Geodynamics Seminar

第315回ジオダイナミクスセミナー

"Numerical simulations of thermal convection of fluids with spatial variations in physical properties"

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主催：愛媛大学地球深部ダイナミクス研究センター
日時：1/27（金）午後 4時30分～
場所：総合研究棟 4F 会議室

Abstract

We performed a linear stability analysis on the onset of thermal convection of fluid in the presence of spatial variation of physical properties such as viscosity, thermal expansivity and conductivity. The viscosity of the fluid is exponentially dependent on temperature, while thermal expansivity and conductivity are linearly dependent on pressure (or depth). The planar layer model geometry is employed. Velocity and temperature distributions are solved for infinitesimal perturbations for given horizontal wave number. We seek for the condition for the onset of convection by changing the values of Rayleigh number and wave number. Then, we examine the influence on incipient convection patterns of the magnitude in spatial variation in physical properties.

Our analysis successfully reproduced the transition in flow patterns into the stagnant lid regime where a thick and stagnant lid of cold fluid develops at the top surface because of the very strong temperature dependence of viscosity. These flow patterns are quite similar to those obtained in finite-amplitude convection. Moreover, we found that the presence of spatial variation in thermal expansivity and conductivity, together with the strong temperature dependence in viscosity, changes the critical wavenumber of convection and moderately affects the onset of stagnant lid regime.

In the presentation, the details of numerical results will be discussed with special emphasis on the nature of the stagnant lid convection. These results will be also discussed further through the comparison with our recent results from finite amplitude convective

詳細は当センターホームページ: http://www.ehime-u.ac.jp/~grc/をご覧ください
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