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Energetics of coastal and estuarine upwelling

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A realistic numerical simulation of the Columbia River estuary and plume is used to explore the physics of vertical turbulent buoyancy flux in this system. Buoyancy flux is important because it is linked to nitrate flux to the euphotic zone. It is found that the forcing for buoyancy flux varies geographically. Within the estuary and in the near-field plume region tidal forcing is most important, while in the far-field plume region wind forcing dominates, as expected. The net buoyancy flux is found to be greater in the far-field plume, despite the relatively small mixing rates; this is because of the greater area of the far-field region.