

# Climatic instability and drier phases in the central Mediterranean in the last thousands of years: lessons from the past to understand future changes

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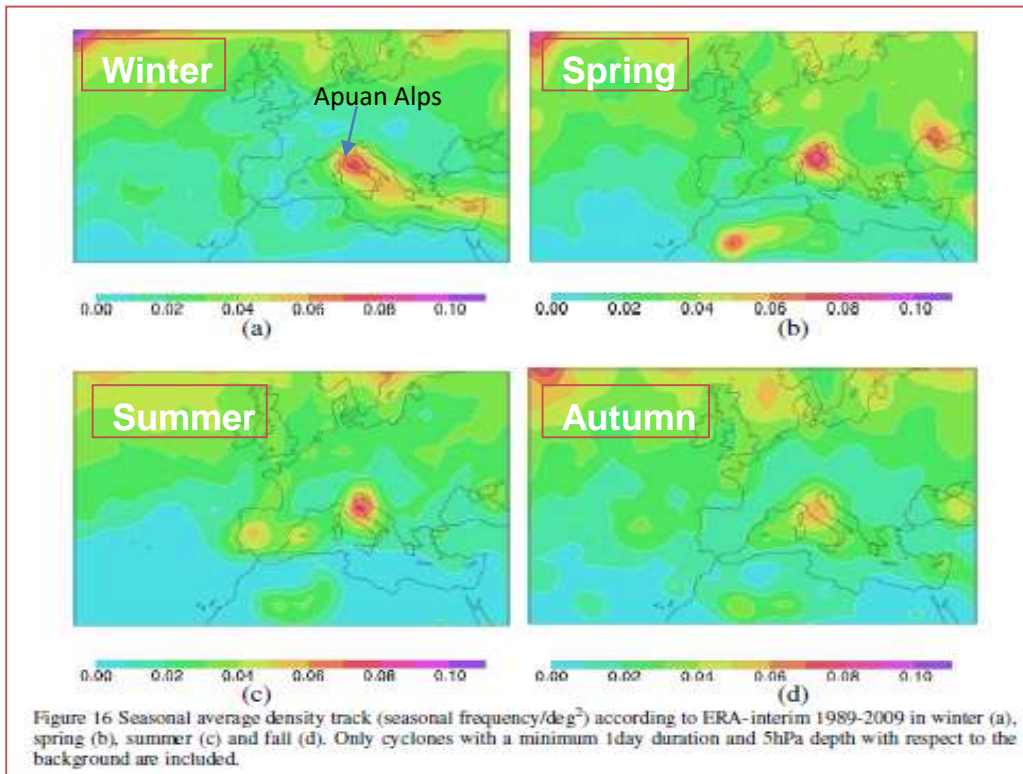
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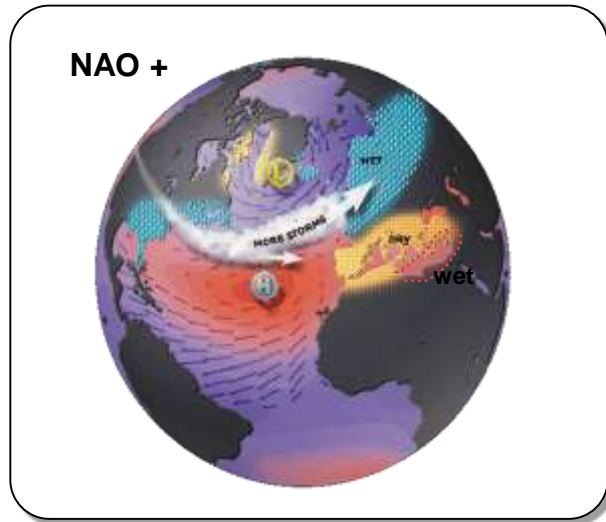
# LA CATENA APPENNINICA:

## IL SISTEMA DI RICARICA DELLE FALDE PIU' IMPORTANTE DEL MEDITERRANEO CENTRALE

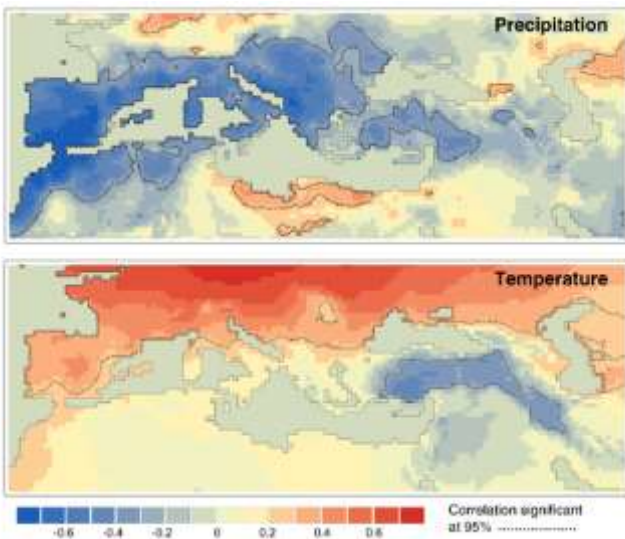


### SEASONAL AVERAGE DENSITY TRACK OF CYCLONES

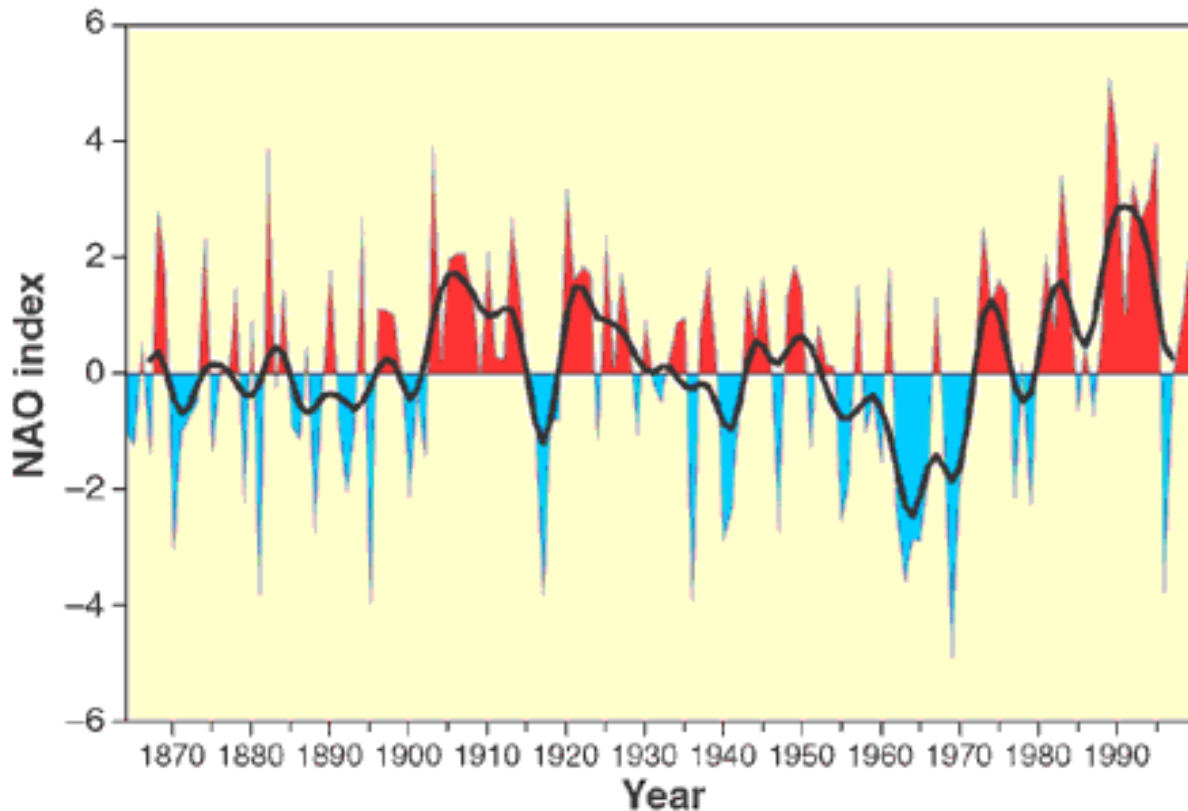
# NORTH ATLANTIC OSCILLATION (NAO)



In the Northern Hemisphere, the main circulation pattern is the *North Atlantic Oscillation (NAO)*, characterized by a north–south dipole structure with simultaneous atmospheric pressure anomalies between temperate and high latitudes in the North Atlantic region (Hurrell *et al.*, 2003). The NAO index is commonly calculated from the gradient in surface pressure between observatories located in Iceland and the area west of the Iberian Peninsula, including the Azores (Hurrell, 1995).



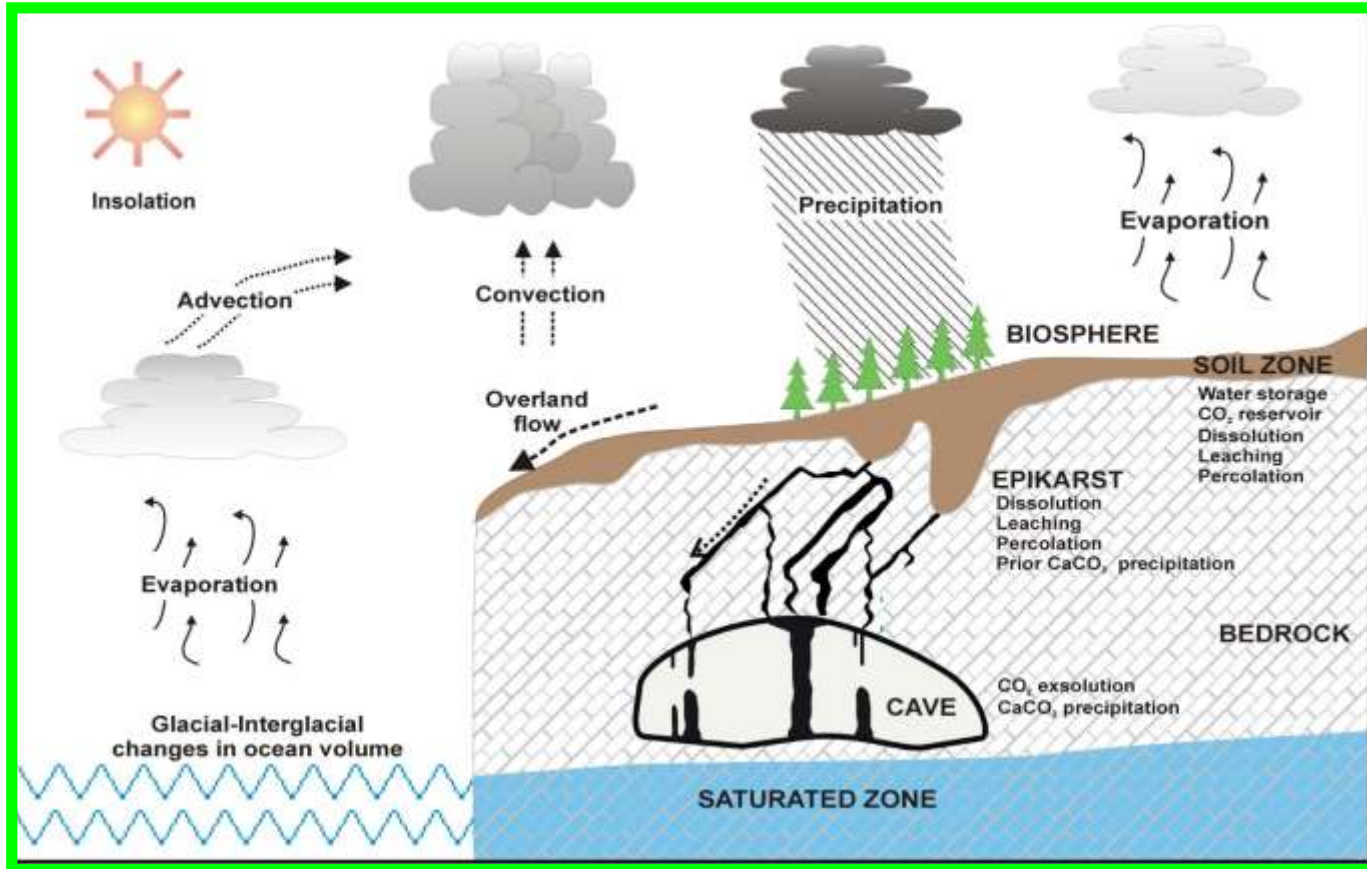
Observed Pearson’s correlation coefficients between the winter (DJFM) NAO and precipitation and temperature for the **period 1950–2005**. Dotted line delimits the sectors where correlation is significant at a 95% of confidence (after Lopez-Moreno *et al.*, 2011 GPC).



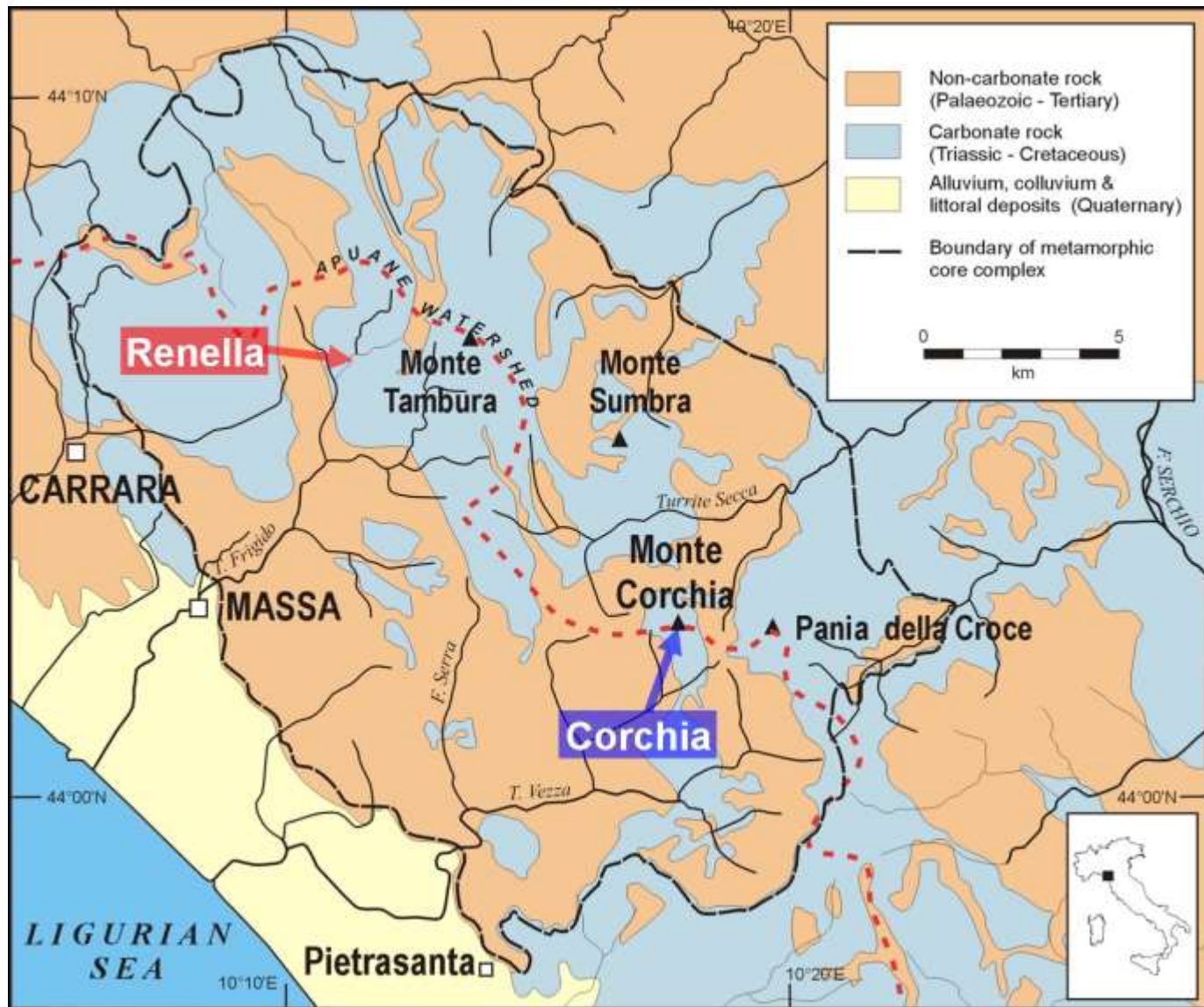
Winter (December to March) index of the NAO based on the difference of normalized pressures between Lisbon, Portugal, and Stykkishólmur/Reykjavik, Iceland from 1864 through 2000. The heavy solid line represents the meridional pressure gradient smoothed to remove fluctuations with periods less than 4 years.



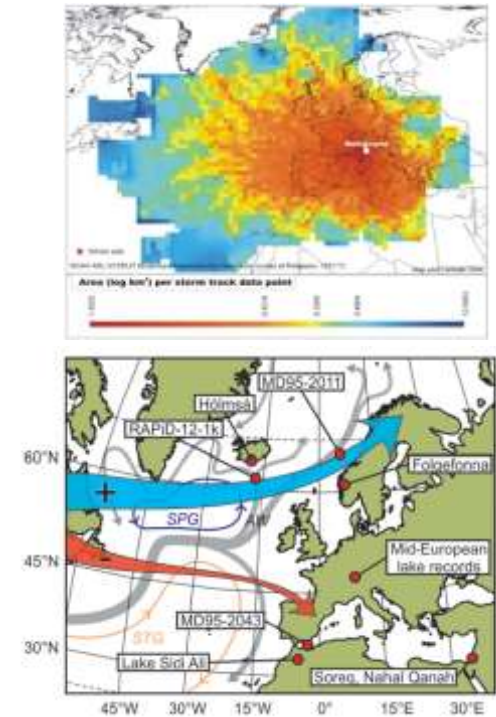
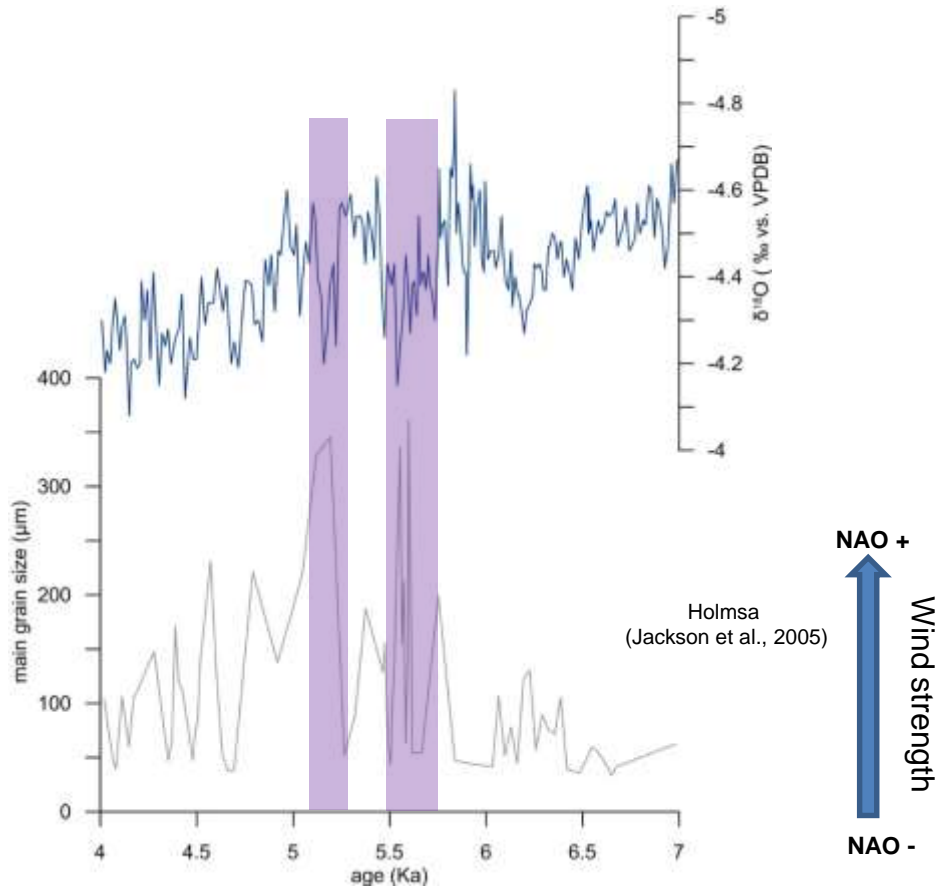
ave concretions (speleothems) are part of the hydrological cycle and then they c  
ententially suitable for collecting information on hydrological changes (and NAO coo



# APUAN ALPS CAVES: THE RECORDER OF THE GENOA CYCLOGENTIC CENTRE



Decadal-to-century scale periods of reduction in precipitation are recorded in the Apuan Alps speleothems indicating reduction in the activity of the cyclogenetic centre of Genoa Gulf associated to NAO positive conditions.

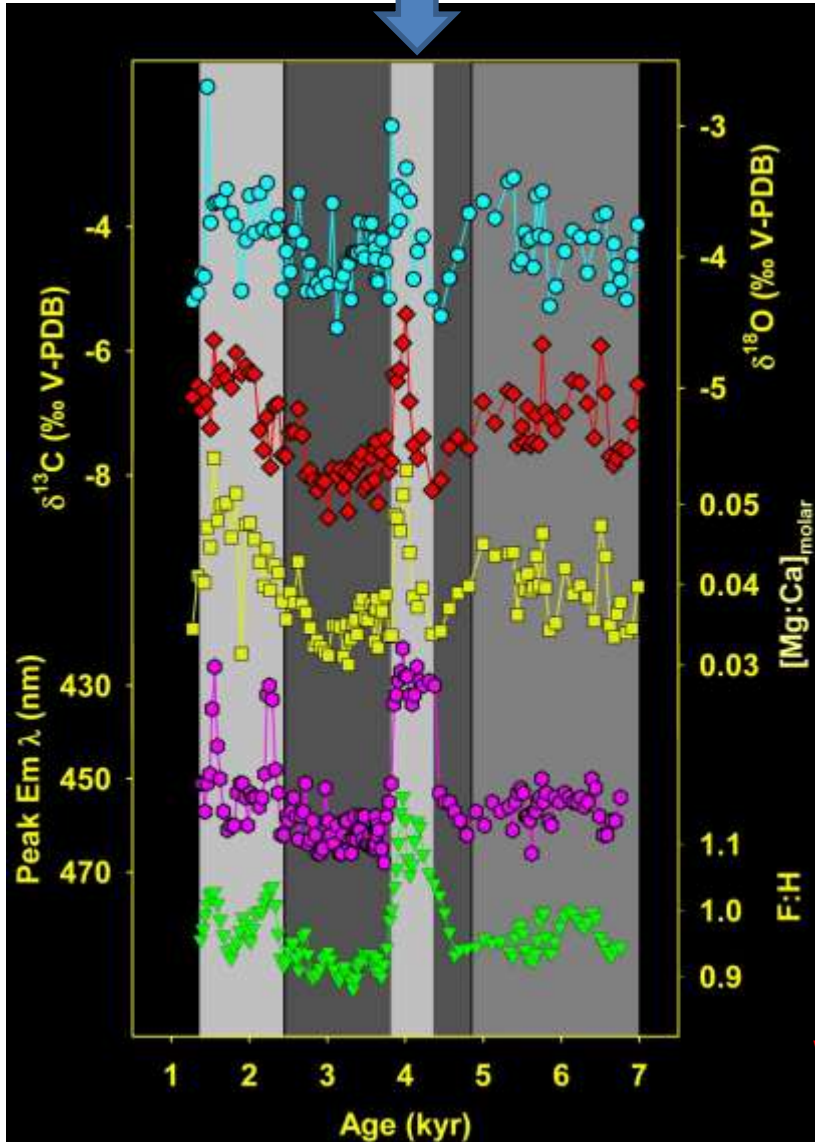


The general trajectory of the atmospheric westerlies is shown for an intensified (+) and weakened state (-) as associated with the positive and negative modes, respectively, of the North Atlantic Oscillation (Fletcher et al., 2013).



# RENELLA CAVE: a multicentennial dry event centred at 4.2 ka

4.2 event: Magadrought?

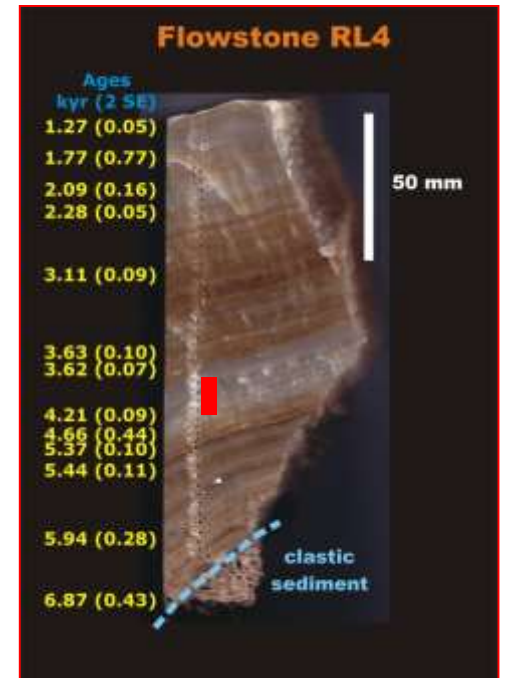


Drier



Recharge rate

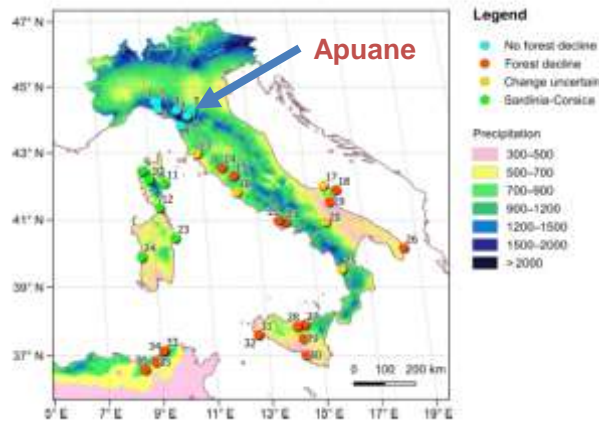
Wetter



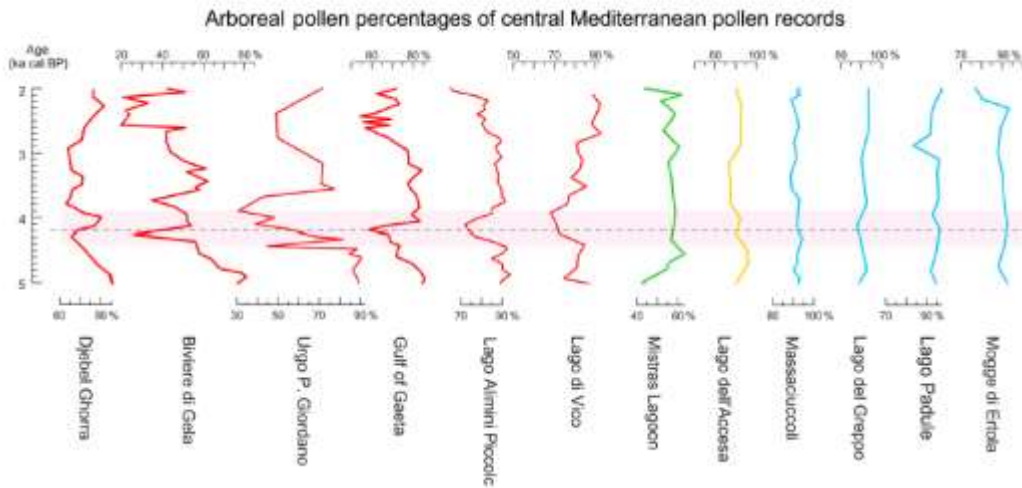
Drysdale et al., 2006, Geology



# IMPACT ON VEGETATION OF THE 4.2 EVENT



In the central and southern Italy pollen data indicate opening of the forest during the 4.2 event (drier conditions); whereas in the northern Apennine no particular changes seems to occurs. This exactly the major centre of cyclogenesis in the Mediterranean. So from this reconstruction we have a contraction but not a significant



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# CONCLUDING REMARKS

- Paleoclimatic data indicates that positive NAO condition may last (on average) for decadal to multicentennial periods.
- «Paleoproxy» indicate that there is an effective reduction in efficiency of the cyclogenesis in the Gulf of Genoa;
- However, for vegetation seems to have few effect on this sector of the Apennine, whereas drier condition with the opening of the forest are documented for most of peninsular Italy;
- Impact on long-lasting different NAO condition