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Satellite observations of the Mediterranean Sea reveal extremely complex circulation patterns which are highly time-dependent. This is in stark contrast to the simple idealized flow patterns presented in historical studies based on limited in situ observations. These pre-satellite studies were based on collections of data which were not synoptic in time nor space, and resulted in overly smooth idealized flow patterns.

A series of process studies using a hierarchy of numerical ocean models has been undertaken in an attempt to ~~illuci~~-date the dynamics controlling the observed circulation. The numerical models used are variations of a multilayered primitive equations model. The simplest version is a one-active layer, reduced gravity model forced by winds, inflow/outflow mass flux and/or density variations. The results from this simplest version yields flow patterns which are qualitatively similar to the historical representations, but do not help to understand the highly time-dependent mesoscale variability observed in the remotely-sensed data.

Adding additional complexities, such as multiple layers and thus allowing for baroclinic instabilities, bottom topography; realistic non-climatic wind stress, etc., increasingly adds to the realism of the numerical simulations. However, with the more complex models, it becomes increasingly evident that simple explanations for the causes of the observed mesoscale variability will not be forthcoming. By a systematic series of process studies, various responses to the specified forcing can be ascertained. The results to date reveal that no single forcing mechanism by itself can explain all the variability and in most cases a combination of forcing mechanisms are required to produce a simulation of the observed circulation patterns. Keywords: Ocean currents/models.

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