Geophysical Fluid Dynamics Institute
Computational Science

SEMINAR AND DISSERTATION DEFENSE

Title

THE DYNAMICS OF THE ROSS GYRE: RELATIVE IMPORTANCE OF WIND, BUOYANCY, EDDIES, AND ANTARCTIC CIRCUMPOLAR CURRENT

Speaker

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(Major Professors: Dr. Eric Chassignet & Dr. Kevin Speer)

Time and Place

2:00 PM, Monday, October 31, 2022
Melvin Stern Seminar/Reading Room – 018 Keen Building
Refreshments will be served at 1:15 pm
Dissertation Defense will follow the Seminar

Abstract - Formation of cold, dense waters south of the Antarctic Circumpolar Current (ACC) is one of the main drivers of the global overturning circulation, with major implications on the earth's climate. A key region where the densest water on earth is formed is the Ross Sea which is separated from the ACC by the Ross Gyre. The strength and variability of the Ross Gyre circulation impacts the formation and export of dense water, and it is therefore important to understand its circulation and dynamics. Observations in the Ross Gyre are limited because of its remote location and the severe weather conditions. Furthermore, the ice cover limits the application of remote sensing techniques. Quantitative estimates of the gyre's strength are difficult to obtain from hydrographic observations alone due to the limited sampling and the relatively weak stratification. In this dissertation, we use a combination of observations and modeling studies to a) provide an estimate of the strength and variability of the Ross Gyre transport and b) investigate the relative contributions of the wind and buoyancy forcing, eddies, and the presence of ACC to the Ross Gyre circulation. We find that the mean transport of the Ross Gyre can be as high as ~45 Sv, about twice of the typical estimate ~20 Sv reported in the literature. Sensitivity experiments to wind and buoyancy forcing, nonlinear terms, and the ACC were performed with a regional configuration of the Hybrid Coordinate Ocean Model (HYCOM). The numerical experiments show that the Ross Gyre, and its variability, are primarily wind-driven. The ACC is responsible for part of recirculation. Buoyancy and nonlinearity/eddy do not appear to play a major role in the gyre dynamics.