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Factors controlling basin-scale Mediterranean circulation: Insight from idealized models

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In order to assess to what extent the Neogene sedimentary record of the Mediterranean basin reflects—and thus potentially provides insight to—global climate, one way forward is to use ocean general circulation modelling. Given the tectonically active setting of the basin, the Mediterranean sediments are expected to have recorded not only changes in climate but also the effects of a changing basin geometry. Modelling allows us, first of all, to separately assess the response of the circulation to these two factors. Secondly, circulation models provide a tool to examine the role of different elements of atmospheric forcing: e.g., changes in momentum flux (wind stress) versus changes in freshwater/heat flux.

In a first step towards achieving these objectives we explore the possibilities and limitations of models with idealized basin shape and/or idealized atmospheric forcing. At the cost of limited resolution of details and processes, these models have the advantage that they focus on the essence of a given forcing mechanism, require a minimum of assumptions regarding ill-known parameters, and allow for long model integration times. The latter is important in order to truly determine the steady-state circulation associated with a certain combination of forcing factors and to be able to determine low-frequency transient behaviour.

As we will illustrate, the idealized models provide a physics-based test of interpretations of the geological record. Moreover, the insight based on the idealized model simulations allows for a better recognition and understanding of the expressions of climate change in the Mediterranean basin, and thus contributes to the use of the Mediterranean record in the study of global paleoclimate.