Vortex interactions in two-dimensional turbulence analysed using wavelets and wavelet packets

Fact Sheet

Project Information

Grant agreement ID: FMBI950365

Project closed

Start date
1 February 1996

End date
31 January 1998

Funded under
Specific research and technological development programme in the field of the training and mobility of researchers, 1994-1998

Total cost
No data

EU contribution
No data

Coordinated by
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE
France

Objective

Direct Numerical Simulations (DNS) have shown that coherent vortices pl an essential role in two-dimensional (2D) turbulent flow dynamics. Classical statistical theories of 2D turbulence describe the average behaviour of ensembles of many real-

isations of a turbulent flow and hence cannot account for the appearance and effect of vortices in a given realisation. This fact suggests that an understanding of vortices and their interactions is necessary to understand 2D turbulence, and that the vortical structure of 2D turbulence may be used to construct more efficient numerical simulations.
The research proposed here has two objectives: the first is to analyse the nonlin- ear interactions of vortices. This analysis will use a new mathematical technique. the wavelet transform, to relate physical structure to spectral quantities. We first consider a highly nonlinear elementary interaction: the merger of two positive vortices in the presence of a negative vortex. We then analyse the more complicated nonlinear interactions of a fully turbulent flow when many vortices have been formed. The second objective is to develop a more efficient and physically realistic way of numerically simulating turbulence bv compressing the vorticity field using a wavelet packet basis. The largest wavelet packet modes have been found to correspond physi- cally to the large vortices in a turbulent flow making this simulation method particu- larly appropriate for following the dynamics of coherent vortices in fully developed 2D turbulent flows. The Navier-Stokes equations will be solved on a wavelet packet basis and the vorticity field will be compressed by keeping the minimum number of wavelet modes required to retain a specified fraction of the total enstrophy.

Programme(s)

FP4-TMR - Specific research and technological development programme in the field of the training and mobility of researchers, 1994-1998

Topic(s)

0302 - Post-doctoral research training grants

TP05 - Fluids and Plasmas

Call for proposal

Data not available

Funding Scheme

RGI - Research grants (individual fellowships)

Coordinator

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

EU contribution

No data

Total cost

No data

Address

Ecole Polytechnique
91128 PALAISEAU
France

Participants (1)

Not available

Ireland

EU contribution

No data

Address

Total cost

No data

Last update: 17 March 1998

Permalink: https://cordis.europa.eu/project/id/FMBI950365