

High resolution reconstructions of climate variability in the sub-Antarctic during the last two millennia (AMBIZIONE)

Our understanding of present global climate and the ability to predict future changes are limited by the comparative lack of data from the Southern Hemisphere. The mid to high latitudes of the Hemisphere are dominated by the westerly winds. These are important because changes in their strength determine precipitation and temperature regimes in this region. They are also a key factor influencing global carbon dioxide flux because the winds control the upwelling of deep ocean water rich in carbon, which in turn is exchanged with the atmosphere.

Despite their importance to both Southern Hemisphere and global climates, little is known about how the westerly winds changed in the past. Several key questions remain:

1. What is the past variability in the strength of the westerly winds and how do they influence precipitation and temperature in the Southern Hemisphere and the carbon dioxide sink in the Southern Ocean?
2. How comparable is the pattern of change in the winds between different regions of the sub-Antarctic, Antarctica, mid latitudes of the Southern and the Northern Hemispheres?
3. Are changes in the 20th century of similar rate and magnitude to other periods in the last 2000 years?

The proposed project aims to address these questions by developing and applying new lake sediment-based proxies for changes in wind strength, temperature and/or precipitation at three sub-Antarctic islands (Campbell, Macquarie and Marion Islands) in order to develop 2000-year long climate reconstructions. Sub-Antarctic islands are the only landmasses between Antarctica and the southern extremities of South America, Africa and Australia where terrestrial climate records are available, making them crucial locations for linking southern mid- and high-latitude climate data.

This approach combines a novel, innovative method for reconstructing wind strength with established proxies for temperature and precipitation. To develop circum-hemispheric high resolution reconstructions of changes in westerly wind strength, precipitation and/or temperature over the last 2000 years, the records from Campbell, Macquarie and Marion Islands will be integrated with climate records developed for Tasmania, southern South America and nearby sub-Antarctic islands.

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