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Recent changes in the physical regime of the Aral Sea and its response to wind forcing

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This paper is intended to present the results of the latest (summer 2008) field survey of the Aral Sea, a major, critically desiccating salty lake in the Central Asia. This survey was the 9th expedition to the lake conducted by the Shirshov Institute of Oceanology since 2002. Hydrographic CTD profiling and water sampling were done in the western and the eastern basins of the Large Aral. In addition, in the western lobe, we deployed 2 mooring stations, one on the western and the other one on the eastern slope. Each of the stations was equipped by an acoustic current meter and pressure gauge. The moorings were active during 6 days of June, 2008. The measurements were accompanied by continuous registration of meteorological data from a portable automatic meteorological station installed on-site.

In the western basin, the salinity was about 120 ppt (with the maximum at about 10 m depth), while in the eastern basin, it attained the highest ever value of 211 ppt. The vertical structure of the thermohaline fields indicated that the water exchanges between the basins through the connecting strait turned greatly reduced because of the strait narrowing and the shrinking of the eastern basin itself. To support this conclusion, we also demonstrate the recent high resolution satellite imagery of the strait area elucidating its shallowing. We, therefore, are now witnessing the passage of the Large Aral Sea to a new physical regime.

The velocity/level/meteorology measurements yielded some insight in the response of the lake's circulation to the wind forcing. We demonstrate that the level variability in response to the wind stress is determined by the direct wind drag rather than the Ekman transport. This means that the horizontal spatial scales of the shrinking lake have turned too small for the Coriollis force to have significant impact on fast surface currents. The maximum correlation between the wind stress and the level surge corresponds to the time lag of about 24 hours. On the other hand, the near-bottom currents exhibited rather high ($\tilde{0}.8$) simultaneous correlation with the lake level, thus pointing on barotropic nature of the deep circulation – that is, for slow near-bottom currents, the influence of rotation is apparently still significant.