

# Study of onset of convection in a triple diffusive system bounded by rigid isothermal / isohaline boundaries

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## 1. INTRODUCTION & OBJECTIVE

Convection is a method of heat transfer that occurs in fluids through the movement of molecules. Triple diffusive convection is a phenomenon where three components such as heat, mass or chemical species diffuse simultaneously, leading to complex flow patterns. If the fluid, additionally has salt dissolved in it, then there are potentially two destabilizing sources for the density difference, the temperature field and the salt field. The solution behavior in the double-diffusive convection problem is more interesting than that of the single component situation in so much as new instability phenomena may occur which is not present in the classical Benard problem. When temperature and two or more components (or three different salts) are present then the physical and mathematical situations become increasingly richer.

Very interesting results in triply diffusive convection (in which the density depends on three independently diffusing stratifying agencies) have been obtained by Griffiths [1], Pearlstein et al. [2], Terrones [3], Pranesh et al. [4], Pranesh et al. [5] have also theoretically studied the onset of convection in a triply diffusive fluid. In such a fluid layer confined between rigid boundaries, the specification of a linear stability criterion can require as many as three critical Rayleigh numbers. The onset of instability of the motionless basic state may occur via the stationary or the oscillatory state.

The objective of the present paper is to make a comparison between results of triple diffusive convection using realistic and idealistic boundary conditions.

## 2. RESULTS & HIGHLIGHTS OF IMPORTANT POINTS

A semi-analytical method is used in determining the critical wave number and the Rayleigh number for the problem of triple-diffusive convection with rigid isothermal / isohaline boundaries. The eigen function concerning the stream function, temperature and two immiscible solutes is a combination of trigonometric sine or cosine function and a 20-term power series.

The critical values are obtained to an accuracy of  $10^{-3}$ . Comparison is made between the results of rigid and free isothermal / isohaline boundaries. Double diffusive magnetoconvection as a triple diffusive system is also discussed. Thermal convection, double diffusive convection and double diffusive magnetoconvection are limiting cases of the study. The critical value of the Rayleigh number of the rigid isothermal boundary is found to be greater in magnitude compared to the free case. In all cases considered, the critical eigenvalue and the corresponding wave number are determined to a three-digit accuracy.

## REFERENCES

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