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Peculiarities of marine eddy manifestation in the structure of surfactant slick band

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Slick structures on the sea surface can mark processes occurring in upper ocean and atmosphere. Spiral shape of slicks observed in optical and radar images of water surface is traditionally interpreted through the manifestation of marine eddy which length scale is supposed to be equal to the scale of spiral. This assumption implies that wind has no effect on the kinematics of forming slick band, which, according to our estimation, is incorrect even at moderate wind velocities. This approach can cause misinterpretation of remote sensing data when estimating the characteristics of observed marine eddies. This study is devoted to the investigation of conditions necessary for the formation of slick spiral and to some peculiarities of its shape and scale.

The system of equations for the description of kinematics of Lagrangian particle (element of water surface covered with surface active substance) in the fields of axisymmetric eddy with non-zero radial velocity component and homogeneous wind was obtained. It is demonstrated that the spiral center is not collocated with the center of the eddy; the distance between them can achieve the eddy length scale. It is shown that the displacement of the spiral center and the direction of the main axis is quasi perpendicular to the wind direction when radial component of the eddy is small compared to the tangential component. The presence of the threshold wind velocity corresponding to the breakdown of the spiral structure is demonstrated analytically. The possibilities of correct retrieval of length scales and character velocities of observed sub mesoscale marine eddies are discussed.

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