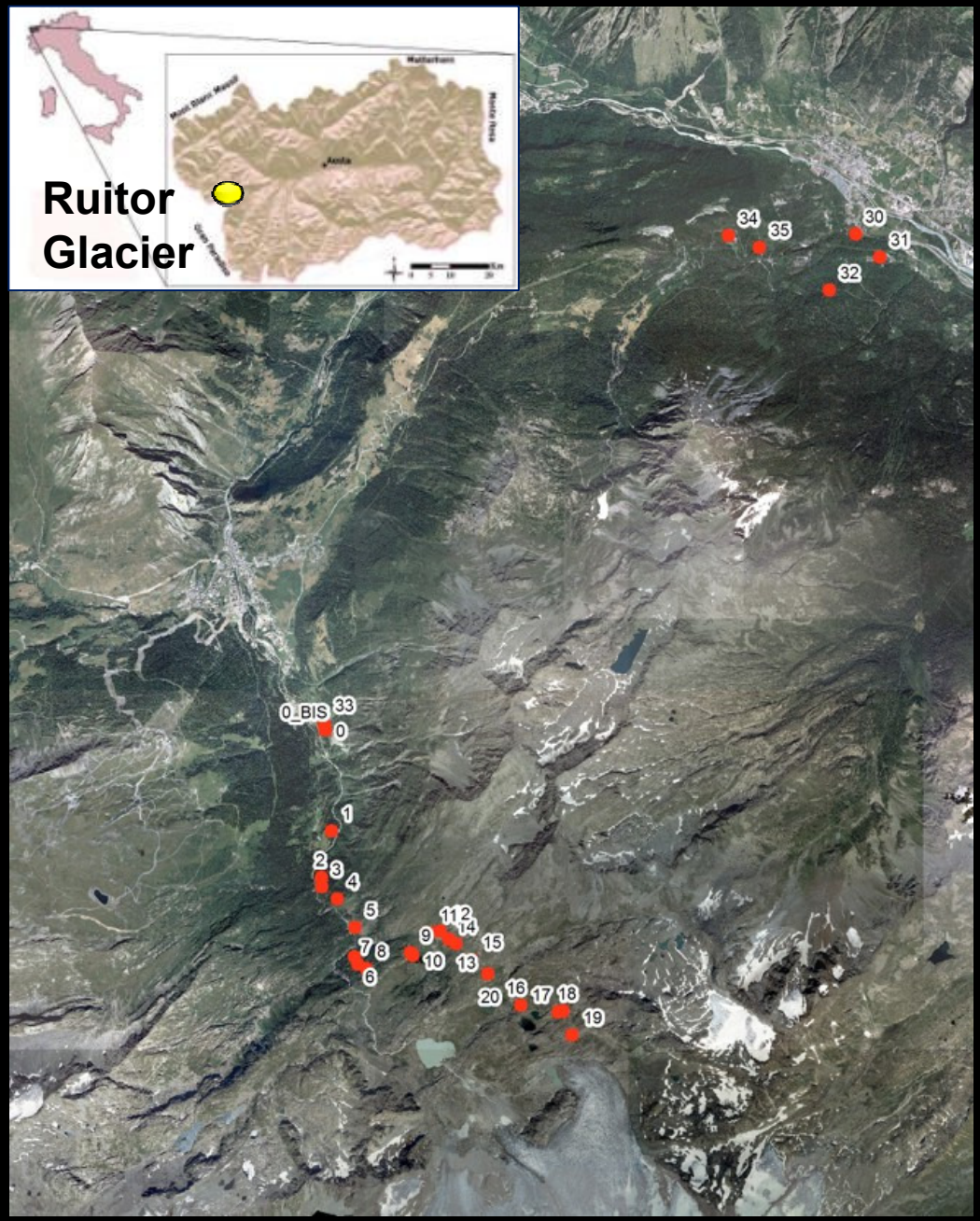
anomalie MWP - LIA

(iv) work in progress: ricostruzione delle T per gli ultimi 3mila anni al Lago Alimini

Successione pollinica con buon controllo cronologico e risoluzione di circa 100 anni. Mostra significative variazioni ambientali durante gli ultimi 3000 anni, dovute in parte ad attività antropica (per es. disboscamento e coltivazioni) e in parte a cambiamenti naturali (cf. aumento di chenopodiacee)



La messa a punto di un training set altitudinale locale nelle Alpi Occidentali



26 siti di campionamento
da 983 m slm (***sito n°30***)
a 2668 m slm (***sito n° 19***)

transetto altitudinale Valle di La Thuile

(Lab. Palinologia e Paleoecologia CNR-IDPA, lavoro in corso)