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

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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 δ^{18} O and deuterium excess compared to 2-m AWS temperature



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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 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 δ^{18} O (and d-excess) and measured δ^{18} O (and d-excess)

<u>ECHAM6</u> simulated δ^{18} O (and d-excess) and measured δ^{18} O (and d-excess)



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



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



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



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



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 \rightarrow precipitation
- A comparison between simulated and measured T_{2m} , $\delta^{18}O_p$ 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



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