Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Turbulent wake vortex system at equilibrium, and its interaction with a ground at $Re_\Gamma = 2.0\,10^5$ GREGOIRE WINCKELMANS, OLIVIER THIRY, MATTHIEU DUPONCHEEL, Universite catholique de Louvain (UCL), LAURENT BRICTEUX, Universite de Mons (UMons), IVAN DE VISSCHER, Wake Prediction Technologies (WaPT) — A turbulent two-vortex system (T-2VS) at statistical equilibrium is first obtained. This is done by putting two vortices with analytical circulation distribution in a weak homogeneous isotropic turbulence field (obtained by LES), and then further running the LES. The system goes unstable and a turbulent equilibrium is obtained after some transient. This is believed to be representative of the state reached by the wake behind a real aircraft, when it is fully rolled up. The T-2VS is also characterized (vortex circulation profile, turbulence, etc.), which provides useful information to support further modeling and theory. Next, that T-2VS wake is put in near ground proximity, and a wall-resolved LES at $Re_\Gamma = \Gamma/\nu = 2.0\,10^5$ is carried out: this is ten times larger than the published works on wake vortices interacting with a ground. As the T-2VS comes down, it goes in ground effects (IGE), and then strongly interacts with the ground and rebounds. The physics of the interaction with the ground are analyzed (also relatively to previous works where the 2VS was made of 2D analytical vortices with white noise added), and diagnostics are obtained: vortex rebound and trajectory, vortex global circulation decay, state of the vortices long after rebound (also an equilibrium).

Gregoire Winckelmans
Universite catholique de Louvain (UCL)

Date submitted: 28 Jul 2017 Electronic form version 1.4