



The role of southern sea-ice export in the formation of deep waters in PMIP-2 simulations of the Last Glacial Maximum

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The formation of Southern Ocean sea-ice is thought to have a major impact on the rate and depth of bottom water formation around Antarctica, especially during glacial climates. In turn, the characteristics of the southern end-member of the deep ocean circulation might have a profound impact on the relative contribution of north Atlantic versus Southern Ocean to the rates of deep ocean ventilation. This is a crucial question as the rates of ventilation of the deep ocean are thought to strongly determine the carbon storage capacity in the deep glacial ocean. We here take the opportunity of the existing Last Glacial Maximum coupled simulations to investigate the role of Southern Ocean sea-ice on the formation of bottom and deep waters around Antarctica. We show that in models for which the southern ocean was considered in an earlier study as a main player in determining the changes in ocean overturning, we find a quasi-linear relationship between the change of meridional sea-ice export velocity and the rate of Southern Ocean deep water formation. We also relate the changes of southern sea-ice export to the changes in wind stress patterns and strength. These results are further analysed with aid of several sensitivity simulations of the Last Glacial Maximum climate in one coupled climate model (LOVECLIM) to better understand the mechanisms at work.