

I S 2k

A community-sourced global database
of paleo-water isotopes from the past two millennia

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Jud Partin, U. Texas at Austin

The challenges of synthesizing hydroclimate proxy records...

“Precipitation is so localized!”

“Hydro proxies are so complicated!”

And the usual suspects:

- low-res & hi-res records
- age model uncertainties
- seasonal biases
- etc. etc.

...are the origins of Iso2k

The Iso2k strategy:

“Precipitation is so localized!”  Use proxies for regional patterns

“Hydro proxies are so complicated!”

And the usual suspects:

- low-res & hi-res records
- age model uncertainties
- seasonal biases
- etc. etc.

 Own it
Document it

Many proxy archives record $\delta^{18}\text{O}$ and δD of environmental waters



K. Cobb (Georgia Tech)



NOAA-NCDC



USGS



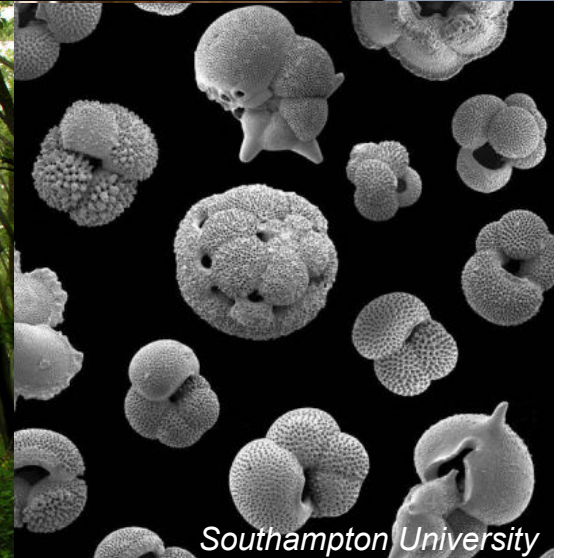
U. Maine



U. Missouri

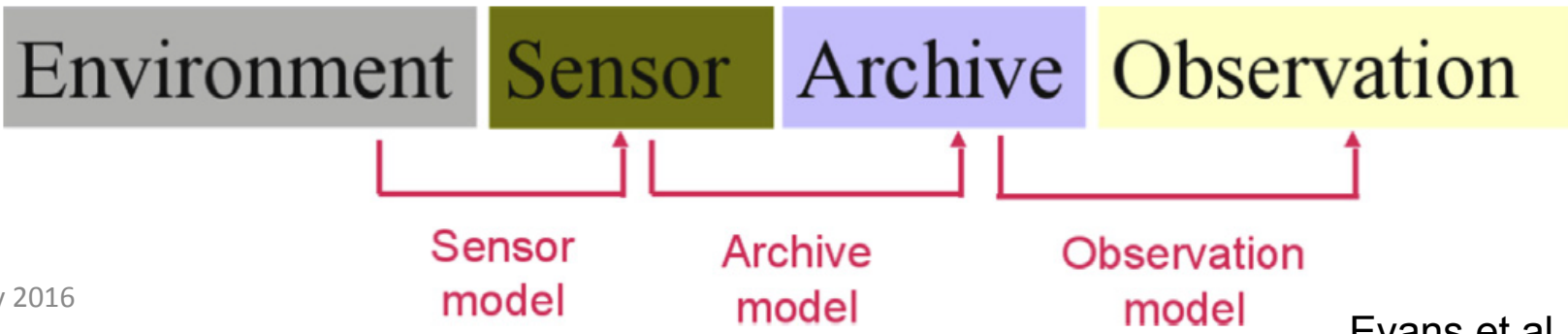
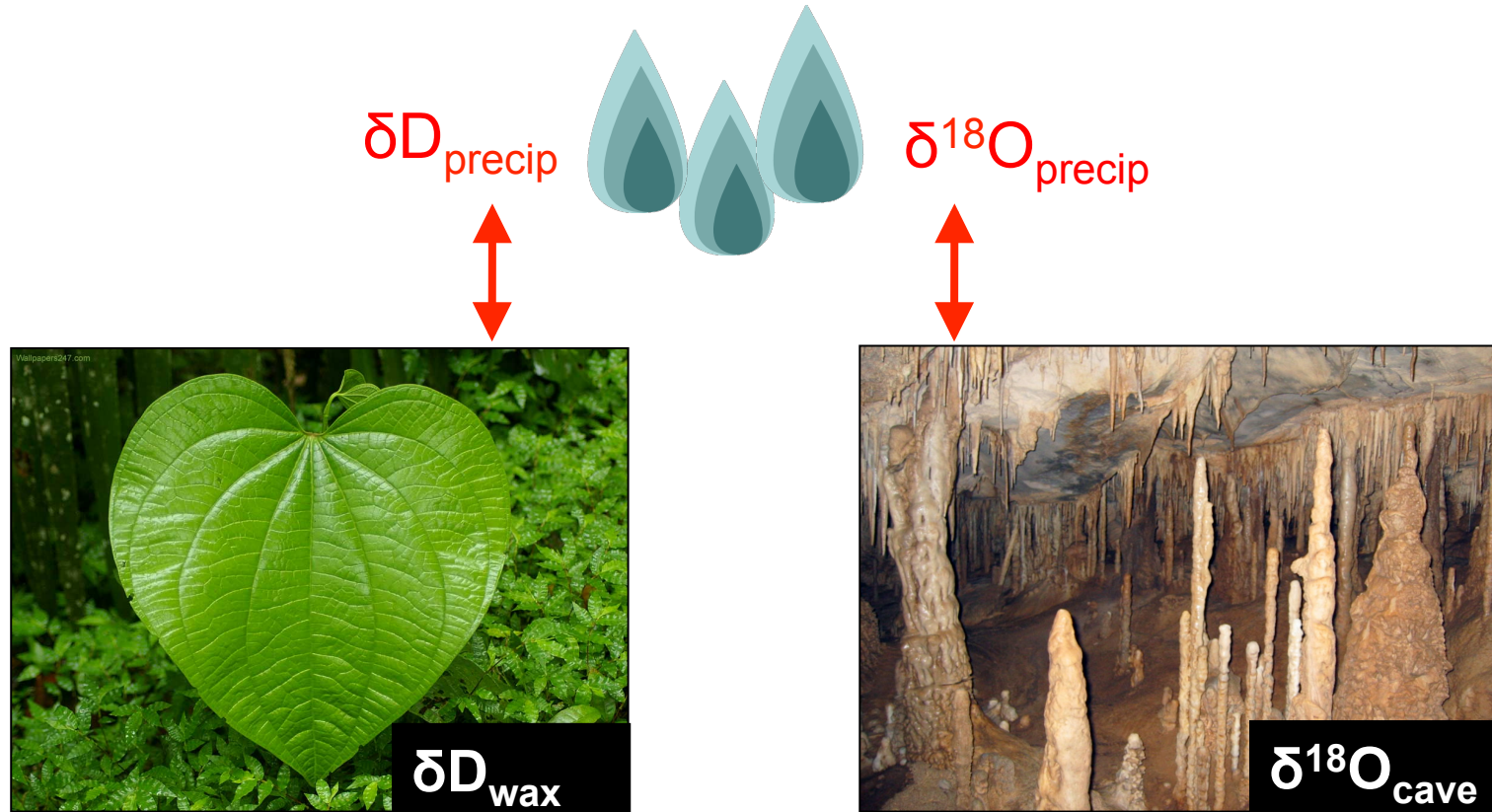


WWF

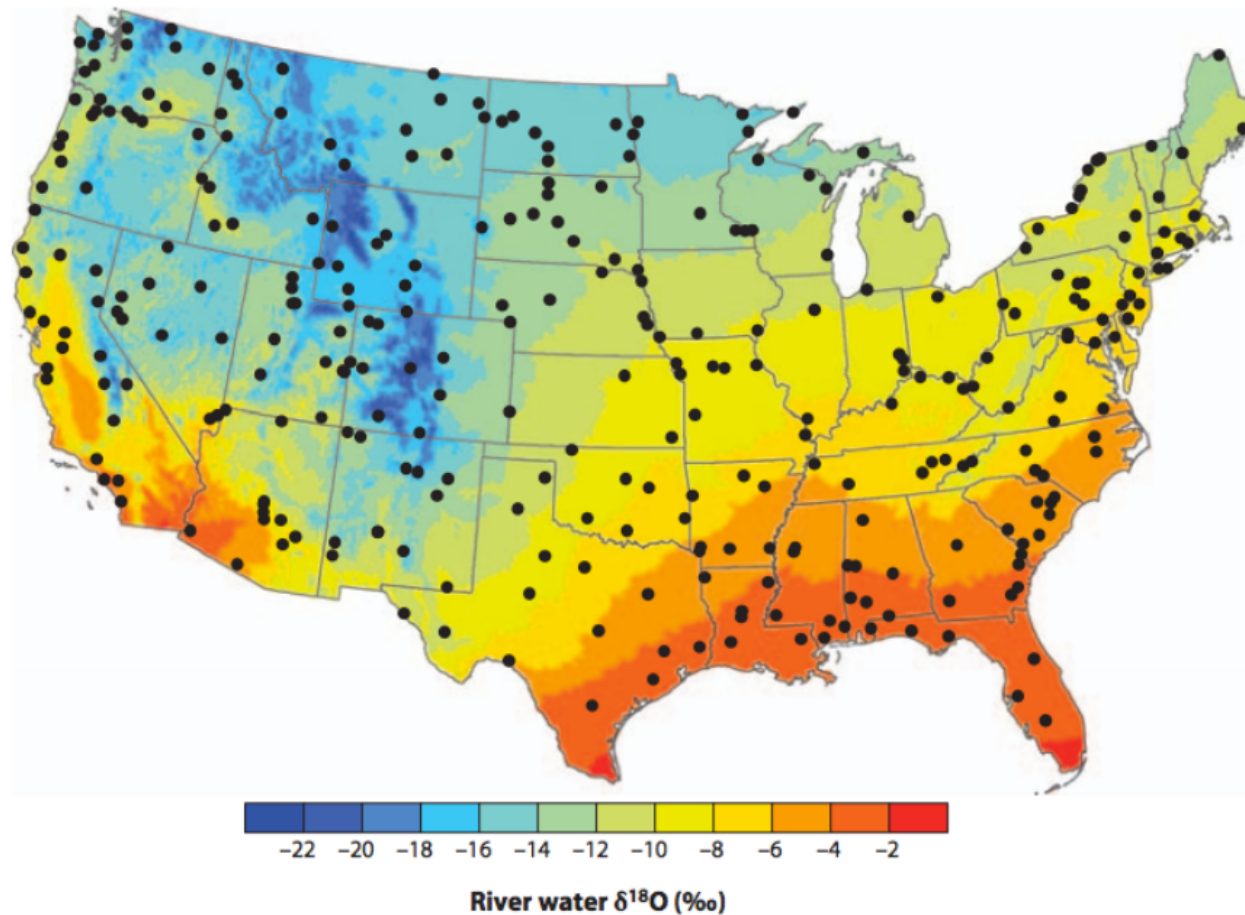


Southampton University

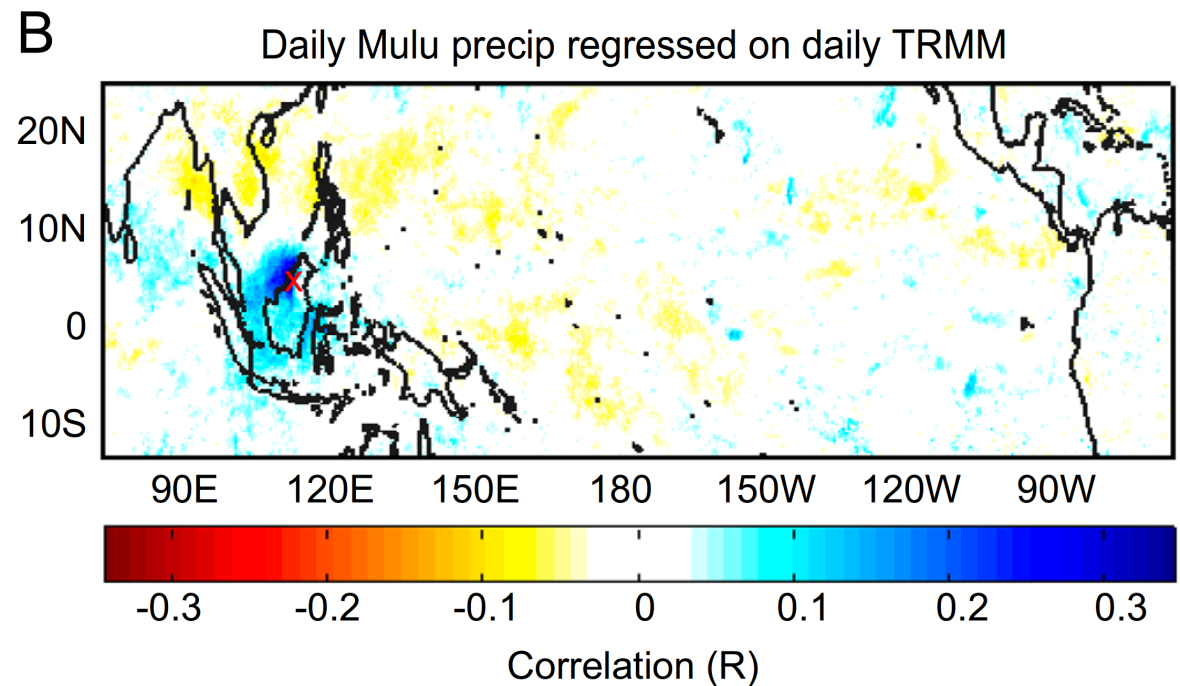
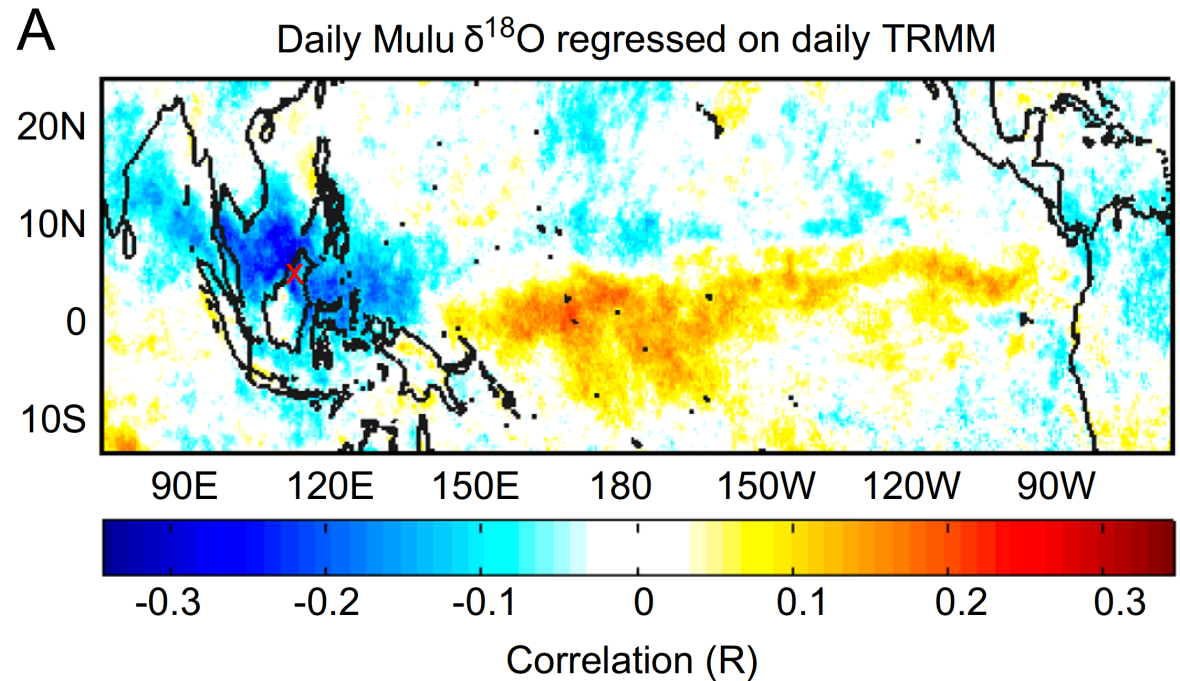
These archives often record a **common signal**



The $\delta^{18}\text{O}$ and δD of environmental waters (precip, vapor, groundwater, surface water, seawater, etc.) track **regional circulation**



Example of $\delta^{18}\text{O}$ and δD tracking regional circulation



Team of archive experts

Co-Leader	Bronwen Konecky (U. Colorado/Oregon State U., USA)
Co-Leader	Jud Partin (U. Texas-Austin, USA)
Data Management	Nick McKay (Northern Arizona U., USA)
Corals	Diane Thompson (NCAR, USA)
Fossil Groundwaters	Kei Yoshimura (U. Tokyo, Japan)
Ice Cores	Valérie Masson-Delmotte (IPSL/LSCE, France)
Lake Sed - Biomarker	Elizabeth Thomas (U. Buffalo/U. Massachusetts, USA)
Lake Sed - Macro	Darrell Kaufman (Northern Arizona U., USA)
Marine Sed - Biomarker	Guillaume Leduc (CEREGE, France)
Marine Sed - Nonorg	Lukas Jonkers (Bremen Univ., Germany)
Speleothems	Jud Partin (U. Texas-Austin, USA)
Tree Ring Cellulose	Shreyas Managave (Pondicherry U., India, and Brown U., USA)

We designed every aspect of this project together— open and transparent

Iso2k Project Members

Bronwen Konecky, Jud Partin, Michael Evans, Shreyas Mangave, Kei Yoshimura, Valerie Masson-Delmotte, Nick McKay, Darrell S Kaufman, Diane Thompson, Lucien von Gunten, Elizabeth Thomas, William D'Andrea, Dmitry Divine, Belen Martret, Guillaume Ledus, Julien Emile Coey, Grzegorz Skrzypek, Helen McGregor, Manahan, Churakova Olga, n Sayani, Timothe Bolliet, ng, Christian Holme, stubh Thirumalai and n



Key Science Question

- Do regional/global hydroclimate patterns exhibit coherent responses to decadal- to centennial-scale temperature changes (from PAGES2K Temperature reconstructions) over the past 2 kyr?

Other Key Topics

- Iso2k patterns & relationship with temperature
- Tropical water cycle
- Dominant controls on terrestrial $\delta^{18}\text{O}/\delta\text{D}$ worldwide
- Dominant controls on marine $\delta^{18}\text{O}$
- Climate response to North Atlantic ocean circulation
- Isotopic data assimilation
- Climate response to North Pacific ocean circulation
- Pre-industrial to industrial climate transition
- Isotopic response to volcanic eruptions
- Lake water isotopes and climate model comparison
- $\delta^{18}\text{O}$ in tree-rings
- Pacific coral $\delta^{18}\text{O}$ records

Data selection criteria for Iso2k (designed to be inclusive)

	Annually banded		Non-annually-banded	
	<u>Terrestrial</u>	<u>Marine</u>	<u>Terrestrial</u>	<u>Marine</u>
Min record duration	30 yr	30 yr	200 yr	200 yr
Min resolution			at least 5 data points/2kyr	at least 5 data points/2kyr

We are a METADATA RICH project

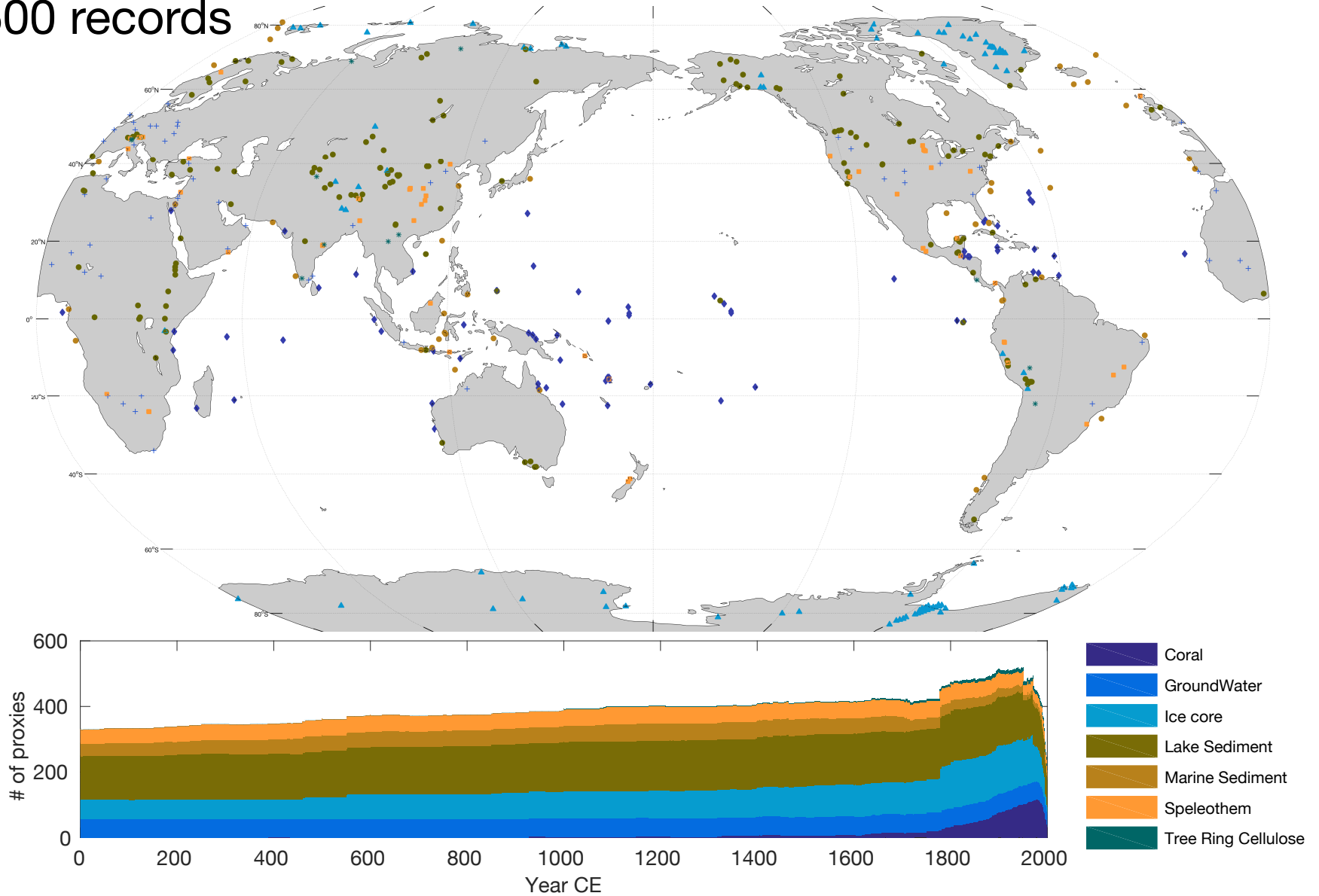
	A	B
1	metadata about isotope timeseries	Description
2	parameter	what is this thing
3	parameterType	is this a measured or inferred parameter
4	description	human-readable description of the parameter
5	units	units
6	standard	standard used for measurement
7	instrument	what instrument was this measured on
8	measuredMaterial	what type of material was measured
9	materialScreening	was the material evaluated for diagenesis/alteration
10	samplingMethod	what method was used to sample the material?
11	reproducibility	reproducibility of measurements
12	analyticalUncertainty	analytical precision (reproducibility of a standard on specific instrument)
13	isotopeInterpretation.inferredMaterial	d18O or dD of what material is inferred?
14	isotopeInterpretation.equilibriumEvidence	evidence for equilibrium conditions during formation
15	isotopeInterpretation.integrationTime	over how much time does the sample integrate isotopic values (e.g., karst or lake resident), often different than and potentially longer than sample duration on age model
16	isotopeInterpretation.integrationTimeUnit	unit of time (months or years)
17	isotopeInterpretation.integrationTimeUncertainty	uncertainty of integration time (in yrs)
18	isotopeInterpretation.integrationTimeUncertaintyType	type of uncertainty
19	isotopeInterpretation.integrationTimeBasis	basis for knowing integration time and uncertainty
20	isotopeInterpretation.independentParameter1.name	what is this parameter that controls isotopic variability?
21	isotopeInterpretation.independentParameter1.rank	rank the parameter in order of importance to controlling the isotopic variability (1 explains the most)
22	isotopeInterpretation.independentParameter1.fraction	If a proportion of variance explained by the parameter can be estimated, put that here
23	isotopeInterpretation.independentParameter1.coefficient	if this is part of an equation with known coefficients, put the coefficient here
24	isotopeInterpretation.independentParameter1.seasonality	during what season does the interpretation apply
25	isotopeInterpretation.independentParameter1.direction	does the isotopic value increase (positive) or decrease (negative) with increases in the interpreted parameter
26	isotopeInterpretation.independentParameter1.mathematicalRelation	linear or nonlinear
27	isotopeInterpretation.independentParameter1.basis	the basis for this interpretation. Quotes from the paper, or references to a paper work well for this.
28	isotopeInterpretation.independentParameter2....	And so on for additional Parameters

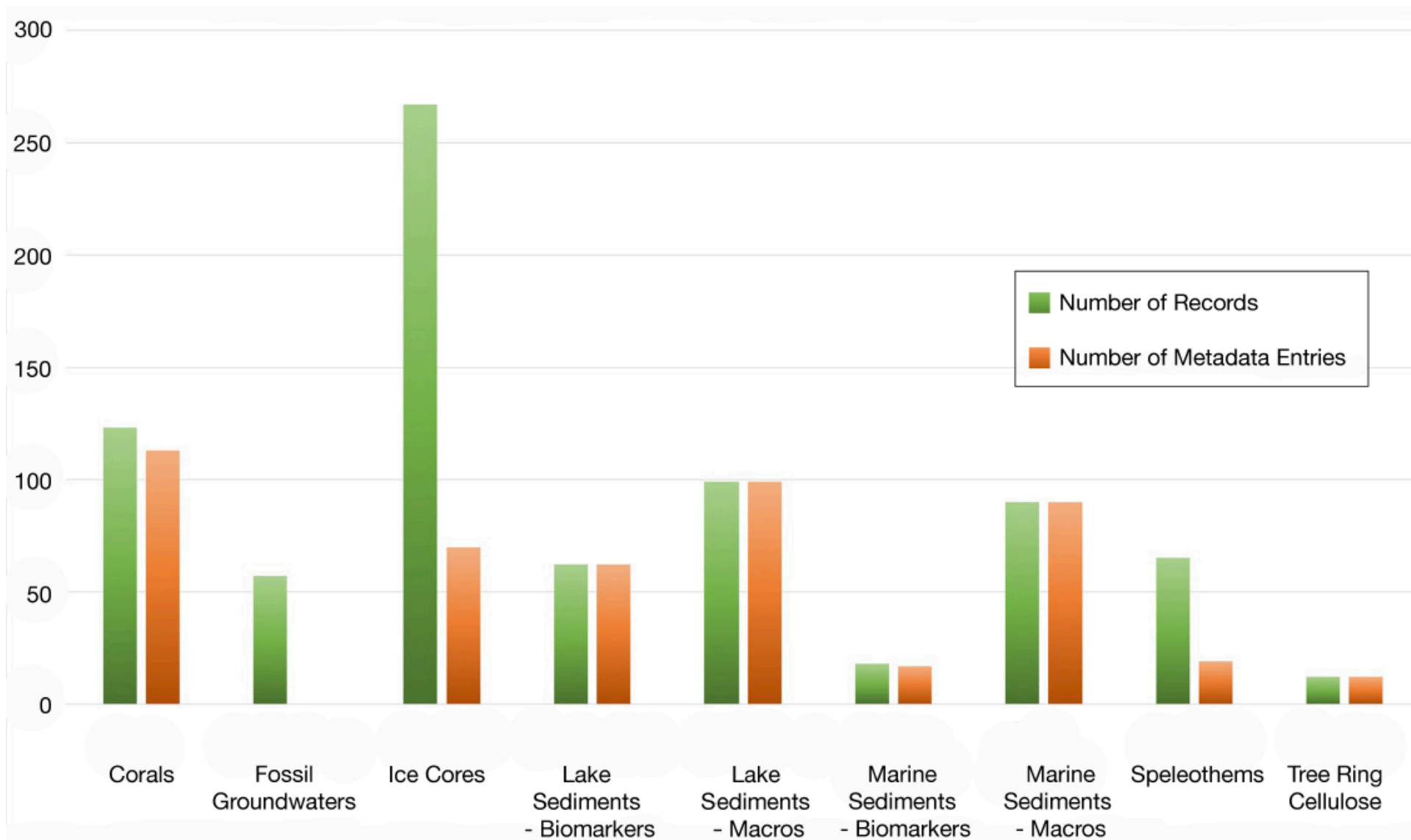
We are a METADATA RICH project

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28	isotopeInterpretation.independentParameter2....	And so on for additional Parameters
29	climateInterpretation.parameter	what climate parameter is this interpreted to record
30	climateInterpretation.parameterDetail	answers the question "of what?"
31	climateInterpretation.seasonality	during what season does the interpretation apply
32	climateInterpretation.interpDirection	does the parameter increase (positive) or decrease (negative) with increases in the interpreted climate parameter
33	climateInterpretation.basis	the basis for this interpretation. Quotes from the paper works well for this.
34	calibration.equation	if this is an inferred parameter, there's probably some calibration equation, report it here
35	calibration.DOI	is there a reference associated with this calibration?
36	calibration.uncertainty	is there a constant uncertainty for this calibration?
37	calibration.uncertaintyType	how was that uncertainty derived?
38	proxySystemModel.sensorModel	the equation or reference to the sensor model to be used for this parameter
39	proxySystemModel.archiveModel	the equation or reference to the archive model to be used for this parameter
40	proxySystemModel.observationModel	the equation or reference to the observation model to be used for this parameter
41	modernSystem.instrumentalDatasetURL	where can I find this dataset
42	modernSystem.instrumentalDatasetCoordinates	where in the world is this dataset
43	modernSystem.description	description of the modern system in terms of how it influences the interpretation
44		
45		
46		
47	external reproducibility/precision/heterogeneity? e.g. an aliquot or a different core sample	<-- notes of how this was done
48	address multiple levels of uncertainty with coral records-- "total uncertainty"?	

The Iso2k database v.0 as of 12/2015
(v.1 expected ~end of summer 2016)

~600 records





We continue to welcome help from the community. If you want to help, please contact:

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Jud Partin (jpartin@ig.utexas.edu)