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Solitary wave trains and internal undular bores

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In the weakly nonlinear long wave regime nonlinear internal waves in the coastal oceans, can be modelled with the variable-coefficient Korteweg-de Vries equation,

$$A_t + cA_x + \frac{cQ_x}{2Q}A + \mu AA_x + \lambda A_{xxx} = 0\,. \tag{1}$$

Here $A(x,t)$ is the amplitude of the relevant linear long wave mode, usually mode 1. c is the with linear long wave phase speed, Q is a linear magnification factor which ensures that wave action flux is conserved, μ, λ are system-dependent coefficients, and all these vary slowly with x. We show that an adaptation of Whitham modulation theory to a solitary wave train can be used to describe the evolution of internal undular bores over variable topography. The theory can be used for both amplitude growth over a slope, and for situations where there is a polarity change.