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How do coupled GCMs perform in representing wind-driven upwelling in the Southern Ocean?

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We will show first results form a comparative study of the GCMs in the CMIP3 database concerning wind-driven upwelling in the Southern Ocean. This is motivated by the widespread assumption that wind-driven upwelling (WDU) is one of the drivers of the Atlantic meridional overturning circulation (AMOC). While diapycnal mixing of heat, the other driver of the AMOC, has been extensively studied, the role of WDU as a driver of the AMOC deserves more attention. For instance, it needs to be studied whether the observed increasing wind strength in the Southern Ocean has stabilized the AMOC, or whether it might do so in the future. The amount of WDU depends on a balance of the surface wind forcing, the position of the isopyncal surfaces in the ocean, and the eddy-driven recirculation. In representing this balance, coupled GCMs are challenged because most of them do not explicitly model the eddy activity in the ocean, but merely parameterize it. In a precursory study we analyzed the dependence of the southward outflow of the AMOC at 30ºS on quantities characterizing WDU in the Southern Ocean. That southern outflow is thought to represent the wind-driven part of the AMOC. We cannot detect a significant dependence of the southern outflow on the wind stress in the Southern Ocean among the control runs of the models. There appears only a weak correlation with the strength of the ACC. Interestingly the amount of the southern outflow increases with higher model resolution. This seems counter-intuitive because high resolution models tend to have a stronger eddy recirculation, which reduces the net northward surface flow of the AMOC. The results presented on this poster are preliminary and the analysis is currently being extended to further quantities as well as to global warming scenarios.