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Process Oriented Predictablity Studies

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LONG-TERM GOALS

My overall goal is to increase understanding of the general circulation of the ocean. This includes the large-scale circulation and the mesoscale eddies within it, their mutual interactions and their predictability.

OBJECTIVES

The particular objectives of this study are to study the predictability properties of the wind-driven gyre scale circulation, and the mesoscale eddies within that system. We are interested both in the predictability of the mesoscale eddies themselves and their effect on the larger scale.

APPROACH

The methods used are primarily numerical and analytic. Idealized quasi-geostrophic models are used explore mechanisms, and comparisons with more realistic models and observations will serve as check on their accuracy and realism.

WORK COMPLETED

A quasi-geostrophic model of a two-gyre system has been set-up and a preliminary exploration of its predictability properties has begun. A study of the dynamics of stratified geostrophic turbulence was initiated, to explore the life-cycle of baroclinic eddies in a realistically stratified oceanic flow.

RESULTS

The life-cycle of baroclinic eddies in the ocean does not follow the ‘classical’ (i.e. atmospheric) paradigm of baroclinic growth and barotropic decay, becaase the vertical extent is insufficient for

bottom drag to be a significant sink of kinetic energy. Rather, a baroclinic (thermal) damping appears to be an important effect.

Preliminary results were obtained regarding the predictability properties of a two-gyre system containing mesoscale eddies. It was found how the initial predictability growth was shown to be related to certain aspects of the strain field.

IMPACT/APPLICATIONS

The results suggest that the error growth of an eddying ocean can be quantified by relating it to certain dynamic quantities (such as vorticity and strain) in the initial flow. This is important in ascertaining both the inherent and practical limits to predictability in the ocean.

TRANSITIONS

None at present.

RELATED PROJECTS

Those in the research initiative on Oceanic Predictability.

PUBLICATIONS

Oetzel, K. and Vallis, G. K. Strain, vortices, and the enstrophy inertial range in two-dimensional turbulence. *Physics of Fluids*, 10, 2641-54. 1997.

Smith, K. S. and Vallis, G.K. Linear wave and instabiliy properties of extended range geostrophic models. *J. Atmos. Sci.*, (in press, 1998).