Implications of the vortex dynamics on the evolution of vortex ripples in an oscillatory flow

B. Sishah[1], G. Vittori[1]
[1] Department of Civil, Chemical and Environmental Engineering.
University of Genoa, Genoa (Italy)

The oscillatory turbulent flow over fixed two dimensional ripples is numerically solved by using an appropriate turbulence closure. The aim of the contribution is that of detecting features of the flow field which influence the ripple shape and the sediment transport.

The flow depends on three dimensionless parameters: the Reynolds number (Re), the ripple steepness (h/L) and the ratio between the amplitude of fluid excursion close to the sea bed and ripple wavelength (A/L).

The results suggest that, for increasing values of A/L, the vortex shed on one side of the ripple crest is no longer the mirror image of the vortex shed on the other side of the ripple during the following half oscillation cycle. This suggests, for ripples forming in an erodible bottom, an uneven degree of sediment entertainment from the two sides of the ripple crest. Moreover, steady recirculating cells form (see figure 1). The number of cells which form per ripple length can be either one or two, depending on the values of the parameters. The presence of steady recirculating cells is expected to influence the equilibrium shape of the ripples. The evaluation of the plane and time averaged velocity component shows the formation of an horizontal steady streaming, which is directed either onshore or offshore. Such steady streaming is bound to influence the cross-shore sediment transport.

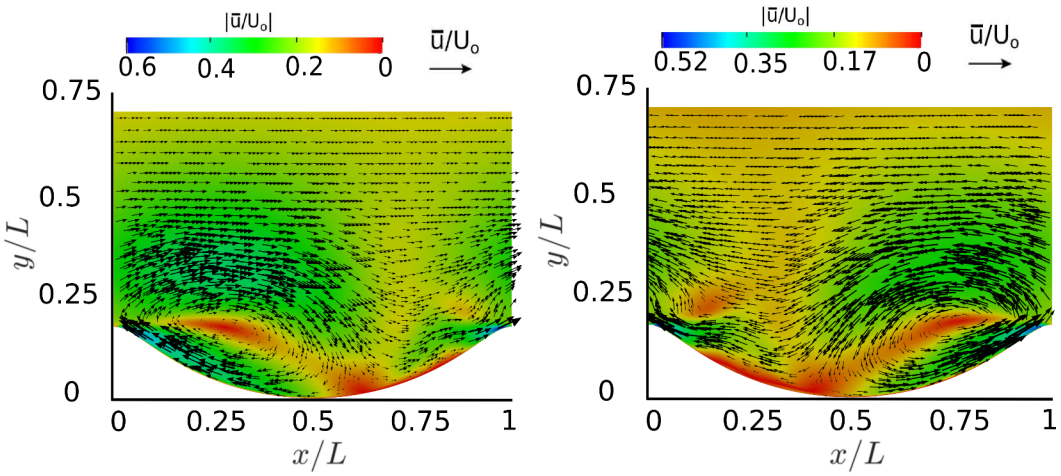

Figure 1: Steady velocity component computed considering the 11^{th} cycle. $Re = 1.4 \times 10^5$, $h/L = 0.18$. Left panel A/L=1.44, right panel A/L=1.53.