

Reconstruct Past Climate

Data Source, Proxies

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Outline

- 1 Reconstruct Past Climate
- 2 Data Source
 - Documentary Data
 - Speleothem
- 3 Discussion

Parameter and Resolution

Parameter

- temperature
- precipitation
- wind
- ...

Resolution

- daily
- monthly
- seasonal
- annual

Data Source

- instrumental records (since 18 cent.)
- documentary data
 - descriptive
 - proxy
- speleothems
- tree rings
- corals
- boreholes
- vermetids
- ice cores
- sediments (lake, ocean, . . .)

Descriptive Documentary Data

Weather Observations

- reports from chronicles
- daily weather reports
- travel diaries
- ship logbooks

Example of a Ship Logbook

4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Fresh Wind from the N. ward with a large Swell. B.M. moderating got up Top Gall. Mast & Main Top Gall. & Mast																				
Saturday. 27.																				
Winds Variable at 1/2 past 4 A.M. Weather & got as high as the Pan Land, but falling little Wind Run back again for did the other Ships & Anchored in 7 F. Water with the Best Bower, the Buoy of the Pan Patch Land N.W. Dist. about 1/2 a Mile.																				
Sunday. 28.																				
Windy, Winds & small Rain. at 5 A.M. Weather & got as high as the Buoy of the Mouse got 1/2 past 11 Anchored with the Best Bower in 11 F. Water the Buoy of the Mouse N.W. Dist. at 1/2 Mile. At noon came on board 2 of his Majesty's Lieutenants to implore our Men which they refused & came to defend themselves. At 5 A.M. Weather & at 1/2 past 9 P.M. past the Conquistador at the Nose, was shot at by several Ships, but could not bring our Ship too, the People refusing to blow the Sails up or let go the Anchor; his Majesty's Frigate the Albemarle Cap. Nelson ship being shot at us one of which struck off the Chuck of the Main Mast another through the Main Course.																				
D M M. B.M. lying Barring & Tish.																				
Several eyes had, when the Officer came to let go the Top sail they found them right off at last with difficulty they the Chief & a Mast let go the Anchor all of a sudden the Ship being dead right on for the Shore & having fresh way when brought up found ourselves in 1/2 F. the Buoy of the Nose. Eld. came on board Cap. Nelson with 1000 Men which they all refused.																				

► Transcript

Parameter and Resolution

Resolution

- daily or more

Parameter

- Wind: force and direction
- General accounts of the weather
- After 1850 most ships provided instrumental data

Documentary Proxy Data

More indirect evidence that reflects weather events or climate conditions

- agricultural activities e. g. grape-harvest (Swiss German: Wümmet)
- time of freezing and opening up of waterways
- religious ceremonies
- tax e. g. tithe (German: der Zehnte)
- ...

Good dating control and high temporal resolution

Documentary Proxy Data



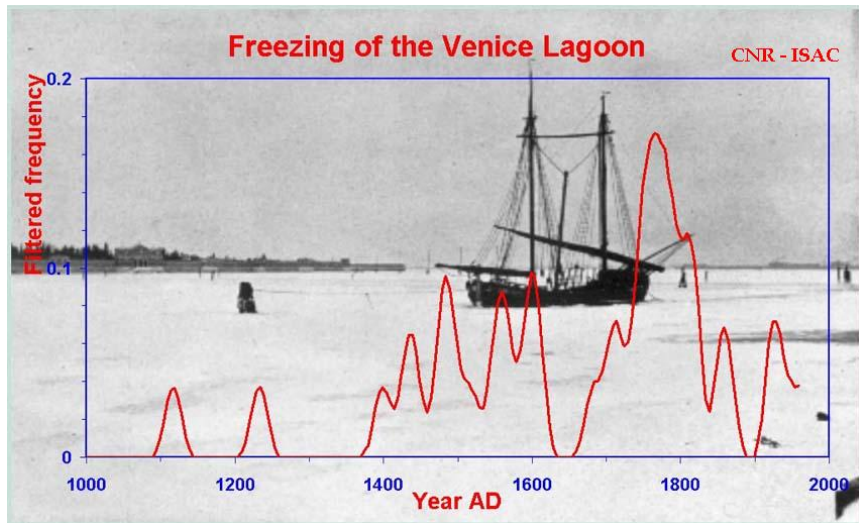
Documentary Proxy Data

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Good dating control and high temporal resolution

Speleothem

Secondary Cave Deposits such as

- stalactites
- stalagmites

Speleothem

From the Greek for "cave deposit".

German: Speläotheme (sekundäre Mineralablagerungen in Höhlen)

Stalactites and Stalagmites



Memory hook

English

Stalagmites grow from the **g**round, stalactites grow from the **ceiling**

German

Stalagmiten haben schon viel „mitgemacht“ sind daher „müde“ und deswegen am Boden, während Stalaktiten **t**ropfen und an der Decke hängen.

Children: Die Stalaktiten kommen von der „**T**“ecke, und die Stalag**m**iten wachsen **mit** dir mit.

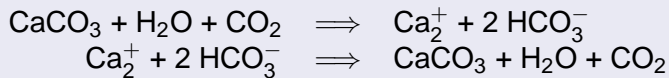
Adult: Die Mi(e)ten steigen und die (Stalak)tit(t)en hängen.

French

La Stalag**m**ite **m**onte, la stalag**t**ite **t**ombe

Development of Speleothems

Reaction



Parameter

Example: Stalagmite Q5 from a Oman Cave (Fleitmann et. al., 2003)

Age

- Thorium-Uran (Th-U)
- 18 measurements

Precipitation

- $\delta^{18}\text{O}$
- more negativ $\delta^{18}\text{O} \rightarrow$ more precipitation

► Location of Oman

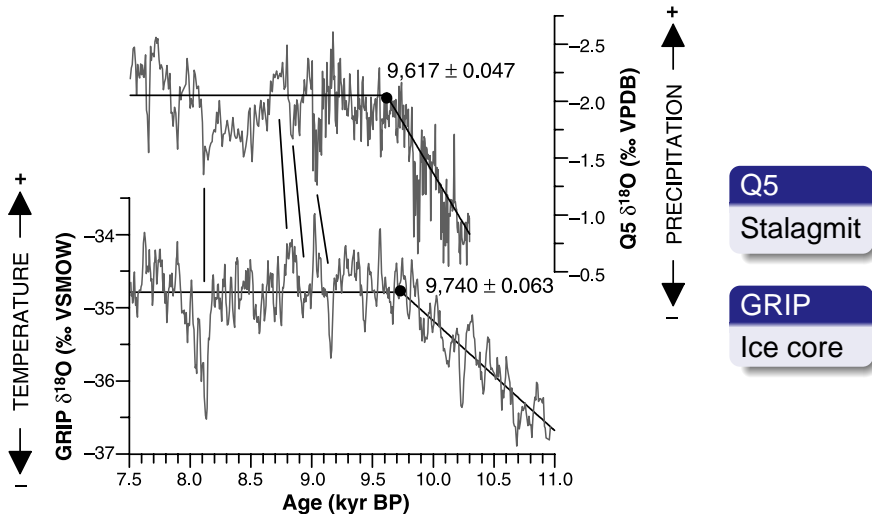
Resolution

Percipitation

- 1405 $\delta^{18}\text{O}$ measurements every ≈ 0.7 mm
- 10.3 to 2.7 ky B. P.^a and 1.4 to 0.4 ky B. P. Total 8.6 ky
- Resolution ≈ 6 year

^a"present" is defined as 1950 A. D. on the ^{14}C absolute age scale

Comparison of $\delta^{18}\text{O}$ Record



Discussion

- What proxy do you like best
- Why
- Different proxies and their pros and cons
- Parameters in ship logbooks
- $\delta^{18}\text{O}$

List of figures I



Wümmet

<http://images.gadmin.ch/5145/8331/picbase/1168.jpg>



Freezing of the Venice Lagoon

<http://clima.ictr.pd.cnr.it/immagini/freezing.jpg>



Ship logbook

<http://www.bl.uk/learning/images/texts/ship/Oct-28th-81--lg.jpg>



Cave with Stalactites and Stalagmites

http://www.ici.ro/romania/images/turism/mc_dambo3.jpg

List of figures II



Location of Oman

Google Earth



Frequency of flooding tides at Venice

[http://clima.ictr.pd.cnr.it/immagini/
acqualta.jpg](http://clima.ictr.pd.cnr.it/immagini/acqualta.jpg)



Drill to take samples for dendrochronology from trees

[http://en.wikipedia.org/wiki/Image:
Dendrochronological_drill_hg.jpg](http://en.wikipedia.org/wiki/Image:Dendrochronological_drill_hg.jpg)

Bibliography



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Developments in Earth & Environmental Sciences,
4:27–148, 2006.



D. Fleitmann et. al.

Holocene Forcing of the Indian Monsoon Recorded in a Stalagmite from Southern Oman.

Science, 300:1737–1739, 2003.

Transcript of the logbook

The Halsewell Logbook, 28th October, 1781

Fresh Winds form the Northward with a large swell. PM moderating got up Top gallant Mast and Main Top Gallant Yard

Saturday 27

Winds variable at 12 past 4 AM Weighed and got as high as the Pan Sand, but falling little Wind Run back again as did the other Ships Anchor in 7F Walter with the Best Bower, the Buoy of the Pan Patch Sand NNE Distance about 1/2 a Mile

Sunday 28

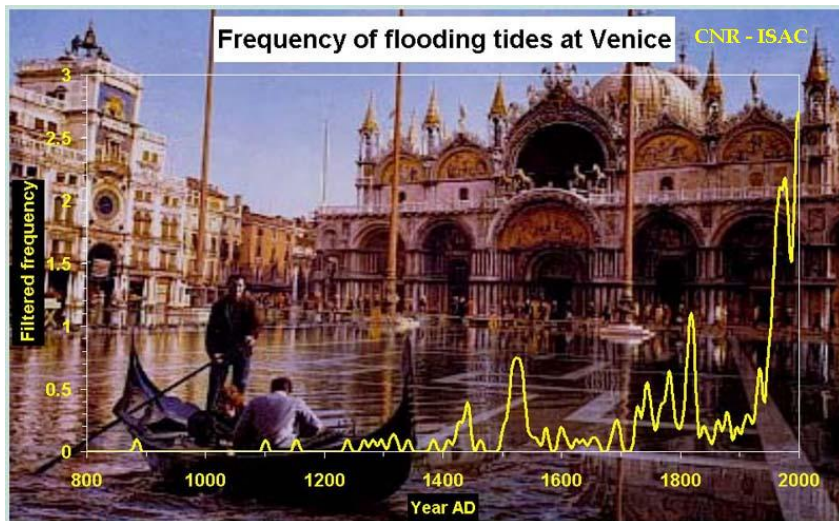
Northerly winds and small Rain at 5 AM Weighed & got as high as the Buoy...

Oman



◀ Parameter, Stalagmite Q5

Frequency of flooding tides at Venice



◀ Documentary Proxy Data

Tree Rings

Drill to take samples for dendrochronology from trees



◀ Data Source