Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Tornado-like flows driven by magnetic body forces[1] GUNTER GERBETH, ILMARS GRANTS, TOBIAS VOGT, SVEN ECKERT, Helmholtz-Zentrum Dresden - Rossendorf, Institute of Fluid Dynamics — Alternating magnetic fields produce well-defined flow-independent body forces in electrically conducting media. This property is used to construct a laboratory analogue of the Fiedler chamber with a room-temperature liquid metal as working fluid. A continuously applied rotating magnetic field (RMF) provides the source of the angular momentum. A pulse of a much stronger travelling magnetic field drives a converging flow at the metal surface, which focuses this angular momentum towards the axis of the container. The resulting vortex is studied experimentally and numerically. In a certain range of the ratio of both driving actions the axial velocity changes its direction in the vortex core, resembling the subsidence in an eye of a tropical cyclone or a large tornado. During the initial deterministic spin-up stage (T. Vogt et al., JFM 736, 2013, pp. 641) the vortex is well described by axisymmetric direct numerical simulation. Being strong enough the flow develops a funnel-shaped surface depression that enables visual observation of the vortex structure. As the RMF strength is increased the eyewall diameter grows until it breaks down to multiple vortices. A number of further observed similarities to tornado-like vortices will be discussed.

[1]The work is supported by the German Helmholtz Association in frame of the LIMTECH alliance.

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Date submitted: 30 Jul 2014 Electronic form version 1.4