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Influence of Southern Ocean dynamics on Antarctic temperatures and on the global carbon cycle over the past two millennia.

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Reconstructions of Antarctic surface temperature covering the past millennia display a large centennial variability that is not synchronous with fluctuations recorded on other continents and which is generally not well simulated by models. Many processes can be at the origin of these temperature variations such as teleconnections with tropical oceans and changes in the Southern Ocean. The focus here will be on the latter, in particular on the influence of westerly winds that have a large impact on the exchange of heat and carbon between the ocean and atmosphere. Changes in the Southern Ocean circulation and stratification also influence the carbon cycle at global scale. It is generally suggested that atmospheric CO₂ variations over the past two millennia were mainly controlled by land processes but the Southern Ocean might have also played a role. We will thus test whether the joint analysis of Antarctic temperature and atmospheric CO₂ concentration fluctuations can inform us on the origin of the observed changes over this period. In this purpose, we use the climate model LOVECLIM which includes a representation of the global carbon cycle. Experiments over the last two millennia will address the sensitivity to realistic perturbations of the wind stress. Finally, experiments with data assimilation will allow assessing what constraints are needed for model results to better reproduce the atmospheric CO₂ concentration and reconstructed temperature history.