TURBULENCE STRUCTURE AND CO_2 TRANSFER AT THE AIR-SEA INTERFACE AND TURBULENT DIFFUSION IN THERMALLY-STRATIFIED FLOWS

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1. INTRODUCTION

A supercomputer is a nice tool for simulating environmental flows. The Center for Global Environmental Research (CGER) of the National Institute for Environmental Studies purchased a supercomputer SX-3 of CGER about three years ago, and it has been used for various environmental simulations since. Although one of the main purposes for which the supercomputer was used was to simulate global warming with a general circulation model (GCM), our research organization used the supercomputer for more fundamental work to investigate heat and mass transfer mechanisms in environmental flows. Our motivations for this work was the fact that GCMs involve a number of uncertain submodels related to heat and mass transfer in turbulent atmospheric and oceanic flows. It may be easy to write research reports by running GCMs which were developed in western countries, but it is difficult for numerical scientists to do original work with such second-hand GCMs. In this sense, we thought that it would be more original to study the fundamentals of heat and mass transfer mechanisms in environmental flows rather than to run a GCM. Therefore, we tried to numerically investigate turbulence structure and scalar transfer both at the air-sea interface and in thermally stratified flows, neither of which were well modeled by GCMs. We also employed laboratory experiments to clarify the turbulence structure and scalar transfer mechanism, since numerical simulations are not sufficiently powerful to clarify all aspects of