Using reflection seismic method to estimate the fluid dynamics parameters related to wakes

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In this study, when using reflection seismic data to study the wakes of the Batan Islands, a method for estimating the fluid dynamics parameters such as the relative vorticity (relative Rossby number) and the relative potential vorticity is proposed. Although the relative Rossby number estimation method proposed in this study cannot guarantee absolute accuracy in the calculation value, this method is more accurate in describing the positive and negative vorticity distribution for the wakes, and the resolution of the positive and negative vorticity distribution described by this method is higher than the result of the reanalysis data. For the wakes developed in the Batan Islands, the reflection events in the wake development area have the larger inclination than the reflection events in the western Pacific water distribution area. It is also found that the negative vorticity wakes are mainly distributed on the west side of the island/ridge, and the positive vorticity wakes are mainly distributed on the east side of the island/ridge. This is consistent with the understanding of previous wakes simulations. The strong vorticity values in the study area are mainly distributed at depths above 300m, and the maximum impact depth of wakes can reach 600m. At the downstream position of the wake on the survey line 7, it can be seen that the bottom boundary layer has separated, and there is the negative vorticity wakes on the west side intruding into the positive vorticity wakes on the east side, which is presumed to be caused by the disturbance of the small anticyclone existing near the Batan Islands. For the survey line 7, the negative potential vorticity is mainly distributed on the west side of the island/ridge, and the influence range can reach the sea depth of 600m. In the negative potential vorticity region, there is strong energy dissipation and vertical shear. In this study, we don't find the existence of submesoscale coherent vortices on the survey line 7, but find the reflection structure similar to filaments on the seismic section. Combined with the analysis of the balanced Richardson number angle of survey line 7, we speculate that the wake in the negative potential vorticity distribution area has the characteristics of symmetrical instability, and the symmetrical instability may destroy the process of filaments forming submesoscale coherent vortices.