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Recruitment to the Ekman drain from the shelf edge to the west of Scotland

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A persistent, but somewhat variable, slope current flows poleward along the shelf edge to the west of Scotland. It has been proposed that the downslope Ekman transport on the base of the slope current represents a significant export of water and suspended material from the shelf. The detailed dynamics of this 'Ekman drain' remain poorly understood, however. This largely reflects uncertainty surrounding the source of the fluid and material within the drain, and also concerning the interaction between this water and more strongly-stratified overlying water. Here we examine one aspect of this system: recruitment to the Ekman drain as stratified water is drawn into the bottom boundary layer on the shelfward flank of the slope current.

During the summer of 2013, as part of a concerted study of shelf edge exchange in this region (the FASTNEt project), a dye tracer was injected into the water column at mid depth near the shelf break, close to the 200 m isobath. This was within the shelfward flank of the slope current. The resulting dye patch was tracked for more than 4 days as it advected alongslope, remaining close to the 200 m isobath, at a mean speed of around 8 cm s^{-1}. The cross-slope shear on this flank of the slope current implies a divergent bottom Ekman transport, which in turn requires a balancing downward flux. The dye-laden water was seen to deepen with time, at around 10 m day^{-1}. It also crossed density surfaces, with its density increasing until it was entrained into the 50-100 m thick bottom boundary layer. Microstructure data collected during dye tracking help to clarify the vertical advective-diffusive behaviour of the dye-laden water during its modification and ultimate entrainment.