

CLIVASH2k meeting 4<sup>th</sup> August 2020  
Notes and summary – Liz Thomas and Diana Vladimirova

SUMMARY:

CLIVASH2k aims to understand the drivers of climate variability in Antarctica and the Southern Hemisphere over the past 2000 years. Following the initial workshop in 2018 the working group have been very productive, with a number of papers published during 2019. Including nine papers published in the CLIVASH2k special issue in geosciences. Presenting marine, ice core and terrestrial reconstructions as well as data-model inter-comparison, and review papers.

The previous PAGES 2k compilations, of snow accumulation (Thomas et al. 2017) and stable water isotopes (Stenni et al. 2017), have been widely used. Generating several spin-off studies and publications (eg Dalaiden et al 2020; Cavitte et al., 2020), and highlighting the value of this data beyond the paleoclimate community. Following from this success we are initiating a new call for data. Our motivation is to provide a complete picture of past climate variability by compiling additional proxies.

Preliminary discussion suggests we should focus on routinely measured chemistry, which is available from multiple locations. The focus will be on Na<sup>+</sup> and SO<sub>4</sub><sup>2-</sup>.

Unlike the previous PAGES2k compilations we are seeking both published and unpublished records. Data contributors will be offered co-authorship and be encouraged to contribute to the data interpretation and analysis. We discussed the value of high and low resolution records and agreed that both have merit and should be included in the data call. High resolution coastal records are expected to provide valuable information about seasonal changes while the lower accumulation (thus lower resolution) records provide valuable insight into longer-term trends.

SHORT MINUTES:

Liz Thomas - Introduction, CLIVASH2k overview:

- 2k activities - Antarctic accumulation and isotopes
- improve our understanding of large amount of variability
- aims- expand on paleo archives, not only ice cores, and expanding proxies not only isotopes and accumulation
- 9 papers published in the special issue last year including review by E. Thomas on sea ice reconstruction based on the marine and ice core records
- CLIVASH2k will be supported by PAGES

Introduction of participants

21 participants from Italy, UK, US, Australia, New Zealand, Belgium

Tessa Vance - Australia 2k overview:

- The new Australian Antarctic Program Partnership - AAPP, 10 yr research project, administered by Uni of Tasmania, partners - Australian Antarctic Division and CSIRO, currently 2 and eventually 4 researchers, focus on Mt Brown South, gases.
- Part of Indian Ocean 2k array.
- Mt Brown CFA is complete, data processing underway.
- Danielle Udy's PhD on how high latitude ice core represents low latitude variability - Law Dome conditions matches with SAM- mode, other variability is cyclonic, precipitation record vs ERA5.
- Camilla Crockett's MSc on El-Nino Southern Ocean oscillation in Mt Brown South record
- The plan is to look further in ice core records and Southern oscillations footprints.

Diana Vladimirova - data available:

- 6 records spanning 2k at EDML, EDC, Law Dome. The last spans only the past century.
- They are resolved differently.
- Missing published data?
- Hunting for unpublished data.
- Intercomparison of labs and instruments?
- Concentration or fluxes?
- Na<sup>+</sup>, SO<sub>4</sub><sup>2-</sup> or other ions?

Hugues Goosse - an ice core chemistry database:

- Existing databases - Thomas et al 2017 on snow accumulation, Stenni et al 2017 on stable water isotope.
- Dalaiden et al 2020 showed that if combine d18O and acc we find a better paleoclimate reconstruction than if use acc and d18O records separately.
- Mayewski et al. 2017 sodium records and Thomas et al. 2019 MSA records - if we can combine chemistry and glaciological data, we could obtain more information on winds, atmospheric variability

Dan Dixon - WAIS chemistry correlation:

- Data compilation using the US ITASE cores and others from West Antarctica.
- max Na, mean Na, max nssSO<sub>4</sub>, mean nssSO<sub>4</sub>, as well as max MS and mean MS - different correlations with AADC max, mean, and min sea ice extent.
- nssCa correlation with NCEP zonal winds.
- Ice core transect from Ellsworth to Ross Ice Shelf
  - Na and nssSO<sub>4</sub> seasonal signals do not vary much with location
  - concentration vs fluxes – not much different at these relatively high-accum. sites. For low-accum. sites it will likely be different.
- West Antarctic Na in austral spring (SON) has a hot spot with ERA-Interim MSLP off the coast of West Antarctica.
- Final Thoughts:
  - Flux vs concentration – Does accumulation matter? When to adjust?
  - Ice core locations – The same chemical but different proxies.

- Spatial distribution of proxies – Na:MSLP correlation in West Antarctica may not be the same around the East Antarctic coastline
  - Proxy vs Time – Is it safe to assume that a proxy relationship (e.g. Na:MSLP) holds over long time periods e.g. 2000 to 10,000 years?
- Liz Thomas: we should do the same data gathering in the continent scale to establish the threshold of changing correlations and fluxes.

Rachael Rhodes - process-based modelling of sea salt (Na<sup>+</sup>):

- Sodium has two sources - open ocean sea salt (aerosols) and sea ice sea salt (channels of brine, aerosols).
- Merge Na and SO<sub>4</sub> is a good idea (mirabilite salt).
- p-TOMCAT mode based on ERA Interim - wet and dry deposition is the key for concentration vs flux.
- calculate Na flux and use modelled precipitation to get ppb - worked well for Arctic but not for Antarctic.
- correcting for the precipitation bias, using the PAGES 2k snow accumulation, improves snow/ice Na simulation.
- a possibility to fill in the gap between data using modelling.

## DISCUSSION

- Dan Dixon - 2 kyr Na WAIS and Siple are available.
  - <https://nsidc.org/data/agdc/data-wais-divide> ○ <https://nsidc.org/data/NSIDC-0251/versions/1> ○ <https://nsidc.org/data/NSIDC-0246/versions/1> ○ <https://nsidc.org/data/agdc/data-sets> ○ <https://nsidc.org/data/nsidc-0544/versions/1/documentation>
- Tessa Vance - 2k record of Law Dome Na from here <https://www.sciencedirect.com/science/article/pii/S0277379116305479?via%3Dihub>
- Liz Thomas - we are going to initiate the data call now: which ions are we asking for? Unpublished data.
- To everyone - please ask your collaborators for contribution.
- Andrea Spolaor - comparison of IC and ICPMS – ICP-MS sees a bit more than IC, since ICP-MS is able to determine part of Na might present in the dust particles while IC not. This difference is more evident\important in more “dusty area”. Trend is identical however.
- -> spatial intercomparison of different analytical methods?
- There are plenty of measurements using IC and ICPMC in West Antarctica - ask Dan Dixon.
  - IC detects dissolved ions, ICPMS detects total chemistry (dissolved and particulate)
- Provide a plan of research for people who are going to contribute the data:
  - phase 1 - data collection
  - phase 2 - help with interpretation of the data
  - phase 3 - further research in a few groups (winds, circulation modes, climatic/atmospheric modelling, proxies comparison etc.)

- Can we bring in some other records, terrestrial maybe? - if lake sediments then they have to be measured in a matrix;
- how to be inclusive for the data and people - if we look for wind belts in Indian Ocean? maybe that I something to look into in future;
- Resolution: it's hard to guess what will be needed for different users; maybe having both - low and high res; ask for as high as possible resolution - all the data can be useful; two tracks – high resolution coastal records i.e.what controls seasonality and multiannual for decadal and centennial variability.
- uncertainty of the age scale matters! if the timescale has a big uncertainty then high resolution does not make any sense.

Final notes and next steps:

If you would like to be involved in the data compilation and subsequent publications then please get in touch. Email Liz ([lith@bas.ac.uk](mailto:lith@bas.ac.uk)) and Diana ([dv332281@gmail.com](mailto:dv332281@gmail.com)).

We will provide a summary for the CLIVASH2k mailing list to keep members updated and encourage others to get involved.

We are working on a template and will initiate a call for data shortly. Please distribute the call for data widely and encourage colleagues to submit their data and get involved.