News from ACOSIA

Atmospheric Controls On Stable Isotopes in Antarctica

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ACINN INSTITUTE OF ATMOSPHERIC AND CRYOSPHERIC SCIENCES · NCAR NATIONAL CENTER FOR ATMOSPHERIC RESEARCH · austrian polar research institute · NORSK POLARINSTITUTT · LSCE · AWI · FWF Der Wissenschaftsfonds.

Motivation

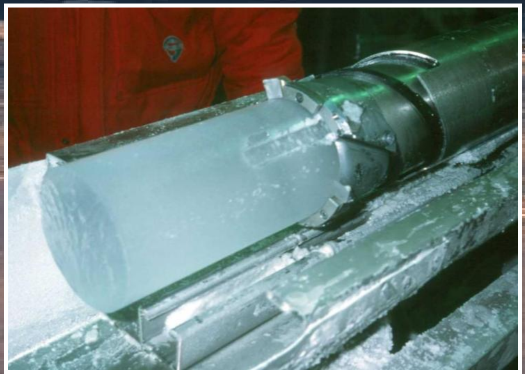
Ice cores yield most valuable information about paleoclimate!

Ice core properties: air bubbles
impurities
ice = former snow = former precipitation

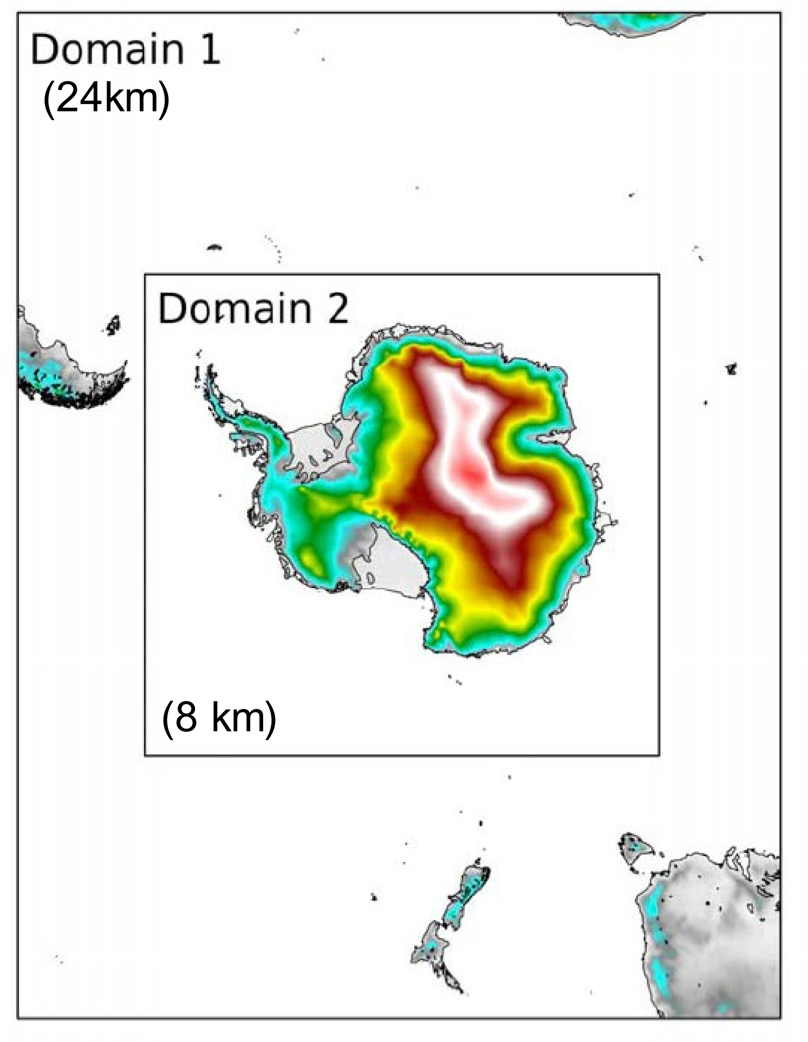
We must study precipitation origin, formation etc. = “pre-depositional processes”

This influences the physical properties of the pure ice!

In particular: Stable isotopes – paleotemperatures !



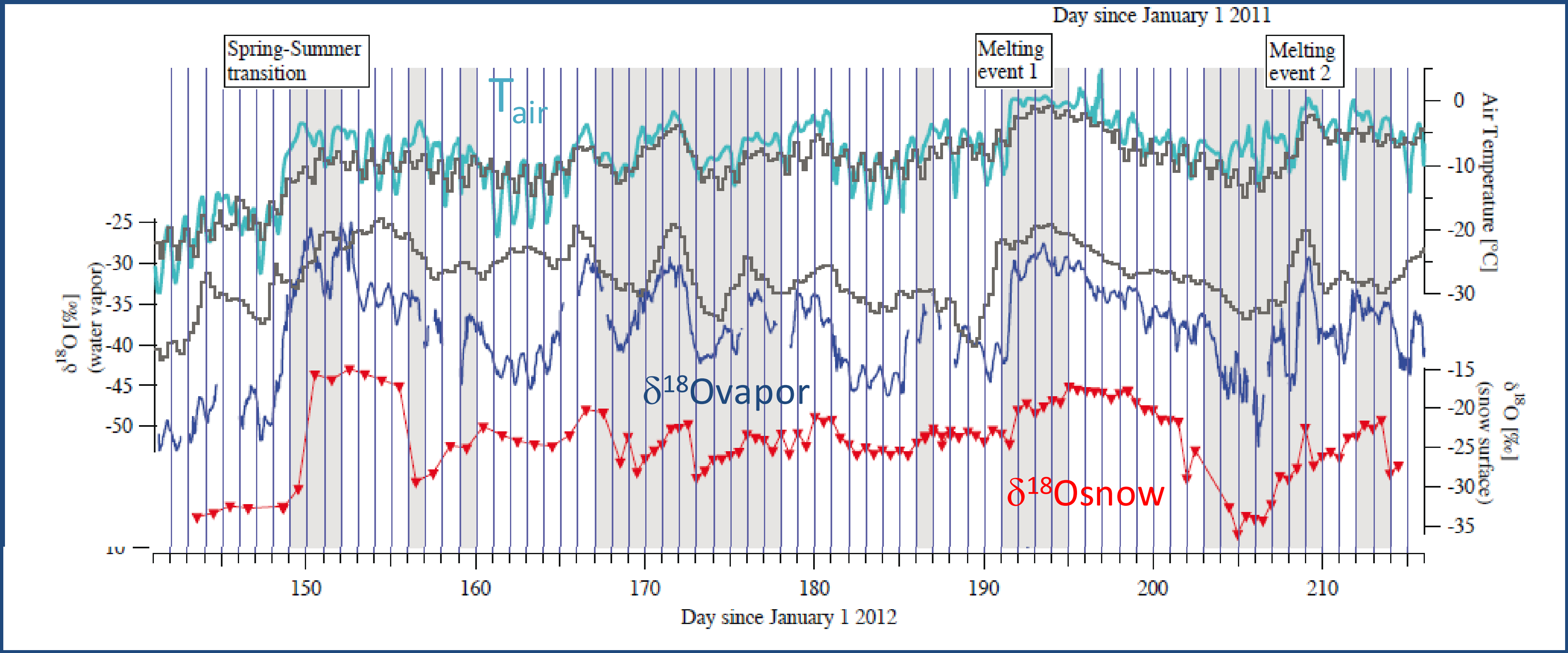
The Antarctic Mesoscale Prediction System (AMPS)



Mesoscale model, adapted for polar regions:

- Fractional sea ice coverage in grid cells
- Specified thermal properties of sea ice
- Modified properties of snow and ice
- Use of latent heat of sublimation for latent heat flux over ice surfaces
- Additional levels in MM5's soil model (better representation of heat transfer in ice) (accordingly in Polar WRF)

Periods between precipitation events also influence stable isotopes ratios!



Steen-Larsen et al, Climate of the Past 2014

Interaction between atmosphere and snow pack not negligible!

New instruments enable us to measure water vapor isotopes continuously.

Atmospheric controls on Stable Isotopes in Antarctica (ACOSIA)

- Continuous measurements of stable isotope ratios of water vapour at NM*
- Combined with fresh-snow samples since 1981,
- Modelling (AMPS), trajectories, synoptic analysis
- Stable isotope modelling (MCIM, ECHAM5-wiso, LMDZiso)
- Humidity inversions

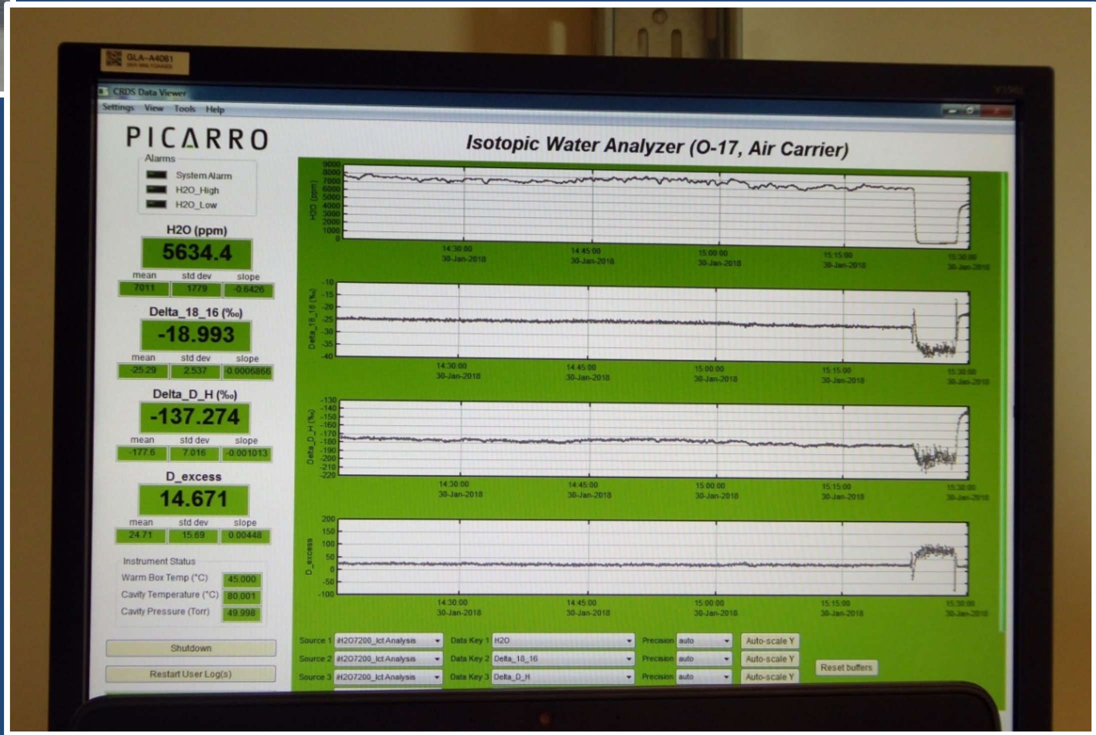
*back after 26 years… in 2017/18 ☺

Laser spectrometer (Picarro):

- continuous measurement of stable isotope ratios of water vapor
- smaller, cheaper and transportable compared to mass spectrometer
- box (25cm) with mirrors, thus effective path length of laser beam > 20km, absorption yields info about stable isotopes

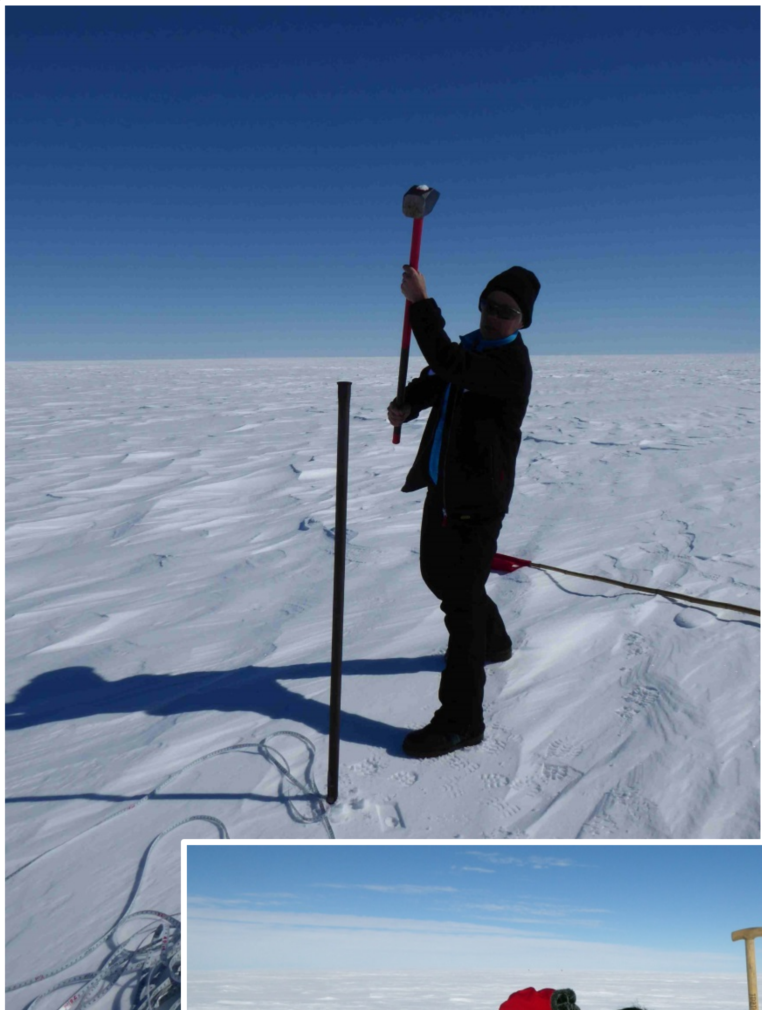
Complex calibration procedures necessary:

- humidity response curve
- drift (calibration with standards)



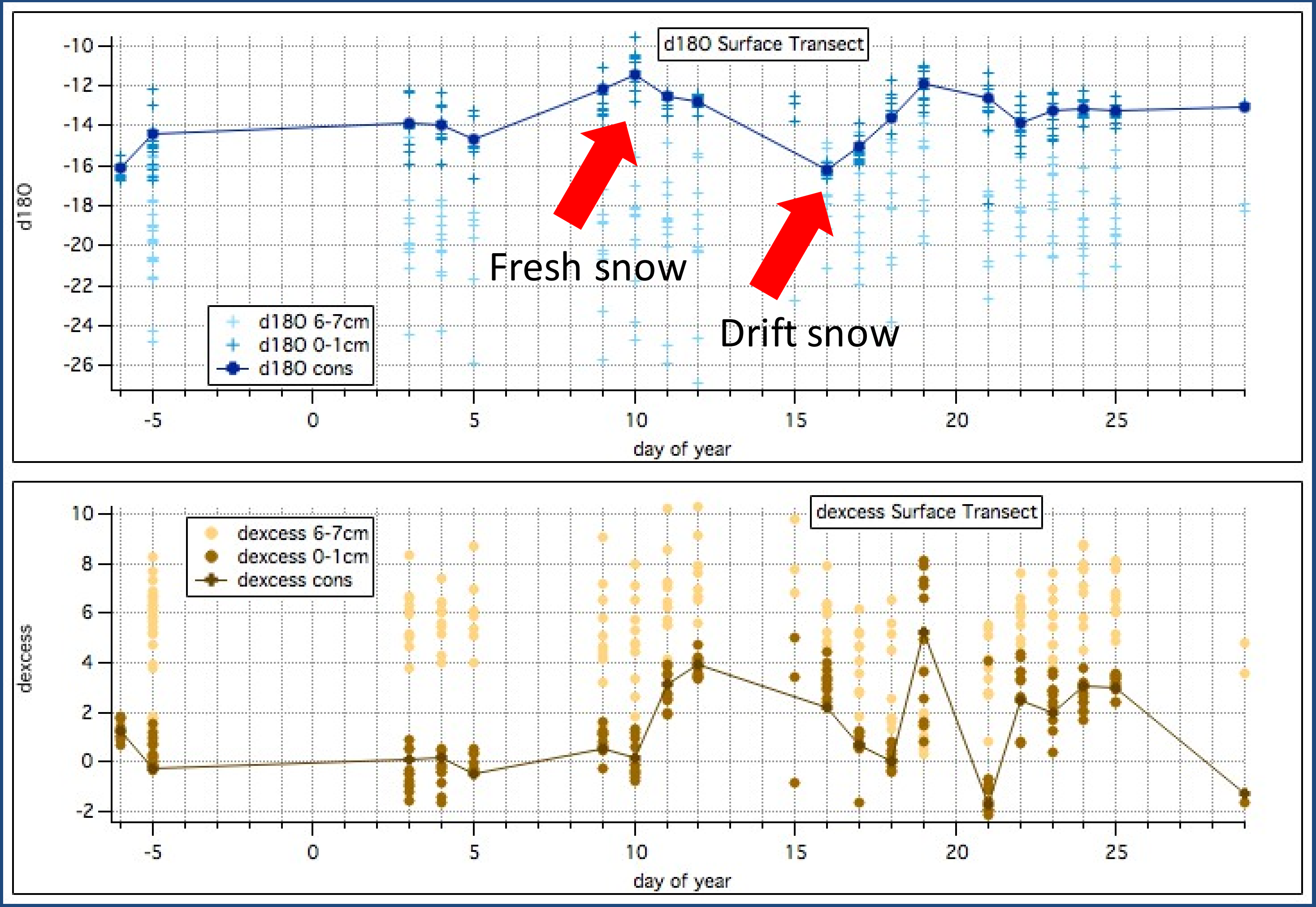
Inlet for Picarro on station roof

Snow sampling transect



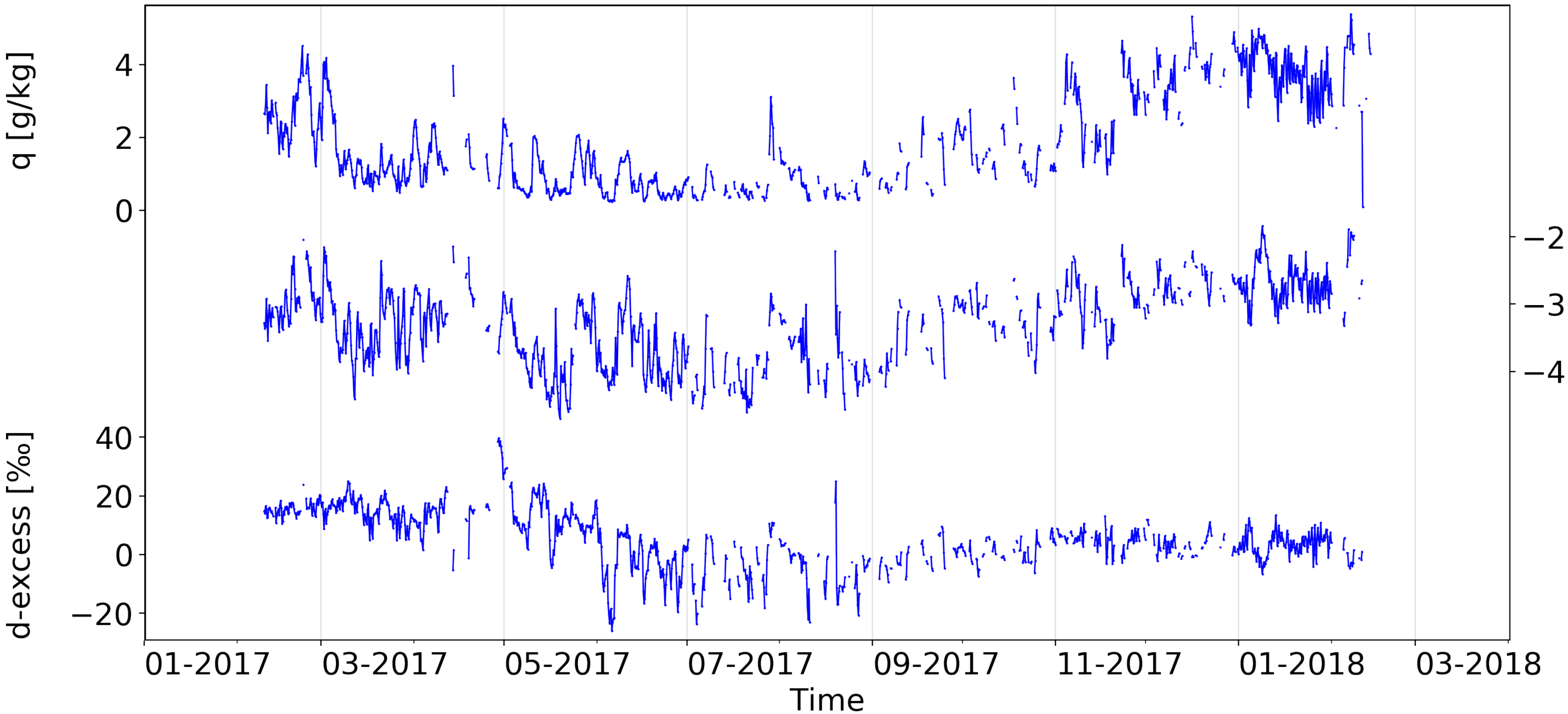
Construction of Science Trench

First results from snow samples Surface Transect:



(courtesy Maria Hörhold)

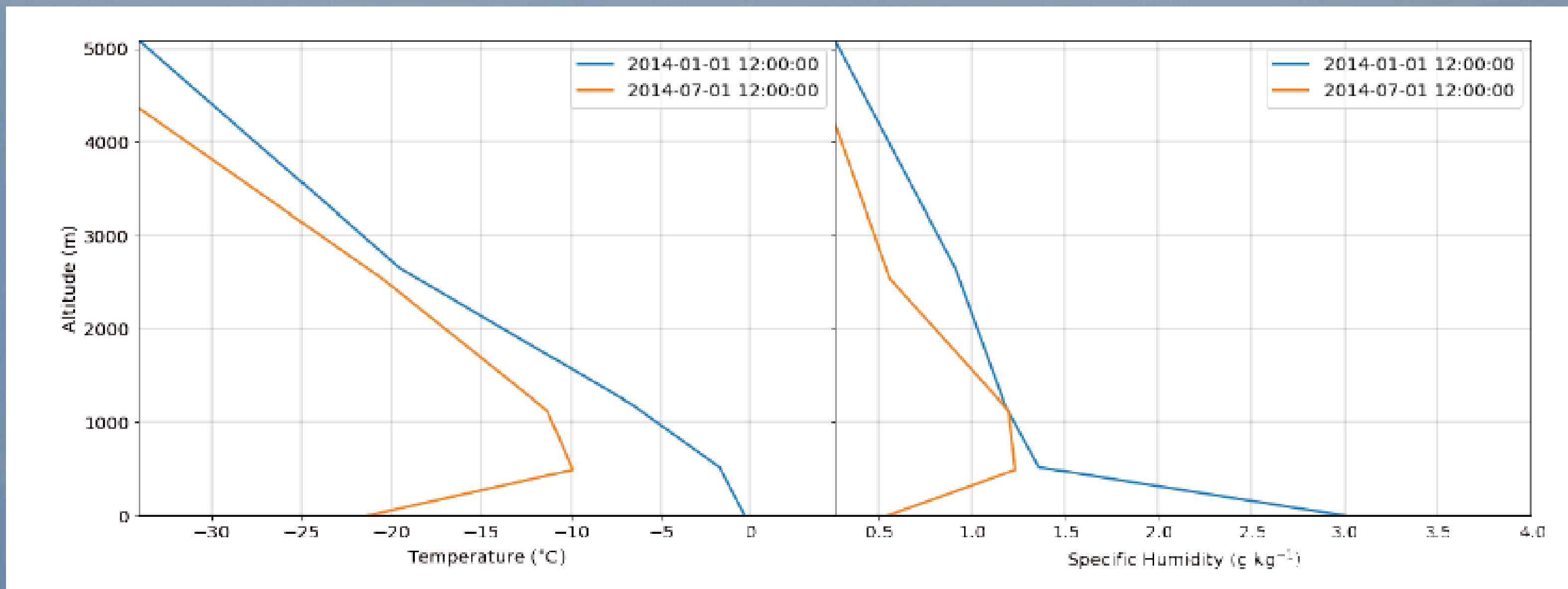
will be compared to Picarro data and meteorology



Preliminary data from Picarro (courtesy Saeid Bagheri)

Next steps:

- ➢ Investigation of temperature and humidity inversions (Master student)



- ➢ Comparison snow samples /water vapor isotope ratios

- ➢ Case studies precipitation events

Projects, Publications, People

ACOSIA 2016-2021 (384.000 EUR, FWF)

ACE 2016-2019 (20.000 EUR~ 3 months of salary, EPFL/Paulsen (private))

PI: E. Schlosser

Tiago Manuel Ferraira da Silva (Master student)

Publications since last APRI meeting 2016:

2018

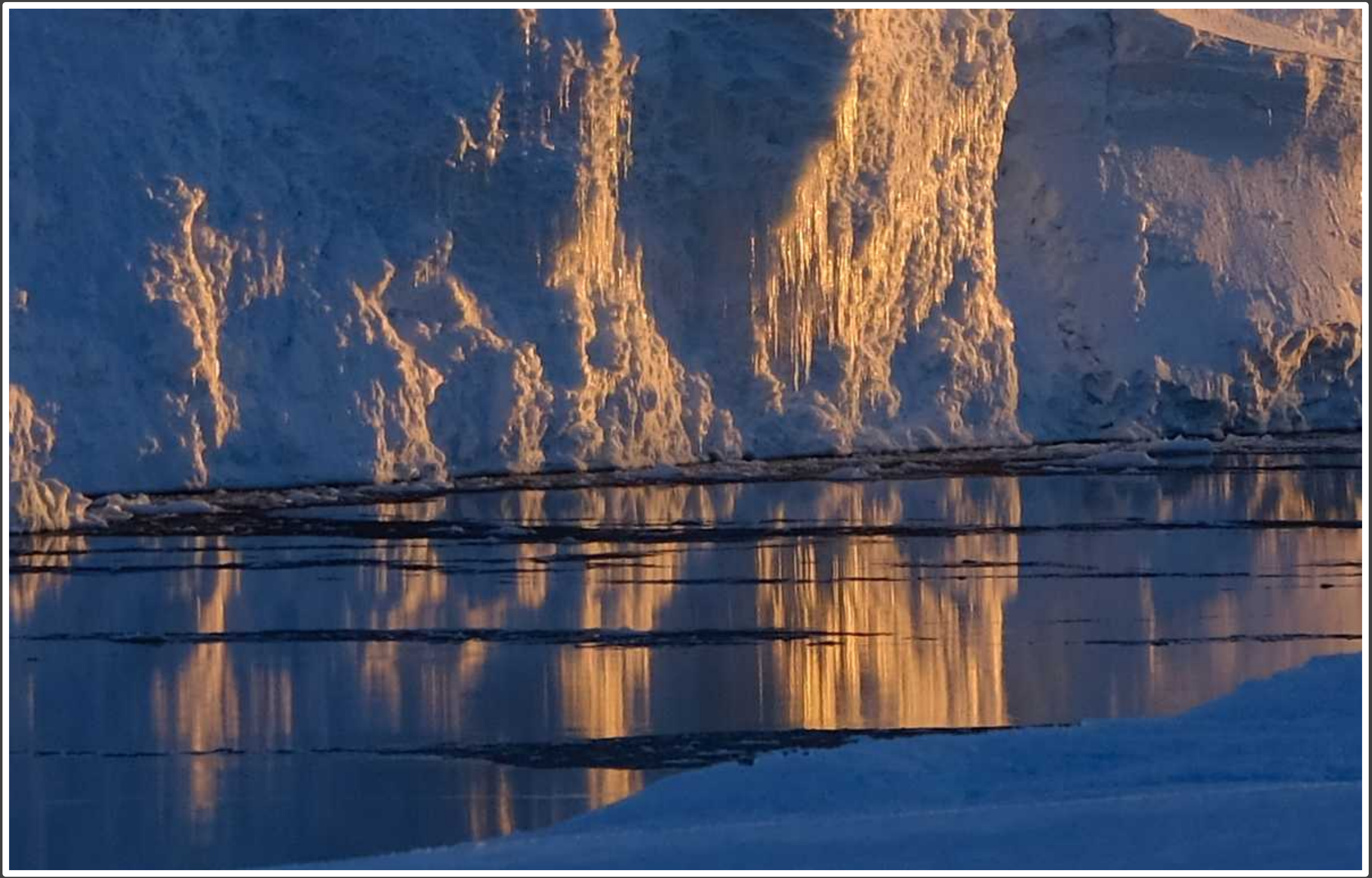
Schlosser, E., F. A. Haumann, M. N. Raphael, 2018: Atmospheric influences on the anomalous 2016 Antarctic Sea Ice decay. *The Cryosphere*, 12, 1-17. https://doi.org/10.5194/tc-12-1103-2018. https://www.the-cryosphere.net/12/1103/2018/

Vega, C. , E. Isaksson, **E. Schlosser**, D. Divine, T. Martma, R. Mulvaney, A. Eichler, and M. Schwikowski, 2018: Spatial and temporal variability of sea-salts in ice cores and snow pits from Fimbul Ice Shelf, Antarctica, *The Cryosphere*, 12, 1681-1697. https://doi.org/10.5194/tc-12-1103-2018. https://doi.org/10.5194/tc-2017-148

2017

Schlosser, E., A. Dittmann, B. Stenni, J. G. Powers, K.W. Manning, V. Masson-Delmotte, M. Valt, A. Cagnati, P. Grigioni, and C. Scarchilli, 2017. The influence of the synoptic regime on stable water isotopes in precipitation at Dome C, Antarctica. *The Cryosphere*, 11, 2345-2361. https://doi.org/10.5194/tc-11-2345-2017. https://www.the-cryosphere.net/11/2345/2017/

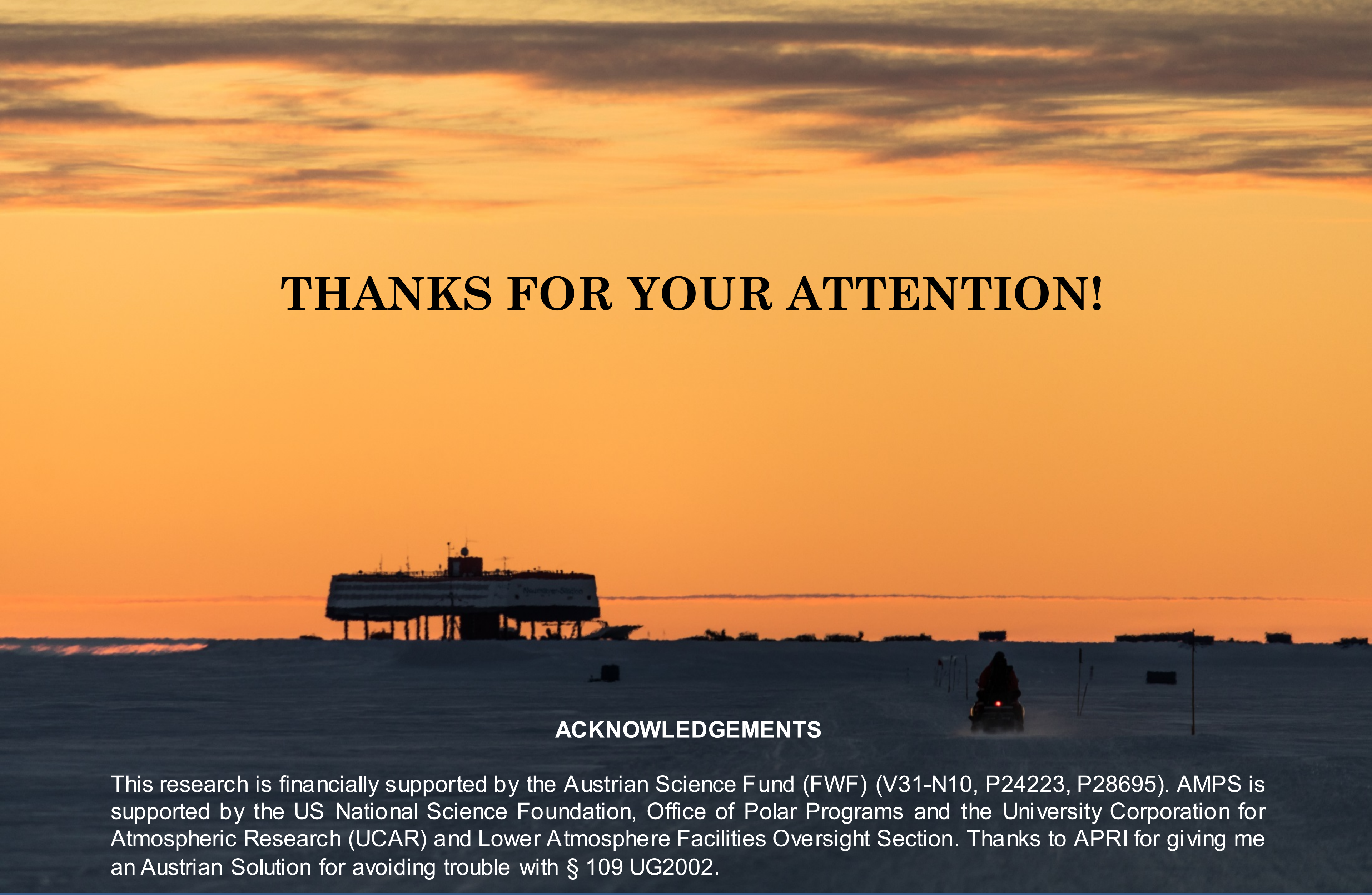
Thomas, E., J. Melchior van Wessem, J. Roberts, E. Isaksson, **Elisabeth Schlosser**, TJ Fudge, P. Vallelonga, B. Medley, J. Lenaerts, N. Bertler, M. R. van den Broeke, D. A. Dixon, M. Frezzotti, B. Stenni, M. Curran, A. A. Ekaykin, 2017. Review of regional Antarctic snow accumulation over the past 1000 years. *Climate of the Past,* 13, 1491-1513. https://doi.org/10.5194/cp-13-1491-2017. https://www.clim-past.net/13/1491/2017/



Inlet at Atka Bay

First sunset with Full Moon

Young emperor penguins at a frozen inlet



THANKS FOR YOUR ATTENTION!

ACKNOWLEDGEMENTS

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