

Invitation to
Fluid Mechanical Engineering
Colloquium #5/03

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Date : 19 December 2003

日時と場所 平成 16 年 1 月 13 日 (火) 14 : 00 ~ 15 : 30

機械科学専攻セミナー室 B (A5-66)

講師 Mr. Jori Ruppert-Felsot

Graduate Research Assistant,
Center for Nonlinear Dynamics, The University of Texas

講演題目 Coherent Structure in a Rotating Turbulent Flow Experiment

Presentation:

We study turbulent quasi-geostrophic flow in a tall rotating tank with small-scale forcing. Using Particle Image Velocimetry (PIV), we observe many long-lived coherent vortices with a wide range of sizes. The observed vorticity fields exhibit a rich range of dynamics including vortex birth, merger, scattering, and destruction. We use a wavelet packet transform to analyze the vorticity fields. We separate the flow into a coherent component and an incoherent remainder based upon an entropy criterion and thresholding of the wavelet packet coefficients. The coherent component contains relatively few (approx. 10%), albeit large amplitude, coefficients of the transform yet accounts for most of the total enstrophy and retains the global properties of the flow, such as the coherent structures, long spatial and temporal correlations, overall shape of the vorticity PDF, and transport properties. The incoherent component contains the remaining small amplitude coefficients and accounts for a small part of the total enstrophy. It is void of coherent structures, rapidly loses correlation in time, and does not represent a significant contribution to the transport properties. This motivates the possibility that one can simulate turbulent flow using only a relatively small number of wavelet packet modes.

皆さんとの刺激的な Discussion を期待しています。(武田 靖)