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Embedded Mode-2 Internal Solitary Waves

Inside stratified fluids, regions of rapid density variation with respect to depth (pycnoclines) act as waveguides for horizontally propagating internal waves. In this talk we shall examine internal waves of the second baroclinic mode (mode-2), by computing travelling wave solutions to a simplified three-layer model. We will be presenting numerical solutions to both the full Euler system, and a reduced model called the three-layer Miyata-Choi-Camassa (MCC3) equations. Mode-2 waves (typically) occur within the linear spectrum, and are hence associated with a resonant mode-1 oscillatory tail. However, in line with recent results for the MCC3 system by Barros, Choi & Milewski (JFM, 2020), we will present numerical evidence that these oscillations can be found to have zero amplitude, resulting in truly localised solutions. We relate large amplitude solutions to the so-called conjugate states of the system, where the limiting solutions of many of the solution branches are a heteroclinic orbit between conjugate states (i.e. wavefront solutions).