Award Details

Turbulent oceans and atmospheres of the rotating planets: down to small scale

Research Details

Competition Year:	2019	**Fiscal Year:**	2019-2020
Project Lead Name:	Afanassiev, Iakov	**Institution:**	Memorial University of Newfoundland
Department:	Physics and Physical Oceanography	**Province:**	Newfoundland and Labrador
Award Amount:	30,000	**Installment:**	1 - 5
Program:	Discovery Grants Program - Individual	**Selection Committee:**	Geosciences
Research Subject:	Physical oceanography	**Area of Application:**	Oceans, seas and estuaries
Co-Researchers:	No Co-Researcher	**Partners:**	No Partners

Award Summary

The ability to predict climate is one of the vital problems in science. Climate systems include the Earth's oceans and atmosphere and are notoriously difficult to predict because of inherently turbulent nature of flows. My overall research objective is to better understand the dynamical processes that govern the behavior of the stratified and rotating fluids that comprise the Earth's oceans and atmosphere, as well as the atmospheres of other planets. Dynamical processes relevant to fluids on Earth are often similar to those on other planets. In this coming grant cycle the focus will be on thermal convection. This is a process which can be easily observed in your kitchen on small scale, yet it drives circulations of planetary atmospheres. Examples include bands and vortices on Jupiter and Saturn; wealth of data on these flows was recently provided by Juno and Cassini spacecrafts. Within an oceanographic context, our objective is to investigate turbulence at the range from the submeso-scale to a large-scale where the beta-effect is important. Mixing and the Lagrangian transport of tracers and drifters by turbulent motions of different scales are of particular interest. ******Our approach includes both theory and numerical simulations, and we also employ laboratory experiments to study geophysical flows. Our laboratory tank is less than two meters across but can be rotated fast around its axis. This setup allows us to create an idealized “ocean” or “atmosphere” of a rotating planet. We use a state-of-the-art measuring technique which we have been developing here in our lab. We call it the Altimetric Image Velocimetry. With this technique the data can be collected with precision and high resolution. Our laboratory tank can be thought of as an analogue computer where we can run numerous simulations/experiments with real fluid. The experiments do not require any assumptions which are routinely used in numerical simulations dealing with “virtual” fluid. This research will yield new results on the flows driven by convection and contribute to our understanding of nonlinear dynamics of turbulent oceans and atmospheres. The outcome of the proposed research will be of interest for oceanographic and atmospheric science communities who are working to include non-geostrophic dynamics in what traditionally have been quasi-geostrophic idealizations of ocean and atmosphere.**