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# A Nine-year series of daily oxygen and hydrogen isotopic composition of precipitation at Concordia station, East Antarctica

Stenni B.[1], Dreossi G.[1,2], Casado M.[3], Scarchilli C.[4], Landais A.[5], Del Guasta M.[6], Grigioni P.[4], Casasanta G.[7], Werner M.[8], Masiol M.[1], Cauquoin A.[8,9] and Ciardini V.[4]

1. Department of Environmental Sciences, Informatics and Statistics, Ca' Foscari University of Venice, Italy
2. CNR-ISP, Venice, Italy
3. Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Telegrafenberg A6, 14473 Potsdam, Germany
4. ENEA, Centro Ricerche Casaccia, Rome, Italy
5. Laboratoire des Sciences du Climat et de l'Environnement/IPSL, UMR 8212, CEA-CNRS-UVSQ, Gif/Yvette, France
6. CNR-INO, Sesto Fiorentino (FI), Italy
7. CNR-ISAC, Rome, Italy
8. Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Bussestraße 24, 27570 Bremerhaven, Germany
9. Institute of Industrial Science, The University of Tokyo, 5-1-5 Kashiwanoha, Kashiwa, 277-8574 Chiba, Japan



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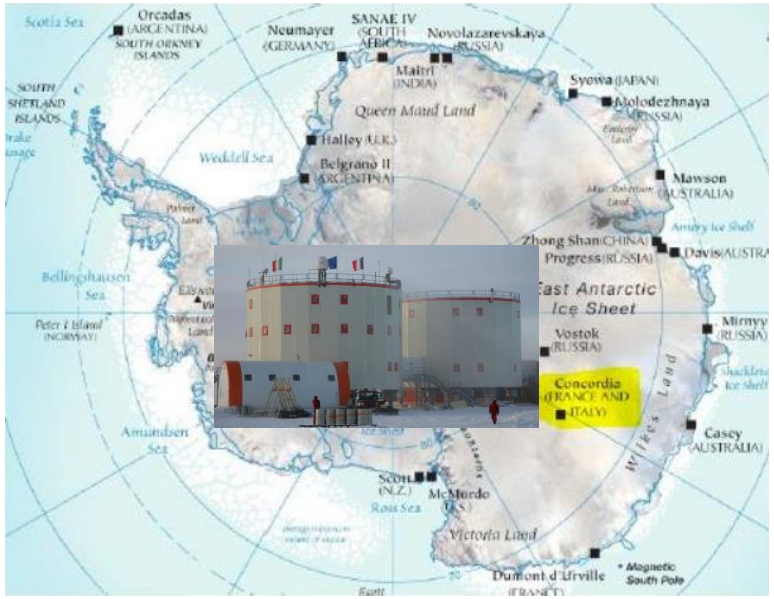
# Dome C (East Antarctica)




**Concordia base**

75°06'S 123°21'E

Altitude: 3233 m a.s.l.
Temperature at 10 m of depth: -54.5°C
2-m Temperature (AWS): -51.2°C (2008-2016)
Mean snow accumulation rate: 25 kg $m^{-2}$ $yr^{-1}$

**Ideal place for ice coring**

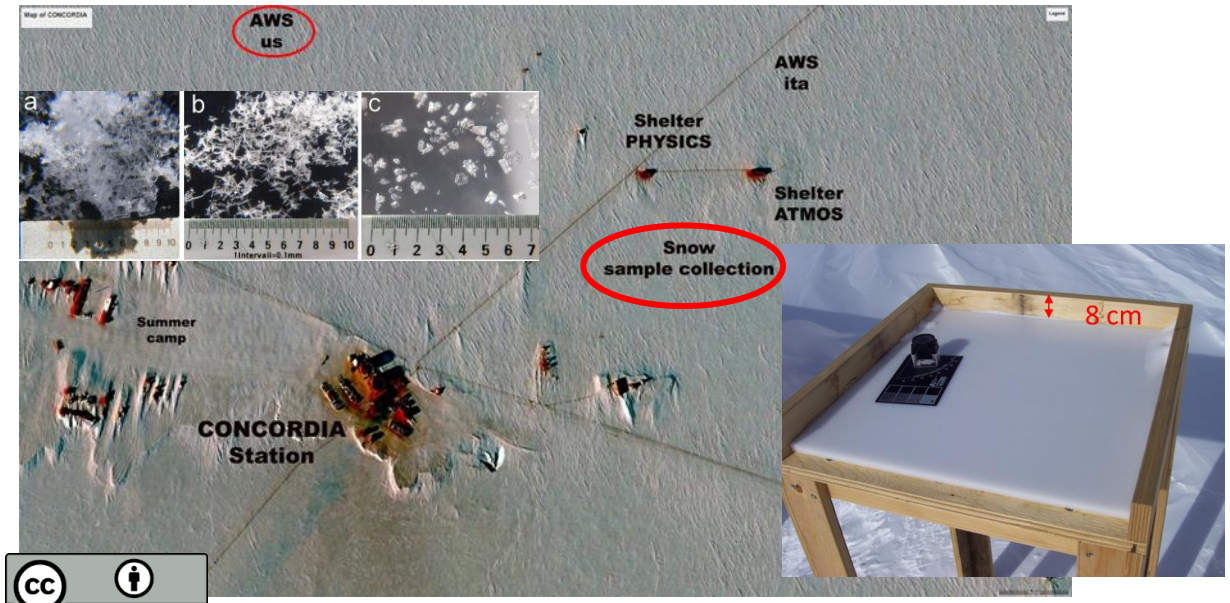
**Dome C (2004)**

3.3 km – 800,000 years

**Little Dome C, 35 km from Dome C (2025)**

2.7 km – 1,500,000 years

The aim is to reach 1.5 Ma, to reconstruct the climate and measure GHGs during the mid-Pleistocene transition





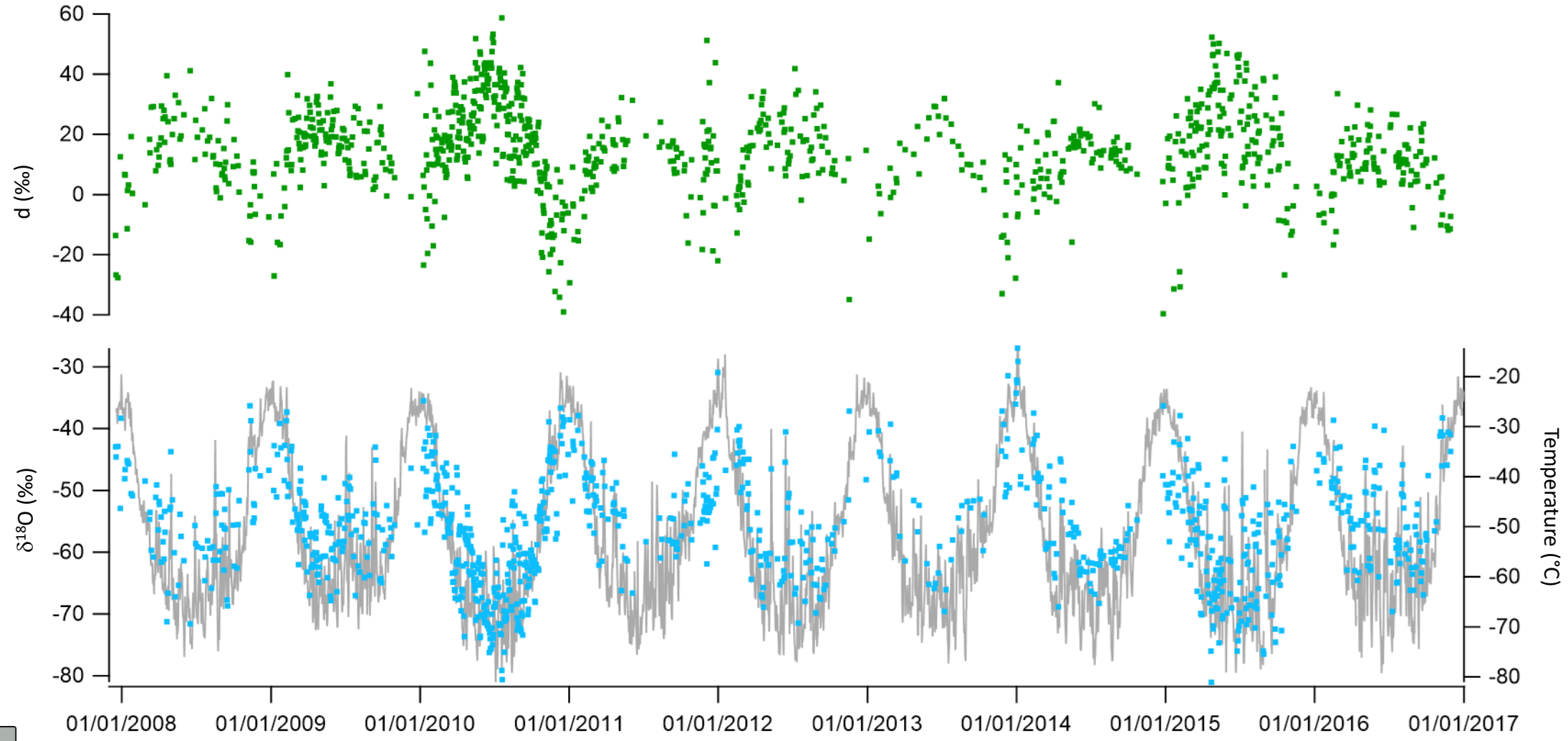


# Precipitation sampling

- Precipitation collected on teflon plates (height: 1 m), 800 m from the base
- Daily precipitation collected continuously since 2008 (in progress)
- The first and so-far only multi-year series of isotopes in daily precipitation in Antarctica (snow surface samples collected at Neumayer St. 1981-2000)
- The instrumental temperature has been recorded by the US AWS, ~1.5 km from the base

# Isotopic data and temperatures

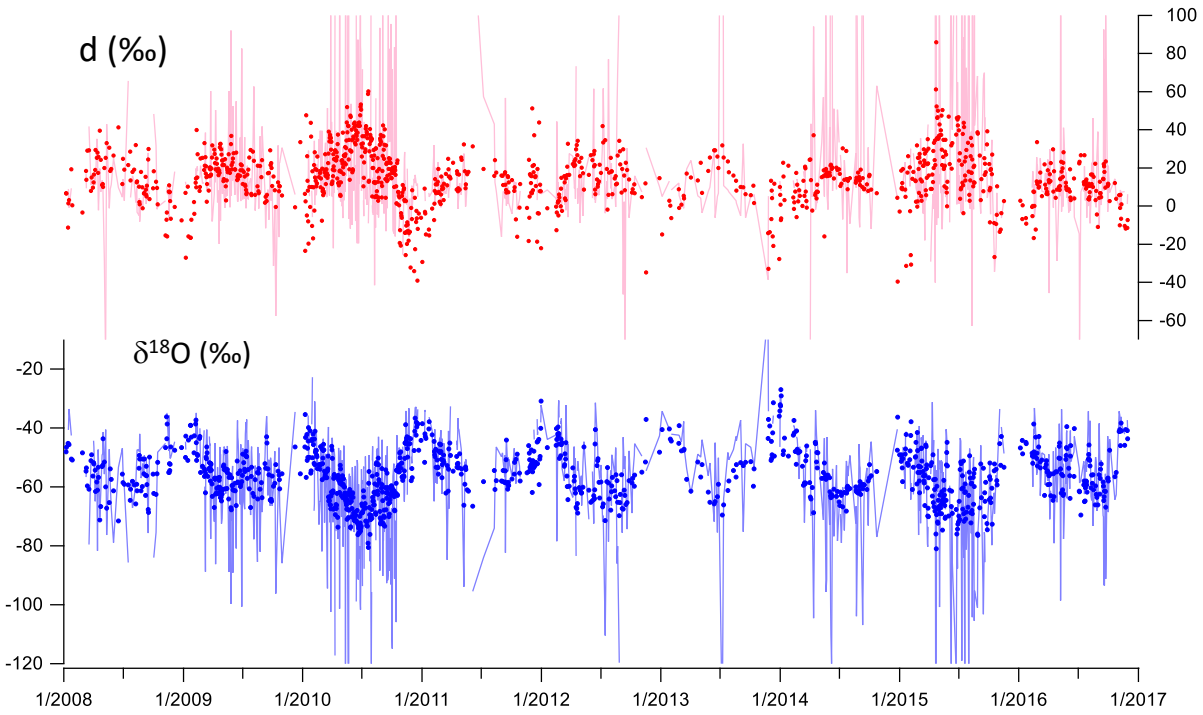
2008-2016 Daily precipitation $\delta^{18}O$ and deuterium excess compared to 2-m AWS temperature



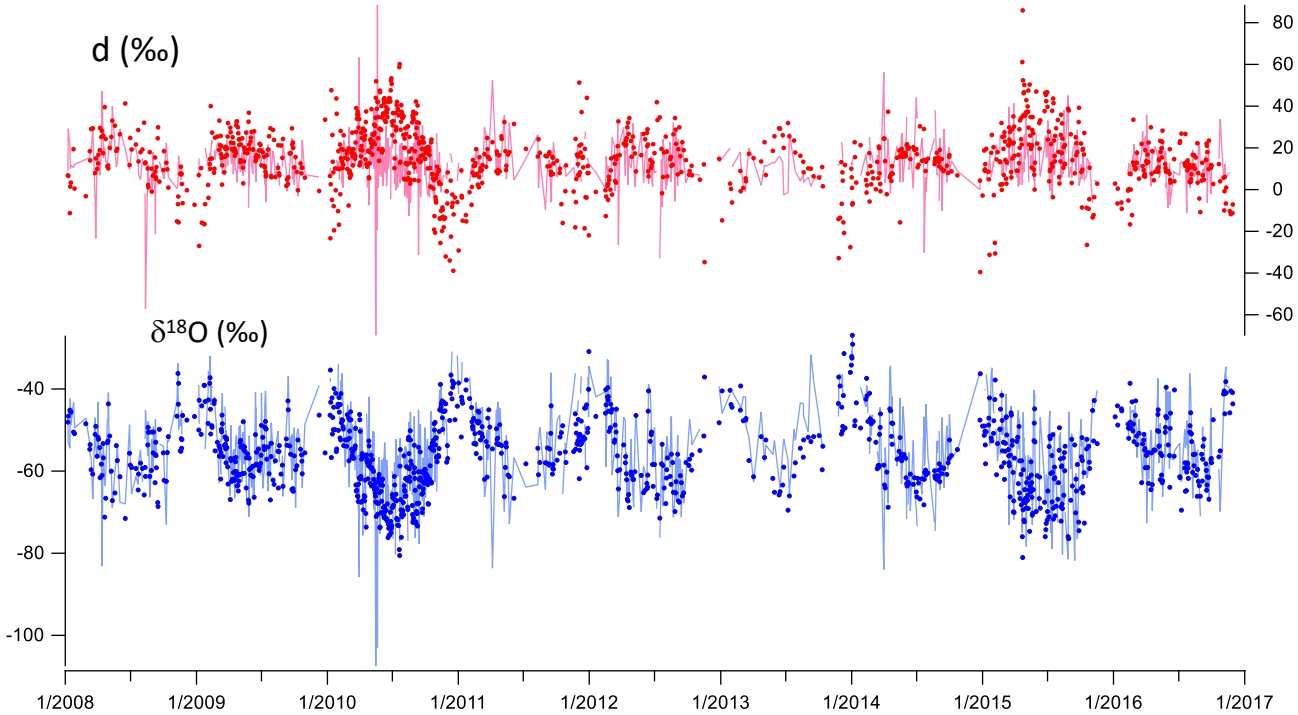
# Measured and modeled isotopic data

ECHAM5-wiso horizontal spatial resolution: 1.1° x 1.1°, ECHAM6-wiso horizontal spatial resolution: 0.9° x 0.9°
ECHAM5-wiso vertical resolution: 31 levels, ECHAM6-wiso vertical resolution: 95 levels
ECHAM5-wiso is nudged to ERA-Interim reanalyses data (Butzin et al., 2014)
ECHAM6-wiso is nudged to ERA5 data (*see also display by Cauquoin and Werner, EGU2020-12319*)

ECHAM5 simulated (lines) $\delta^{18}O$ (and d-excess) and measured (dots) $\delta^{18}O$ (and d-excess)

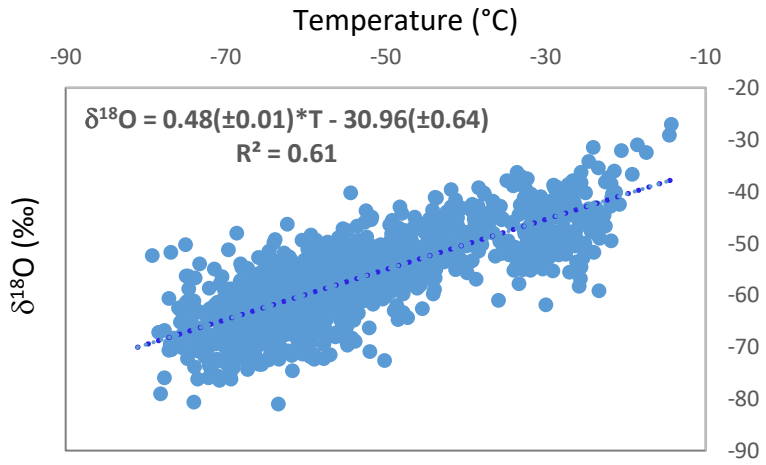



ECHAM6 simulated (lines) $\delta^{18}O$ (and d-excess) and measured (dots) $\delta^{18}O$ (and d-excess)

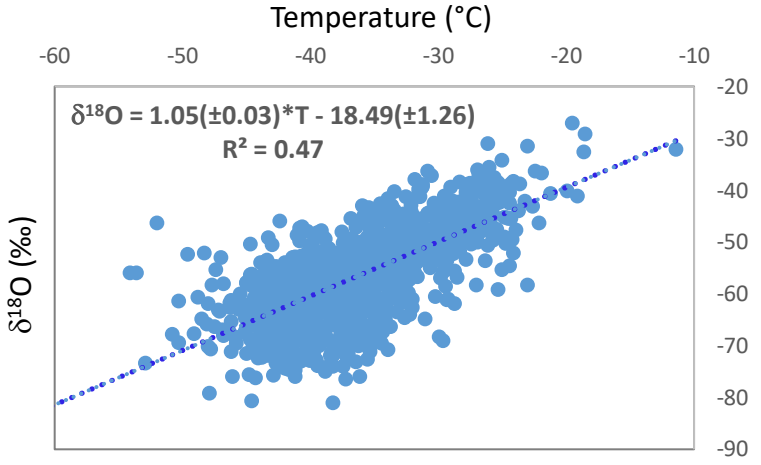


# $\delta^{18}O_p$-T relationship (daily values)

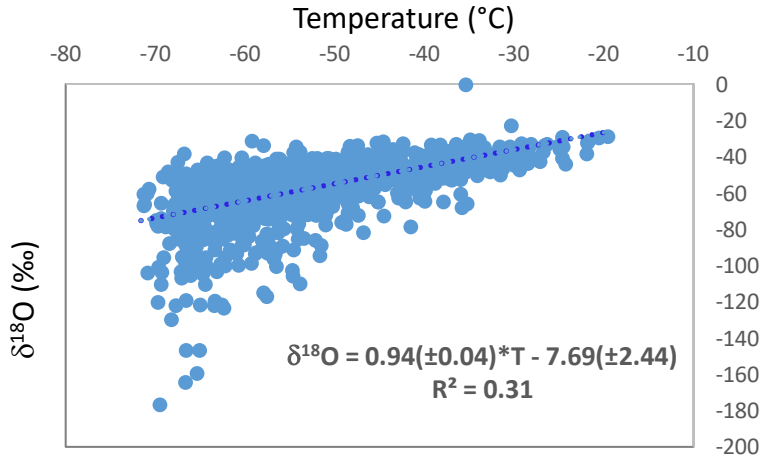
Daily $\delta^{18}O$ precipitation values: 2008-2016
Temperature: $T_{2m}$



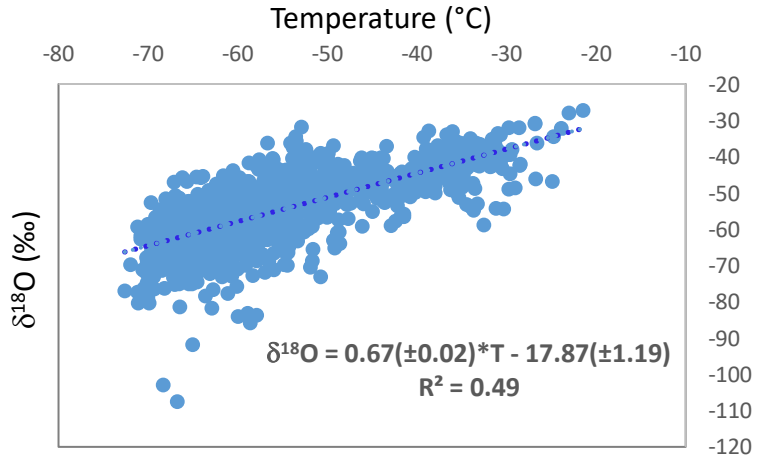

Daily $\delta^{18}O$ precipitation values: 2008-2016
Temperature: $T_{inv}$ (radiosounding)




Daily ECHAM5 $\delta^{18}O$ precipitation values: 2008-2016
Temperature: ECHAM5 $T_{2m}$




Daily ECHAM6 $\delta^{18}O$ precipitation values: 2008-2016
Temperature: ECHAM6 $T_{2m}$



# Conclusions

- An unprecedented isotopes-in-precipitation series is being carried out on a daily basis at Concordia Station (East Antarctica) since 2008
- Both ECHAM5 and ECHAM6 simulated $T_{2m}$ show a good correlation with Dome C AWS $T_{2m}$, but fail to capture summer highest and winter lowest values, as well as winter spikes in temperature, which could be due to advection of moisture masses → precipitation
- A comparison between simulated and measured $\delta^{18}O_p$ and d-excess has been carried out, showing a significant improvement in ECHAM6 simulations, particularly for d-excess
- The linear relationship between measured $\delta^{18}O_p$ and AWS $T_{2m}$ is robust even for daily values, but improves using mean monthly values
- The linear relationship between simulated $\delta^{18}O_p$ and $T_{2m}$ is better captured in ECHAM6-wiso, with a slope closer to the one found in observations

# References


Butzin, M., Werner, M., Masson-Delmotte, V, Risi, C., Frankenberg, C., Gribanov, K., Jouzel, J., Zakharov, V.I. 2014. Variations of oxygen-18 in West Siberian precipitation during the last 50 years. Atmospheric Chemistry and Physics, 14(11), 5853-5869, https://doi.org/10.5194/acp-14-5853-2014

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# Thanks