



## Testing the ideal ice-core record for past temperature reconstructions using combined isotope and impurity analyses

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Ice cores represent one of the most important palaeoclimate archives, which record, among many other parameters, changes in stable oxygen and hydrogen isotopic composition and soluble ionic impurities. While impurities serve, for example, as proxies for sea ice, marine biological activity and volcanism, records of isotopic composition are the major proxy for the reconstruction of natural polar temperature variability. The latter is based on the temperature-dependent distillation and fractionation of the isotopic composition of water vapour along its atmospheric pathway and empirically determined relationships thereof.

However, temperature is by far not the only driver of isotopic composition changes. A single isotopic ice-core record will comprise variations caused by a multitude of processes, from variable atmospheric circulation and moisture pathways to the intermittency of precipitation and finally to the mixing and re-location of surface snow by wind drift (stratigraphic noise). Taken together, these additional processes constitute a large amount of noise in the single isotope record, which masks the true temperature-related variability. Averaging a sufficient number of records to reduce overall noise is one means to allow for quantitative reconstructions, but its effectiveness depends on the spatial scales of the involved processes. Here, we discuss an alternative approach. Assuming that major impurity species exhibit a seasonal cycle and are mainly also, along with the isotopic composition, deposited by precipitation and redistributed by wind, a large portion of their interannual variability should be linked, which would offer the possibility of using the impurities to correct the variability of the isotopic records.

In this contribution, we present the "ideal" dataset for testing this idea. We sampled and analysed isotopic composition and major impurity species on a four metre deep and 50 metre long trench at Kohnen Station, East Antarctica. This enables us to study the two-dimensional structure and relationship of both proxies to learn about their deposition mechanisms, their seasonality, and to test the ability of a combined isotope-impurity approach to reconstruct local temperatures by comparing so obtained temperature reconstructions with the local weather station data.