

# Holocene southern westerly wind variability in the Southern Indian Ocean Sector: a dust record from Amsterdam Island

*Chuxian Li*<sup>1,2\*</sup>, *Jeroen Sonke*<sup>2</sup>, *Gaël Le Roux*<sup>1</sup>, *Nathalie Van der Putten*<sup>3</sup>, *Natalia Piotrowska*<sup>4</sup>, *Catherine Jeandel*<sup>5</sup>, *Nadine Mattielli*<sup>6</sup>, *Giles Wiggs*<sup>7</sup>, *François De Vleeschouwer*<sup>1\*\*</sup>

1. EcoLab, Université de Toulouse, CNRS, INPT, UPS, Toulouse, France.
2. Laboratoire Géosciences Environnement Toulouse, Université de Toulouse, CNRS, IRD, UPS, Toulouse, France.
3. Faculty of Science, Vrije Universiteit Amsterdam, the Netherlands.
4. Silesian University of Technology, Institute of Physics-CSE, Gliwice, Poland.
5. LEGOS Université de Toulouse, CNRS, CNES, IRD, UPS, Toulouse, France.
6. Laboratoire G-Time, DGES, Université Libre de Bruxelles (ULB), Belgium
7. School of Geography and the Environment, University of Oxford, Oxford, United Kingdom.

\* Corresponding author, [chuxian.li@ensat.fr](mailto:chuxian.li@ensat.fr)

\*\* Now at: Instituto Franco-Argentino para el Estudio del Clima y sus Impactos (UMI IFAECI/CNRS-CONICET-UBA), Universidad de Buenos Aires, Argentina

Atmospheric dust production, long-distance transport and subsequent deposition are intricately linked to source conditions, climate and human activities [1]. Holocene dust origins and deposition processes are poorly understood in the Southern Indian Ocean, which limits our understanding of Southern Hemisphere (SH) climate change. An important feature of SH climate is the Southern Westerly Wind Belt (SWW), which influences Southern African, Australian and Southern American aeolian dust trajectories [2].

Here we use elemental and Nd isotope (denoted as  $\epsilon\text{Nd}$ ) proxies in a peat core from Amsterdam Island (AMS) to reconstruct past mineral dust flux, dust provenance, climate change and anthropogenic influence. The peat core covers 6600 years and provides a high-resolution record ( $0.76 \text{ mm yr}^{-1}$ ) of dust deposition from the mid to late Holocene. Two mineral dust flux minima occur during 6.2 - 4.9 cal. kyr BP and 3.9 - 2.7 cal. kyr BP, and may correspond to a strengthening/expansion of the SWW at its northern edge [3, 4]. Lower dust deposition on the peatland under higher wind speed can be explained by wetter local conditions (decreasing dust mobility), and removal of distal airborne particles enroute to AMS by enhanced turbulent wind and enhanced wet deposition [5]. The  $\epsilon\text{Nd}$  and REE ratios show that mineral dust deposited at AMS is a mixture of local and distal sources. This highlights the influence of SWW transporting the dust particles. Using a multi-proxy mixing model,  $\epsilon\text{Nd}$  and REE ratios indicate that the peat received approximately 45% local, 15% Southern African and 50% Southern South American dust. Proportional dust contribution from these three sources were relatively constant for 6600 years, except during the last 120 years. Since 1890 AD, there is a distinct decrease in the local dust input (15%), while the contribution of Southern Africa doubled (32%). The contribution of Southern South America input is relatively constant (53%). Moreover,  $\epsilon\text{Nd}$  values shift from 0.5 to -9.6 over the last 120 years in parallel with a southward-shifted SWW. This suggests an enhanced dust mobilization in the distal sources due to land use, over-grazing and agriculture, especially in Southern Africa. Recent dust compositions therefore suggest that anthropogenic activities play more and more a key role in the SH dust cycle during the last 120 years.

References:

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