In the above, is a normal random variate, *wt* is the total vertical velocity at time *t*, *W*(*d*) is the deterministic (directed) swimming speed at depth *d*, *D* is the diffusion constant, and is the integration time step. If *W*(*d*) = 0 for all *d*, (i.e., no directed swimming occurs), then the *variance* of the vertical displacement of a particle from its initial depth increases like over time (i.e., like a white noise process). The effect of the terms in parentheses in *W*(*d*) is to make the directed swimming speed smoothly go to zero as an individual approaches its preferred depth range (e.g., Fig.1).

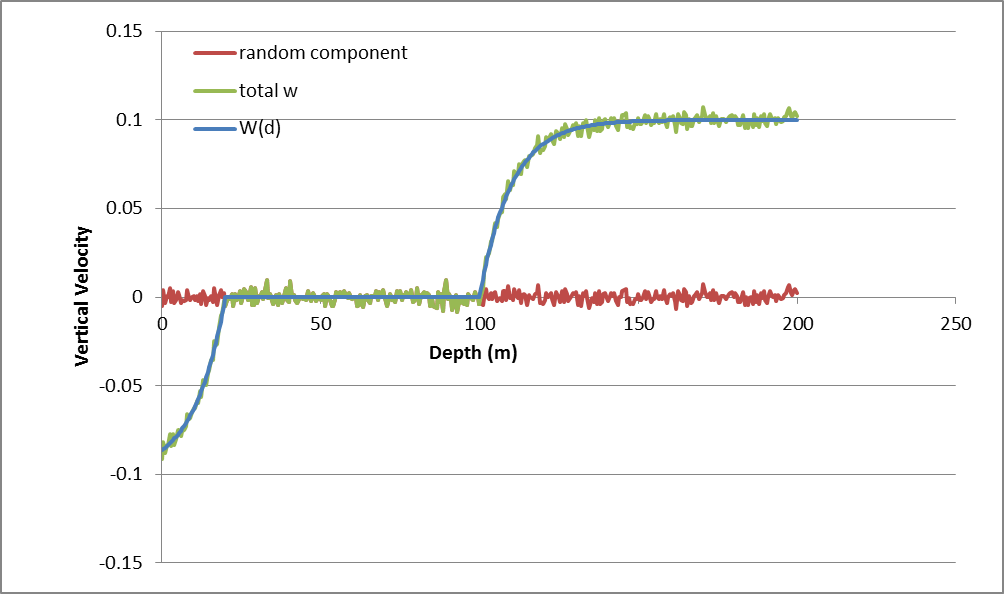


Figure . Example profile of vertical velocity. m. m. *v* = 0.1 m/s, *D* = 0.01 m2/s, s.