We present simulations of low mass planet-disc interactions in inviscid three dimensional discs uniquely enabled by PRACE Tier-0 computing resources. We show that a wind-driven laminar accretion flow through the surface layers of the disc does not significantly modify the migration torque experienced by embedded planets. More importantly, we find that 3D effects lead to a dramatic change in the behaviour of the dynamical corotation torque compared to earlier 2D theory and simulations. Whereas it was previously shown in those 2D models that the dynamical corotation torque could act to slow and essentially stall the inward migration of a low mass planet, our results in 3D show that the dynamical corotation torque has the complete opposite effect and speeds up inward migration. Our numerical experiments implicate buoyancy resonances as the cause. They torque the gas librating on horseshoe orbits in the corotation region and drive evolution of its vortensity, leading to the negative dynamical corotation torque. This indicates that at low turbulent viscosity, the detailed vertical thermal structure of the protoplanetary disc plays an important role in determining the migration behaviour of embedded planets. If this result holds up under more a refined treatment of disc thermal evolution, then it has important implications for understanding the formation and early evolution of planetary systems.

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