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Diurnal Internal Tides Observed in the Adriatic

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Internal tides represent a dynamical process that has not been systematically studied in the Adriatic Sea so far. It was believed that the sea surface oscillations are too weak to be connected with significant barotropic tidal flow, which could interact with a steplike topography and cause baroclinic tides when the sea is stratified. In the period between March 2001 and March 2002 three thermistors were placed on the submarine cliff on Lastovo Island (southern Adriatic). They provided a vearlong temperature series with 16 min resolution, at the depths of 15, 22 and 36 m. The strongest diurnal oscillations were detected in June at the 22 m depth and during July-August at the 15 m depth. In order to consider thermocline elevations, a step function was fitted to the measured temperature profiles. Temperature and thermocline oscillations were compared with the sea level oscillations and wind changes recorded in Dubrovnik (at a distance of 95 km to the east of Lastovo). Throughout the July-August interval the diurnal changes in the sea temperature were correlated with both the sea level and wind oscillations. The correlation was especially strong during energetic occurrences of winds varying with a daily period and resulting from a coupling of the etesian winds with the sea-land breeze system. However, the strongest connection between the sea surface and thermocline elevations was observed in June, when diurnal wind changes were insignificant while diurnal sea level oscillations achieved annual maxima in the wavelet spectrum. During this month two energetic episodes were present in the sea level spectrum around diurnal period. This modulation occurred because diurnal tidal components have similar periods and different phases in the Adriatic. It also influenced thermocline oscillations, which had two maxima in the month and were in phase with the sea level changes. The range of diurnal sea surface variability was close to 19 cm, while the range of corresponding thermocline variability was about 5.4 m. The analysis of the temperature series near Lastovo represents the first dedicated study of internal tides in the Adriatic. It is deemed to be important for an understanding of different physical and biological processes, including energy transfer from barotropic to baroclinic tides.