Energy Conservation in the Australian Coastal Experiment: Coastal-Trapped Wave Calculations

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A recent paper by Brink (1989) considered the normalization of coastal-trapped wave (CTW) eigenfunctions necessary for the conservation of the energy flux of coastal-trapped waves propagating in a slowly varying medium. In reports of the Australian Coastal Experiment (ACE; see Freeland et al. 1986; Church et al. 1986a,b), an experiment off southeastern Australia designed specifically to examine CTW dynamics, there was no statement of what normalization was used. In light of Brink's recent work, we thought we should report this information, because bottom topography and stratification varies considerably in the ACE region and incorrect normalization would invalidate the results of the calculations.

Very early in the analysis of the ACE dataset it was realized that alongshore variations in shelf topography and stratification strongly affect the amplitude of the eigenfunctions at the different alongshore locations. In completing the CTW calculations for the ACE, the eigenfunctions were normalized by setting (in Brink's terminology) $D_n f$ to unity; i.e., in the ACE analysis,

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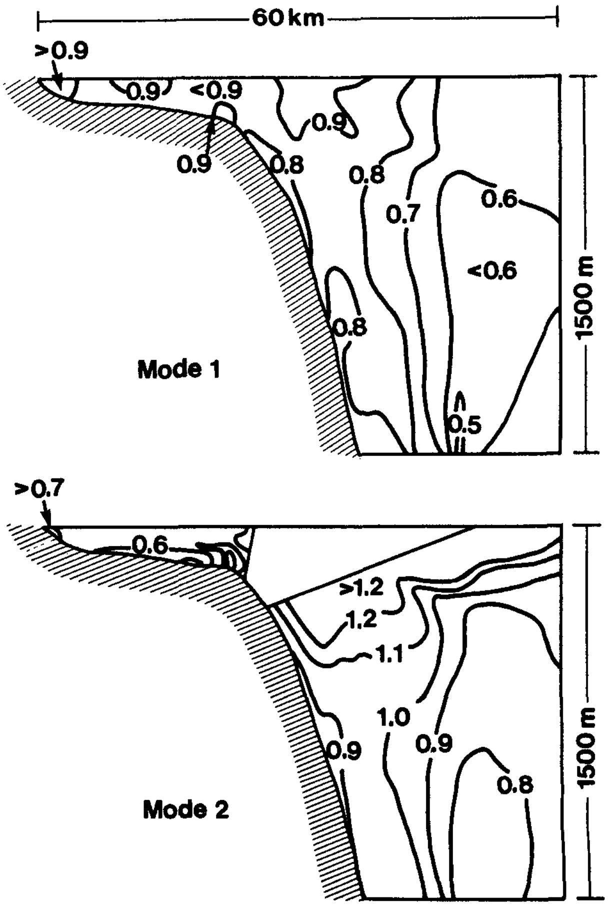

FIG. 1. Ratio of the value of eigenfunction 1 and 2 at Stanwell Park compared with Cape Howe. For the second eigenfunction, no ratios are given in the region near where the eigenfunction changes sign.

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alongshore variations in shelf topography and stratification were allowed for correctly. Figure 1 shows the ratio of the value of the eigenfunctions on the shelf for the ACE mooring lines at Cape Howe (37.5°S) and Stanwell Park (34.3°S). Thus, for unit amplitude of eigenfunction 1 (2), the modelled currents on the shelf are up to 15% (40%) smaller at Stanwell Park. If this change in the value of the eigenfunctions had not been allowed for then the currents on the shelf at Stanwell Park would have been significantly overestimated.

However, Brink (1989) has shown the constant D_n should be set to unity rather than $D_n f$; i.e. in the normalization used in ACE variations in f (the Coriolis parameter) were ignored, and as a result the modal amplitudes and currents hindcast with the coastal-trapped wave model are slightly too large. For the latitudes of Cape Howe and Stanwell Park, this results in an overestimate of the currents of less than 4%. While in other circumstances this oversight may be a significant error, the impact on the ACE results is well within the noise level.

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