Impact of Weddell Sea shelf progradation on Antarctic bottom water formation during the Miocene

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Abstract

The Weddell Sea is a main location of bottom water formation and, thus, an important component of global ocean circulation. In this study we examine the ocean and climatic responses to a shelf progradation induced by ice sheet advance and glacially transported sediments during the Miocene, using a general circulation model. Our investigations show that relative to a Miocene standard bathymetry, a farther southerly placed shelf break, as reconstructed in a state-of-the-art bathymetry for the Weddell Sea, enables enhanced Antarctic Bottom Water (AABW) formation and gyre transport during the middle Miocene for both relatively high and low atmospheric CO2 concentrations. Furthermore, CO2 sensitivity experiments show that an atmospheric CO2 decline for a setup with the southerly placed shelf break of a new bathymetry has only a minor impact on AABW formation, while the standard setup shows an increase. In combination, these impacts may explain the pronounced deep water formation in the southern high latitudes from the middle Miocene to the late Miocene.