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Longitudinal dispersion in natural channels: 3. An aggregated dead zone model applied to the River Severn, U.K.

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Abstract. An Aggregated Dead Zone (ADZ) model is presented for longitudinal dispersion of tracer in river channels, in which the channel cross-section is divided into two parallel regions: the bulk flow and dead zone storage. Tracer particles in the bulk flow are assumed to obey plug-flow advection at the discharge velocity U without any mixing effects. The dispersive properties of the model are completely embodied in the residence time for tracer storage in the dead zone. The model provides an excellent description and prediction of empirical concentration-time distributions, for times $t < x/U$. Its physical realism is demonstrated by using it to describe the evolution of a tracer cloud in the River Severn, U.K., and by comparing it with a more complex model which incorporates the additional effects of shear flow dispersion within the bulk flow. The ADZ model is a potentially useful tool for practical prediction of dispersion in natural channels.

Keywords: Channels; dispersion; dead zones; tracers; River Severn

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