Generation of zonal flows in rotating fluids and magnetized plasmas

The spontaneous generation of large-scale flows by the rectification of small-scale turbulent fluctuations is of great importance both in geophysical flows and in magnetically confined plasmas. These flows regulate the turbulence and may set up effective transport barriers. In the present contribution the generation of zonal flows will be illustrated in a simple fluid experiment performed in a rotating container with radial symmetric bottom topography. An effective mixing that homogenizes the potential vorticity in the fluid layer will lead to the replacement of the high-potential vorticity near the centre with low potential vorticity from the outside, which will imply the formation of a large-scale flow. The experimental results are supported by direct numerical solutions of the quasi-geostrophic vorticity equation in the beta-plane approximation modelling the experimental situation. The analogy to large-scale flow generation in drift-wave turbulence dynamics in magnetized plasma is briefly discussed.

General information
State: Published
Organisations: Risø National Laboratory for Sustainable Energy
Contributors: Juul Rasmussen, J., Garcia, O., Naulin, V., Nielsen, A., Stenum, B., Bokhoven, L. V., Delaux, S.
Pages: 44-51
Publication date: 2006
Peer-reviewed: Yes

Publication information
Journal: Physica Scripta
Volume: T122
ISSN (Print): 0031-8949
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.14
Web of Science (2017): Impact factor 1.902
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.84
Web of Science (2016): Impact factor 1.28
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.64
Web of Science (2015): Impact factor 1.194
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 0.62
Web of Science (2014): Impact factor 1.126
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.61
Web of Science (2013): Impact factor 1.296
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.67
Web of Science (2012): Impact factor 1.032
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 0.85
Web of Science (2011): Impact factor 1.204
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1