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Interbasin Heat Exchange;
a Study of the Response to Changes in Wind Patterns

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The sensitivity of oceanic interbasin heat exchange, especially the heat transport into the Atlantic, is investigated for changes of the southern-hemisphere wind patterns. Experiments are made with a numerical 3D ocean circulation model, with an idealized two-basin configuration. The model is run until a stationary state is attained. From this solution depth-integrated heat-vectors are determined, by solving the Poisson equation, hereby permitting an efficient mapping of the heat transport patterns.

The interbasin heat exchange is found to be strongly controlled by the wind forcing in the southern hemisphere. Whereas the export of heat from the Pacific remains comparatively unaffected, the wind controls where this heat is released to the atmosphere. In particular, the heat inflow to the Atlantic was found to require wind forcing. For a quiescent atmosphere or weak winds in the southern hemisphere, the results indicate that the Atlantic exports heat to the Southern Ocean, in contrast to the present-day regime with a net northward transport in the entire Atlantic.

In the case of no wind, the interbasin heat exchange is dominated by the cold-water path through Drake Passage, and there is a net southward flow of heat in the southern Atlantic. With wind, the transport along the warm-water path, associated with the Aghullas current, is enhanced, and a large part of the southern ocean starts taking up heat from the atmosphere. As a result, the net flow of heat in the South Atlantic becomes directed northward. Evidently, the wind is responsible for rerouting the excess heat gain of the Pacific into the Atlantic. This means that the upwelling in the southern ocean is not solely responsible for feeding the Atlantic meridional overturning circulation and its attendant heat transport, as frequently argued.