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Decoupling of physical processes between the shelf and deep Black Sea

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In this paper we analyse how sea surface temperature on the extensive Western Black Sea shelf was varying from year to year in comparison with the deep region of the sea over the period from 1910 to 2000. An adaptive grid method with a two-scale covariance function is used to produce high-resolution non-interpolated monthly climatologies of time averaged sea surface temperature on a 0.25° grid from an extended set of basic in-situ observations. Temperature anomaly is then calculated as a difference between each original observation and the climatic average for the appropriate calendar month which was spatially interpolated to the sampling site. Individual temperature anomalies are aggregated in time into 3-month seasonal blocks separately for the shelf regions and the deep sea. Time series of aggregated temperature anomalies are calculated and analysed.

Analysis of the time series has revealed decoupling between the shelf and deep sea regions of the sea in response to climate change. While both the shelf and deep regions of the Black sea have similar periods of variability (10-15 years), they have different amplitudes and the modes of oscillations. Correlation between the seasonally aggregated time series for the shelf and deep sea is reasonably high in summer and autumn (R=0.7), however their link breaks down completely in the spring (R=-0.09).

During the transitional spring period, and in particular, during the month of May the difference between time series of sea surface temperature between the deep sea and the shelf is remarkable. On the shelf, the inter-decadal variations related to various seasons are not well correlated; this is why yearly (rather than seasonal) averages would not have revealed true responses of the shelf water to rapid climate changes. Correlation coefficients for the pairs summer-winter and summer-spring are fairly low, R=0.27 and 0.29 correspondingly. Summer and autumn time series are more closely correlated with R=0.47.

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