Special Program in Applied Mathematics and Applied Mechanics

Gravity currents as a test case: do simple models produce good physical insights, or do good insights generate powerful models?

2013 - 02 - 27 (Wed.)
15:00 - 17:00
308, Mathematics Research Center Building (ori. New Math. Bldg.)

A gravity current appears when fluid of one density propagates into another fluid of a different density, mainly in the horizontal direction. Examples: when we open the door of a heated house, cold air from outside flows over the floor into the less dense warm air inside; when we pour honey on a pancake, it spreads out. Gravity currents are present in the atmosphere, lakes and oceans as winds, cold or warm streams or currents, volcanic clouds, polluted discharges, etc. A gravity current which propagates inside a stratified fluid is called “intrusion”. On the one hand, the gravity current is a very complex flow- field whose Navier-Stokes simulation requires weeks of number crunching on a powerful computer. On the other hand, there are simplified “mathematical models” which determine the behavior of the main flow from analytical considerations and/or numerical solutions that require insignificant CPU time. We present some typical models and solutions. The fact that such simple models give useful results merits attention: is the predictive power of the model a consequence of postulated mathematical simplicity, or is it rather a result of well-selected physical components? The answer to this universally relevant question is discussed. **Reference: M. Ungarish. An Introduction to Gravity Currents and Intrusions. CRC press, 2009.**


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