A drift homogenization problem revisited

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Abstract. This paper revisits a homogenization problem studied by L. Tartar related to a tridimensional Stokes equation perturbed by a drift (related to the Coriolis force). Here, a scalar equation and a two-dimensional Stokes equation with a L^2-bounded oscillating drift are considered. Under higher integrability conditions the Tartar approach based on the oscillations test functions method applies and leads to a limit equation with an extra zero-order term. When the drift is only assumed to be equi-integrable in L^2, the same limit behaviour is obtained. However, the lack of integrability makes difficult the direct use of the Tartar method. A new method in the context of homogenization theory is proposed. It is based on a parametrix of the Laplace operator which permits to write the solution of the equation as a solution of a fixed point problem, and to use truncated functions even in the vector-valued case. On the other hand, two counter-examples which induce different homogenized zero-order terms actually show the sharpness of the equi-integrability assumption.