



## **What sets the heat content of the Southern Ocean mixed layer?**

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The Southern Ocean plays a crucial role in the global ocean's uptake of heat and carbon. The properties of the winter mixed layer determine the properties of the mode waters that are subducted into the deep ocean, where they can potentially remain for decades to centuries. Thus, understanding how air-sea exchanges, such as wind stresses and heat fluxes, affect the properties of the mixed layer is the first step towards understanding how deep waters will be affected by a changing climate. We use an adjoint modelling approach to find where mixed layer properties are most sensitive to surface fluxes. Our initial results indicate there are localised, key regions that can affect mixed layer properties by inducing changes in circulation and/or mixing. These regions tend to be concentrated near topographical features and are as important as, or in some cases more important than, up-stream properties. Our results can be used to design optimal perturbation experiments in high-resolution models and to identify target regions for future observational campaigns.