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## The 21st-century climatic record in a shallow firn core from Möller Ice Stream Basin, Weddell Sea Sector, West Antarctica

### Content

Water stable isotope compositions are the main key to reconstructing the climatic information. This study evaluates the isotopic record of a shallow firn core (TT01: 9.471 m or 3.930 m w. eq. deep; average density of  $0.42 \pm 0.09$  g/cm<sup>3</sup>) recovered in the upstream area of the Möller Ice Stream Basin (Weddell Sea Sector, WAIS). The TT01 firn core was obtained in the 2015 Brazilian Traverse to WAIS, and it was drilled 30 m east of the site where is installed the Automatic Brazilian Scientific Module Criosfera 1 (CR1: 84°00'00''S, 79°29'39''W; 1276 m a.s.l.). Our research purpose is to investigate the climatic record preserved at this site. The TT1 firn core drilling was performed using the Mark III coring system (Kovacs Inc., USA). After the field campaign, the TT01 sections were decontaminated and melted in the ISO Class 5 Cleanroom Labs at Climate Change Institute (UMAINE, USA). The melting procedure was run in the continuous melting with a discrete sampling (CMDS) system of the UMAINE. In total, 309 samples were produced with a resolution of 0.03 m. These samples were analyzed at the Centro Polar e Climático Glaciochemical Labs (UFRGS, Brazil): stable isotopes compositions were obtained using a wavelength-scanned cavity ring-down spectroscopy (WS-CRDS) analyzer (model L2130-i, PICARRO® Inc., USA) and ionic content was determined using two ion-exchange chromatography systems (Dionex™ ICS-2100 and Dionex™ ICS-2000, Thermo Fisher Scientific Inc., USA). The accuracy of the isotopic analysis was better than 0.2‰ and 0.9‰ for  $\delta^{18}\text{O}$  and  $\delta\text{D}$ , respectively. We analyzed the ionic content to date the core by the annual layer counting (ALC) method. We opted to use the nssSO<sub>4</sub><sup>2-</sup>/Na<sup>+</sup> ratio along with the seasonal variations for TT01 dating. Our results covered 16 years (from 1999 to 2015) with an estimated error of  $\pm 1$  year. The mean isotopic composition was  $-39.12 \text{‰} \pm 2.63 \text{‰}$  for  $\delta^{18}\text{O}$ ,  $-308.43 \text{‰} \pm 21.64 \text{‰}$  for  $\delta\text{D}$  and  $4.5 \text{‰} \pm 2.2 \text{‰}$  for d-excess. We computed an average accumulation rate of 0.24 m w. eq. per year. No statistically significant trend is observed in the isotopic signal as well as in the annual accumulation time series, both consistent with other firn core results obtained in the Weddell Sea Sector and with meteorological data from the Automatic Module CR1 and ERA5 reanalysis, reaffirming the regional climatic stability. We present in our study the cross-correlation between the isotopic signal and annual accumulation from the CR1 site and the time series of large-scale modes of climate variability (SAM and ENSO), ASL indices and sea ice extent. The results obtained will assist the interpretation of the 100 m ice core recovered in the CR1 region.

**Keywords:** Water stable isotopes. Shallow firn core. West Antarctica.

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