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Parameter dependence of the mixing behaviour of a wind-driven shallow lake

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As important environmental features, mixing properties of inland water bodies under unsteady flow conditions are investigated. Time dependent motion, often resulting in chaotic behaviour, requires Lagrangian description of the transport. As a simple example, a wind-induced shallow lake is chosen to explore the main chaotic properties. Coherent structures responsible for mixing properties like stable and unstable manifolds are determined and compared by using the finite size Lyapunov exponents (FSLE) and the leaking method. The effect of an internal boundary layer developing over the lake is also considered. We analyse the influence of the changes in water depth and in the shore surface roughness on the evolving chaotic patterns and mixing behaviour. The identification of possible hazardous subregions from the point of view of pollution is explored. We also investigate the effect of aperiodic wind forcing. A case study of a Central-European shallow lake is also provided.