



The fast response of the Southern Ocean to changes in the wind stress

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A model study of the Southern Ocean shows that the Antarctic Circumpolar Current responds within two days to changes in the wind stress at the latitudes of Drake Passage. Further investigation shows that the response is primarily barotropic and that, as one might expect, it is controlled by topography. Analysis of the results show that the changes in the barotropic flow are sufficient to transfer the changed surface wind stress to the underlying topography and that during this initial phase baroclinic processes are not involved.

The model results also show that the Deacon Cell responds to the changed wind stress on the same rapid time scale. It is found that the Deacon Cell response can be explained by the change in the barotropic velocity field, an increase in the zonal wind stress producing an increased northward flow in shallow regions and southward flow where the ocean is deep. This new explanation is unexpected as previously the Deacon Cell has been thought of as a baroclinic feature of the ocean.

The results imply that where baroclinic processes do appear to be involved in either the zonal momentum balance of the Southern Ocean or the formation of the Deacon Cell, they are part of the long term baroclinic response of the ocean's density field to the changes in the barotropic flow.