The impact of vertical shear on hurricane-like vortices with moist neutral cores

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We use an idealised framework to investigate the impact of environmental vertical shear on a hurricane-like vortex with moist neutral conditions in the core. The motivation behind this study is to understand the changes in the vertical circulation seen in idealised modelling studies when the inner core of a tropical cyclone saturates. We do not include an explicit parameterization of moisture in this study, but represent the effects of latent heat release in saturated flow in an idealised manner. For moist neutral conditions in the vortex core the vertical velocities become considerably higher than in dry model runs. A quasi-steady state develops in which the shear in the inner core is almost completely cancelled by the asymmetric secondary circulation. The core is not forced to tilt, but remains upright. The shear is cancelled by the divergent flow directly associated with the vertical motion and by the non-divergent flow that is caused by potential vorticity anomalies generated by the vertical motion. Vortices with moist neutral cores are able to withstand considerably stronger shear than dry vortices. For stronger shear nonlinear effects like the excitation of oscillations are observed.