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Assimilation of space imagery for retrieving of marine surface currents

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Variational assimilation method is applied to retrieve the sea surface velocity from the set of NOAA-AVHRR images with the spatial resolution 1 km. The method is based on the assumptions that the evolution of image contrasts is described by the transport –diffusion model and that the surface velocity field varies much slower than the temperature field observed by space imagery. The set of images of the Black and Caspian Sea surface is processed to analyze surface current scales and intensity. Space observations of fine scale meandering of the Rim Current Jet, fine structure of mesoscale eddy currents and detachment of the wind-induced coastal upwelling are the base of the analysis. Presented examples show that surface currents induced by mesoscale features with typical spatial scale up to few kilometers are very intense. The current speed obtained by the processing of imagery sometimes exceeds twice that retrieved from altimetry measurements, which assumes at least ten km spatial averaging. Maximal of velocity achieves 0.524m/s whereas altimetry assimilation shows broad jet with the current speed about 0.1-0.15 m/s. The current speed in mesoscale eddies in average is about 0.35 m/s while its maximum value achieves 0.444 m/s. The Black Sea Rim Current jet is rather narrow and subjected to the strong meandering. The most intense meanders induce the formation of cyclonic and anticyclonic eddies to the left and to the right of the jet. The current speed of the jet achieves 0.45 m/s which correspond to the restricted direct measurements which were fulfilled at the Black Sea. The comparison with independent measurements of sea surface currents by drifters show good quality of the estimated velocity field.