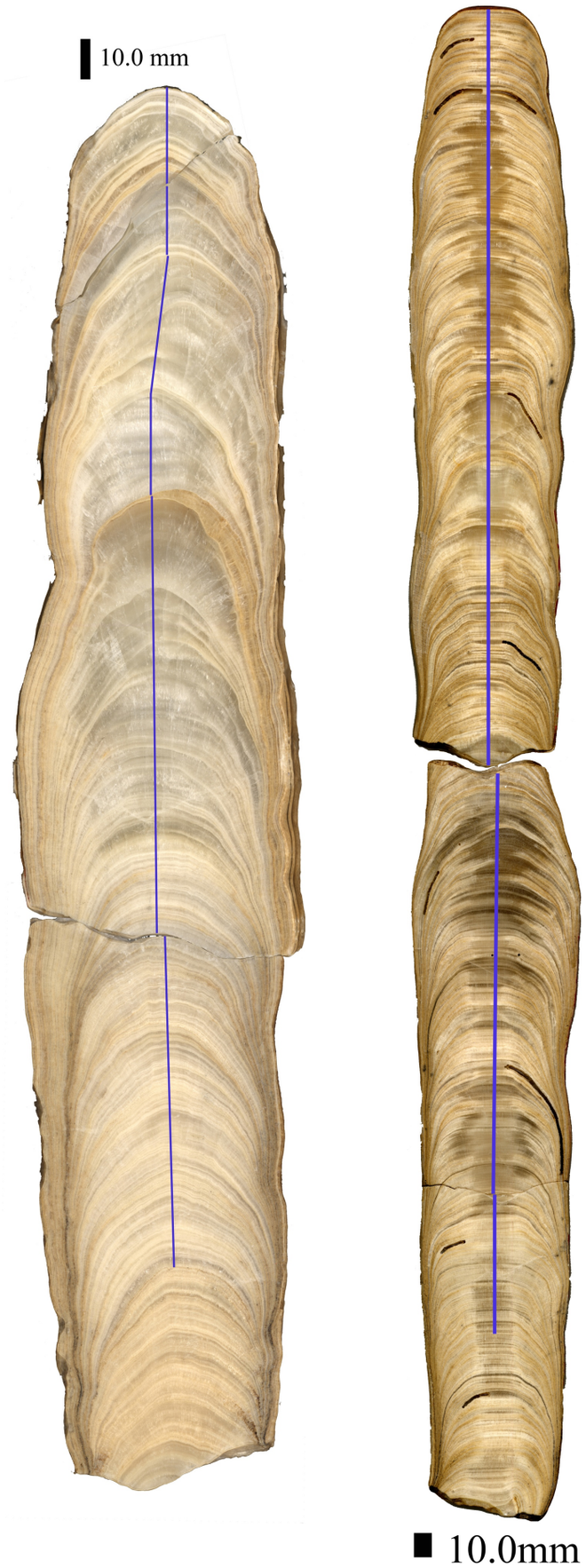
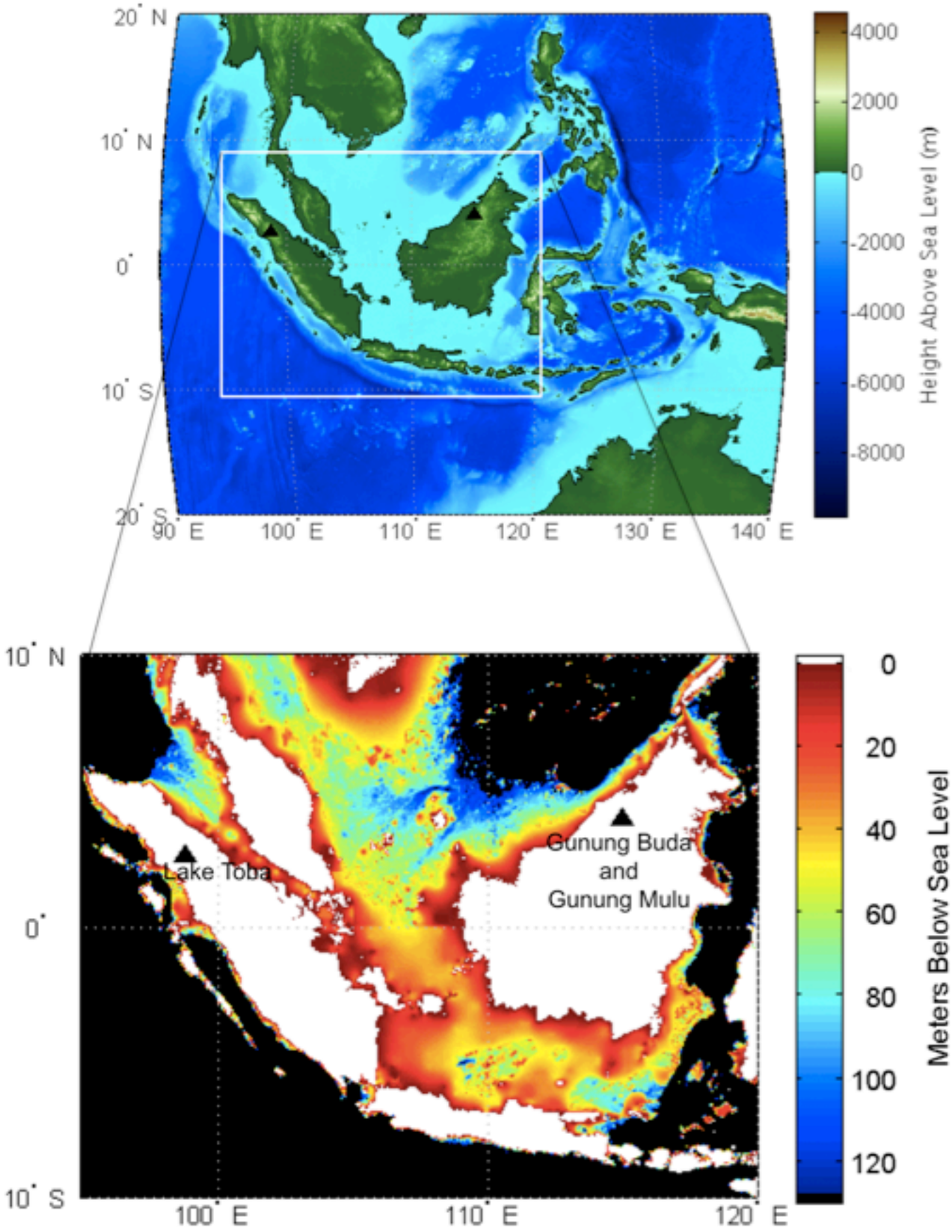


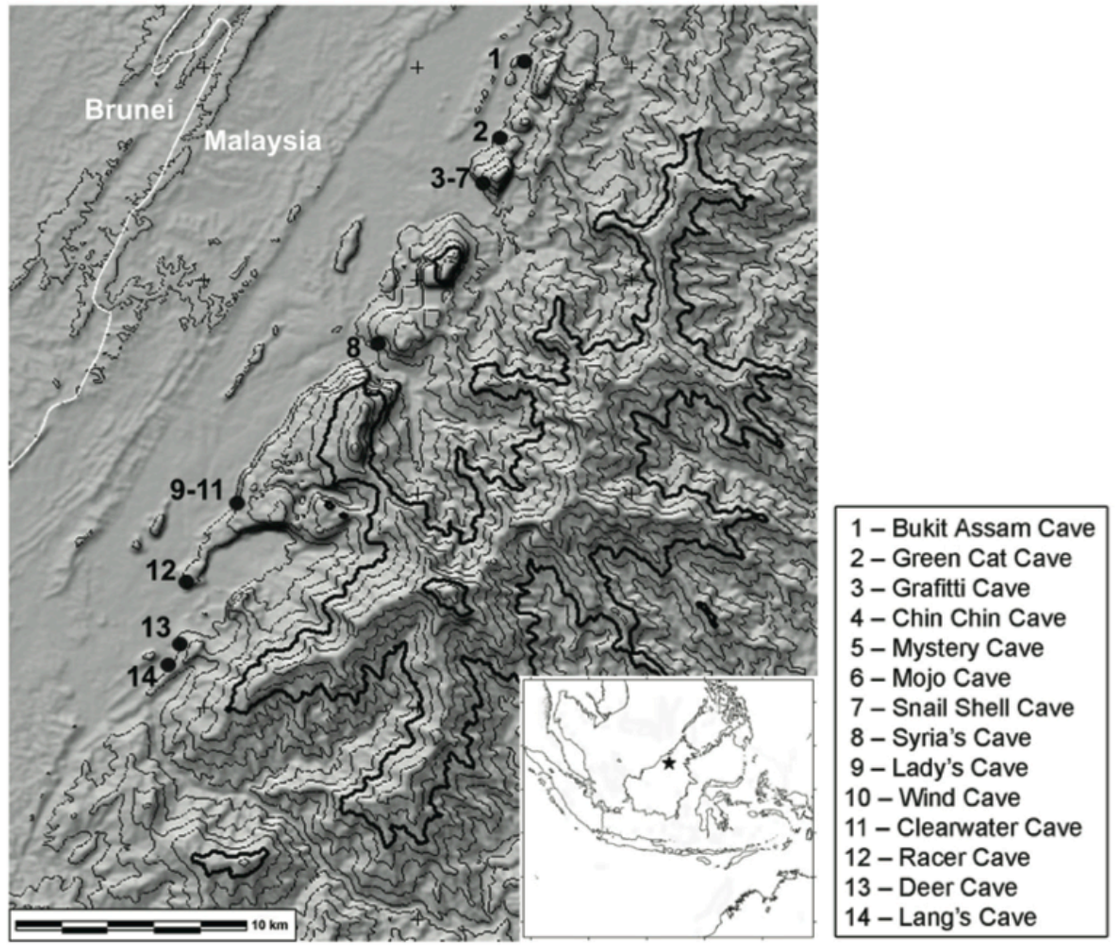
Tropical Climate Change Spanning Glacial Cycles and Rapid Events from Caves in Borneo

Stacy Carolin, Georgia Tech/Caltech
Sang Chen, Caltech
Jessica Moerman, Georgia Tech
Kim Cobb, Georgia Tech
Jud Partin, U Texas
Nele Meckler, ETH-Zurich
Syria Lejau, Mulu National Park
Diego Fernandez, U Utah

The caves of Mulu and Buda are our 'Tropical Ice Cores'[1]

([1]With apologies to Lonnie Thompson)

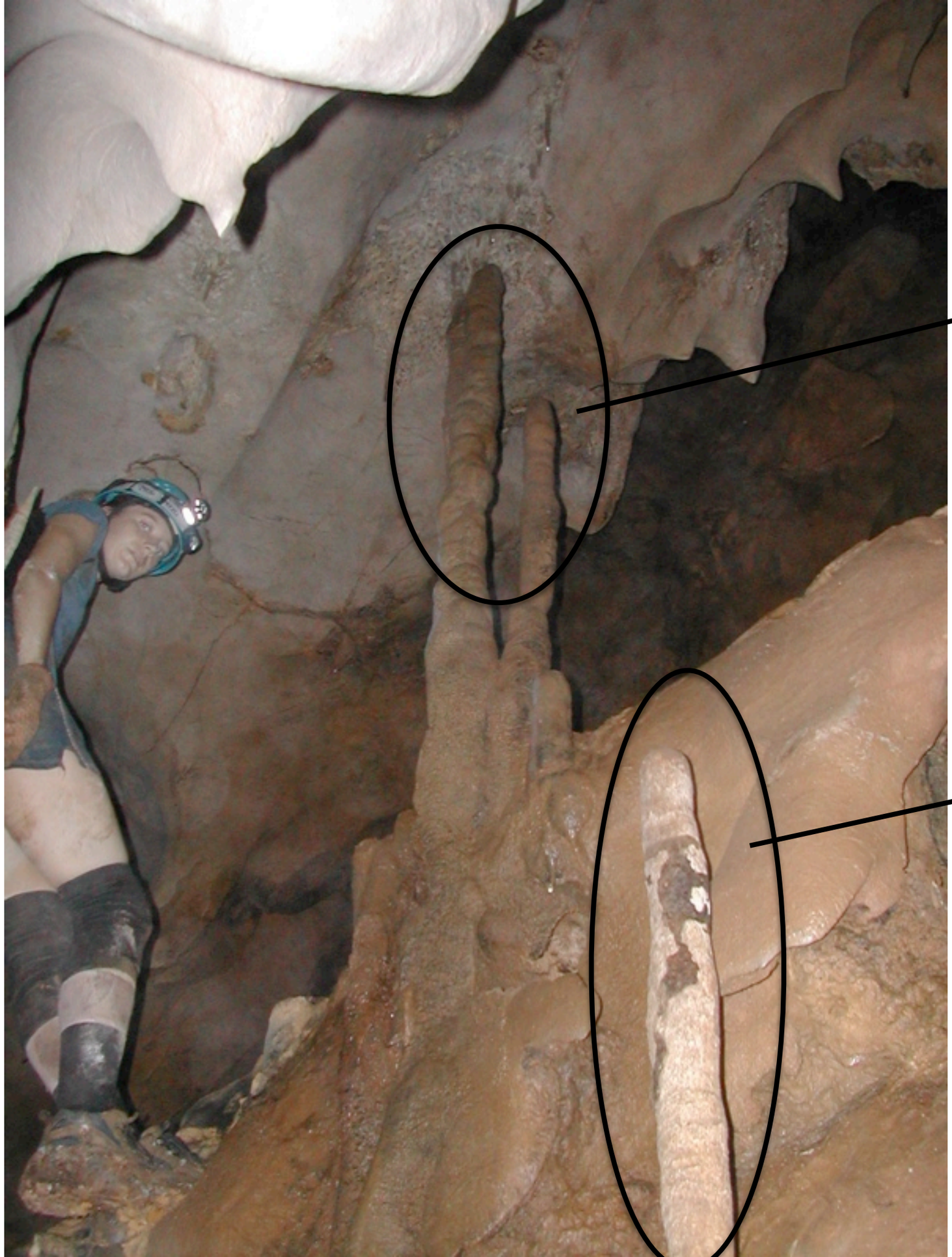





2 10 2003


2 10 2003

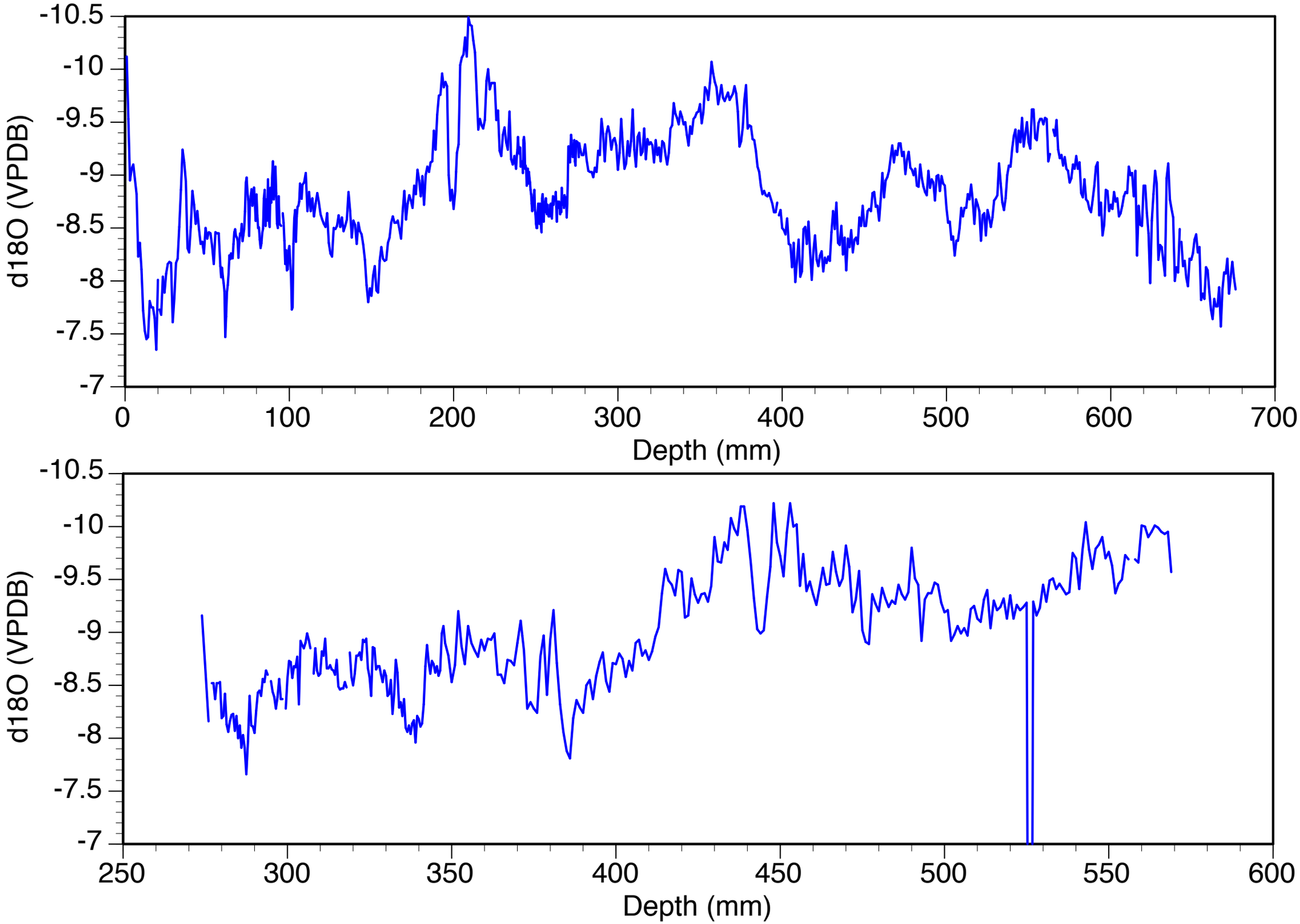

7 9 2003



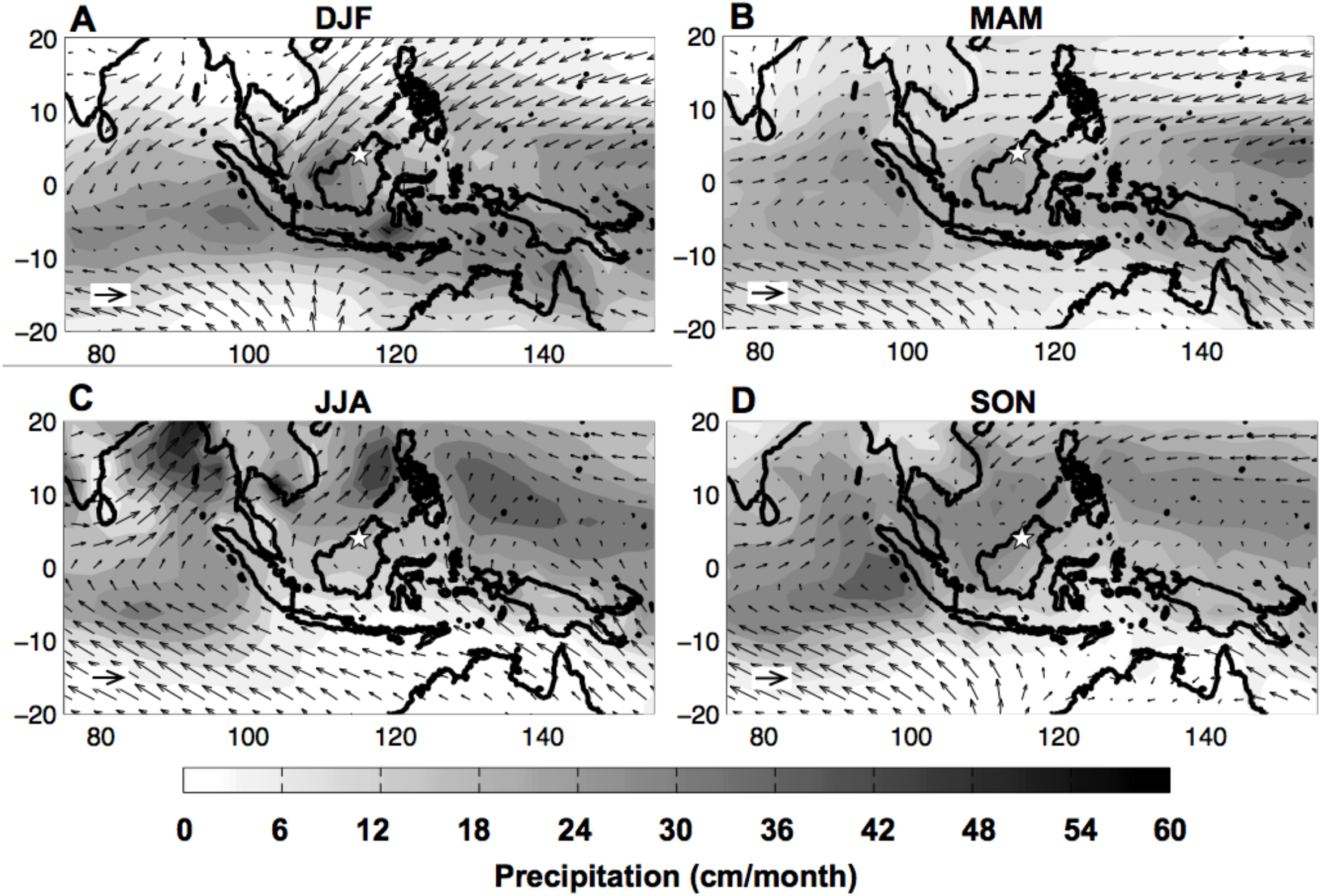
But not these

We sampled this one

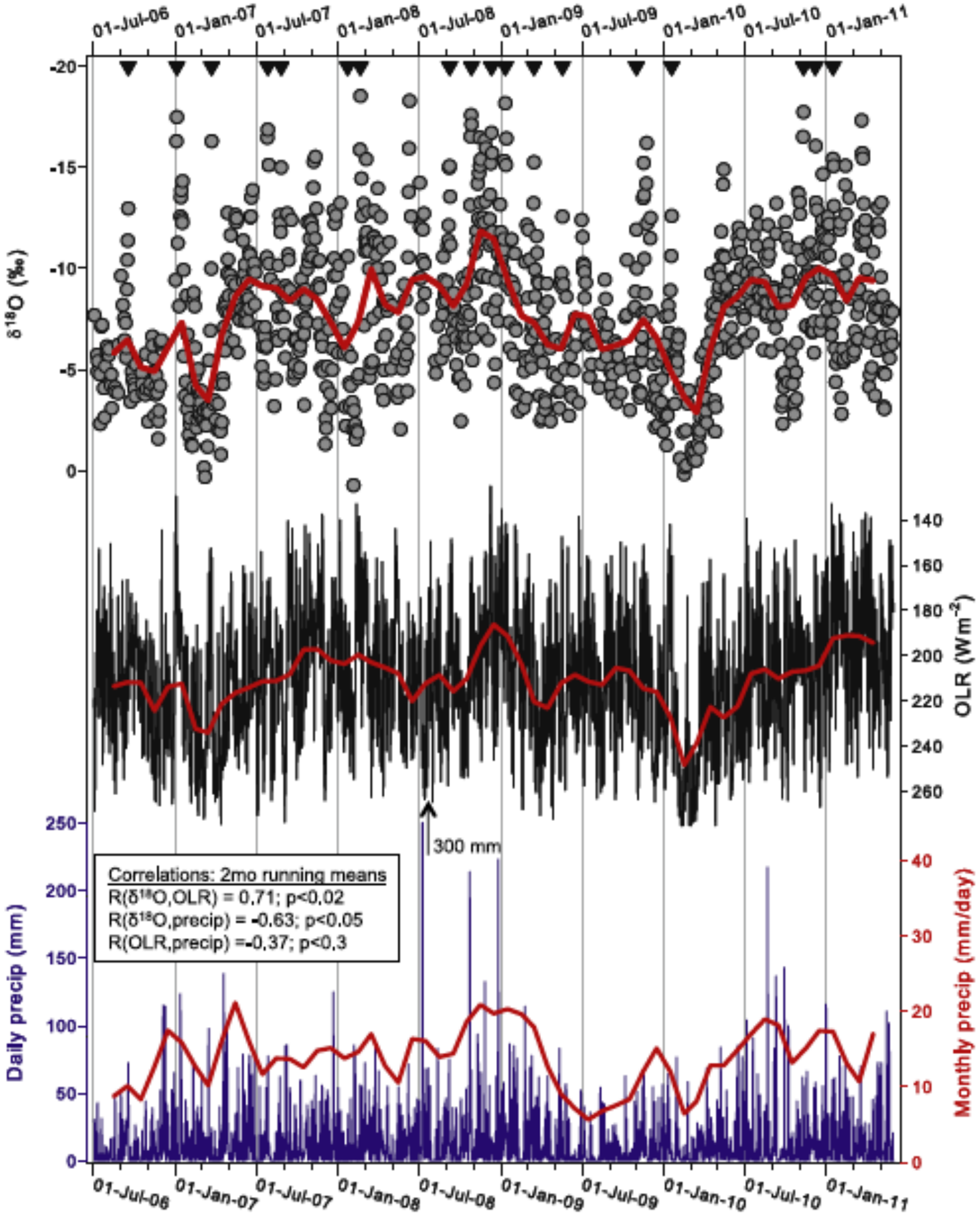
So now we need to develop age models for each stal and get a grip on what the y-axis might mean



There really is no rainy season at our site



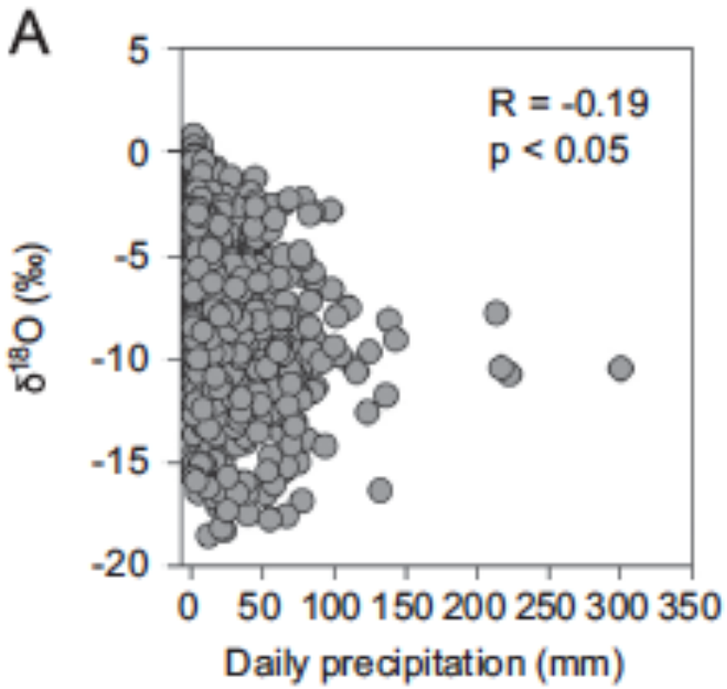
Cobb et al., 2007

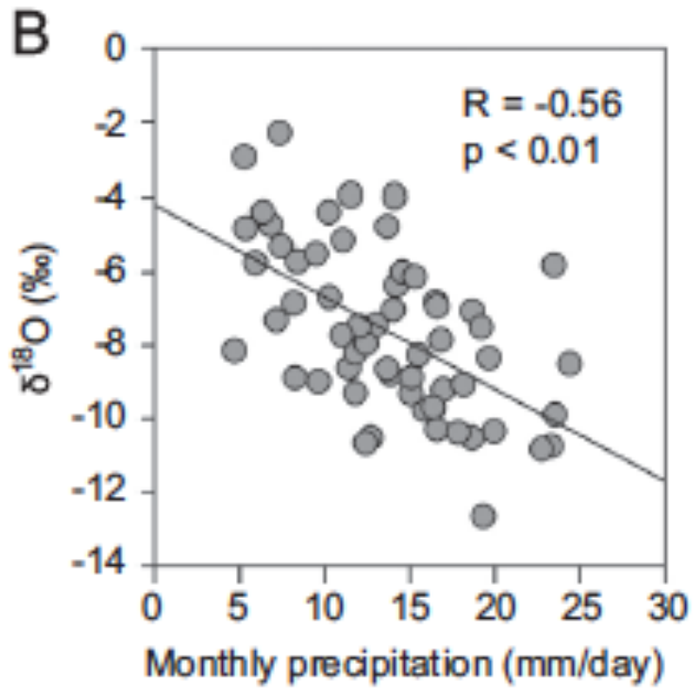


A 5-year record of near daily $\delta^{18}O$ of precipitation at Mulu Park Headquarters

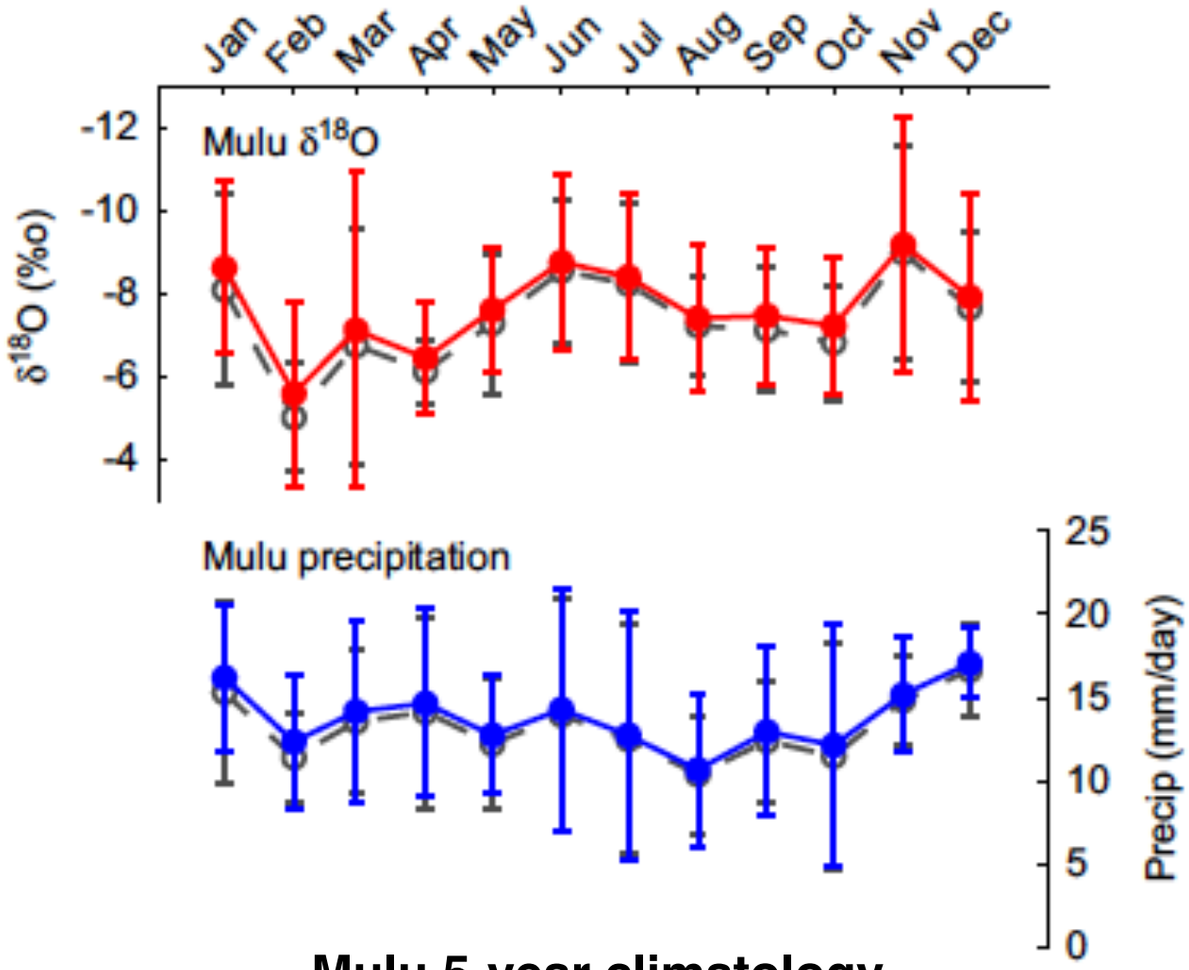
Moerman et al., 2013

Amount Effect 1: Correlation of $\delta^{18}O$ and precip

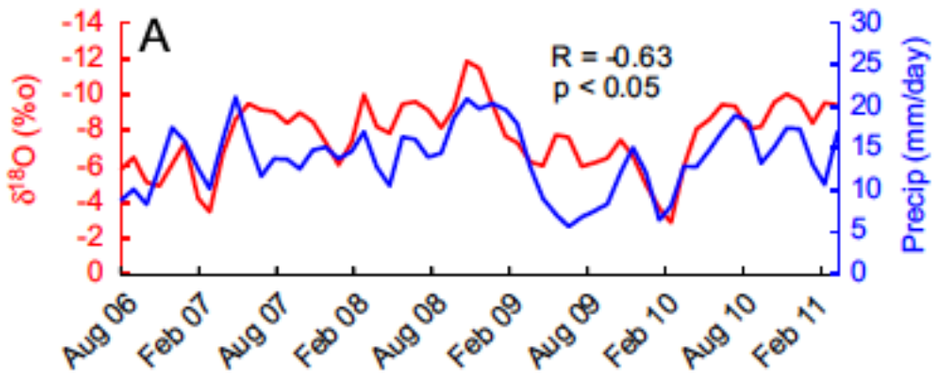




Daily and monthly data



Mulu 5-year climatology

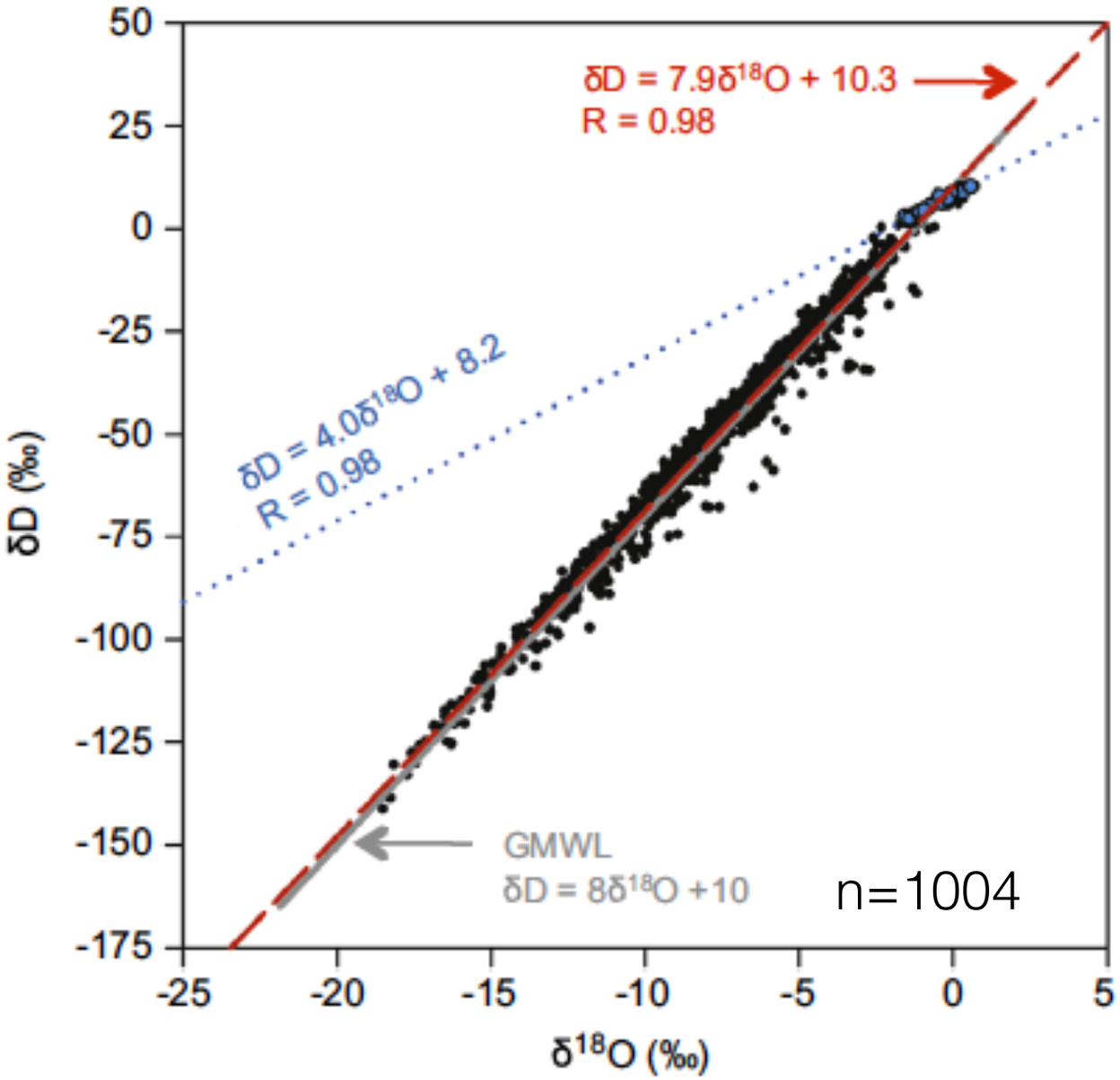


2-month running average over 5 years

Moerman et al., 2013

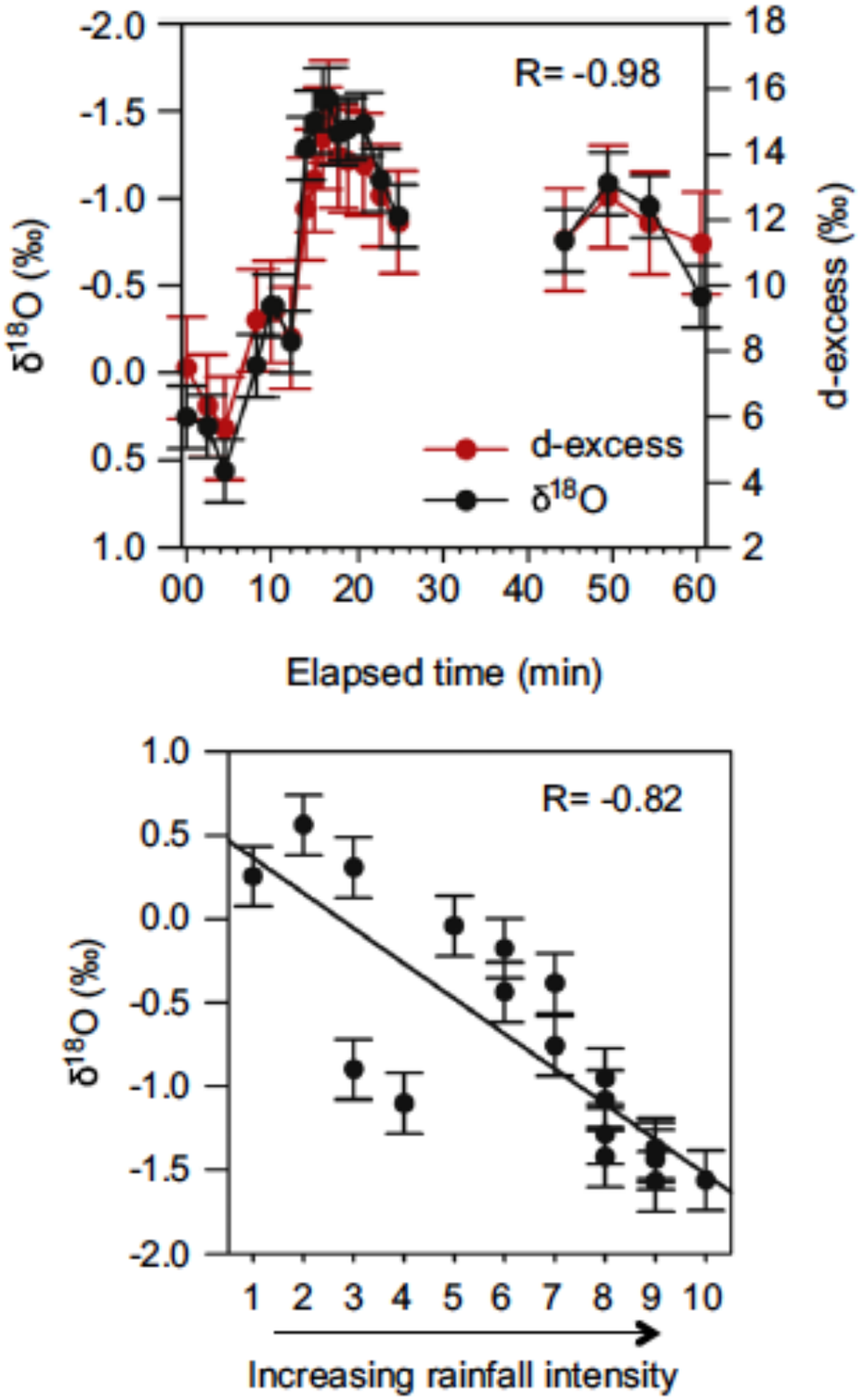
Amount Effect II: Intense Storms

All Data



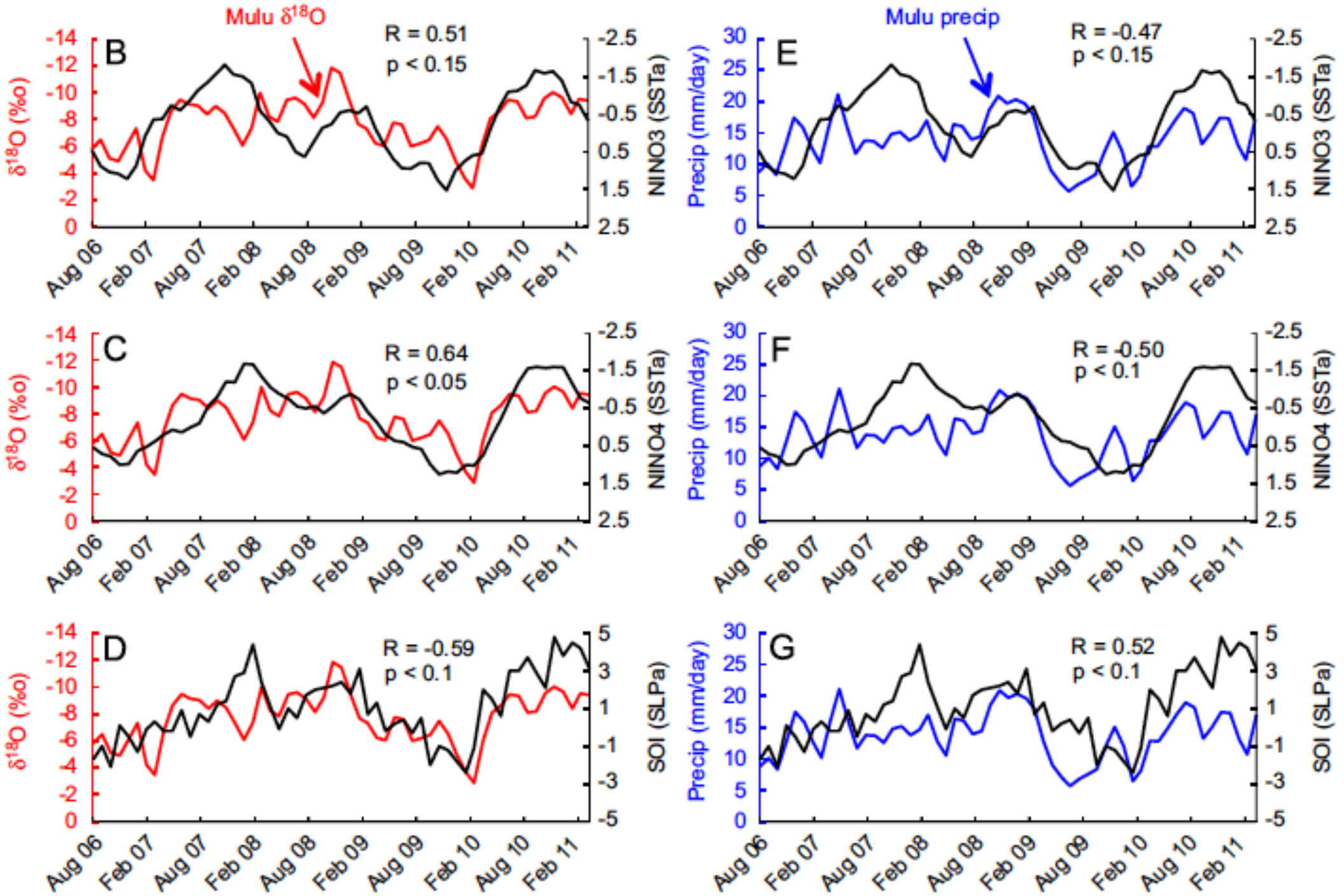
Only one part of the data deviate from regular Rayleigh behavior

Storm on March 7. 2010



Moerman et al., 2013

Time Series of Precip. and $\delta^{18}O$ with Various ENSO 'Votes'



NINO3

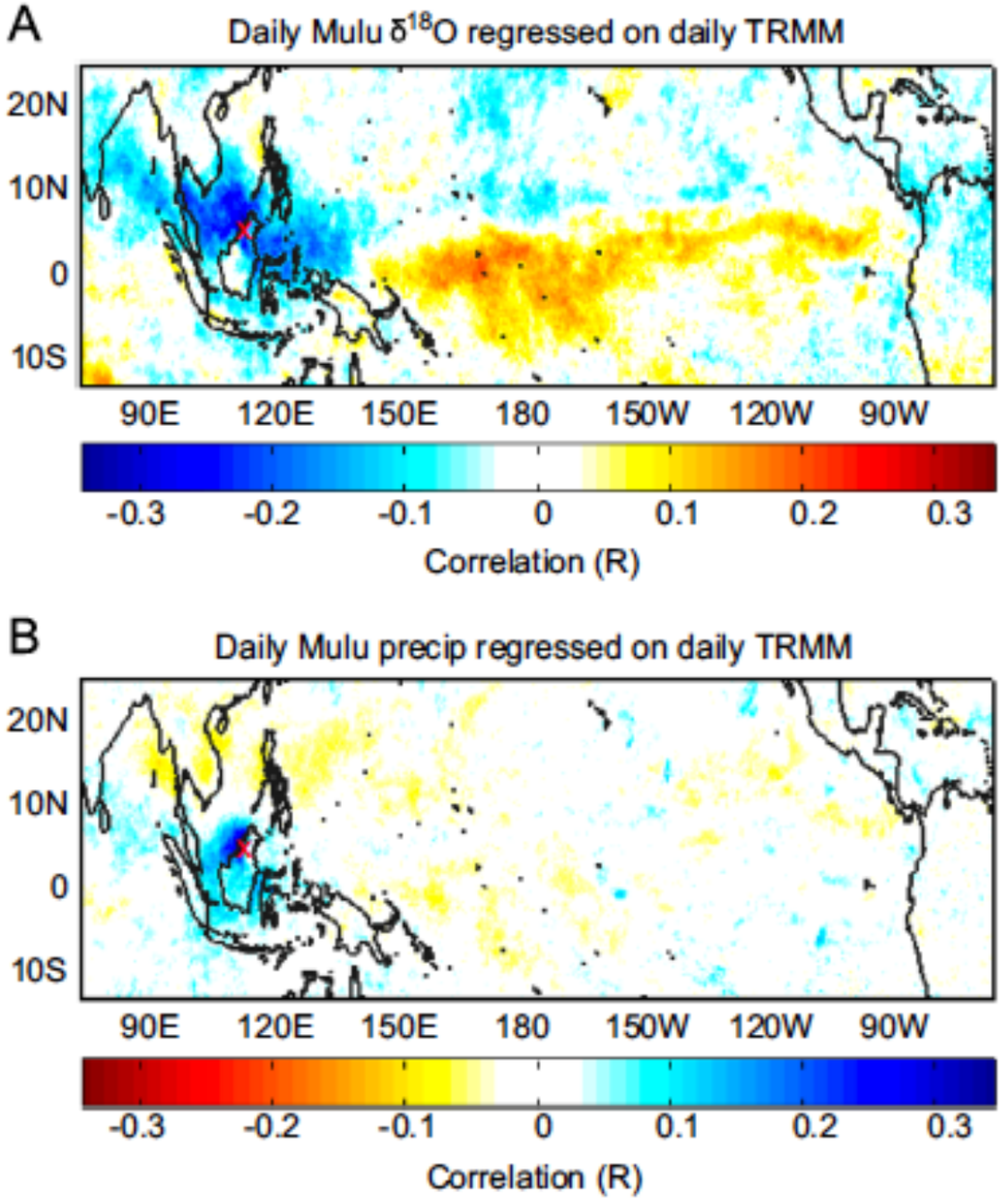
NINO4

SOI

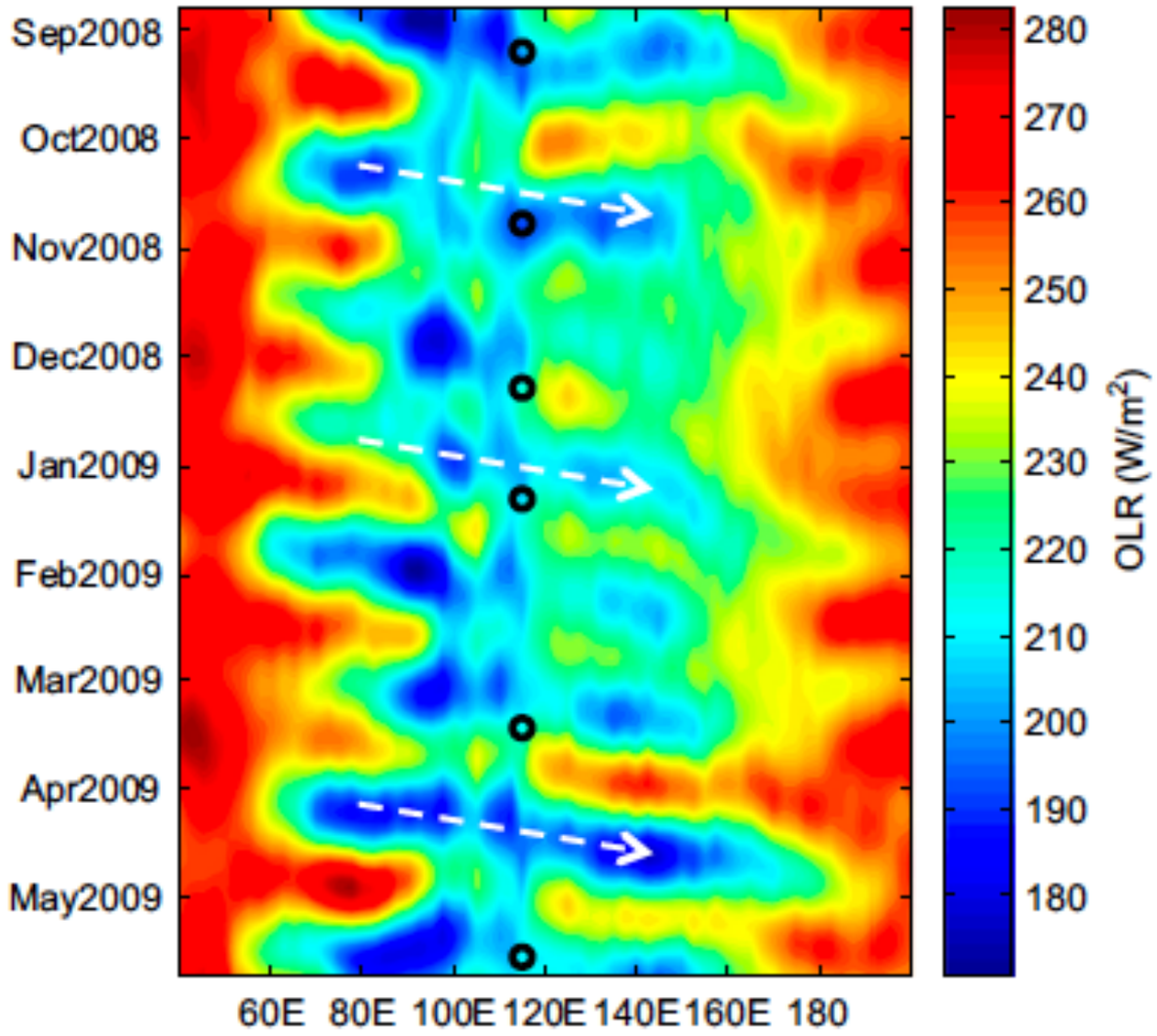
Moerman et al., 2013

$\delta^{18}O$ integrates effects of regional climate/convection better than local precip at the cave site.

Spatial Organization

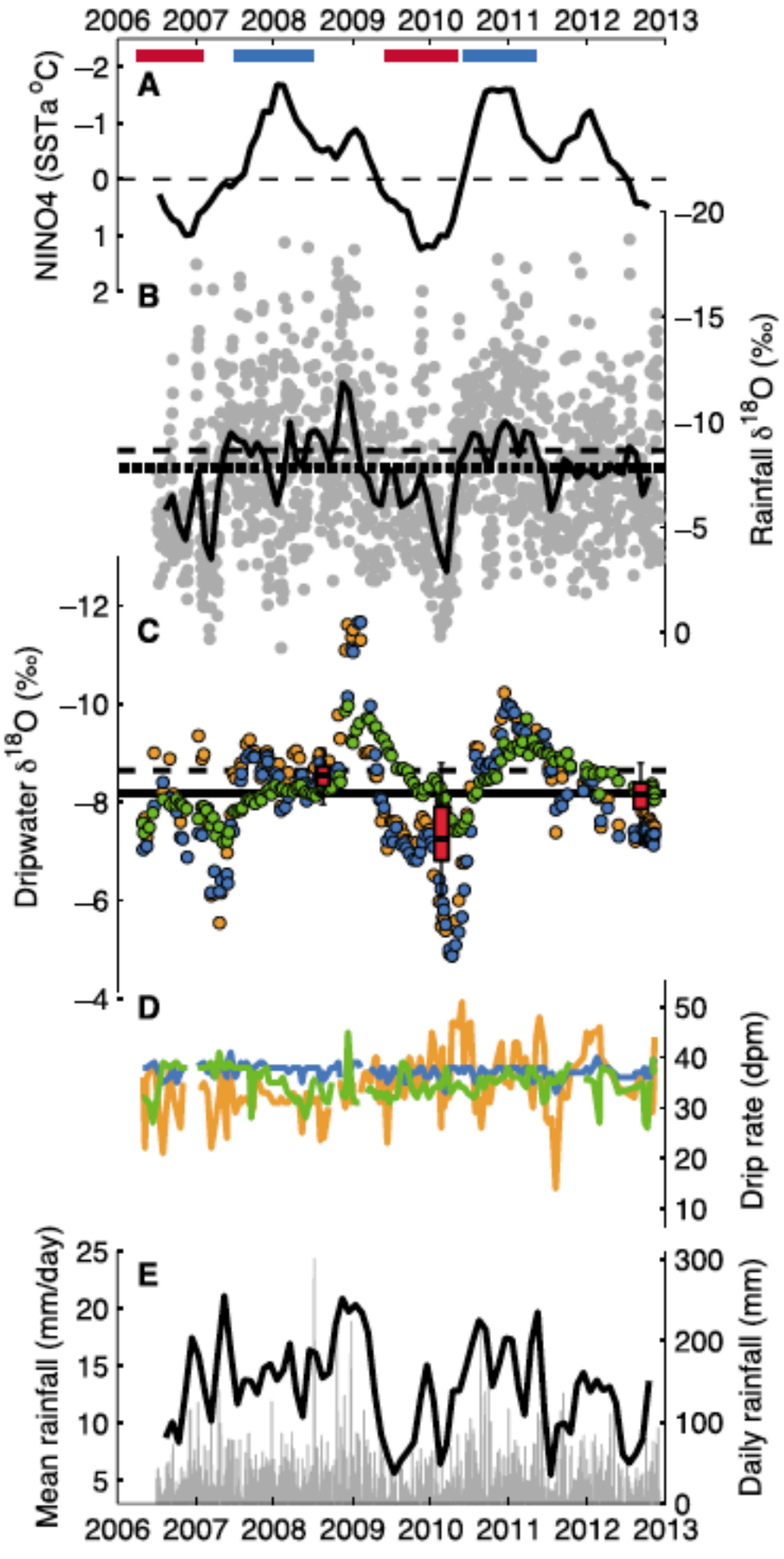


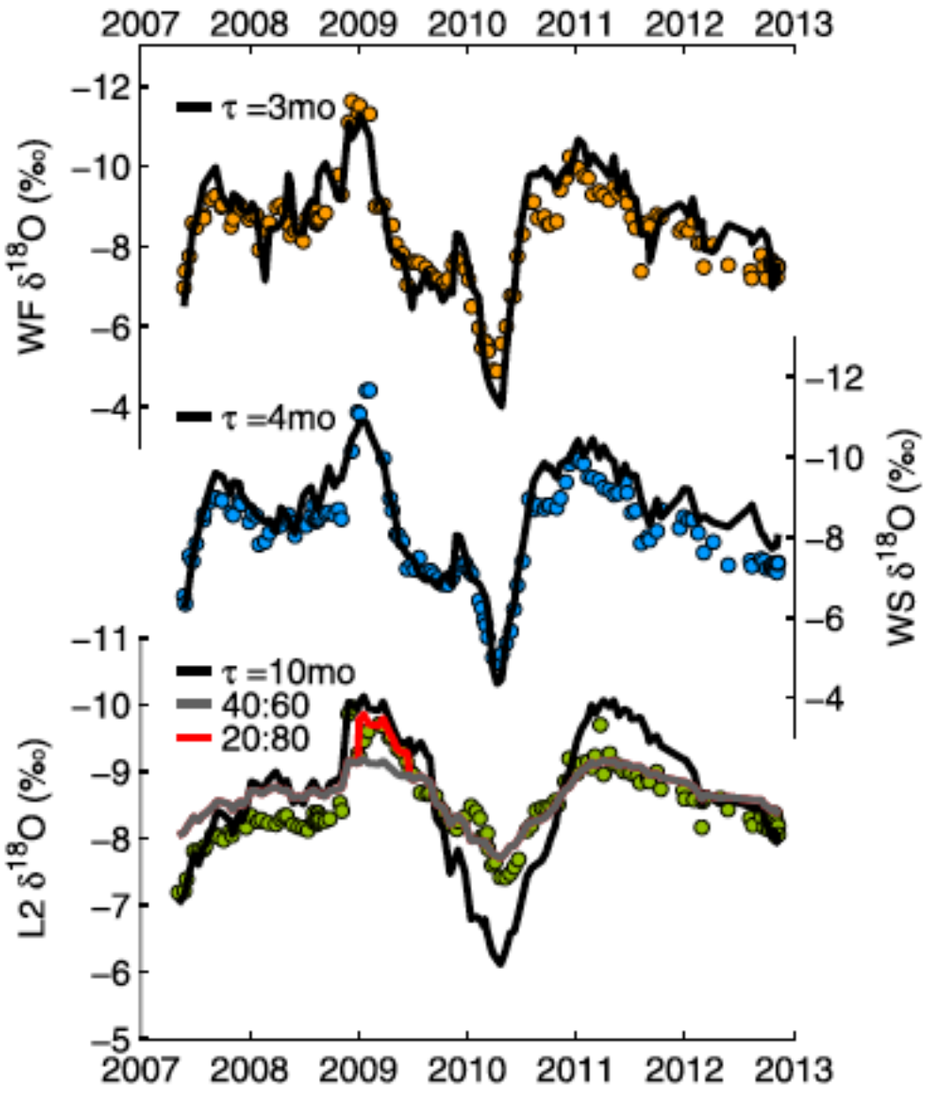
Temporal Organization



Moerman et al., 2013

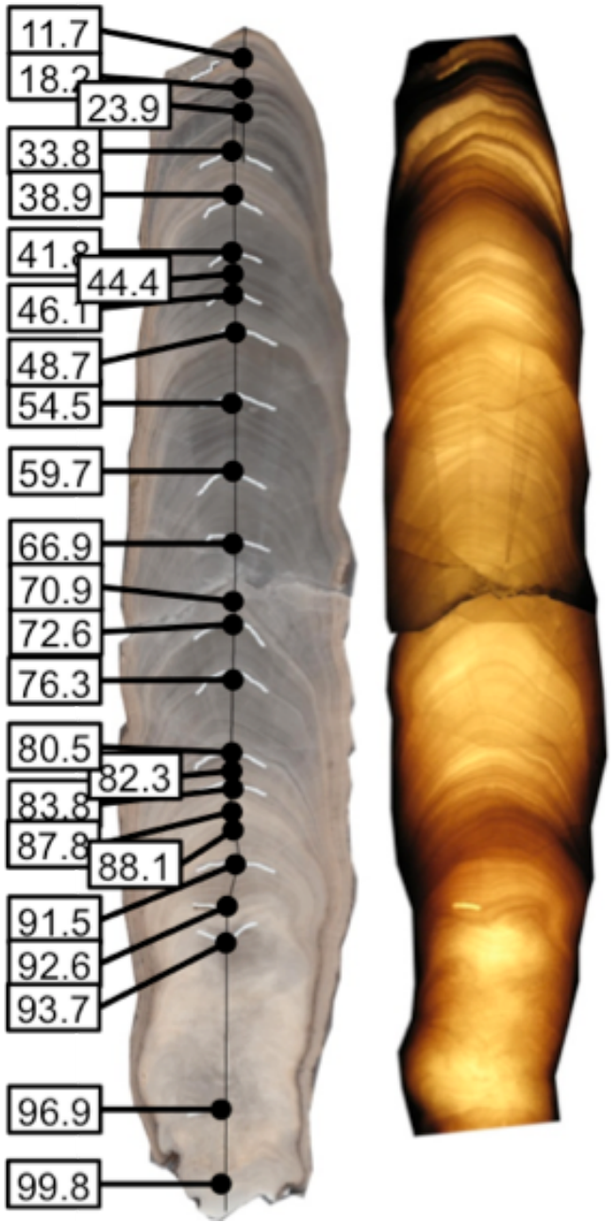
Drip water monitoring helps us understand the karst 'filter'

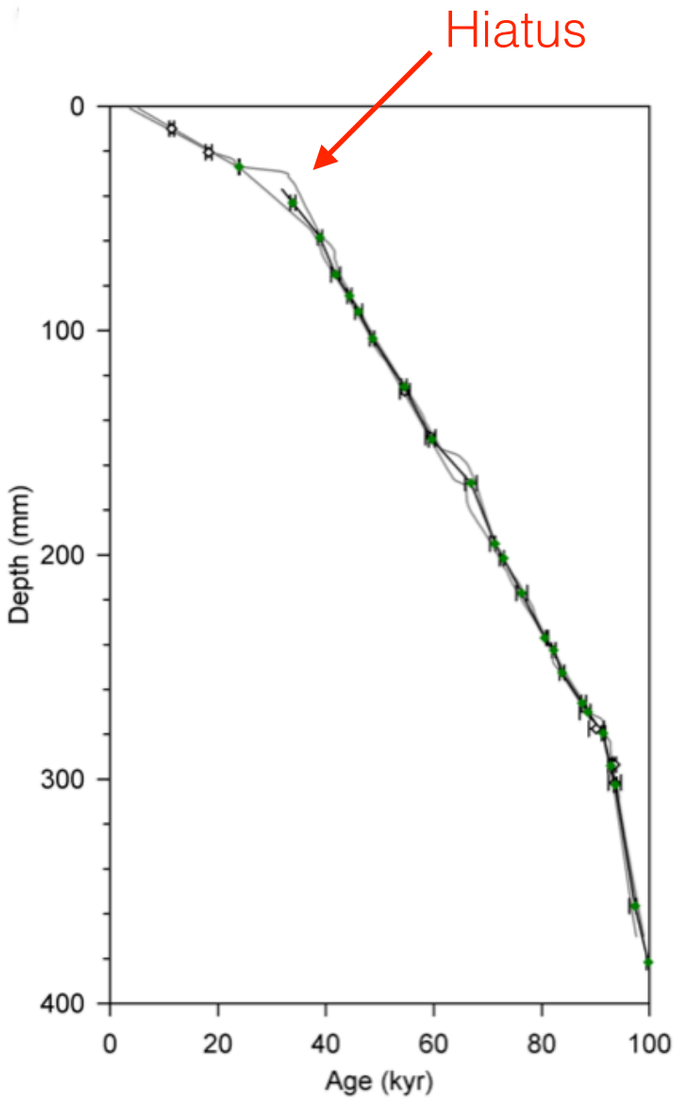




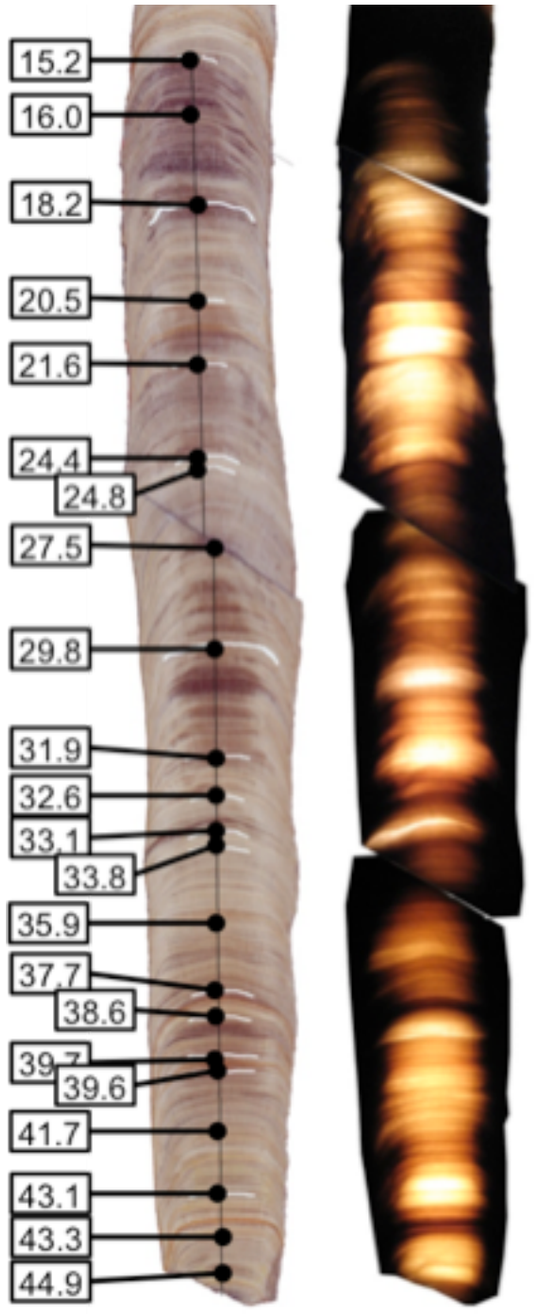
Moerman et al., 2014

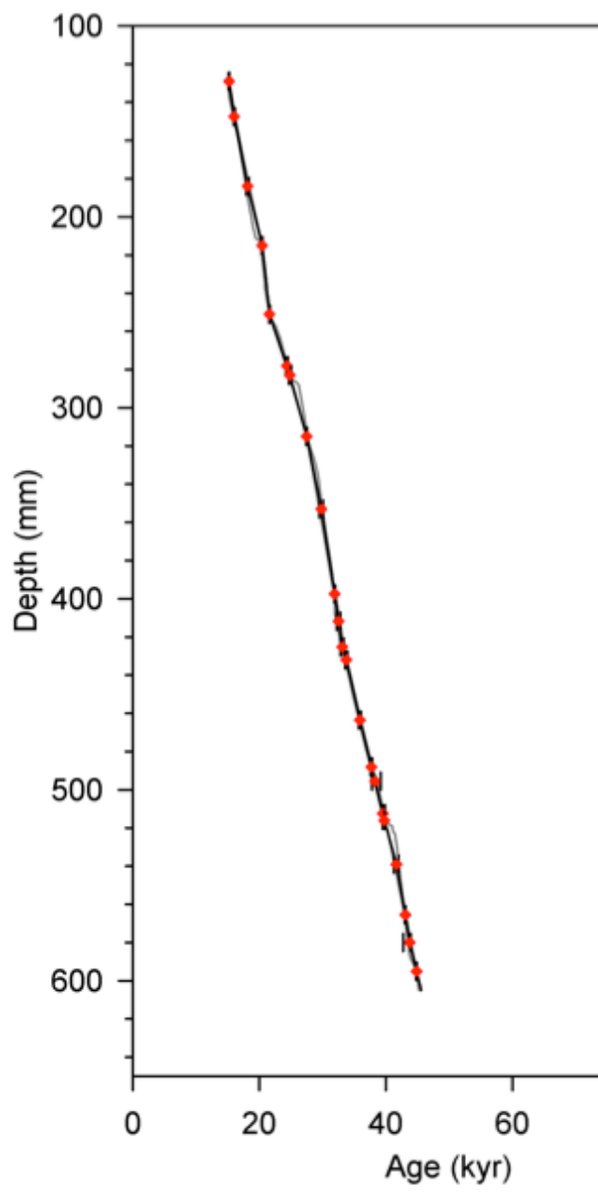
Examples of final age models for two stals





SC03

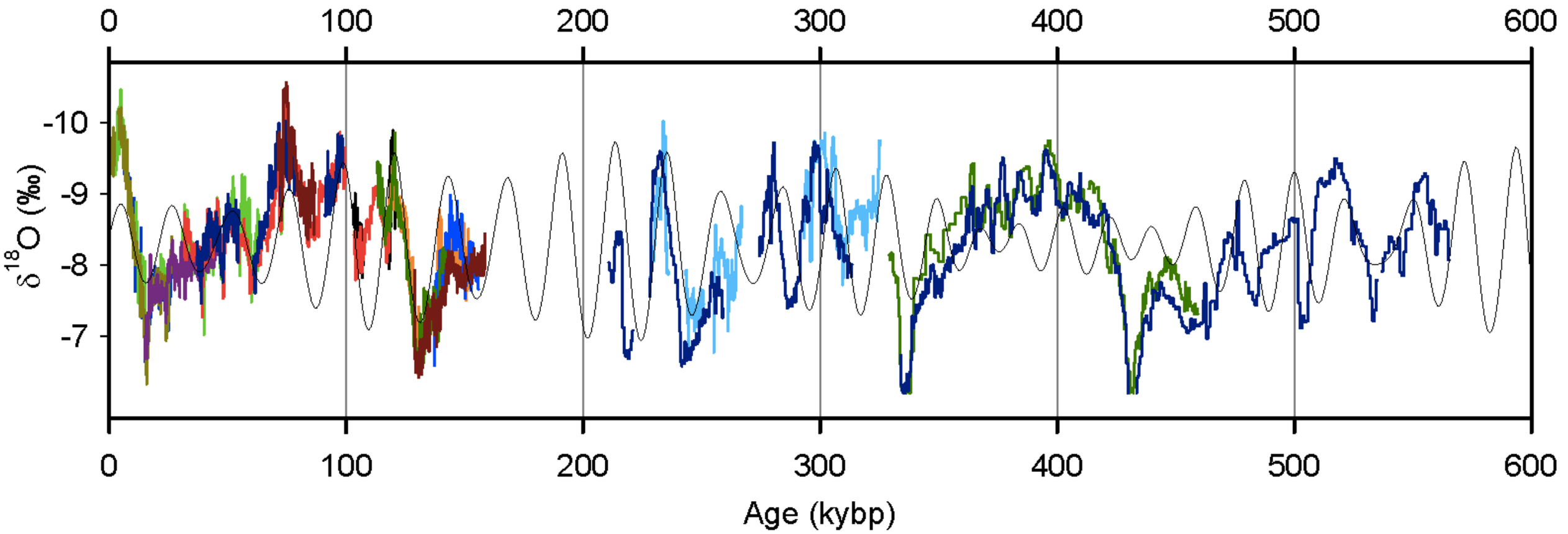




BA02

Solid lines are final age models. Gray line envelopes are 95% confidence limits from ‘StalAge’.

Our most complete record to date



Some Statistics:

-574 U-series ages, 274 in final record

-6,044 d18O measurements

-14 stals in final record

Expeditions:

2003: 60 collected

2005/6: 13 collected

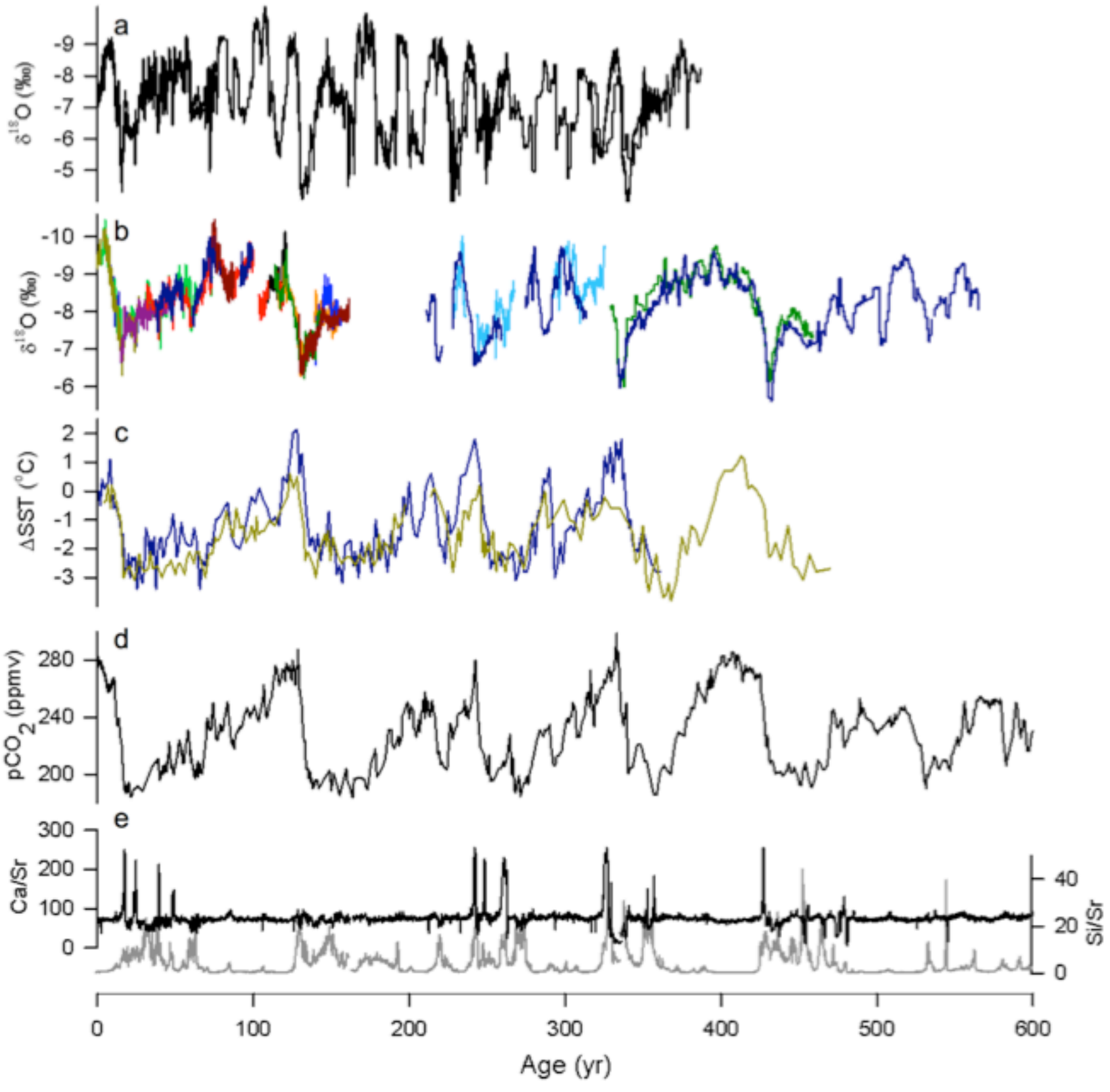
2008: 15 collected

2010: 3 collected

2012: 44 collected

Partin et al., 2007
Meckler et al., 2012
Carolin et al., 2013
Carolin et al., unpublished

There is no 100 kyr signal in tropical precipitation records



China

Mulu

Eq Pac SST

CO_2

N. Atl H-events

Carolin et al., unpublished