Stalagmites from Northern Turkey: Potential Climate Proxies for the Last Three Millennia

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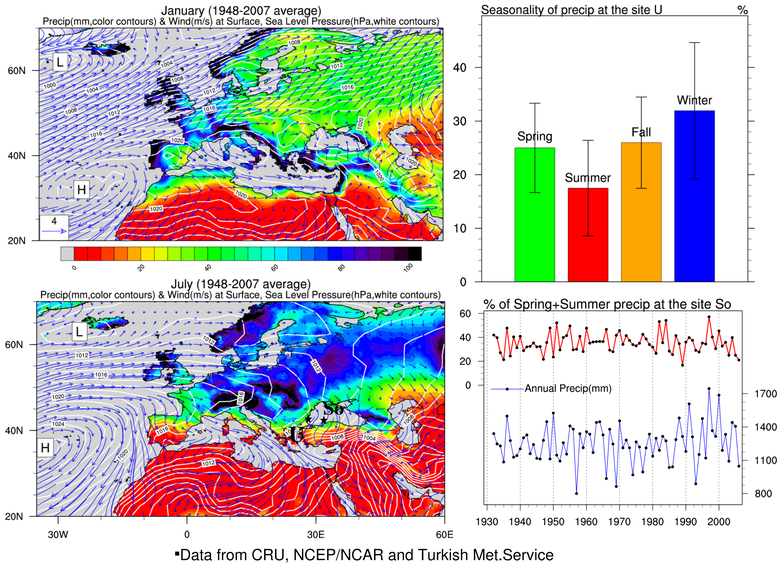
MOTIVATION and STUDY SITES

- ✗ **Turkey**: Influenced by / exhibiting a variety of climate patterns
- ✗ **Very few** climate proxy data available
- ✗ **Highly sensitive** to global warming (IPCC, 2007)
- ✗ **Peculiar location** also in the historical context
- ✓ and..... hosting **thousands of caves with stalagmites!**



▪Data from CRU, NCEP/NCAR and Turkish Met.Service

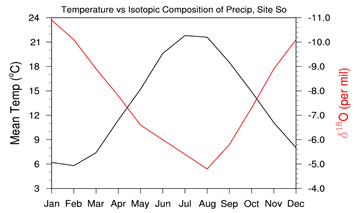
➔ ***Black Sea region***: Ample precipitation, only slightly seasonal
➔ **Moisture sources:** Mediterranean, Black Sea, Atlantic!
➔ Year round **high humidity, low evaporation**
✓ *Assumption:* Relatively uniform stalagmite growth?
✗ *Challenge:* Complex climatic control on stable isotopes

METHODS and AIM

- Age dating: Uranium-Thorium
- Stable isotopes of Oxygen and Carbon
- Trace elements (Mg, Sr, Ba, U etc.)

➔ **Transfer functions** between these proxies and local or large scale climatic variables?

PROXY QUALITY

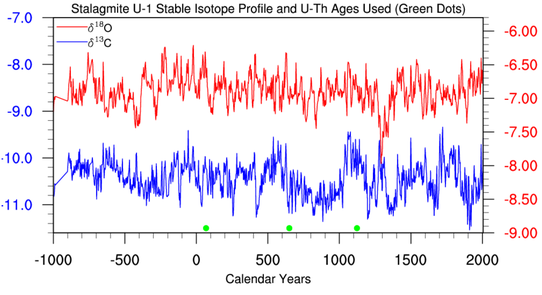


▪Data from GNIP and Turkish Met.Service

✓**δ¹⁸O relates to climate via:**
◆**Temperature,** hence, the time of the year rain falls (see figure to the left).
◆**Amount of the rain falling in a single event.** Rain more intense: lighter Oxygen isotopes.

✓ **δ¹³C relates to climate via:**
◆**Rainfall,** as this effects soil productivity and vegetation density. More rainfall: lighter Carbon isotopes.
◆**Temperature,** as this also effects soil and vegetation. (Fairchild et al. 2006)

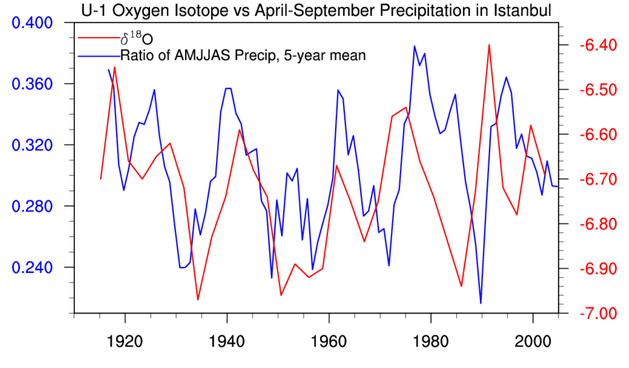
(PRELIMINARY) RESULTS, U-1



➢**Stalagmite U-1**
➢**1580 samples** measured

➢**24 U-Th ages** obtained, age model constructed using highest quality ones, resulting in a **temporal resolution of 2-3 years**

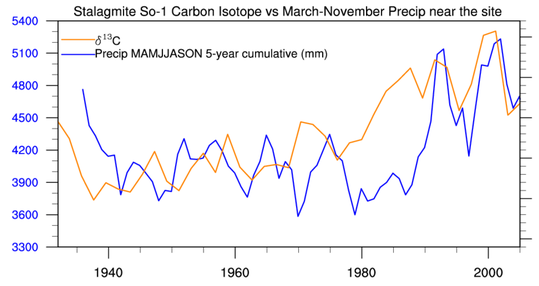
➢Oxygen and Carbon Isotopes seem to be **in the range of natural variability**



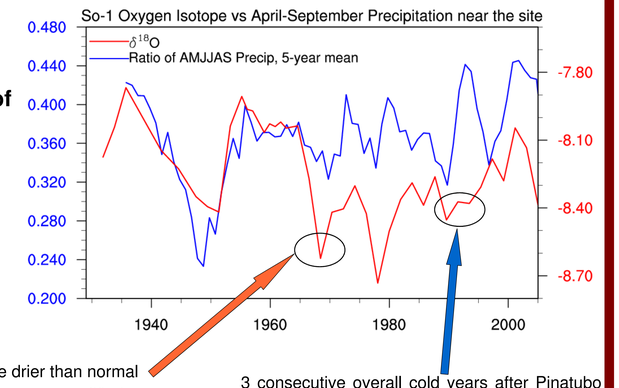
✓ **Striking correlation!**

δ¹⁸O potentially very powerful proxy for the seasonality in rainfall...

(PRELIMINARY) RESULTS, So-1



✓ **Clear increasing trend of lighter Carbon isotope in association with increasing precipitation...**



✗ **Some relation of δ¹⁸O with seasonality, blurred by other, possibly climatic factors**

3 consecutive drier than normal summers, response amplified

3 consecutive overall cold years after Pinatubo eruption in 1991, response damped

OUTLOOK

- ➢ **Project ongoing!**
- ➢ **Higher resolution stable isotope profiles** to be obtained
- ➢ **More precise dating using ¹⁴C** to be performed
- ➢ **Cave monitoring** to be started
- ➢ **Stalagmites from other regions of Turkey** to be collected

References

▪Fairchild IJ, et al. (2006). Modification and preservation of environmental signals in speleothems. *Earth-Science Reviews* **75**, 105-153.
▪Intergovernmental Panel On Climate Change fourth assessment report on scientific aspects of climate change for researchers, students, and policymakers (2007).