Observed energy cascade from internal solitary waves to turbulence via near N-waves in the ocean

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High temporal resolution mooring observations reported here revealed that there exist energy cascades from internal solitary wave (ISW) to turbulent mixing via smaller, high-frequency internal waves near the maximum local buoyancy frequency (near N-waves), which are transient, inhomogeneous in space. These near N-waves, riding on the parent ISW, emerged at the trough and gradually extended to the rear face of ISW with their amplitudes becoming larger and larger. Most of the enlargement occurred in the primary stratified layer, where the displacements between the density surfaces are largest. The near N-waves riding on a typical ISW held approximately 5 percent of the energy of ISW during its passage. Simulations of the KdV-Burgers equation confirmed the emergence of the near N-waves due to the energy cascade, similar as in the observation. The above results point out a new route of energy cascade from ISWs to turbulence in the ocean, which would be helpful on deepening the understanding of the mechanism of wave-induced mixing and energy cascade in internal waves.