

## **Tritium records to trace stratospheric moisture inputs in Antarctica along with stable water isotopes and other tracers**

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Tritium is one of the very few proxies which can document the stratospheric-tropospheric exchange. In fact natural tritium ( $^3\text{H}$ ) is mainly produced in the stratosphere by spallation and rapidly enters the water cycle in the form of tritiated water molecules HTO. Due to the high content of  $\text{H}_2\text{O}$  in the troposphere compared to the stratosphere, the present-day tritium content of the stratosphere is  $10^5$  times the tropospheric one. HTO concentration in precipitation can thus be related to stratospheric moisture input.

Apart from being a key region for climate studies, the East Antarctica Plateau with its low water pressure and precipitation is especially sensitive to stratospheric inputs enriched in tritium. In turn, tritium concentrations in East Antarctica snow should ideally be used to assess the dynamics of stratosphere - troposphere exchanges, but tritium data are very sparse.

In this study, we present high resolution measurements of tritium concentration over the last 50 years at the Vostok station from three different snow pits: this allows us to identify similar cyclic interannual pattern despite stratigraphic noise. For one of the pits, stable water isotopes including  $^{17}\text{O}$ -excess, sodium concentration, as well  $^{10}\text{Be}$  have been measured on the very same samples [1,2]. As for tritium, variations in  $^{10}\text{Be}$  are modulated by the production under the influence of solar activity and partly by the stratospheric inputs, but once produced  $^{10}\text{Be}$  becomes attached to ambient aerosols and are transported and deposited with them. At Vostok, a possible link between  $^{17}\text{O}$ -excess and stratospheric moisture inputs variability has also been suggested [2].

We explore the correlations between these different tracers to confirm the link with stratospheric moisture inputs and to investigate the mechanisms at play in relation with the climatic conditions. In this aim, confrontation with modeling outputs [3] from the LMDZ Atmospheric General Circulation Model enhanced with both stable water isotopes and tritium is very helpful and also allows a comparison of different daily atmospheric profiles corresponding to various patterns in precipitation in terms of amounts and  $^{18}\text{O}$  and  $^3\text{H}$  contents.

The combined use of tritium and stable water isotopes could help to decipher the winters associated with frequent arrivals of warm air from the coast from winters associated with more local moisture inputs.

[1] : Baroni et al., 2011, GCA, 75, 22, 7132-7145

[2] : Winkler et al., 2013, PNAS, 110, 44, 17674-17679

[3] : Cauquoin et al., 2016, JGR Atm, 121, 21, 12612-12629