COURSE TITLE:

LABORATORY PRACTICE FOR ENVIRONMENTAL FLOWS

COURSE DESCRIPTION:

1. Examination of flow fields by PIV method. The PIV (Particle Image Velocimetry) method is one of the most advanced measuring methods which permits the determination of velocity fields in a wide variety of flows. Laser sheet illumination produces two-dimensional cuts from the fluid volume, and imaging of small tracer particles provides quantitative fluid velocity values and flow directions simultaneously. During this training, students learn how to use the tool and get an insight into the measurement of vortices, and various information obtained by this method.

2. Internal waves along the boundary layer of two fluids. Double layer (fresh water on top of salt water) stratification supports propagating internal waves along the density interface. Such waves are formed by a moving body (ship model in our case), the task is the quantitative analysis of internal waves at the interface as a function of the parameters of the movement. The practice provides an introduction to digital image processing methods, too.

3. Baroclinic instability in a rotating annulus. A simple model of baroclinic instability is a differentially heated rotating tank, which is an adequate model reproducing the key features of mid latitude atmospheric flows. Cyclonic and anticyclonic vortices are generated at various temperature contrasts and rotation speeds, and the task is to analyze the properties of the dynamics by post-processing of images taken with a rotating camera.

4. Double diffusion phenomena in a continuously stratified fluid. Gravitationally stable stratified salt solution is produced by the double-bucket technique, and a dyed freshwater ice block is placed into the tank. The melting proceeds in a nontrivial way, where near horizontal layers grow with a characteristic spacing. The properties of layered growth can be analyzed by high-precision thermometer and conductivity probe. The task is to explain the typical patterns by the parameters of the medium.

LITERATURE:

B. Cushman-Roisin: Introduction to Geophysical Fluid Dynamics. Prentice Hall, Engelwood Cliffs, 1994.

J. C. McWilliams: Fundamentals of Geophysical Fluid Dynamics. Cambridge University Press, Cambridge, 2006.

TEACHER:

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