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Mixing related to internal waves and gyres in the western lobe of the Large Aral Sea

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Understanding how mixing develops in the Aral Sea today is important for the evaluation of its future under different scenarios. Mixing is thought to be mainly due to the shear induced by wind currents and to convection. However, new data recorded at the western lobe of the Large Aral Sea in October 2006 under no wind conditions, and within a period of low winds, show the existence of internal waves, suggesting that shear turbulence induced by internal waves could also be an important mixing mechanism.

A 3D hydrostatic circulation model, the POM, was used to simulate the velocity field on the western lobe assuming a horizontally homogeneous salinity and temperature stratification. Numerical results suggest that the origin of these internal waves –which are stationary– could be associated with the interaction of the stratification with the topography. The model also predicts large scale eddies (gyres) within the circulation pattern, possibly driven by the topographic features at the newly formed boundaries of the lake.

Mixing in the lateral zones of the gyres and in the pycnocline where the internal waves are present is analyzed based on the POM results. Because it is unclear how well the Mellor-Yamada model used in the POM can reproduce mixing in conditions of such extreme vertical stratification, these results are discussed from a qualitative rather than a quantitative point of view. The temporal and spatial structure of the simulated internal wave field for different stratifications and under different winds is also analyzed.

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