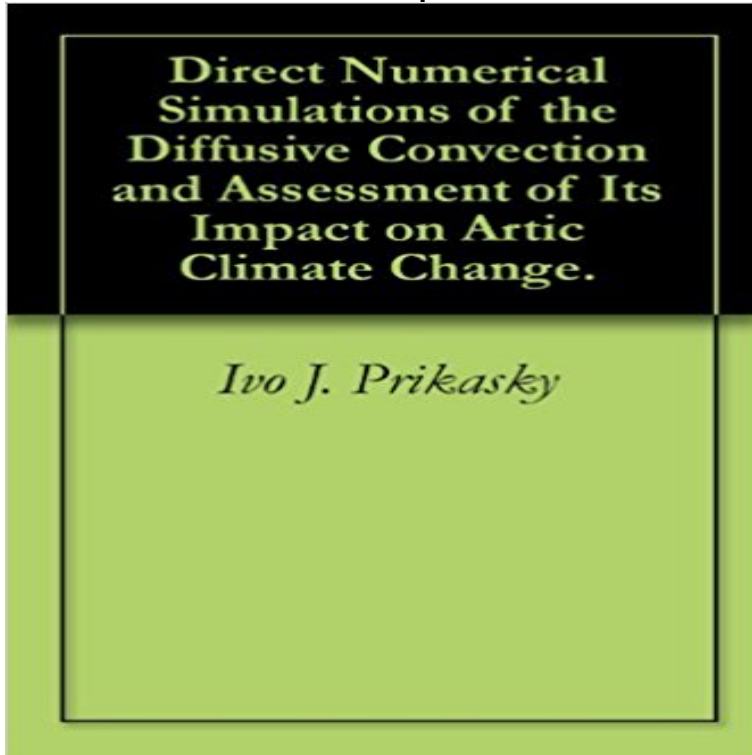


# Direct Numerical Simulations of the Diffusive Convection and Assessment of Its Impact on Arctic Climate Change.



This thesis focuses on the numerical modeling of the oceanic double-diffusive convection, a mixing process which is driven by the two orders of magnitude difference in diffusivities of heat and salt in seawater. This study explores the diffusive regime of double-diffusion. The aim of the research is to quantify the double-diffusive transport in both smooth gradients and thermohaline staircases, and to develop clear insight into the origin of the staircases and specify conditions for their formation. Based on the numerical process modeling, it is determined that the evolutionary pattern of staircases is controlled by the merging events in which weak interfaces erode and disappear. To illustrate dynamics of these events, a theoretical framework merging theorem has been developed. It is numerically confirmed that the merging theorem predicts the time scale of merging events within the order of magnitude. The computed fluxes from numerical experiments are comparable to the diffusive fluxes inferred from the Beaufort Gyre observations and an order of magnitude greater than the fluxes from earlier laboratory-based experiments. The present analysis suggests that the diffusive fluxes could play an important factor in the Arctic heat budget; hence, future study in this field is recommended.

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