

## The evolution of mode-2 internal solitary waves modulated by background shear currents

\*Peiwen Zhang<sup>1</sup>, Zhenhua Xu<sup>1,2</sup>, Qun Li<sup>3</sup>, Baoshu Yin<sup>1,2</sup>, Yijun Hou<sup>1,2</sup>, Antony Liu<sup>4</sup>

1. Institute of Oceanology, Chinese Academy of Sciences, 2. Qingdao National Laboratory for Marine Science and Technology, 3. Polar Research Institute of China, 4. Ocean University of China

The evolution process of mode-2 internal solitary waves modulated by the background shear currents was investigated numerically. The mode-2 internal solitary waves were modulated by background shear currents which were set to overlap or offset the wave center, and the shear current provided a perturbation state generating forward-propagated long waves and amplitude-modulated wave packet, and then the oscillating tail was generated and followed the solitary wave. Forward-propagated long waves were robust to the offset and remained mostly unchanged in all cases. In contrast, oscillating tails and amplitude-modulated wave packet decreased in amplitude with increasing offset. The highest dissipation rate was observed when overlap occurred. In the first 30 periods, nearly 36 percents of the total energy lost at an average rate of  $9 \text{ W m}^{-1}$ , it would deplete the energy of the solitary wave in 4.5 h, corresponding to a propagation distance of 5 km, which is consistent with the hypothesis of *Shroyer et al.* 2010, who speculated that the mode-2 internal solitary waves are "short-lived" in the presence of shear currents.

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