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**Resonant Oscillations of Shallow Flow Past a Cavity: Exchange Coefficients and Depthwise Variations** BURAK AHMET TUNA, EGEMEN TINAR, DONALD ROCKWELL, Lehigh University — Fully turbulent shallow flow past a cavity can give rise to highly coherent oscillations, which arise from coupling between: the instability of the separated layer along the cavity; and a standing gravity wave mode within the cavity. These oscillations yield large increases in the time-averaged entrainment and mass exchange coefficients between the cavity and the main flow. Such increases are due to substantial enhancement of turbulent stresses in the separated shear layer during the coupled oscillation, relative to the stresses associated with no coupling. Patterns of the flow structure have been characterized as a function of elevation above the bed (bottom surface) of the shallow flow. At elevations close to the bed, the time-averaged streamlines are deflected inwards towards their center of curvature. This streamline deflection is due to radial migration of flow along the bed, which arises from a radial pressure gradient. In addition, patterns of normal and shear Reynolds stresses are substantially altered as the bed is approached. These changes of stresses with depth are, in turn, associated with degradation of coherent, phase-averaged patterns of vortex formation in the separated shear layer. All of the foregoing aspects of the depthwise variations of the flow patterns are related to corresponding changes of the entrainment and mass exchange coefficients.

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